

QUICK REFERENCE

CLINICAL

CHIROPRACTIC

HANDBOOK



NIKITA A. VIZNIAK

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Chapter 1..... **History & Exam**

HISTORY & EXAM

NUTRITION

MYOLOGY

Chapter 2..... **Diagnosis & Treatment**Chapter 3..... **Orthoneuro Tests**Chapter 4..... **Chiropractic Physical Therapy**Chapter 5..... **Nutrition**Chapter 6..... **Radiology**Chapter 7..... **Selected Conditions**Chapter 8..... **Neuroanatomy**Chapter 9..... **Myology**Chapter 10..... **Muscle Testing**Chapter 11..... **Medications****Appendix**

DIAGNOSIS & TREATMENT

RADIOLOGY

MUSCLE TESTING

ORTHONEURO TESTS

SELECTED CONDITIONS

MEDICATIONS

CHIROPRACTIC PT

NEUROANATOMY

APPENDIX

I History & Exam 7

General Considerations.....	8
Chief Complaint History.....	9
Past Health History.....	10
Family & Personal History.....	11
General Physical Exam.....	12-13
Cervical Exam.....	14
Lumbar Exam.....	15
General Extremity Exam.....	16
Wrist & Hand Exam.....	17
Elbow Exam.....	18
Shoulder Exam.....	19
Ankle & Foot Exam.....	20
Knee Exam.....	21
Hip Exam.....	22
Neurologic Exam.....	23
Abdominal Exam.....	24
Blood Pressure Exam.....	25
Deep Tendon Reflexes.....	26
Heart Auscultation.....	27
Lung Auscultation.....	28
Muscle Strength Exam.....	29
Peripheral Pulses.....	30
Ophthalmic Exam.....	31
Otoscopic Exam.....	32
Male Genitourinary Exam.....	33
Female Genitourinary Exam.....	34
Breast Exam.....	35
Radiographic Exam Flow.....	174
Cranial Nerve Exam.....	243

II Diagnosis & Treatment.37

Four Part Diagnosis.....	38
Joint Motions.....	39
Segmental Spinal Motion.....	40-41
Spinal Joint Listings.....	42
Gait Types.....	43
Gait Cycle.....	44-45
Scapulohumeral Rhythm.....	46-47
KMP: Hip Extension.....	48-49
KMP: Hip Abduction.....	50-51
KMP: Trunk Flexion.....	52-53
KMP: Shoulder Motion.....	54-55
KMP: Neck Flexion.....	56-57
Clinical Impression.....	58
Outcome Markers & Prognosis.....	59
Narrative Report.....	60-61
Sample Verbiage.....	62
Report of Findings.....	63
Adjustments Cervical.....	64

Adjustments Thoracic & Costal.....	65
Adjustments Lumbar.....	66
Adjustments Pelvis & Misc.....	67
Neutral Pelvis.....	68
Bridge Track.....	69
Dead Bug Track.....	70
Prone & Side-Lying Track.....	71
Quadruped Track.....	72
Rocker & Wobble Board.....	73

III Orthoneuro Tests..... 75

A - General.....	76
A-B - General.....	77
B - General.....	78-80
C-D - General.....	81
D - General.....	82
E-F - General.....	83
F-H - General.....	84
H - General.....	85
H-L - General.....	86
L - General.....	87
L-M - General.....	88
N-O - General.....	89
O-R - General.....	90
R-S - General.....	91
S - General.....	92-93
S-T - General.....	94
T-Y - General.....	95
Wrist.....	96-98
Elbow.....	99-100
Shoulder Observation.....	101
Shoulder Screening.....	102
Shoulder.....	103
Shoulder Impingement.....	104
Shoulder Tendonitis.....	105
Shoulder Labral Tear.....	106
Ankle.....	107-108
Knee Screening.....	109
Knee Ligament Stability.....	110-111
Knee.....	112-113
Knee Patellar Tests.....	114
Knee Meniscal Tests.....	115-116
Hip.....	117
Malingering.....	118
Pathologic Reflexes.....	119

IV Chiropractic PT..... 121

Heat.....	122
Cryotherapy.....	123
Soft Tissue Techniques.....	124
Cross Fiber Massage.....	125
Muscle Energy Technique.....	126
PNF.....	127
Weight Training Protocols.....	128
Key Movement Patterns.....	129
Electrical Modalities.....	130
Motor Points.....	131
High Volt.....	132
IFC & LFAC.....	133
Low Volt Galvanism.....	134
Microcurrent.....	135
Russian Stimulation & TENS.....	136
Ultrasound.....	137

V Nutrition 139

Food Pyramid & Servings.....	140
Calories.....	141
Carbohydrates & Fiber.....	142
Protein.....	143
Lipids.....	144
Lipoproteins & Eicosanoids.....	145
Vitamin A.....	146
Vitamin D.....	147
Vitamin E.....	148
Vitamin K.....	149
Vitamin B1.....	150
Vitamin B2.....	151
Vitamin B3.....	152
Vitamin B5.....	153
Vitamin B6.....	154
Folic Acid.....	155
Vitamin B12.....	156
Biotin.....	157
Vitamin C.....	158
Glucosamine & Chondroitin.....	159
Calcium.....	160
Calcium Metabolism.....	161
Minerals.....	162- 163
Musculoskeletal Trauma.....	164
Tissue Healing Phases.....	165
Nutrient/Nutrient Interactions.....	166
Nutrient/Medication Interactions.....	167
Women Height/Weight Tables.....	168
Men Height/Weight Tables.....	169

VI Radiology 171

Imaging Decisions in LBP.....	172-173
Radiographic Exam Flow.....	174
Standard Radiographic Views.....	175
Cervical Views.....	176
Thoracic Views.....	177
Lumbar Views.....	178
Pelvic Views.....	179
Specialty Views.....	180
Technique Changes.....	181-182
Radiographic Quality.....	183
Radiographic Report.....	184
Cervical Film Report.....	185
Thoracic Film Report.....	186
Lumbar Film Report.....	187
Chest Film Report.....	188
Shoulder Film Report.....	189
Radiographic Measurements.....	190-193
Selected Fractures.....	194-195
Selected Differentials.....	196-197
Primary Benign Bone Tumors.....	198-199
Primary Malignant Bone Tumors.....	200-201

VII Selected Conditions 203

NMS Treatment Parameters.....	204
NMS Considerations & DDx.....	205
Selected NMS DDx.....	206
Abdominal Pain.....	207
Anemia.....	208-209
BPPV.....	210
Concussion.....	211
Constipation.....	212
"Cross Syndrome".....	213
Diarrhea.....	214
Disc Herniation.....	215
Dizziness Differentials.....	216
Facet Syndrome.....	217
Fatigue.....	218
Fever.....	219
Headache Differentials.....	220
Headache Pathologic.....	221
Hypertension.....	222
Instability.....	223
Lung Pathology DDx.....	224
Recurrent Chest Pain DDx.....	225
Rhinitis.....	226
Sacroiliac Syndrome.....	227
Scoliosis.....	228
Sprain/Strain.....	229

Selected Conditions. *continued*

Stenosis 230
 Thoracic Outlet Syndrome..... 231
 Urinary Stones 232
 Weight Gain & Loss 233

VIII Neuroanatomy 235

Anterior Dermatomes..... 236
 Posterior Dermatomes 237
 Spinal Tracts 238-239
 Sensory Loss Patterns..... 240-241
 Cranial Nerves 242
 Cranial Nerve Exam..... 243
 Motor Upper Extremity 244
 Motor Lower Extremity..... 245
 Femoral & Obturator Nerve 246
 Sciatic Nerve 247
 Axillary & Musculocut. Nerve 248
 Median Nerve..... 249
 Radial Nerve 250
 Ulnar Nerve 251

IX Myology 253

Back 254-255
 Neck & deep back..... 256-257
 Shoulder..... 258
 Anterior Chest & Arm..... 259
 Anterior Forearm..... 260
 Posterior Forearm 261
 Torso 262
 Gluteal Region 263
 Middle & Posterior Thigh 264
 Anterior Thigh 265
 Posterior Leg..... 266
 Anterior Leg 267
 Hand..... 268-269
 Foot..... 270-271

X Muscle Testing..... 273

Ankle 274-276
 Ankle & Knee 277
 Knee & Hip 278-281
 Hip..... 282-283
 Shoulder..... 284-288
 Shoulder & Arm..... 289
 Arm..... 290
 Wrist..... 291

XI Medications 293

A 294
 A-C 295
 C 296
 C-D 297
 D-E 298
 F-H 299
 H-K 300
 K-M 301
 M-N 302
 N-O 303
 O-P 304
 P-R 305
 R-S 306
 S-T 307
 T-V 308
 V-Z 309
 NSAIDs 310

Appendix 311

Visceral Pain Referral Patterns 312
 Genetics 313-314
 Dermatologic Terms 315-17
 Blood Draw 318
 Complete Blood Count 319
 Clinical Enzymology..... 320
 Selected Condition Labs..... 321
 Hormone Review 322-323
 Minor Surgery Review 324-325
 Urinalysis..... 326-327
 Research Summary 328
 Sensitivity & Specificity 329
Common Outpatient ICD-9 Codes
 Common Chiropractic ICD-9 330-332
 Neoplasms, Endocrine, Mental 333
 Nervous & cCirculatory ICD-9 334
 Respiratory, Digestive, GU 335
 Skin & Musculoskeletal ICD-9 336
 Abbreviations 337-338

I History & Exam

General Considerations	8
Chief Complaint History	9
Past Health History	10
Family & Personal History	11
General Physical Exam	12-13
Cervical Exam	14
Lumbar Exam	15
General Extremity Exam	16
Wrist & Hand Exam	17
Elbow Exam	18
Shoulder Exam	19
Ankle & Foot Exam	20
Knee Exam	21
Hip Exam	22
Neurologic Exam	23
Abdominal Exam	24
Blood Pressure Exam	25
Deep Tendon Reflexes	26
Heart Auscultation	27
Lung Auscultation	28
Muscle Strength Exam	29
Peripheral Pulses	30
Ophthalmic Exam	31
Otosopic Exam	32
Male Genitourinary Exam	33
Female Genitourinary Exam	34
Breast Exam	35
Radiographic Exam Flow	174
Cranial Nerve Exam	243

The following are items to consider during any clinical encounter.

Red Flags for Serious Spinal Pathology

SYMPTOMS

- Recent unexplained weight loss
- Widespread neurological deficits
- Constant, progressive non-mechanical pain
- Bowel and/or bladder dysfunction
- Saddle anesthesia

HISTORY

- Violent trauma

PAST MEDICAL HISTORY

- Carcinoma
- Systemic steroids
- Drug abuse
- HIV

SIGNS

- Temperature > 100°F / 37.8°C
- Blood pressure > 160/95
- Resting pulse > 100bpm
- Resting respiration > 25bpm
- Auscultation of bruits - carotid, abdominal

Risk Factors for More Complex & Difficult Cases

British Medical Guidelines (BMG-1996)

Agency for Healthcare Practice Research (AHCPR-1994)

Adapted, with permission, from Ronald LeFebvre, DC

HISTORY

- Previous history of low back pain (BMG, AHCPR)
- >4 episodes (Mercy Guidelines)
- Total work loss in past 12 months (BMG)
- Radiating leg pain (BMG, AHCPR)
- Self-rated poor health (Rand)
- Heavy smoking (BMG, AHCPR)
- Psychological distress and depressive symptoms (BMG)
- Disproportionate illness behavior (BMG)
- Low job satisfaction (BMG)
- Personal problems - alcohol, marital, financial (BMG)
- Adverse medico-legal proceedings (BMG)
- Low educational attainment and heavy physical occupation slightly increase the risk of low back pain and chronicity, but markedly increase the difficulty of rehabilitation and retraining (BMG)

EXAMINATION

- Pre-existing structural pathology or skeletal anomaly (eg. spondylolisthesis) directly related to current condition or injury (Mercy Guidelines)
- Severe pain intensity (Mercy Guideline - visual analogue scale)
- Reduced SLR (BMG, AHCPR)
- Signs of nerve root involvement (BMG, AHCPR)
- Reduced trunk muscle strength/endurance (BMG)
- Poor physical fitness (BMG - decreased aerobic capacity)

L O C Q - S M A T

1. Location

- Where? Point to it
- Write as accurate a location as possible ("low back" is too general, "lumbosacral" is better, "shoulder" is too general, "anterior and lateral right shoulder" is better)
- Always indicate R or L
- Does it radiate? Where?
- How far (elbow, wrist, hand, fingertips?)
- What aspect/surface? (lateral/medial/posterior)

2. Onset (what happened and when?)

- When did it happen? Gradual or sudden? What caused it?
- Look for specific actions, changes in activities, posture, work (worker's compensation)

3. Chronology/Timing

(Symptom patterns)

- Constant or intermittent (episodic)
- If constant, is it truly 24 hours a day? Does it prevent sleep?
- If intermittent: is it associated with specific circumstances? (e.g. eating certain foods? certain activities?)
- Frequency and duration of the episodes
- Diurnal patterns (worse in morning? end of day?)
- Is there night pain (wake or prevent sleep?)
- Getting worse (progressive)? Getting better? Staying the same?
- Prior history: has this ever happened before? When? How long? What did you do about it?

4. Quality

- Describe pain or symptoms (sharp, dull, etc.)
- If description is unusual, use patient's words in quotations

5. Severity/Effect on ADL

- Pain mild, moderate or severe?
- Pain scale (1-10)
- ADL: can you go to work? Affect performance? Affect hobbies? Sexual activity? Simple activities such as putting on a shirt? Get specific activities and exactly how the patient is affected. (ADL = activities of daily living)

6. Modifying Factors

- What increases the symptoms or pain? Be specific.
- What makes it better? Avoiding what? Changing posture? Rest? Medication (how much and how often?)

7. Associated Symptoms

- Do you have any other symptoms or problems that you feel are related to this complaint?
- Additional specific questions are asked based on what the patient presents with and what the doctor thinks it could be; for example:
 - Neck or back complaint: is there numbness, tingling, or weakness in an extremity?
 - Low back: does your back ever catch or get locked? Change in bowel habits? Change in bladder habits? Change in sexual function? Change in menses?
 - Knees: any popping, clicking, snapping? Knee ever lock? Swell? Give way?

8. Treatment, Previous...

- Who did they see? When? What tests done?
- What diagnosis? What treatment? Did it help?

9. Relevant Injuries/X-rays

- When? What happened?
- Eventual outcome/residual effects?

10. Goal (optional)

- What is patient's treatment goal?
- If long standing problem, why did they come in now?

Is there anything else you can tell me about your condition that I have not asked?

Use appropriate language, explain why you are asking and be empathetic to patient

Differential Diagnosis List

1. Biomechanical?
2. Bony pathology?
3. Systemic disease?
4. Neurological condition?

Adapted, with permission, from Ron LeFebvre, DC

1. Serious Illness

- Have you ever had any serious illness(es)?
- Any other problems?

2. Hospitalizations/Surgeries

- Have you ever been hospitalized?
- Have you had any surgeries?

3. General Trauma, Accidents, Injury

- Have you experienced any physical trauma that required treatment or should have been treated?
- Have you had any accidents? MVA?
- Any other injuries you can think of?
- Were there any residual problems or prolonged side effects?

4. Menses, Menopause

- Do you remember the first day of your last menstrual period?
- Do you have any problems w/ menstrual cycle?
- Have there been any changes in your menstrual cycle?
- Any abnormal bleeding?

Patients over 50:

- Are you still having menstrual periods? If yes,
- Do you remember the first day of your last menstrual period?

Physiologic menopause:

- At what age did you experience menopause?
- Did you/are you taking hormone replacement?
- What? How is it administered?

Surgical menopause:

- Why did you have a hysterectomy? (Cancer?)
- Did they remove your ovaries?
- Are you taking hormone replacement?
- What? How is it administered?

5. Contraceptives, Pregnancies

Contraceptives:

- Are you using any kind of hormonal contraceptive or an IUD?
- If yes, what and any problems?

Pregnancies:

- Have you ever been pregnant? If yes,
- Were there any complications?

6. Medications

- Do you take any prescribed medications?
- Do you take any over the counter medications?
- Do you take any vitamins?
- Have you ever taken medication for extended periods of time?
- E.g. Steroids, antidepressants, NSAIDs

7. Allergies

- Do you have any allergies?

8. X-rays

- Have you ever had any x-rays? If yes, why?
- Were there any problems identified on the x-ray?

9. Chiropractic Care

- Have you ever received chiropractic care?
- If yes; what for? Describe the care. Did it help?

10. Last Physical Exam

- When was your last physical exam?
- What was it for?
- Were any problems identified?

Females:

- When was your last GYN exam and PAP smear?
- Do you remember the results?

Females over 50:

- Have you had a mammogram? How often?
- Do you remember the results?

Males 15-35:

- Do you perform self-testicular exam?
- Have you ever been taught how to?

Males over 40:

- Have you ever had a rectal exam to evaluate your prostate?
- If yes, do you remember the results?

Family Health Problems

- Are there any conditions that run in your family (diabetes, high blood pressure, stroke, heart disease, cancer)
- I'd like to start with your mother. Is she alive? Does she have any health problems?
- How about your mother's mother?
- How about your mother's father?
- Your father? Your father's mother? Your father's father?
- Brothers? Sisters?
- If there is a deceased relative; how old were they when they died? Cause of death?
- Any other health problems?

1. Living Situation

- Can you describe your living situation to me?

2. Occupation

- What is your occupation?
- Describe your activities at work. Hours?
- Do you like your job?

3. Exercise

- Do you participate in regular exercise?

4. Interests/Other Activities

- Do you have any other interests, hobbies or activities you enjoy?

5. Diet

- What do you eat for ... breakfast? Lunch? Dinner? Snacks?
- What beverages do you drink throughout the day?
- How often do you eat ... vegetables? Fruit? Sweets? Fast food?
- How much water do you drink a day?

6. Sleep Pattern

- How many hours do you sleep each night?
- Have there been any recent changes?
- Do you feel you get enough sleep?

7. Bowel Habits

- How often do you have a bowel movement? Any recent changes?

Patients over 50:

- Do you ever notice any bleeding?

8. Urinary Habits

- Do you have any problems with urination? Any recent changes?

9. Habits

Alcohol:

- Do you drink alcohol?
 - What do you drink?
 - How often do you drink? How much?
- If you have concern about patient's drinking (CAGE):*

- Have you ever felt the need to Cut down on drinking?
- Have you ever felt Annoyed by criticism of drinking?
- Have you ever had Guilty feelings about drinking?
- Have you ever taken a morning "Eye opener"?

Smoking:

- Do you use or have you ever used tobacco products/smoke?
- What do you use?
- How much do you smoke? For how long? When did you stop?

Drugs:

- Do you use any recreational drugs? What? For how long?

10. Domestic Violence

- Are you currently or have you ever been in a relationship where you were physically hurt or made to feel threatened?

11. Stress factors/Support System

- Have there been any significant stresses in your life lately? (e.g. deaths, divorce, family, work)
- Have you noticed a change in your ability to handle stress?
- What resources do you have for support for...?

Vitals

Temperature, pulse, respiration, BP bilaterally

Standing (out of exam room)

Height, weight, Snellen chart, gait, heel walk (L5), toe walk (S1), tandem Romberg (heel to toe)

Standing (in exam room)

Squat and rise, observe posture, Romberg, finger to nose (*cerebellar*), arm drop, GROM (*Adam's sign: as far as they can go? pain? where?*), Belt test (*Neri's bowing sign & Minor's sign*), SI motion w/ Trendelenberg

Seated (standing in front of patient)

Active cervical ROM, inspection of head & neck, active shoulder ROM
TMJ ROM

Cranial Nerves:

1. Smell (I)
2. Cardinal fields of gaze (III, IV, VI)
3. Accommodation (III)
4. Peripheral vision (II)
5. Facial expression (VII)
6. Stick out tongue (XII)
7. Trap/SCM muscle test (XI)
8. Hearing (VIII) if (+): Webber, Rinne
9. Consensual light reflex (II, III)
10. Exam mouth
11. Say "ahhhh" (IX, X)
12. Bite (V)

Oto /ophthalmo /rhino - scope exam
VBI test (may be done supine)

Neuro: V, brachial plexus**Sensory:**

Corneal reflex (V, VII)
Light touch (face/arms)
Sharp/dull or pinwheel (face/arms)
Vibration (DIP, 3rd digit)

DTR:

Biceps (C5)
Brachioradialis (C6)
Triceps (C7)
Patella (L4)
Hamstring (L5)
Achilles (S1)

Motor: (may be done lying down)

Deltoid (C5, C6)(axillary)
Brachioradialis (C5, C6) (radial)
Biceps (C5, C6) (musculocutaneous)
Triceps (C6, C7, C8, T1) (radial)
Wrist extensors (C6, C7, C8) (radial)
Wrist flexors (C6, C7) (median/ulnar)
Finger flexors (C7, C8, T1) (ulnar/median)
Interossei (C7, C8, T1) (ulnar)

Auscultate: heart & carotid arteries

Cervical palpation: masseters/parotids, submandibular glands, submental glands, thyroid, trachea

Seated (have patient turn around)

- Percuss lung fields
- Check respiratory excursion
- Auscultate

Cervical palpation:

Preauricular nodes, postauricular nodes, superficial cervical nodes, supraclavicular nodes, SCM, mastoids, deep cervical chain, suboccipital triangle & nodes, posterior cervical muscles, facets, trapezius, levator scapulae

Cervical orthopedics:

- Muscle test neck
- Cervical compression (neutral, maximal)
- Cervical distraction
- Shoulder depression

TOS tests: (if arm/hand symptoms present)

Roos's, Eden's, Wright's, Adson's

Seated (patient straddles table)

- Spinal percussion
- Kemp's test
- Lumbar/thoracic motion palpation

...Continued on next page 

Supine (*Dr. stands/sits at head of table*)

Upper extremity muscle tests (unless already done seated)

Abdominal Exam (see page 190):

1. Inspect
 2. Auscultate
 3. Percuss
 4. Palpate
 5. Abdominal strength
- Check ASIS height (optional)
Palpate inguinal nodes

Supine (*Dr. stands at foot of table*)

- Inspect feet
- Palpate temperature of feet
- Dorsal pedis & posterior tibial pulses
- Leg length (optional)
- Internal/external rotators

Neuro: lumbosacral plexus, cord**Sensory:**

Light touch, sharp/dull or pinwheel
Vibration (DIP, 3rd digit)

UMN: Babinski (L1 & above)

Motor:

Tibialis anterior (L4, L5) (deep peroneal)
Extensor hal. longus (L4, L5, S1) (deep peroneal)
Peroneus longus (L5, S1) (superficial peroneal)

Supine (*Dr stands at side of table*)

Low back/pelvis orthopedics:

- Active SLR
- Double SLR
- Passive SLR
- Braggard
- Goldthwaite (if there is back pain)
- Patrick FABER
- Hip circumduction
- Thomas (w/leg off the table)

Side Posture

- Active hip abduction
- Ober's Test

Prone (*Dr. stands at foot of table*)

- Check leg length
- Derefield check (optional)
- Internal/external rotation w/ knees bent
- Palpate for calf tenderness

Prone (*Dr. stands at side of table near thigh*)

Low back/pelvis orthopedics:

- Active leg extension
- Heel to buttock (Nachlas)
- Heel to opposing buttock (Ely)
- Thigh rotated away from midline (Hibb's)
- Palpate piriformis
- Yeoman's
- Soft tissue/joint evaluation

Palpate:

Hamstrings, TFL, glut max, glut medius, SI joint, PSIS/crest height, palpate lumbar, thoracic spine & ribs

Adapted, with permission, from Ronald LeFebvre, DC

Vitals temp, pulse, respiration, BP bilaterally

Standing (out of exam room)

height, weight, Snellen chart

Standing (in exam room)

observe posture, SI motion palpation

Seated (standing in front of patient)

Active cervical ROM (rotation with neck flexed if indicated), inspection of head & neck, active shoulder ROM

Cranial Nerves:

1. Smell (I)
2. Cardinal fields of gaze (III, IV, VI)
3. Accommodation (III)
4. Peripheral vision (II)
5. Facial expression (VII)
6. Stick out tongue (XII)
7. Trap/SCM muscle test (XI)
8. Hearing (VIII) if \pm : Webber, Rinne
9. Consensual light reflex (II, III)
10. Exam mouth
11. Say "ahhhh" (IX, X)
12. Bite (V)

Oto/ophthalmo/rhino - scope exam

Auscultate: heart & carotid arteries

Jaw swing (visualize, palpate)

Cervical palpation: masseters/parotids, submandibular glands, submental glands, thyroid, trachea

VBI test (seated or supine)

Neuro: V, Brachial Plexus

Sensory:

- Corneal reflex (V, VII)
- Light touch (face/arms)
- Sharp/dull or pinwheel (face/arms)
- Vibration (DIP, 3rd digit)

DTR:

- Biceps (C5), brachioradialis (C6), triceps (C7), patella (L4), hamstring (L5), Achilles (S1)

Motor: (may be done lying down)

- Deltoid (C5, C6 - axillary)
- Brachioradialis (C5, C6 - radial)
- Biceps (C5, C6 - musculocutaneous)
- Triceps (C6, C7, C8, T1 - radial)
- Wrist extensors (C6, C7, C8 - radial)
- Wrist flexors (C6, C7 - median/ulnar)
- Finger flexors (C7, C8, T1 - ulnar/median)
- Interossei (C7, C8, T1 - ulnar)

Hoffman (or dynamic Hoffman)

Dynamometer (optional)

Girth measurement (arm, forearm)

Seated (have patient turn around)

Cervical palpation:

Preauricular nodes, postauricular nodes, superficial cervical nodes, supraclavicular nodes, SCM, doorbell sign, mastoids, deep cervical chain, suboccipital triangle & nodes, posterior cervical muscles, facets, trapezius, levator scapulae

Note: much of the soft tissue may also be palpated in the supine position

Spinal percussion (C₁-T₆)

Cervical orthopedics:

Muscle test neck
Cervical compression, neutral, maximal
Cervical distraction
Shoulder depression

TOS tests: (if arm/hand symptoms present)

Roo's, Eden's, Wright's

Seated (patient straddles table)

Thoracic rib motion palpation

Supine (Dr. stands/sits at head of table)

Active flexion, passive ROM (includes Soto-Hall), VBI (if not already done), motion palpation (occiput and cervicals), brachial stretch test (if indicated)

Supine (Dr. stands at patient's chest)

upper extremity muscle tests (unless already done in the seated position)

Supine (Dr. stands at foot of table)

Neuro: cord

Sensory in feet:

Light touch, sharp/dull or pinwheel
Vibration (DIP, 3rd digit)

UMN: Babinski (L1 & above)

Motor:

Tibialis anterior (L4, L5 - deep peroneal), Extensor hal. longus, (L4, L5, S1 - deep peroneal), Peroneus longus, (L5, S1 - superficial peroneal)

Adapted, with permission, from Ronald LeFebvre, DC

Vitals

Temperature, pulse, respiration, BP bilaterally

Standing (*out of exam room*)

Height, weight, Snellen eye chart, gait

Standing (*in exam room*)

Toe raises (multiple), heel walk (L5), squat and rise, observe posture

GROM as far as they can go? Pain? Where?

Flexion: (*includes Adam's sign*)

Check lumbopelvic rhythm, Belt test (*if flexion causes pain*), (*Neri's bowing sign & Minor's sign*)

SI motion w/ Trendelenberg, standing crest and trochanteric heights

Seated (*standing in front of patient*)

DTR: patella (L4), hamstring (L5), Achilles (S1)

Motor: (may be done lying down)

Quadriceps muscle test (L3, L4)

Hip flexor muscle test (L1, L2, L3)

Orthopedics

- Seated SLR
- Bechterew's, Deyerle (if (+) Bechterew's)
- Bechterew's+ Linder + Valsalva
- Muscle test trunk rotation & lat. bending

Seated (*patient straddles table*)

Spinal percussion

Kemp's test, if (+), do slump test

Supine (*Dr. stands at foot of table*)

Inspect feet, palpate temperature of feet, dorsal pedis & posterior tibial pulses, leg length (optional), internal/external rotators, Anvil test

Neuro: lumbosacral plexus, cord

Sensory:

Light touch, sharp/dull or pinwheel

Vibration (DIP, 3rd digit)

UMN: Babinski (L1 & above)

Motor:

Tibialis anterior (L4, L5 - deep peroneal)

Extensor hal. longus, (L4, L5, S1 - deep peroneal)

Peroneus longus (L5, S1 - superficial peroneal)

Flexor hallucis brevis (L5, S1)

Supine (*Dr. stands at side of table*)

Hamstring reflex (L5, S1)

Low back/pelvis orthopedics:

- Active/double/passive - SLR
- Bragard, if SLR was (+)
- "Maximal SLR" (SLR + adduction & internal rotation + Bragard + head flexion + Valsalva)
- Bowstring (if SLR leg pain)
- Goldthwaite (if there is back pain)
- Kernig
- Patrick FABER
- Modified LaGuerre (internal & external rotation)
- Hip circumduction
- Thomas (w/ leg off the table)
- Double hip flexion (passive)

Check ASIS height (optional), compress/distract SI, palpate pubic symphysis, Allis'

Leg length measurements:

Greater trochanter to lateral malleolus

Pubic symphysis to medial malleolus

Umbilicus to medial malleolus

Leg girth measurements (thigh & calf)

Abdominal Exam:

Auscultate, percuss, palpate, palpate inguinal nodes, sit up (abdominal strength & Beevor's sign)

Supine (*Dr. stands/sits at head of table*)

- Soto-Hall (Brudzinski's)
- Cervical motion palpation

Side (*Dr. stands near patient's hip*)

- Active abduction
- Gluteus medius test
- Ober's
- SI compression
- Gaenslen's (if not done prone)

Prone (*Dr. stands at foot of table*)

Check leg length

Palpate for calf tenderness

Orthopedics

- Extension (passive, active, resisted)
- Muscle test - glut max, hamstrings
- Nachlas', Ely's, Hibb's, Yeoman's
- Farfan Torsion
- Palpation - entire region

Adapted, with permission, from Ronald LeFebvre, DC

1. Observation/Inspection

- A. Atrophy, asymmetry, antalgia, alignment, abrasion, abscess
- B. Blood, bruising, bone out of place, bumps, burns, bunion, boil
- C. Contusion, color change, consciousness, contour, contracture
- D. Deformity, discoloration, displacement, diaphoresis
- E. Ecchymosis, erythema, edema
- F. Fracture, fungus, furuncle
- S. Scars, swelling, shape, symmetry, size change

2. Fracture Screen

- Older than 55
- Four step test
- Torsion test
- Percussion, light palpation
- 128 Hz tuning fork, ultrasound (optional)

3. Active ROM

NOTE: Steps 1-3 should be performed first, and the following steps may be done depending on the patient's clinical presentation. With more acute and potentially serious injuries a vascular and neurological screen should be done earlier during the physical exam. Don't forget that there is a person attached to the extremity you are examining.

4. Passive ROM**5. Functional Screen****6. Neurological Screen**

- Sensory: light touch (dermatomes), vibration (3rd digit)
- DTR's, Pathologic reflexes
- Muscle tests

7. Vascular Screen

- Pulses, blanching, temperature

8. Palpation (static/motion) Joint Play

- Give an anatomy lesson: bony landmarks, muscles, ligaments, tendons

9. Orthopedics**10. Screen Adjacent Area**

- Observation, AROM, palpation, key orthopedic tests

11. Spinal Screen

Adapted, with permission, from NMS 2 Lab, by M.A. Carnes, DC

Special Considerations

History of wrist sprains/instability?

Observation

Asymmetry, bruising, bumps, color, swelling

Fracture Screen (older than 55?)

1. Thumb in anatomical "snuffbox"
2. Torsion
3. Bony tenderness on palpation
4. Percussion, tuning fork (128 Hz)

AROM**Wrist**

Flexion	(80°)
Extension	(70°)
Ulnar Flexion	(30°)
Radial Flexion	(20°)

Fingers

Flexion (MP)	(90°)
Extension (MP)	(40°)
Abduction	(20°)
Adduction	(20°)

PIP joint

Flexion	(70°)
Extension	(0°)

DIP joint

Flexion	(80°)
Extension	(20°)

Neurologic Screen**Sensory**

Light touch/two point discrimination
Vibration (3rd digit), Tinel's

DTR's

Biceps (C5)
Brachioradialis (C6)
Triceps (C7)

Muscle tests

Flexion, extension, ulnar & radial flexion

Girth measurements

Grip strength (Dynamometer)

Vascular/Pulses/Temperature

- Pulses - brachial, radial, ulnar
- Nail bed blanching, Allen's test
- Temperature

PROM/Joint Play/Palpation**Carpal Bones**

Scaphoid, Lunate, Triquetrum, Pisiform
Trapezium, Trapezoid, Capitate, Hamate
Styloids (radial/ulnar)
Metacarpals (1st-5th)
Phalanges (1st-5th digits)

Snuff Box, Carpal tunnel, thenar/hypothenar pad, triangular complex, collateral ligament.

Muscles/Tendons

Wrist flexors (C7), pronator teres, pronator quadratus, wrist extensors (C6), supinator, thumb extensors, interossei

Orthopedic Tests

- Opposition test (median nerve)
- Froment's test (ulnar nerve)
- Pinch test (median/ulnar nerve)
- Finkelstein's Test
- Thumb grind tests
- Thumb abduction tests
- Scaphoid Fx. test
- Scapholunate ballottement
- Lunate-triquetral ballottement
- Finger stress tests
- Finger flexor tests
- Bunnel-Littler tests
- Retinaculum test

Carpal Tunnel Tests

- Tinel's
- Phalen's (1 min)
- Modified Phalen's
- Reverse Phalen's

Elbow/Shoulder Screen**Spinal Screen**

Special Questions

- Did you fall on outstretched hand? (AC sep. valgus stress overload)
 Overuse? (Medial/lateral epicondylitis)
 Direct trauma? (Pointer, fracture, AC)

Observation

Asymmetry, bruising, bumps, color, swelling, carrying angle

Fracture Screen (older than 55?)

1. Torsion
2. Bony tenderness on palpation
3. Percussion, tuning fork (128 Hz)
4. Ultrasound

AROM

- Flexion 150°
 Extension 0° to -5°
 Pronation 90°
 Supination 80°-90°

Neurological Screen**Sensory**

- Light touch/two point discrimination
- Vibration (3rd digit)
- Tinel's

DTR's

- biceps (C5)
- brachioradialis (C6)
- triceps (C7)

Muscle tests

- Flexion, extension, ulnar & radial flexion, pronation, supination
- Girth measurements
- Grip strength (Dynamometer)

Vascular/Pulses/Temperature

Radial, brachial, blanching, temp

PROM/Joint Play/Palpation

med. epicondyle	extensor tendon
ulnar groove	anconeus
med. collateral lig.	brachioradialis
com. flexor tendon	ext. carpi ulnaris
flexor carpi ulnaris	ext. carpi rad. longus
palmaris longus	ext. carpi rad. brevis
flexor carpi radialis	extensor digitorum
pronator teres	supinator
biceps tendon/apon	triceps tendon
head of radius	triceps muscle
radial tunnel	olecranon
lat. epicondyle	olecranon bursa
lat. collateral lig.	cubital fossa
med. epicondyle	brachialis

Orthopedic Tests

- Valgus stress (0°) – forearm supinated
- Valgus stress (30°)
- Varus stress (0°) – forearm pronated
- Varus stress (30°)
- Cozen's test
- Mill's Test
- Middle finger test
- Book lift test
- Reverse Cozen's
- Reverse Mill's
- Tinel's (wrist)
- Tinel's (elbow)
- Elbow flexion test
- Pronator stretch test
- Sustained flexion test

Wrist/Shoulder Screen**Spinal Screen**

Special Questions

- Did you fall on outstretched hand?
- Overuse/overhead work? (Impingement)
- Direct trauma? (Pointer, fracture, AC)

Observation

- Asymmetry, bruising, bumps, color, swelling, height, head tilt, winging

Fracture Screen (older than 55?)

1. Torsion
2. Bony tenderness on palpation
3. Percussion, tuning fork (128Hz)
4. Ultrasound

AROM

- Flexion 180°
- Extension 50°
- Int./ext. rotation 90°/80°
- Abduction 180°
- Adduction 30°
- Horizontal Add./Abd. ... 110°/30°
- Scapulocostal rhythm (see page 46-47)

Neurological Screen**Sensory**

- Light touch, two point discrimination
- Vibration (3rd digit), Tinel's

DTR's

- Biceps (C5)
- Brachioradialis (C6)
- Triceps (C7)

Muscle tests

- Flexion, extension, ulnar & radial flexion
- Girth measurements
- Grip strength (Dynamometer)

Vascular/Pulses/Temperature

- Radial, brachial, blanching, temp

PROM/Joint play/Palpation

- Scalenes, SCM, SC (sup/inf, ant/post, rot), pec (maj/min), clavicle, AC (ant/post, inf), coracoid, humerus (gr/less tub), GH (ant/post, inf, lat, int/ext rot), deltoid (bursa/tuberosity), S.I.T.S., traps, lev scap, rhomboids, lat. dorsi, triceps, biceps

Muscle Testing**Sitting:**

- supraspinatus, infraspinatus, teres minor, int/ext rot x2, neckx4, SCM, lev scap, trap.

Supine: deltoids, serratus ant, pec maj/minor, lat. dorsi, biceps, triceps

Prone:

- subscapularis, teres major, trap, rhomboids

Side:

- Scapula (sup/inf, med/lat glide, med/lat rot, protraction/retraction, distraction)

Orthopedic Tests**Screening**

- Apley's scratch
- Codman's arm drop
- Dugas

Impingement

- Hawkins-Kennedy
- Impingement sign
- Painful arc
- Passive Neer's test

Biceps tendonitis

- Hyperextension
- Speed's
- Yergason's
- Mod Yergason's

Rotator cuff

- Empty can
- Mod empty can

Labral tear (SLAP lesion)

- Hyperabduction
- Clunk
- Crank
- O'Brien's muscle test

Glenohumeral joint stability

- Ant/post drawer
- Ant/post apprehension
- Load and shift

Spinal Screen

Special Considerations

History of ankle sprains/instability?
Immediate swelling? (hemarthrosis)

Observation

Asymmetry, bruising, bumps, color, swelling

Fracture Screen (older than 55?)

1. Torsion
2. Bony tenderness on palpation
3. Percussion, tuning fork (128 Hz)
4. "4 step test"

AROM

Plantar flexion40°
Dorsiflexion20°
Inversion20°
Eversion 10°
Internal rotation
External rotation

Functional Screen

Walk on toes/heels, squat and rise, touch toes, stand on one leg, forward stork, swayback stork, hop in place, turn in place

Neurologic Screen**Sensory**

- Light touch/two point discrimination
- Vibration (3rd digit)
- Tinel's

DTR's

- Patellar (L4)
- Hamstring (L5)
- Achilles (S1)

Muscle tests

Plantar flexion, dorsiflexion, inversion, eversion, great toe-extension/flexion

Vascular/Pulses/Temperature

- Pulses - femoral, tibial, dorsal pedal
- Blanching, Buerger's claudication test
- Temperature

PROM/Joint Play/Palpation

Give an anatomy lesson, bones ligaments, tendons, plantar fascia, etc.

Orthopedic Tests

- Anterior drawer/plantar flexed
- Anterior drawer/neutral
- Inversion talar tilt (neutral)
- Inversion talar tilt (plantar flex)
- Eversion talar tilt
- Rotational stress
- Simmond's/Hoffa's sign
- Simmond's/Thompson's test
- Achilles squeeze
- Morton's foot squeeze
- Calcaneal squeeze (x3)
 1. Sides of calcaneus
 2. Calcaneal tuberosity
 3. Medial calcaneal tuberosity
- Homan's sign/calf squeeze
- Tinel's sign

Knee Screen

- PROM/AROM
- Lachman's
- MacIntosh
- Varus/valgus stress
- Crepitis

Hip Screen

- PROM/AROM
- Anvil test
- Passive circumduction
- LaGuerre's
- Patrick (FABERE)

Spinal Screen

Special Questions

- Does it ever buckle, lock, grind, catch?
Do you have pain going up/down stairs?
Any swelling? (Onset - sudden/slow)

Observation

Asymmetry, bruising, bumps, color, swelling,

Fracture Screen (older than 55?)

1. Torsion
2. Bony tenderness on palpation
3. Percussion, tuning fork (128 Hz)
4. "4 step test"

AROM

- Flexion 150°
Extension 0° to -5°
Internal rotation 5°
External rotation 5°

Functional Screen

Walk on toes/heels, squat and rise, touch toes, stand on one leg, forward stork, swayback stork, one leg hop in place, one leg turn in place

Neurological Screen**Sensory**

- Light touch (dermatomes)
Vibration (3rd digit)

DTR's

- Patellar (L4)
- Hamstring (L5)
- Achilles (S1)

Muscle tests

Quads, hamstrings, internal rotation, external rotation

Girth (atrophy)**Vascular/Pulses/Temperature**

- Pulses - femoral, tibial, dorsal pedal
- Nail bed blanching
- Temperature

PROM/Joint Play/Palpation

Patella (facets/bursa/inf. tendon/retinaculum), joint line (meniscus), int/ext rot, ant/post glide, collateral ligs, all 4 condyles, fib head, ant/post/sup/inf tib glide, bicep femoris, Gerdy's tub (insertion of IT band), tibial tuberosity, pes anserine (sartorius, gracilis, semitendinosus), popliteal fossa, gastroc heads, popliteus (lat-med), Baker's cyst, saphenous vein, adductor canal, quads.

Orthopedic Tests**Patella**

- Ballottement (A-P)
- Bounce home (hand on popliteal fossa)
- Bulge/sweep
- AP grinding
- Facet (medial/lateral apprehension test)
- Modified Clark's (hold pat, contract quad)
- Step-up test
- Renne (Nobel while weight bearing)

Plica

- Active stutter (sitting active flex)
- Houston's push off (med apprehen while passive flex, supine).

Meniscus

- Wilson's (sit, ext while palp popliteal fossa)
- Steinman's (palp joint with passive ext/flex, supine)
- McMurray's
- Apley's compression/distraction, hyperflexion

Ligament stress

- Valgus/varus stress (30° & 0°)
- Wobble test
- Post sag sign
- Recurvatum (hyperextension)
- Ant/post drawer (3 parts - int/ext rotation Slocum's, active)
- Lachman's
- Macintosh (pivot-shift) test

Ankle/Hip Screen

AROM/PROM, Anvil test, passive circumduction, LaGuerre's, Patrick (FABER)

Spinal screen

Special Questions

Hx of hip pain or Degeneration/Arthritis?

Observation

Asymmetry, bruising, bumps, color, swelling, height, leg length

Fracture Screen (older than 55?)

1. Torsion
2. Bony tenderness on palpation
3. Percussion, tuning fork (128cps)
4. Ultrasound

AROM

Flexion80°-90° (straight leg)
 Extension30°
 Internal rotation40°
 External rotation50°
 Abduction50°
 Adduction30°

Functional Screen

Walk on toes/heels, squat and rise, touch toes, stand on one leg, forward stork, swayback stork, hop in place, turn in place

Neurologic Screen**Sensory**

- Light touch/two point discrimination
- Vibration (3rd digit)

DTR's

- Patellar (L4)
- Hamstring (L5)
- Achilles (S1)

Muscle tests

Flexion, extension, internal rotation, abduction, adduction

Vascular/Pulses/Temp

- Pulses - femoral, tibial, dorsal pedal
- Nail bed blanching
- Buerger's claudication test

PROM/Joint Play/Palpation

Give an anatomy lesson, bones, ligaments, tendons, bursa, etc.

Orthopedic Tests

- Trendelenburg
- Standing stork
- Heel walk
- Toe walk
- Toe touch
- Squat & rise
- Anvil
- Alli's sign
- Patrick (FABER)
- Laguerre's
- int rot/add/circumduction/scouring
- SI - distraction / compression
- Straight Leg Raise (SLR)
 1. Active
 2. Passive
 3. Double
 4. Maximal
- Bragard's
- Valsalva / Naffziger
- Ober / Nobel / Renné's
- Nachlas'
- Ely's
- Hibb's
- Yeoman's
- Gaenslen's / Thomas
- Kemp's

Ankle/Knee Screen**Spinal Screen**

Key History Considerations

1. Headache
2. Head injury
3. Dizziness/vertigo
4. Seizures
5. Tremors
6. Weakness and/or incoordination
7. Numbness or tingling
8. Difficulty swallowing
9. Difficulty speaking
10. Significant past history
11. Environmental hazards

Mental Status (brain/cortex)

Behavior? (Alert, lethargic, confusion, speech)

History? (Gather info. from family & friends)

Orientation (Time, person, place & situation)

Memory/Concentration

- Name President, 3 word/place recall
- (100) - (7) up to five times (93, 86, 79...)

Cranial Nerves (brainstem) see page 243

1. Smell (I)
2. Cardinal fields of gaze (III, IV, VI)
3. Accommodation (III)
4. Peripheral vision (II)
5. Facial expression (VII)
6. Stick out tongue (XII)
7. Trap/SCM muscle test (XI)
8. Hearing (VIII) if (+): Webber, Rinne
9. Consensual light reflex (II, III)
10. Exam mouth
11. Say "ahhhh" (IX, X)
12. Bite (V)

Ophthalmoscopic exam

Otoscopic exam

Rhinoscopic exam

Cerebellum (RADAR)

Rapid alternating movements

- Finger, hand, foot tapping
- Rapid forearm pronation/supination

Accessory movements

- Intentional tremors
- Nystagmus

Dysmetria (past pointing)

- Finger to nose, finger to finger
- Heel to shin

Ataxia

- Gait - heel to toe, walk in a circle

Rebound phenomenon

- Holme's sign (let go of resistance = hit self)

Spinal Cord & Peripheral Nerves**SENSORY***Posterior Columns*

- Light touch (fasciculus gracilis/cuneatus)
- Vibration (128Hz tuning fork)
- Stereognosis (ID object by touch)
- Graphesthesia (ID number written on skin)
- Proprioception (dorsospino-cerebellar Tract)
 - Romberg (eyes closed)
 - Position changes

Lateral Columns (spinothalamic tract)

- Pain - sharp/dull
- Temperature - hot/cold

MOTOR (corticospinal tract)

- Deltoid (**C5**, C6) (axillary)
- Brachioradialis (C5, C6) (radial)
- Biceps (C5, **C6**) (musculocutaneous)
- Triceps (C6, **C7**, C8, T1) (radial)
- Wrist extensors (**C6**, C7, C8) (radial)
- Wrist flexors (C6, **C7**) (median/ulnar)
- Finger flexors (C7, **C8**, T1) (ulnar/median)
- Interossei (C7, C8, **T1**) (ulnar)
- Tibialis anterior (**L4**, L5) (deep peroneal)
- Extensor hallucis longus (L4, **L5**, S1) (deep peroneal)
- Peroneus longus (L5, **S1**) (superficial peroneal)

REFLEXES

Deep Tendon Reflexes (DTR):

- Biceps (C5)
- Brachioradialis (C6)
- Triceps (C7)
- Patella (L4)
- Hamstring (L5)
- Achilles (S1)

Superficial

- Abdominal - umbilicus moves to stimulus
- Cremasteric, Perianal wink

Pathologic

- Hoffman's (clawing of hand w/ finger flick)
- Babinski & Babinski-like reflexes

Nerve Root Tension Orthopedic Tests

SLR, Braggard's, Bowstring, etc

Shoulder depression, Brachial stretch, doorbell sign, etc

Sequence of an Abdominal Exam

(Proper patient position – knees bent, head raised - pillow)

1. **Observation**
 - Skin, symmetry, contour, visible peristalsis, respiratory movement
2. **Auscultation**
 - 4 quadrants for 15-30 sec each
 - Bowel sounds, vascular sounds, friction rubs, muscle hums
3. **Percussion**
 - Sizing of liver and spleen, detection of ascites, Murphy's punch
4. **Light Palpation**
 - Muscle tone, masses
5. **Deep Palpation**
 - Abdominal aorta, spleen, liver, gall bladder, kidneys, rebound tenderness
 - Abdominal aorta should be 2.5-4.0 cm in diameter
6. **Strength** (sit-up, Beevor's sign)

Right Upper Quadrant

Liver
 Gall bladder
 Duodenum,
 Head of pancreas
 Right adrenal gland
 Portion of right kidney
 Hepatic flexure of colon
 Portions of ascending and transverse colon

Left Upper Quadrant

Left lobe of liver
 Spleen
 Stomach
 Body or pancreas
 Left adrenal gland
 Portion of left kidney, splenic flexure of colon
 Portions of transverse and descending colon

Right Lower Quadrant

Lower pole of right kidney
 Cecum and appendix
 Portion of ascending colon
 Ovary and salpinx
 Uterus
 Right spermatic cord
 Right ureter

Left Lower Quadrant

Lower pole of left kidney
 Sigmoid colon
 Portion of descending colon
 Ovary and salpinx
 Uterus
 Left spermatic cord
 Left ureter

See page 207 Abdominal Pain

Proper Technique

1. Pt. seated, back supported, arms bare & supported at heart level
2. Pt. should not smoke or ingest caffeine before measurement, should start after 5 min of rest
3. **Take palpatory BP first:** check for auscultatory gap (if present may indicate ↑risk of CVD)
4. Sphyg. needle descent rate should be: 2-3 mmHg/sec
5. **Major hypertension risk factors:** smoking, dyslipidemia, diabetes mellitus, age > 60 yrs, male & post-menopausal women, women < 65 yrs. or men < 55 yrs.

Record key Historical Findings

Analyze pt. history, look for:

- Causes of secondary hypertension (uncommon, 10% of cases)
- Target organ damage and/or cardiovascular disease (CVD) (see Hypertension page 222)
- Other risk factors for CVD or concomitant disorders (eg. diabetes)

Stage of Hypertension

Within Normal Limits		Systolic	Diastolic	Follow-up
	Optimal	<120	<80	
	Normal	<130	<85	2 years
	High Normal	130-139	85-89	1 year
Hypertension				
Stage 1	Mild HTN	140-159	90-99	2 months
Stage 2	Moderate HTN	160-179	100-109	1 month
Stage 3	Severe HTN	180+	110+	1 week

Sources of Error

Factor: examination	Systolic BP change	Diastolic BP change
Cuff too narrow	-8 to +10 mmHg	+2 to +8 mmHg
Elbow too low	+4 mmHg	
Cuff over clothing	+5 to +50 mmHg	
Back unsupported	+6 to +10 mmHg	
Arm unsupported	+1 to +7 mmHg	+5 to +11 mmHg
Factor: examinee	Systolic BP change	Diastolic BP change
'White coat' HTN	+11 to +18 mmHg	+3 to +15 mmHg
Recent tobacco use	+6 mmHg	+5 mmHg
Recent caffeine use	+11 mmHg	+5 mmHg
Distended bladder	+15 mmHg	+10 mmHg

Significant Difference Arm to Arm

- Normal to have difference of up to 10mmHg between two arms
- If difference is greater than 10mmHg, there is some sort of occlusion of the arteries in the arm with the lower reading or the reading was performed incorrectly

Dx of Hypertension Based On

- **6 consecutive readings** over at least three consecutive visits (2 each visit – at start & end)

Pulse Pressure & Significance

- Systolic minus diastolic, helps control what blood gets to tissues (should stay ~40 mmHg)
- High pulse pressure = high stroke volume, possibly due to stimulants, fever, anemia, pregnancy
- Low pulse pressure means low stroke volume, due to sleep and/or stenosis

Procedure

1. Patient is relaxed
2. Moderately stretch muscle to be tested
3. Use a quick, precise stimulus
4. *Jendrassik Maneuver* may be required
 - Isometric contraction at another location to distract patient
5. **Compare results bilaterally**
6. Note presence or absence of *Clonus*
Clonus: a repeating reflex with alternate muscular contraction & relaxation in rapid succession

Note: some elderly patients will have decreased or complete lack of an Achilles reflex

Reflex Grading Scale

Based on Wexler scale

GRADE	DESCRIPTION
5+	Hyperreflexia - sustained clonus
4+	Hyperreflexia - transient clonus
3+	Hyperreflexia
2+	Normal (lower half of range)
1+	Hyporeflexia (trace response)
0	Absent / no response

Lower Extremity**Patellar (L4)**

Afferent Nerve: Femoral Nerve

Level: L3 & L4

Efferent Nerve: Femoral Nerve

Normal: brisk contraction of quadriceps muscle & extension of the leg at the knee.

Hamstrings (L5)

Afferent Nerve: Sciatic Nerve

Level: L5 & S1

Efferent Nerve: Sciatic Nerve

Normal: brisk contraction of hamstring muscle.

Achilles (S1)

Afferent Nerve: Tibial Nerve

Level: S1 & S2

Efferent Nerve: Tibial Nerve

Normal: brisk contraction of the gastrocs & soleus muscles & plantar flexion of the foot.

Upper Extremity**Biceps (C5)**

Afferent Nerve: Musculocutaneous Nerve

Level: C5 & C6

Efferent Nerve: Musculocutaneous Nerve

Normal: brisk contraction of biceps muscle & flexion of the forearm at the elbow.

Additional Response: brachioradialis DTR

Brachioradialis (C6)

Afferent Nerve: Radial Nerve

Level: C5 & C6

Efferent Nerve: Radial Nerve

Normal: brisk contraction of brachioradialis muscle & supination of the forearm.

Additional Response: biceps DTR

Triceps (C7)

Afferent Nerve: Radial Nerve

Level: C6 & C7

Efferent Nerve: Radial Nerve

Normal: brisk contraction of triceps muscle & extension of the forearm at the elbow.

Hyporeflexia

Diminished to absent DTRs

Potential Causes:

1. **Technique error** (most common)
2. **LMNL** (Lower Motor Neuron Lesion)
3. **Peripheral neuropathy** (common)
 - Diabetic neuropathy
 - Carpal tunnel syndrome & median nerve
 - Brachial, Lumbar plexus – neurogenic
4. **Radiculopathy (nerve root – disc lesions)**

Hyperreflexia

Increased or hyper active DTRs

Potential Causes:

1. **UMNL** (Upper Motor Neuron Lesion)
2. **Clonus**

Where to hear each valve**A PET Monkey** (mnemonic)**A**ortic – right 2nd intercostal space**P**ulmonic – left 2nd intercostal space**E**rb's point – can hear certain insufficiencies and regurgitation's here**T**ricuspid – left 4th or 5th intercostal space, near sternum**M**itral – left 4th or 5th intercostal space, along the mid-clavicular line**S1 (1st heart sound) 'Lub'**

- Closure of mitral and tricuspid valves

S2 (2nd heart sound) 'dup'

- Closure of aortic and pulmonic valves
- Physiologic splitting of S2 may occur because of decreased intrathoracic pressure delaying closure of Pulmonic valve - ∴ S2 may sound split – during inspiration

PMI (point of maximum impulse)

- 5th left intercostal space at mid-clavicular line
- Normal for 50% of population to have a PMI, but brief and smaller than the size of a quarter (2 cm in diameter)
- If PMI larger or sustained, may indicate left ventricular hypertrophy
- If apical beat is displaced beyond left mid-clavicular line, may indicate left ventricular dilation ("decompensation")

Common Murmurs**Aortic Stenosis**

- 'Harsh' sounding systolic murmur
- 'Jet-like' ejection of blood intensely vibrates aortic wall
- Common features:
 - Left ventricular hypertrophy
 - Chronic ↑ in blood volume

Aortic Regurgitation

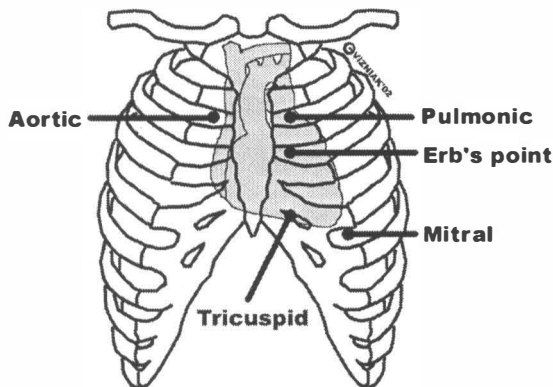
- 'Blowing' type of diastolic murmur
- Aortic valve does not completely close resulting in blood flowing from aorta back into left ventricle during diastole
- Common features:
 - Left ventricular hypertrophy

Mitral Stenosis

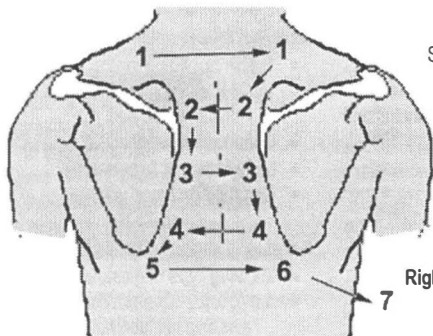
- 'Weak' sounding diastolic murmur
- Best heard during mid/late diastole
- Blood has a hard time going from left atrium to left ventricle
- May get left ventricular hypertrophy

Patent Ductus Arteriosus

- Murmur heard during both systole and diastole



Refer to page 225 Recurrent Chest Pain DDx



Sample method for lung auscultation.

Right middle lobe, anterior to mid-axillary line

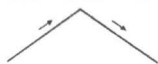
Normal Lung Phonics

Bronchial



1:2 = inspiration: expiration (harsh)
Harsh and loud
Heard best on expiration over central major airways
Originate from trachea and primary bronchi

Bronchovesicular



1:1 inspiration: expiration (medium)
Medium pitch and intensity
Heard equally in inspiration and expiration
Originate from larger bronchi

Vesicular or Alveolar



5:2 inspiration: expiration (rustle)
Soft, low-pitched, breezy sounds
More pronounced during inspiration
Most noticeable in peripheral lung, away from trachea and larger bronchi
Originate from lung parenchyma, terminal respiratory bronchioles, alveoli

Pathological Lung Phonics

Rales (crackles)

- Discontinuous sounds apparently caused by air passing through accumulated moisture (fluid)
- Rales are most often heard during inspiration
- Fine rales seen in pulmonary edema or congestive heart failure
- Course rales seen with resolution stage of lobar pneumonia

Rhonchi (wheezes)

- Continuous sounds from air passing through narrowed airways
- More often heard during expiration
- **Polyphonic wheezes** (sibilant rhonchi) seen in asthma
- **Monophonic wheezes** are seen in obstruction
- **Sonorous rhonchi** (low-pitched) seen with excess mucus production of chronic bronchitis

Stridor - high pitched, monophonic, inspiratory, louder in neck than over chest wall. (Croup, foreign body aspiration or some tumors)

Pleural friction rub - pleurisy, specific sound, course and low pitched

Fremitus - vibration (squeaking) of chest wall due to rubbing of inflamed pleural surfaces

Refer to page 224 Common Lung Pathology DDx

See chapter 10 for specific muscle tests

Grading System

Grade		Definition
5	Normal	Complete ROM against gravity with full resistance
4	Good*	Complete ROM against gravity with some resistance (Reduced fine movements and motor control)
3	Fair*	Complete ROM against gravity but no resistance
2	Poor*	Complete ROM with gravity eliminated
1	Trace	Evidence of slight contractility (No joint motion or inability to achieve complete ROM with gravity eliminated)
0	Zero	No evidence of contractility (flaccid paralysis)

ROM = range of motion; *Muscle spasm or contracture may limit ROM. Place question mark after grading a movement that is incomplete from this cause. Chart as a rating out of 5; 5/5, 4/5, 3/5, 2/5, 1/5, 0/5

Muscle	Cord level	Peripheral nerve
Deltoid	<u>C5</u> , C6	Axillary
Brachioradialis	C5, C6	Radial
Biceps	C5, <u>C6</u>	Musculocutaneous
Triceps	C6, <u>C7</u> , C8, T1	Radial
Wrist flexors	C6, <u>C7</u>	Median/ulnar
Wrist extensors	<u>C6</u> , C7, C8	Radial
Finger flexors	C7, <u>C8</u> , T1	Ulnar/median
Interossei	C7, C8, <u>T1</u>	Ulnar
Tibialis anterior	<u>L4</u> , L5	Deep peroneal
Extensor hallucis longus	L4, <u>L5</u> , S1	Deep peroneal
Peroneus longus	L4, L5, <u>S1</u>	Superficial peroneal

Muscle Length Evaluation

1. How far will the joint move?
2. How tight does it feel?
3. Compare bilaterally
4. Look for early movements in other areas of the body

Chart as: e.g.: bilateral hams. Tight, R>L

Soft Tissue Tenderness Grading***

Grade	Description
0/4	No tenderness
1/4	Tenderness with no physical response
2/4	Tenderness with grimace and/or flinch
3/4	Tenderness with withdrawal (+ jump sign)
4/4	Withdrawal to non-noxious stimuli

***Tenderness grading pressure should be just enough to blanch Dr.'s nail bed

Peripheral Pulses

- Radial, brachial, ulnar
- Carotid
- Femoral, popliteal, dorsal pedis, posterior tibial

Normal

Children 90-110 bpm

Adult 70-80 bpm

Bradycardia < 60 bpm

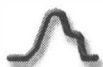
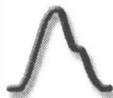
Tachycardia > 100 bpm

Pulse Parameters

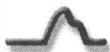
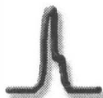
1. **Beats per minute** (bpm)
2. **Quality** – strong, weak, good, thready
3. **Regularity** – regular, regularly irregular, irregularly irregular (monitor 1 min. if irregular)

Pulse Documentation (Pulse amplitude/strength)

- 4+ Hyperkinetic or bounding:** pulsus magnus (↑ cardiac output) may be noted during strenuous activity or cardiovascular pathologies
- 3+ Increased or full**
- 2+ Normal:** pulse is as expected
- 1+ Barely palpable:** pulsus parvus (low pulse pressure)
- 0 Absent:** not palpable

**Normal****Pulsus magnus** – a 'bounding' or 'hyperdynamic' pulse (3+ or 4+).

Suggests increased cardiac output, which should be accompanied by a wide pulse pressure (<40mm Hg) when taking BP

**Pulsus parvus** – a weak pulse (1+). Suggests decreased stroke volume and should be accompanied by a narrow pulse pressure**Pulsus alternans** – alternates in amplitude from beat to beat, early sign of left ventricular failure**Pulsus celer** – sharp rise & quick collapse (3+ or 4+), suggests aortic regurgitation (aortic insufficiency)**Pulsus tardus** – (plateau pulse) slow rising and weak (1+), suggests aortic stenosis

Sequence of Ophthalmic Exam**1. Red Reflex****2. Cup/Disc**

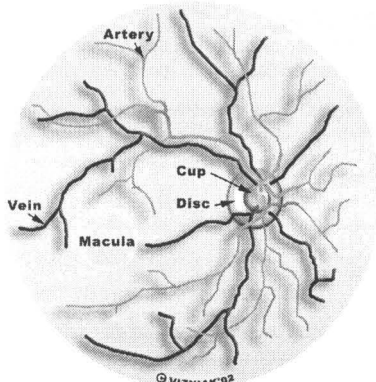
- Disc margins well defined
- Cup: disc ratio = 1:2

3. Tracing Blood Vessels

- Arteries are smaller & lighter than veins

4. Macula

- Have pt. look into light
- Darker area of retina

5. Dial Out (anterior chamber)**Common DDx****Optic disc bulging**

Papilledema, hypertensive retinopathy

Optic disc cupping

Glaucoma, usually chronic open-angle

Diabetes

Diabetes affects the veins more than the arteries

1. During early venous stasis

- Microaneurysms
- Dot & blot hemorrhages

2. During late venous stasis

- Hard exudates (lipoid exudates)
- Soft exudates (cotton wool spots)
- May lead to regional hypoxia

Non-proliferative diabetic retinopathy

Proliferative diabetic retinopathy
(neovascularization)

Hypertension

Hypertensive retinopathy affects the arterioles
more than the veins

Stage	Changes
I	<ul style="list-style-type: none"> • copper wire deformities
II	<ul style="list-style-type: none"> • A-V nicking • Silver wire deformities • Flame / splinter hemorrhages
III	<ul style="list-style-type: none"> • Soft exudates or • Cotton wool spots
IV	<ul style="list-style-type: none"> • Perivascular sheathing

Papilledema

1. Early: hyperemic disc, congested retinal veins, indistinct disc margins, 'splinter hemorrhages'
2. Late: obliterated physiologic cup, flame hemorrhages, soft & hard exudates, ↑ visual field deficits, blindness
3. Patient SSx: usually painless, bilateral, pt. may notice transient episodes of blurred vision

Glaucoma

1. ↑ Cup: disc ratio, nasal displacement of retinal vessels, ↑ loss of peripheral vision, optic nerve atrophy, blindness
2. Glaucoma begins with loss of peripheral fields, especially superior & medial
3. Problem is ↑ intraocular pressure

Absent Red Reflex

Usually not absent, but diminished

1. This is the reflection of the retina
2. Make sure that during the exam, you compare the red reflex bilaterally, as this is the only way to know whether the red reflex is diminished or not
3. Possible causes: cataracts or a tumor, such as a *retinoblastoma*

Optic Disc Atrophy

1. Optic disc becomes gray or white
2. Patient complains of a marked loss of vision
3. Atrophy is usually secondary to another disease -long standing papilledema, optic neuritis, optic nerve compression, glaucoma, retinal degeneration, trauma, neurosyphilis, & some drugs.

Otoscopy

Adult: traction pinna posteriorly & superiorly

Infant: traction ear inferiorly (perhaps posteriorly)

Pneumatic Otoscopy

Use insufflation bulb

Normal:

- Membrane moves briskly in and out with ease
- ↓ Motion normal in infants younger than 7 months

Abnormal:

- Sluggish or absent response may indicate presence of fluid behind membrane

Disorders of Membrane

Scarring:

Collagen scar formation (white & chalky)

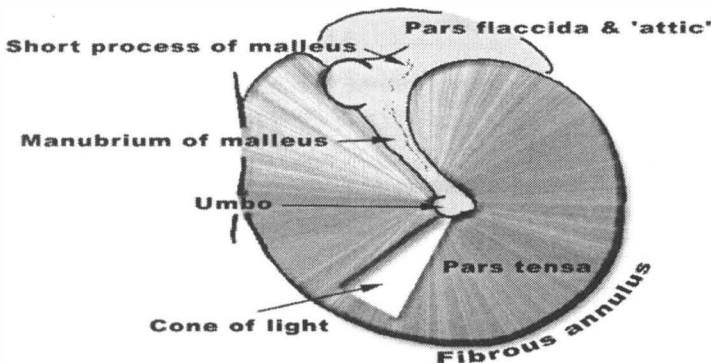
Myringosclerosis – often late result of acute otitis media (white-yellowish plaques)

Tympanosclerosis – deposition of hyaline within middle ear

Cholesteatoma: potentially lethal, high incidence with marginal & attic perforations

Pt. presents with:

- Otorrhea (discharge)
- Conductive hearing loss
- Apparent perforation
- Epithelial debris in ear canal



Tympanic Membrane

Landmarks

- Short process of malleus (lateral process)
- Manubrium of malleus ('handle')
- Umbo
- Cone of light (light reflex)
- Red reflex (vascular strip that supplies tympanic membrane)

Perforations of Membrane

'Central' – involve Pars tensa, heal more easily

'Marginal' – involve Fibrous Annulus, much less easily healed

'Attic' – involve Pars Flaccida, much less easily healed

Large central – involve fibrous stratum, more prone to re-perforation

Other Disorders

Ramsey Hunt Syndrome: herpetic lesion of pinna, external canal, tympanic membrane, middle & inner ear,

Patient presents with: excruciating ear pain, sensory neural hearing loss (CN VIII), Facial nerve palsy (CN VII)

Bullous Myringitis: non-bacterial infection of tympanic membrane (Mycoplasma pneumonia, Herpes zoster),

Patient has otalgia (ear pain), conductive hearing loss, swollen/ distorted tympanic membrane, self limiting – resolves in ~3 weeks

Initial (patient seated)

- Palpate costovertebral angle for tenderness
- Murphy's Punch

Patient Supine (knees bent)

- Drape lap
- Inspect skin (skin lesions, scars, rashes)
- Light & deep palpation of kidney (bimanual palpation) & bladder (percuss - inferior to superior)

Patient Standing**Inspection**

- Pubic hair pattern, parasites, rashes, lesions, all surfaces of penis & scrotum (symmetry, rashes, urethral discharge)

Note: most cancers of the penis are at coronal sulcus

Penis palpation

- Open meatus (discharge, color)
- Base to glans (tenderness, strictures, nodules)
- Milk penis (open meatus & observe for discharge)

Scrotal Palpation (have patient lift penis)

- Examine scrotum (rashes, swelling, rugae)
- Palpate testes
 1. Normal: smooth, rubbery, free of nodules
 2. Masses: tumor, infection, cystic changes
 3. Transillumination
 - (+) → hydroceles, spermatoceles
 - (-) → tumor, indirect hernia, hematoceles
 4. Increased testis weight → testicular cancer
- Light pressure - decreased sensitivity → syphilis or diabetic neuropathy
- Epididymus (masses, nodules, tenderness)

Hernia Exam

Observe for swelling in inguinal region while pt. coughs

Palpation

- Place fingertip at most dependent portion of scrotum
- Invaginate scrotal wall to external inguinal ring
- Gently insert finger into canal along spermatic cord
- Move finger laterally & cephalad
- Patient coughs, strains or performs valsalva

Hernia exam continued...

Findings

- Small Indirect Hernia may slightly tap end of finger
- Large Indirect Hernia may be palpable as mass
- Direct Inguinal Hernia may be felt on pad of finger
- Spermatic cord tenderness (Funiculitis)

Prostate Exam (Dr. seated & gloved)

Address patient's anxiety about exam

Position pt. (knee chest, left lateral Sims, or bent over table)

- Separate buttocks & inspect (lumps, rashes, inflammation, pilonidal cysts, tufts of hair, tags, warts, hemorrhoids, fissures, fistulas)
- Lubricate finger (KY jelly), press pad to anal opening, ask pt. to bear down (open anal sphincter)
- Check anal tone (pt. tightens anal sphincter around finger)
 1. Increased tone → scarring, spasticity, fissures, inflammation, anxiety
 2. Decreased tone → neurologic deficit

Prostate palpation

Inform patient: "You may feel the urge to urinate but you won't"

- Normal prostate
 1. Symmetrical, firm, smooth
 2. Size: 4 cm side to side
 3. Median sulcus should be palpable
 4. Refer if increased size, nodules found
- Prostate massage
 1. Lateral to medial bilaterally
 2. first strokes deep, subsequent closer to anal opening
 3. Secretions should be cultured & examined
- Rectal sweep (masses, nodularity, polyps, tenderness)

Anoscope

- Abnormal finding should be referred for evaluation
- Assist patient to comfortable position & provide tissue & privacy to dress

Initial (patient seated)

- Palpate costovertebral angle for tenderness
- Murphy's Punch

Patient Supine (feet in stirrups)

- Drape lap
- Inspect skin (skin lesions, scars, rashes)

Speculum Exam

- Warm speculum before insertion
- Insert specula with blades in vertical position
- After insertion rotate blades to horizontal
- Separate blades, lock in place
- Visualize cervix (size, color, discharge, ulcerations)
- Make slide preparation for PAP smear (cotton applicator or Ayres spatula)
- As you withdraw the speculum, inspect vaginal walls

Bimanual Exam

- Lubricate & insert index & middle fingers into vagina
- Palpation
 - Vaginal walls, base of bladder, urethra
 - Labia majores, Bartholin's glands
 - Cervix, anterior wall or rectum
- Place free hand on external abdomen
- Flex internal fingers & palpate
 - Uterus (size, shape, mobility)
 - Ovaries (adnexal region – size, shape, tenderness)
- Remove inserted fingers, relubricate
- Insert index finger into vagina & index finger into rectum as patient bears down
- Palpate vaginal & rectal walls (note presence of masses or in consistencies)
- Remove fingers and keep gloved hand out of patients line of sight

Assist patient to comfortable position & provide tissue & privacy to dress

Refer to appropriate physician if indicated

General Information

Focus history on

- Self breast exam performance
- Breast lump
- Nipple discharge
- Skin changes
- Breast pain

High risk areas for breast cancer

1. Upper outer breast (most common)
2. Sub-areolar (deep to areola) (second most common)

Risk factors associated with breast cancer

- Beginning menstruation early &/or late menopause
- No children or children born after age 30
- History of fibrocystic disease
- Family history of breast cancer

Timing of Exam

Optimal during follicular phase - one week after onset of menstruation (days 5-10)

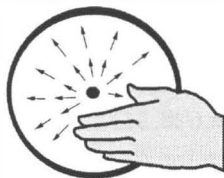
- Less engorgement, more comfortable

Technique (patient supine)

Use pads of the 1st-3rd fingers
Start with light, then medium,
then deep pressure

Palpation PatternsWedge Pattern

"Spokes of a wheel" or
"Hands of a clock"
Palpate in radial pattern
around breast



Focus breast palpation on:

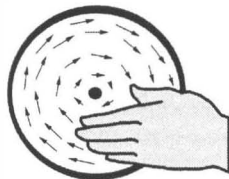
- Background nodularity (fibroadenomas)
- Asymmetry
- Dominant mass
- Nipple discharge

Vertical Strip

Similar to plow lines on a field

Circular Pattern

Spiral pattern from nipple to outer breast

**Breast Examination Schedule****Age 20 – 35**

- Breast self-exam once a month, one week after onset of menstruation
- Physical Exam Yearly

Age 35 – 40

- Breast self-exam once a month, one week after onset of menstruation
- Baseline mammography
- Physical exam yearly

Age 40 – 50

- Breast self-exam once a month, one week after onset of menstruation
- Mammography every one to two years
- Physical exam yearly

Age 50 +

- Breast self-exam once a month, one week after onset of menstruation
- Post-menopausal women - the same day each month

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Additional Recommended Information Resource:

Refer to the Western States Chiropractic College Clinics - Conservative Care Pathways
Clinical Standards, Protocols, and Education (CSPE)
Order through - <http://www.wschiro.edu/>

II Diagnosis & Treatment

Four Part Diagnosis	38
Joint Motions	39
Segmental Spinal Motion.....	40-41
Spinal Joint Listings.....	42
Gait Types	43
Gait Cycle	44-45
Scapulohumeral Rhythm	46-47
KMP: Hip Extension.....	48-49
KMP: Hip Abduction	50-51
KMP: Trunk Flexion	52-53
KMP: Shoulder Motion.....	54-55
KMP: Neck Flexion.....	56-57
Clinical Impression.....	58
Outcome Markers & Prognosis	59
Narrative Report	60-61
Sample Verbiage	62
Report of Findings	63
Adjustments Cervical.....	64
Adjustments Thoracic & Costal.....	65
Adjustments Lumbar.....	66
Adjustments Pelvis & Misc.....	67
Neutral Pelvis	68
Bridge Track	69
Dead Bug Track.....	70
Prone & Side-Lying Track.....	71
Quadruped Track.....	72
Rocker & Wobble Board	73

Classification*Phase:* Mild / Moderate / Severe*Stage:* Acute / Subacute / Chronic / Chronic Recurrent / Subclinical**1. Pathoanatomical/Named Syndrome (ICD-9)***Location:* Cervical, Thoracic, Lumbar, SI...med/lat, ant/post, etc...*Type:* Sprain/Strain (postural, traumatic, overuse), traction, hyperextension*Pathology:* Disc herniation, stenosis, spondy, sacroiliitis, AS, bursitis, adhesive capsulitis*Named Syndrome:* TOS, facet syndrome, Guillain Barré syn., T4 syndrome, Maigne's syn., Myofascial Pain syn. (Piriformis Syn., Rotator Cuff Syn.)*Diagnosis:* Tension HA, Migraine HA, Cluster HA, etc...

...with...

2. Neurological/Radiating (ICD-9)

Numbness, tingling, weakness, sensory loss, atrophy, DTR asymmetry

Hyper-reflexia: UMNL, w/ or w/o clonus*Hypo-reflexia:* LMNL, decreased or absent to...[location]*Peripheral Neuropathy:*

Symmetric Polyneuropathy: diabetic neuropathy, alcoholic neuropathy

Mononeuropathy: Carpal Tunnel Syn., median nerve neuropathy, etc...

Plexopathy: brachial/lumbar/sacral (eg. TOS)

Radiculopathy: disc lesion, SOL

Radiation: radicular, scleratogenous referral, etc...include right or left.

How far? - Past knee to foot/toes? Or past elbow to hand/fingers?

Surface? - ant/post, med/lat, thigh/arm, etc...

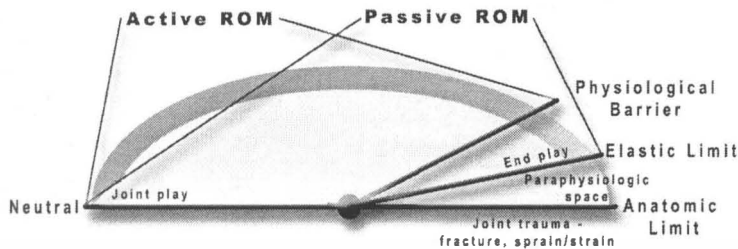
...with associated...

3. Biomechanical/Soft Tissue (ICD-9)*Type:* Intersegmental joint dysfunction / subluxation / joint fixation/restriction*Location:* cervical, thoracic, lumbar, pelvis, knee, wrist, etc...*Soft Tissue:* myospasm, myofascial trigger point, myofascitis, hypertonicity

...complicated by...

4. Local Complications (ICD-9)*Local:* stenosis, ligamentous instability, DJD, transitional segment, spondylolisthesis, scoliosis, block vertebrae, muscle deconditioning, muscle imbalance, leg length inequality, avoidance behavior, etc...*Non-Local:* (separate number on problem list), diabetes, smoking, alcohol, drugs, over-pronation, posture, stress, diet, exercise

Adapted, with permission, from Ronald LeFebvre, DC



Joint play - Discrete, short-range movements of a joint independent of action of voluntary muscles, determined by springing each vertebra in neutral position

Active ROM - Movement accomplished without outside assistance; patient moves part him/her-self

Passive ROM - Movement that is carried through by operator without conscious assistance or resistance by patient

Physiological Barrier - End of active joint movement

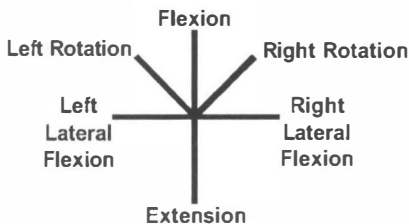
End play (end feel) - Discrete, short-range movements of a joint independent of action of voluntary muscles, determined by springing each vertebra at limit of its passive range of motion

Elastic barrier - Elastic resistance that is felt at end of passive range of movement; further motion toward anatomic barrier may be induced passively by examiner

Paraphysiologic space - Area of increased movement beyond elastic barrier available after cavitation within joint's elastic range (adjustment/manipulation zone)

Anatomic limit - Limit of anatomical integrity; limit of motion imposed by anatomic structures, forcing movement beyond this barrier will produce tissue damage

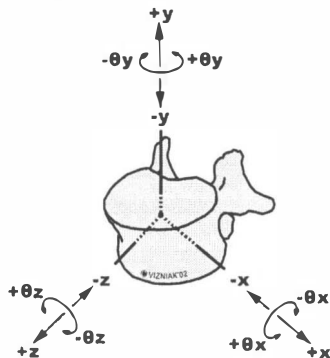
Motion Listings



Restrictions

I = mild, II = moderate, III = marked

Orthogonal System



Coupled Spinal Motion

Cervical

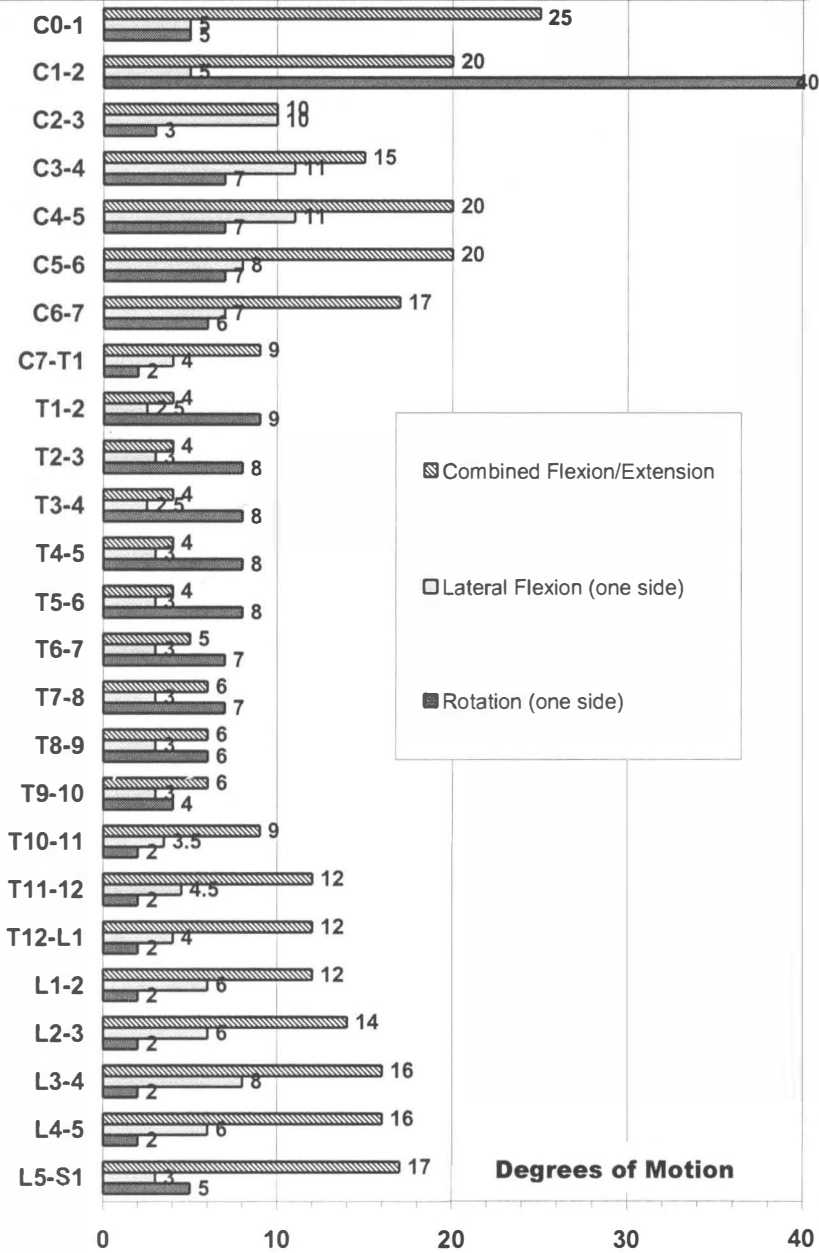
• Same side rotation & lateral flexion - right lateral flexion, vertebra body rotates right

Thoracic

- T1-T6 = same as cervical spine
- T7-T12 = same as lumbar spine

Lumbar

- Opposite side rotation & lateral flexion - right lateral flexion, vertebra body rotates left

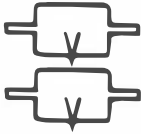


Degrees of Motion

Degrees of Motion

Motion Segment	Combined Flexion/Extension	Lateral Flexion (One side)	Rotation (One side)
C0-1	25°	5°	5°
C1-2	20°	5°	40°
C2-3	10°	10°	3°
C3-4	15°	11°	7°
C4-5	20°	11°	7°
C5-6	20°	8°	7°
C6-7	17°	7°	6°
C7-T1	9°	4°	2°
T1-2	4°	2.5°	9°
T2-3	4°	3°	8°
T3-4	4°	2.5°	8°
T4-5	4°	3°	8°
T5-6	4°	3°	8°
T6-7	5°	3°	7°
T7-8	6°	3°	7°
T8-9	6°	3°	6°
T9-10	6°	3°	4°
T10-11	9°	3.5°	2°
T11-12	12°	4.5°	2°
T12-L1	12°	4°	2°
L1-2	12°	6°	2°
L2-3	14°	6°	2°
L3-4	16°	8°	2°
L4-5	16°	6°	2°
L5-S1	17°	3°	5°
Total ROM	287°	128°	161°

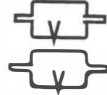
Adapted from: White, A & Panjabi, M. Clinical Biomechanics of the Spine. Lippincott. 1978.



NEUTRAL



Medicare: Left Rot. Malposition
National: LP (Left post. Body)
Gonstead: PR (Post. Right SP)
Motion: Right Rot. Rest.
Orthogonal: + θ y malposition



Medicare: Right Rot. Malposition
National: RP (Right post. Body)
Gonstead: PL (Post. Left SP)
Motion: Left Rot. Rest.
Orthogonal: - θ y malposition



Medicare: Right Lat. Flex. Mal.
National: RI (Right inf. Body)
Gonstead: none
Motion: Left Lat. Flex. Rest.
Orthogonal: + θ z malposition



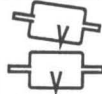
Medicare: Left Lat. Flex. Mal.
National: LI (Left inf. Body)
Gonstead: none
Motion: Right Lat. Flex. Rest.
Orthogonal: - θ z malposition



Medicare: L Rot. L Lat. Flex. Mal.
National: LPI (L post. inf. Body)
Gonstead: PRS (Post. R sup. SP)
Motion: R Rot. R Lat Flex. Rest.
Orthogonal: + θ y, - θ z mal.



Medicare: R Rot. R Lat. Flex. Mal.
National: RPI (R post. inf. Body)
Gonstead: PLS (Post. L sup. SP)
Motion: L Rot. L Lat. Flex. Rest.
Orthogonal: - θ y, + θ z mal.



Medicare: L Rot. R Lat. Flex. Mal.
National: LPS (L post. sup. body)
Gonstead: PRI (Post. R inf. SP)
Motion: R Rot. L Lat. Flex. Rest.
Orthogonal: + θ y, + θ z mal.



Medicare: R Rot. L Lat. Flex. Mal.
National: RPS (R post. sup. body)
Gonstead: PLI (post. L inf. SP)
Motion: L Rot. R Lat. Flex. Mal.
Orthogonal: - θ y, - θ z mal.



Medicare: Left Lateral Listhesis
National: LL (Left Lat. body)
Gonstead: none
Motion: Right lateral restriction
Orthogonal: +x malposition



Medicare: Right Lateral Listhesis
National: RL (Right Lateral Body)
Gonstead: none
Motion: Left lateral restriction
Orthogonal: -x malposition



Medicare: Flexion Malposition
National: AI (Ant. Inf. Body)
Gonstead: none
Motion: Extension Restriction
Orthogonal: + θ x malposition



Medicare: Extension Malposition
National: PI (post. inf. Body)
Gonstead: P (post. SP)
Motion: Flexion Restriction
Orthogonal: - θ x malposition



Medicare: Anterolisthesis
National: A (anterior body)
Gonstead: none
Motion: Posterior Restriction
Orthogonal: +z malposition



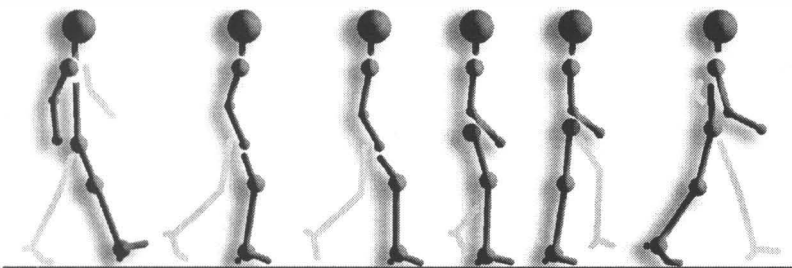
Medicare: Retrolisthesis
National: P (posterior body)
Gonstead: P (posterior SP)
Motion: Anterior Restriction
Orthogonal: -Z malposition

Rot = rotation, Mal. = Malposition, SP = spinous process, inf. = inferior, sup. = Superior, post. = posterior, Ant = anterior, Lat. = lateral, L = Left, R = Right, Rest. = Restriction, Flex. = Flexion, Ext. = Extension

Adapted, with permission, from Lester Partna, DC

DIAGNOSIS & TREATMENT

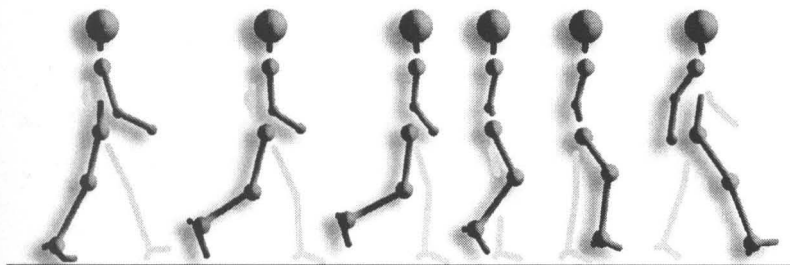
Type	Description	Potential Causes
Cerebellar or Ataxic	Unsteady, reeling to one side, slow start, unexpected/erratic	Stroke; tumor; mid-cerebellar tumor
Drunken or Staggering	Inability to tandem walk (Walk a straight line)	Alcohol; Multiple Sclerosis Brain tumor; Drugs; general paresis
Hemiplegic	Swinging	Stroke; hip or knee disease; immobility, sacroiliac fusion
Hysterical	Varies - usually grotesque movements	Hysteria, check for malingering
Mincing / Short Step	Little tiny steps that are slow from obvious pain	Lumbar disc syndrome Diffuse Cerebellar Disease
Propulsion / Festination	Slow to fast; falling forward, arms held at sides; steps are short & shuffling	Parkinson's Disease
Scissors	Spastic paraplegia - knees are pulling together & body swings laterally from the stepping limb	Cerebral palsy
Steppage or Foot Drop	Toe drop (slap); has to raise thigh of affected side excessively high to compensate (usually will not recover)	Unilateral peroneal neuritis progressive muscle atrophy; Bilateral - polio
Tabetic or Ataxic	Wide stance; heel slapping	Syphilis; Posterior Column disease which causes proprioception loss
Waddling/Clumsy	Pt. waddles side to side Gower's/Minor's sign - pt. climbs up front of their thighs upon rising from a chair	Myo-Dystrophy, weak hip



STANCE PHASE (60%)

FOOT STRIKE (~27%)	MIDSTANCE (~40%)	TAKE OFF (~33%)
<p>Foot lands ahead of COG*. Foot is moving posteriorly.</p> <p>Foot adapts to ground & absorbs shock by pronating.</p> <p>Pronation: Twisting motion involving eversion, abduction & plantar flexion. Arches collapse to absorb shock.</p> <p>Heel strike: Heel lands ~2° supinated & neutral to slightly dorsiflexed. Rapid ankle plantar flexion is controlled by ant. & post. leg muscles – especially tib. anterior.</p> <p>Forefoot strike: followed by rapid ankle dorsiflexion & pronation. Tibialis anterior eccentrically controls pronation, gastrosoleus controls dorsiflexion & absorbs shock.</p> <p>Lower limb rotates internally, the same hip adducts slightly, & the pelvis drops to the opposite side. Controlled by gluts.</p>	<p>Momentum carries body over fixed foot. COG over a single stance limb.</p> <p>Foot starts fully pronated. It supinates through neutral & ends slightly supinated.</p> <p>Mid-foot: With mid-foot pronation the ankle dorsiflexes</p> <p>Supination: foot inverts, adducts & ankle dorsiflexes at mid tarsal & subtalar joints.</p> <p>Primary eccentric contraction of gastrosoleus.</p> <p>Concentric contractions of gluteus max & quadriceps only with resistance (ie. hills/wind).</p> <p>*COG = Center of Gravity</p>	<p>COG anterior to stance limb</p> <p>Gastrosoleus lift (plantar flexes) heel.</p> <p>Tibialis posterior rapidly inverts heel at start</p> <p>Supination of foot is complete (rigid foot) – subtalar locks mid tarsals</p> <p>Toes passively extend (foot rolls like a wheel)</p> <p>Increase weight on larger 1st ray. Metatarsal break helps distribute weight to other toes</p> <p>Toe flexors eccentrically control toe extension aided by tension of the plantar fascia (Windlass effect)</p> <p>Peroneus longus & big toe flexors stabilizes 1st ray & transverse arch & plantar flexes 1st metatarsal</p> <p>Thigh & leg extend & externally rotate</p>

...Continued →

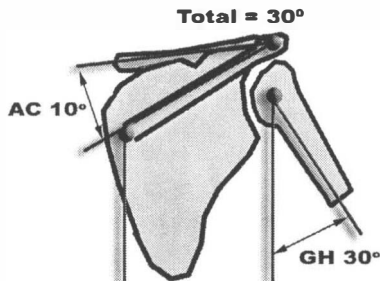
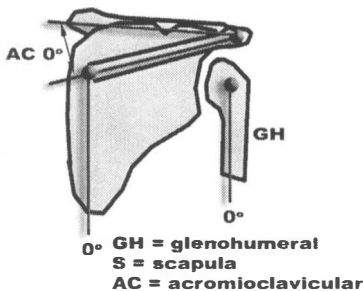


SWING PHASE (40%)

INITIAL SWING	MID SWING	TERMINAL SWING
Starts with Toe Off	Change in direction	Change in direction
Knee flexes, hip extends	Early: Hip flexors & quads 'whip' limb forward ('bowling ball effect')-concentric contraction	Hip & knee extensors rapidly concentrically pull limb back to ground speed
Completion of leg & thigh external rotation	Late: (after swing limb crosses stance limb)	Amount of rotation effects foot orientation (toe-in or toe-out) during foot strike of next stance phase
Anterior thigh (hip flexors) decelerate / stop (eccentric contraction)	Hip extensors & knee flexors (glut max. & hamstrings) decelerate/ stop forward motion (eccentric contraction)	Foot Strike = Heel strike = end of swing phase
Very little initial swing in walking, increased with increased speed (cadence)	Dorsiflexors/ toe extensors: hold foot dorsiflexed/ toes extended; otherwise accentuated hip/ knee flexion or toes drag on ground: 'foot drop' may also occur during foot strike.	
	Internal hip rotators (adductors) & hip capsule internally rotate hip	

Note: during an increased cadence of gait (e.g. running), stance phase decreases (~40%) and swing phase increases (~60%).

Adapted, with permission, from *Biomechanics*, by M.A. Carnes, DC



RESTING PHASE

Shoulder ROM is measured from standard anatomical position
Shoulder hiking in phase 1 may indicate shoulder pathology

GH: 120°

Shoulder Girdle (Scap./SC/AC): 60°
Total Motion = 180°, 2:1 (GH:S)

Clavicle follows the humerus
The inferior capsule folds like an accordion, and unfolds for abduction, loss of this motion = "Frozen Shoulder"
Most important shoulder girdle stabilizer is Serratus Anterior.

PHASE 1 (0°-30°)

Important muscle abductors

Deltoid (60%-70%)
Supraspinatus (30%-40%)
When arm is externally rotated, long head of biceps will help in abduction

Rotator cuff as a group

Depress humerus, cancels superior translation by deltoid

GH: 15°-20°

sup. roll with inf. slide

Scapula: 10°-15°

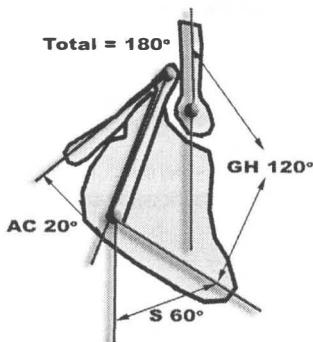
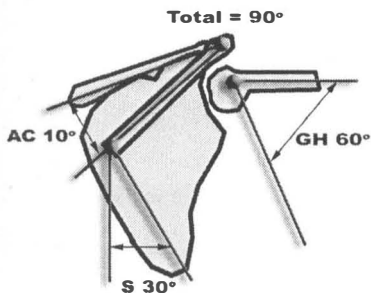
External rotation
Serratus anterior is the major stabilizer, at this point, of the shoulder girdle.
Upper & lower trapezius are minor stabilizers at this point.

SC

Distal end elevates 10°-15°
Superior roll with inferior glide (same as GH)
Upper trapezius is not very active

GH = glenohumeral joint, AC = acromioclavicular joint, SC = sternoclavicular joint, S = scapula

...continued on next page →

**PHASE 2 (30°-90°)****GH:** 40°-45° (55°-65° total)

Superior roll with inferior slide
Deltoid & Supraspinatus - abduction
Rotator Cuff - depress & externally rotate
Greatest impingement: 70°-120°

Scapula: 15°-20° (30° total)

Externally rotates
Serratus Anterior prevents winging
Upper and lower trapezius - force couple and cancel each other out

SC: 15°-20° (30° total)

Elevation of distal clavicle due to superior roll and inferior glide

At end of 1st 30° the coracoclavicular ligs (conoid & trapezoid) become taut and stop the superior roll and inferior slide that makes up the hinge action, which causes rotation in the 3rd phase.

AC: twisting/rotation: 0°-5° (10°-15° total)**AC:** 5°-10° scapula rotation**PHASE 3 (90°-180°)****GH:** 60° (120° total)

Deltoid & Supraspinatus still active, but biceps join in after 90°.

Above 90°, rotator cuff & ligaments act to depress, externally rotate and stabilize the joint
Biceps also help depress the humerus
Triceps long head tendon resists inferior translation
Pec Major & Subscapularis reinforce anterior capsule & resists anterior translation & dislocation.

Inferior Glenohumeral ligament most important anterior capsule ligament

Structures that resist abduction: inferior capsule, latissimus dorsi, pectoralis major, teres major, subscapularis, inferior GH ligament, long head of triceps (resist inferior translation)

Scapula: 30° (60° total) upper more than lower trap,

Serratus Anterior externally rotates scapula
Structures that limit external rotation: Rhomboids (esp. if tight), lower trapezius, upper trapezius

SC: rotates externally & points upwards

Crank-shaped clavicle allows elevation at distal end, while proximal rotates, this causes a 30° elevation at the distal clavicle due to taut coracoclavicular ligs, which stop the hinge & cause rotation, this is resisted by costoclavicular ligs from the 1st rib & eccentric contraction of the subclavius

AC: 10° (20° total) final 10° rotation during phase 1-2 the AC rotation is due to scapular rotation. The AC is the weak link in abduction

Adapted, with permission, from Biomechanics, by M.A. Carnes, DC

Altered Hip Extension

- Weak agonist: gluteus maximus
- Overactive: antagonist: psoas, rectus femoris; stabilizer: erector spinae; synergist: hamstrings

Symptoms related to altered hip extension

- Low back or buttock pain
- Coccyalgia
- Recurrent hamstring pulls
- Recurrent or chronic neck pain

Evaluation

- Patient attempts to raise leg into extension with knee held in extended position
- (+) test if erector spinae musculature contracts before gluteus maximus
- Doctor should observe the activation sequence of hamstrings & gluteus maximus (1st), contralateral lumbar erector spinae (2nd), & ipsilateral erector spinae (3rd)
- Palpation should only be used to confirm the results
- Record activation sequence or firing order of hamstrings, gluteal maximus, lumbar erector spinae, thoraco-lumbar erector spinae (ipsilateral & contralateral)

Postural analysis

- Anterior pelvic tilt
- Hypertrophic erector spinae

Rationale

- Identify incoordination of hip extension
- Determine if gluteus maximus is weak or inhibited
- Determine if erector spinae &/or hamstrings are overactive
- Determine if hip joint has reduced extension mobility or if psoas is shortened

Muscle Length Tests

- Shortened hip flexors, hamstrings &/or erector spinae
- Contralateral up traps &/or levator scap

Trigger Points

- Gluteus maximus, coccygeus, iliopsoas, erector spinae
- Contralateral up traps &/or levator scapulae

Mobility (Joint Dysfunction)

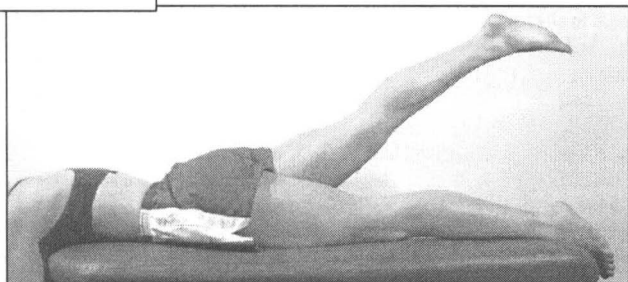
- Lumbosacral &/or thoracolumbar junction
- Contralateral cervical-spine

Treatment

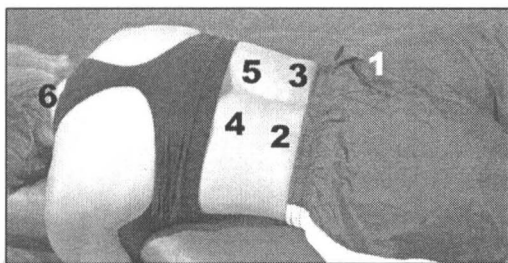
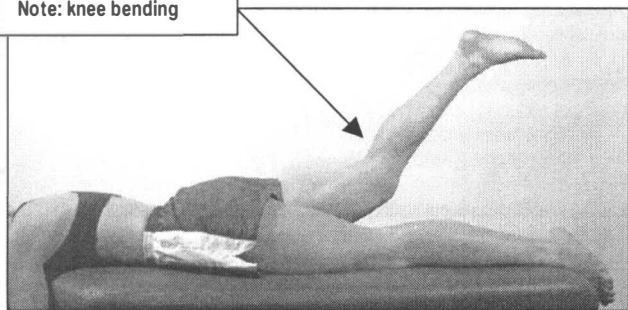
- Adjust/Mobilize low back & hip
- Relax/Stretch ipsilateral hip flexors, overactive erector spinae & hamstrings
- Facilitate/Strengthen glut max (bridges, squats, leg raises)
- Abdominal/gluteal stabilization exercises & biomechanical/ergonomic advice to correct lumbo-pelvic posture (neutral pelvis)

Adapted, with permission, from Ronald LeFebvre, DC (originally adapted from Craig Leibenson, DC)

Normal



Note: knee bending

**Proper Sequence**

1. Gluteus Maximus
2. Contralateral Lumbar Erector Spinae
3. Ipsilateral Lumbar Erector Spinae
4. Contralateral Thoraco-lumbar Erector Spinae
5. Ipsilateral Thoraco-lumbar Erector Spinae
6. Watch for Contralateral Shoulder/Neck Contraction

Altered Hip Abduction

- Weak agonist: gluteus medius
- Overactive: antagonist-adductors; synergist-TFL; stabilizer-QL; neutralizer-piriformis

Symptoms related to altered hip abduction

- Low back or buttock pain
- Pseudo-sciatica
- Lateral knee pain

Evaluation

COORDINATION TEST

- Patient side lying w/lower knee flexed and upper leg extended
- Pelvis is placed in a slightly untucked position

CONCENTRIC TEST

- Upper leg is raised into abduction & held for 2 seconds
- (+) test if any pelvic movement occurs: hip hiking (QL) or posterior rotation of the ilium
- (+) test if hip external rotation occurs (piriformis)
- (+) test if hip flexion occurs (TFL)

NOTE: test fail if patient cannot raise leg, or if shaking or twisting occurs

- Any hip flexion, hip external rotation, excessive hip hiking
- Posterior rotation of upper ilium

FAIL: if patient cannot abduct leg without hip flexion

- If foot raises less than 15 cm;
- If hip externally rotates, pelvis rotates or hip hiking occurs

ISOMETRIC TEST

- Pre-position leg in abduction w/out flexion and ask patient to hold leg for 5 seconds.
- Support may be suddenly removed to increase the difficulty
- (+) test if hip flexion, external rotation, pelvic rotation, or hip hiking occurs

Rationale

- To identify coordination of hip abduction; tightness/overactivity of quadratus lumborum (hip hiking), tensor fascia latae (hip flexion and external rotation), thigh adductors (limited abduction range), piriformis (external rotation), psoas (hip flexion)
- To identify poor hip joint mobility (decreased extension); to identify weakness of gluteus medius

Trigger Points

- Glut. medius, glut. minimus, piriformis, QL, TFL

Mobility (Joint Dysfunction)

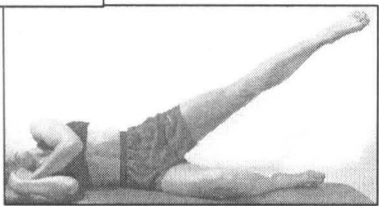
- SI, thoracolumbar junction, L2/L3
- Hip internal rotation

Treatment

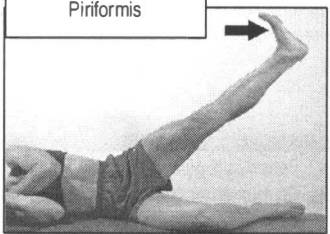
- Adjust/mobilize SI, low back & hip
- Relax/stretch: thigh adductors, TFL & QL, piriformis, hip flexors
- Facilitate/strengthen glut med (see bridge track)

Adapted, with permission, from Ronald LeFebvre, DC (Originally adapted from Craig Leibenson, DC)

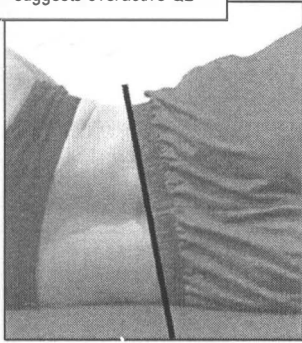
Normal



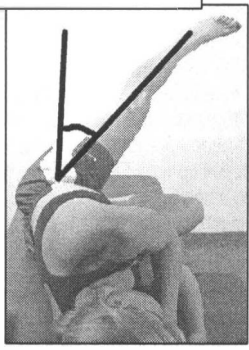
External Rotation:
suggests overactive Piriformis



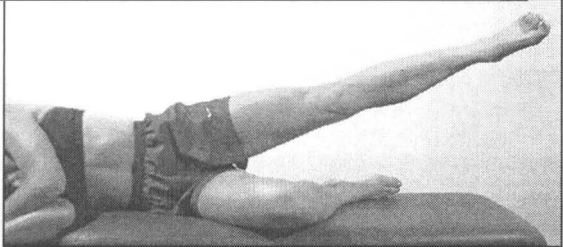
Early Hip Hiking:
suggests overactive QL



Forward Drift/Hip Flexion:
Suggests overactive TFL



Reduced Range of Motion: suggests overactive/tight adductors



DIAGNOSIS & TREATMENT

Altered Trunk Flexion

- Weak agonist: rectus abdominus
- Overactive: antagonist-erector spinae; synergist-iliopsoas

Symptoms related to trunk flexion

- Low back or buttock pain
- Neck pain

Evaluation

- Patient is supine with knees bent, arms across chest, & feet flat on the table
- Dr. may either contact pt.'s heels or place under small of the back
- Patient is instructed to perform posterior pelvic tilt & raise trunk up until scapulae are off the table & then hold for 2 seconds
- Patient should hold the pelvic tilt while lowering back to the table
- Patient is asked to perform 10 repetitions
- The last repetition is held for 30 seconds
- (+) test if heel rises up or pt loses posterior pelvic tilt
- Fewer false (-)'s (more sensitive) if Dr. places hands under heels than if Dr. merely watches feet lift up.
- (+) test if heels rise off table
- (+) test if posterior pelvic tilt cannot be maintained

NOTE: if excessive shaking occurs

- If head is markedly forward of trunk
- If curl up is performed segmentally or as mass movement at the hip joint

FAIL: if heels rise up

- Lumbar spine arches before 10 repetitions & a 30 second hold cannot be accomplished

Rationale

- Quantify rectus abdominis strength/endurance & coordination

Muscle Length Tests

- Shortened lumbar erector spinae &/or shortened hip flexors

Trigger Points

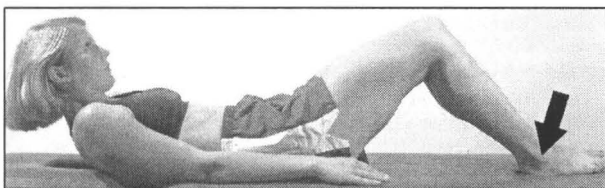
- Erector spinae

Mobility (Joint Dysfunction)

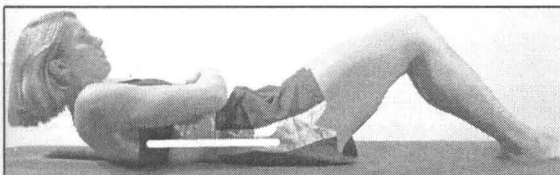
- Lumbar spine
- SI

Treatment

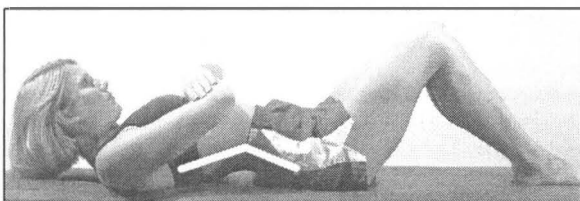
- Adjust/mobilize low back
- Relax/stretch erector spinae & iliopsoas
- Facilitate/strengthen abdominal muscle (dead bug, trunk curls, sit backs)



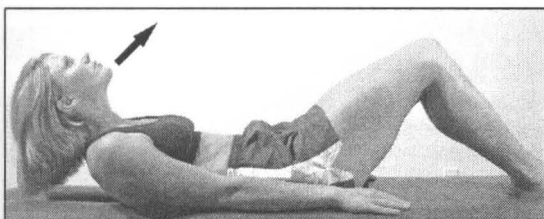
Changes in pressure of heels in either direction suggests recruitment



Posterior pelvic tilt (Flat Back) should be maintained



Inability to hold posterior pelvic tilt suggests recruitment



Chin "jutting or poking" suggests inappropriate recruitment

Altered Scapulohumeral Rhythm

- Weak agnosit: lower & middle trapezius
- Overactive synergist: upper trapezius, levator scapulae & rhomboids

Symptoms related to altered scapulohumeral rhythm

- Neck pain, headaches
- Rotator cuff syndromes (i.e. impingement syndrome)
- Shoulder blade pain

Postural Analysis

- Internally rotated shoulders
- Upward rotation of the scapulae

Gait Analysis:

- Altered arm swing
- Shoulder elevation with arm flexion

Evaluation

- Patient is seated with elbow flexed to 90° to limit unwanted rotation
- Patient is instructed to slowly abduct the arms
- (+) test if scapular elevation or rotation (laterally) occurs in first 30° to 60°
- A false (+) can occur if scapula is already elevated and laterally rotated with arms at side
- See pages 40-41 for more detailed description of scapulohumeral rhythm

Rationale

- Identify loss of normal glenohumeral rhythm due to overactivity of the upper trapezius &/or levator scapulae muscles

Trigger Points

- Upper, mid & low traps; levator scapulae
- Subscapularis
- Mastoid process & C2 & C3 insertion

Mobility (Joint Dysfunction)

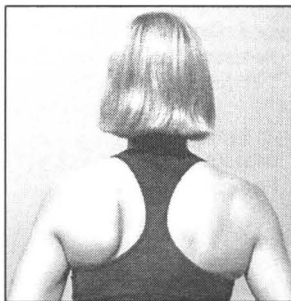
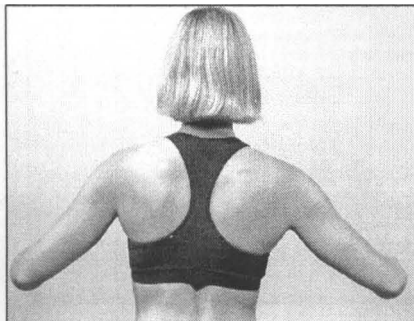
- Upper cervical spine
- Cervical-thoracic junction
- Mid thoracic & scapulocostal

Treatment

- Adjust/Mobilize neck & C/T junction
- Facilitate/Strengthen lower & middle traps
- Relax/Stretch up traps, levator scapulae & subscapularis
- Breathing correction & ergonomic advice

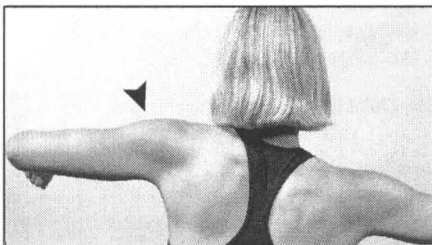
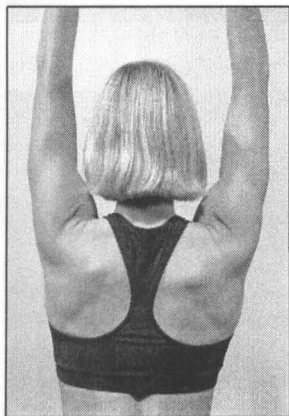
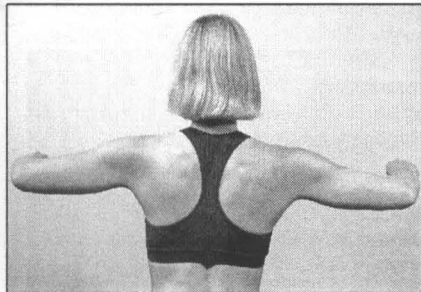
Adapted, with permission, from Ronald LeFebvre, DC (Originally adapted from Craig Leibenson, DC)

Look for a smooth, symmetrical glide of scapulae



Scapular Winging

Suggests weak serratus anterior and/or long thoracic nerve lesion



Shoulder Hiking

Suggests overactive upper trap/levator and/or inhibited middle & lower trapezius

Altered Head/Neck Flexion

- Weak agonist: deep neck flexors
- Overactive antagonist: suboccipitals
- Overactive synergist: SCM

Symptoms related to altered neck flexion

- Headache, neck & shoulder blade pain
- TMJ dysfunction/pain

Postural analysis

- Head forward posture
- Prominence of SCM

Evaluation

- Patient is supine & is instructed to bring chin to chest
- Overpressure may be added at end point
- More sensitive test (fewer false (-)'s) if pt.'s neck is pre-positioned in chin tuck & raised 2 cm off table - hold for 4 seconds

NOTE: FAIL

- If chin juts forward during movement
- If there is shaking during movement
- If there is chin jutting or shaking with overpressure added
- If head elevates from 2 cm position (this indicates a change in the center of mass of the head)
- If chin juts forward during movement or shaking before 4 seconds

Rationale

- To identify if neck flexor weakness or in-coordination is present
- In particular to identify if deep neck flexors are weak & the SCM is tight or overactive

Trigger Points

- SCM, suboccipitals
- Mid traps, masticatory muscles
- Mastoid process

Mobility (Joint Dysfunction)

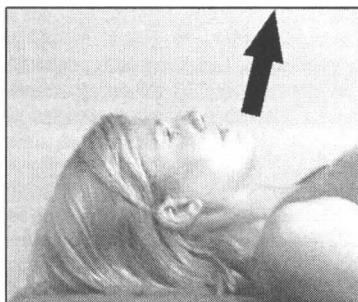
- C0-C1, lower cervicals, cervical-thoracic junction
- TMJ

Treatment

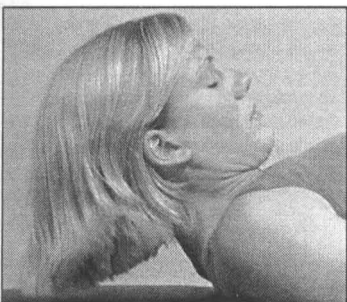
- Adjust/mobilize C0-C1 & C/T junction
- Relax/stretch SCM & suboccipitals
- Facilitate/strengthen deep neck flexors
- Correct poor sitting posture
- Lumbo-pelvic stabilization exercises (neutral pelvis)

Adapted, with permission, from Ronald LeFebvre, DC (Originally adapted from Craig Leibenson, DC)

1. Instruct patient to bend neck to chin
2. Dr. may pre-position patient with neck retracted, 2cm off table



Patient should be able to hold without losing chin tuck or shaking for more than 4 seconds



Chin should remain tucked in



If patient leads with chin poked out consider weak deep neck flexors and/or hyperactive SCM

1. Opening statement including patient's age, occupation, mental status, gender, race, and complaint description & duration
2. Resulting anatomical damage or syndrome (sprain/strain, migraine, etc)
3. Mechanism of injury as specific as possible within reason (trauma, repetitive stress, chronic, postural, etc.)
4. Stage and/or Grade of condition (acute, subacute, chronic, grade I strain, etc.)
5. Neurological findings if present (absence of pathologic neurological signs, nerve tension signs, etc.)
6. Biomechanical faults (joint dysfunctions), soft tissue changes (myospasm) and their relation to the anatomical injury
7. Complicating and contributing factors (instability, anatomical leg length inequality, poor health, diabetes, obesity, DJD, stenosis, poor flexibility, etc)
8. Any other information you feel may be important to the case

Adapted, with permission, from Ronald LeFebvre, DC

Sample #1

Mrs. Back Hurt, a 45 year old Caucasian secretary and mother of two, presented on February 4th, 2002 alert and cooperative with moderate (3.5/10 mVAS) dull, achy low back pain, located centrally at the thoracolumbar (TL) junction and inferiorly to L5-S1. The cause of this patient's pain may be a result of repetitive microtrauma during a vigorous 3 hour tennis match two weeks ago with her 16 year-old son. The pain was worse with serving, a movement involving strong contraction of the iliopsoas and quadratus lumborum muscles.

History and physical suggest that Mrs. Hurt is suffering from TL joint dysfunction secondary to an iliopsoas muscle strain. This diagnosis is consistent with the palpable, grade 2/4 tenderness of the right iliopsoas, reproduction of the TL pain and mild weakness with the iliopsoas length and strength testing. Mrs. Hurt's pain does not wake her up at night or affect her bowel and bladder control, and she is not suffering from any other noted neurological deficits or abnormalities. She also presented with lumbosacral (LS) pain, most likely a result of LS extension occurring as a compensation for the iliopsoas strain causing TL flexion. A major contributing factor to this injury was overall poor conditioning and lack of exercise before undertaking such a vigorous activity. The patient also exhibits signs and symptoms of chronic postural strain with associated cervicogenic headaches, which appear to be unrelated to her low back pain.

Sample #2

Mrs. Jane Doe, a fifty-one year-old female employee of the United States Postal Service (working 9 hrs/day Monday to Friday), presented to the Western States Chiropractic College Clinic on July 16th, 2001 complaining of constant moderate (4/10 mechanical Visual Analogue Scale - mVAS) neck and right shoulder pain with no radiation of two weeks duration. She notes that she cannot open jars with her right hand and can only bowl a maximum of once a week due to the pain (she used to bowl ~3x per week before May). The pain is made mildly better with Flexerol 454 and menthol pads. Furthermore, she has been taking Ibuprofen 2x/day, which also offers some temporary mild relief. Her pain also shows a pattern of improvement on vacation and weekends, with exacerbations throughout the work week: although she still sleeps through the night she reports more difficulty in falling asleep and maintaining sleep since the start of May.

The injury was the result of a repetitive overuse syndrome. Jane recently (early May 2001) had a work change from the graveyard shift to a day shift. Her new shift involves an increased amount of bending, twisting and heavy lifting. Jane states that she "would like to go back to the graveyard shift."

Outcome Markers

Patients should be aware of the parameters you are using to monitor their progression. Any parameter that has the ability to be proven valid and reliable and can be objectively measured has the potential to become a clinical outcome marker. See page 328 Research Review Summary

PAIN - Visual analogue scale (VAS), verbal pain scale (0-10), analgesic use and dosage, centralization of symptoms, duration, frequency

RANGE OF MOTION - active and passive motion before symptoms, goniometer, inclinometer.

ACTIVITIES OF DAILY LIVING (ADL's) - walking, sitting, chewing food, motion, ability to perform specific tasks (work related), playing sports, hobbies, intercourse, etc...

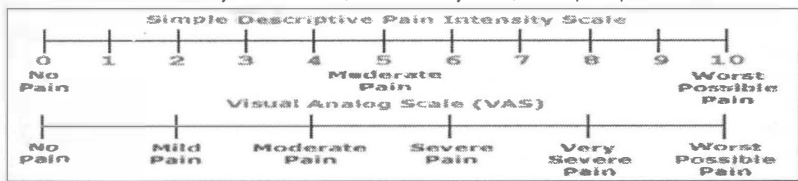
STRENGTH - muscle grading (0-5), dynamometer, grip strength, ability to lift weight...

ENDURANCE - walk/run set distance, back extensions, sit-ups, ability to maintain position...

FLEXIBILITY - range of motion, touch toes, reach behind back/overhead, inclinometer...

NEUROLOGICAL - improvement on nerve conduction studies, normalization of reflexes, loss of pathologic reflexes, centralization of symptoms, decreased sensory deficits...

OUTCOME ASSESSMENT QUESTIONNAIRES - Oswestry Low Back Pain Disability Questionnaire, Roland/Morris Disability Questionnaire, Pain Disability Index, McGill pain questionnaire



Prognosis

Definition - "A forecast of the probable course and/or outcome of a disease."

Stedman's Concise Medical Dictionary

A prognosis is an educated estimate of the potential outcome of a given condition. There are a number of factors that can influence the accuracy of physician prognosis on any given patient:

1. Age, General health
2. Severity and Natural history of condition
3. Complicating factors (e.g. instability, DJD, stenosis, etc...)
4. Physician's skill and experience with condition
5. Patient compliance with suggested treatment plan

Vocabulary: Prognosis is.....excellent.....good.....fair.....guarded.....poor.....pending

Always attempt to do the following:

1. Discuss what your opinion is based upon
2. Differentiate cure from symptomatic relief
3. Indicate the likelihood of recurrence and residual effects
4. Remember that your prognosis can change

Examples

Prognosis is good for relief of the shoulder pain with continued care and patient compliance. The patient's condition is mechanical in nature without neurologic compromise and should resolve without residual dysfunction. This assessment is based on the biomechanical nature of the problem and the general good health and high aerobic activity level of the patient.

Prognosis is poor, due to the general poor health of the patient, previous history of failed treatments, poor compliance with treatment plan, mental handicap and low socioeconomic status.

Prognosis is guarded due to periodic, unavoidable exacerbations from occupational postures that suggest continued treatment will be necessary to maintain the patient's employability.

Adapted, with permission, from Ronald LeFebvre, DC

YOUR LETTERHEAD

address - e-mail - phone - fax

July 16, 2003 [date of report]

Re: Patient: [patient name]
 Date of Injury: July 2nd, 2003
 Employer: US Postal Service
 File #: WC54362400-3342

Introductory Statement

This narrative report details the patient's chief complaint, examinations performed, treatment received and other pertinent information regarding her case.

History

In a brief paragraph summarize the patient's history relative to his/her chief complaint. Giving particular attention to location/radiation of symptoms, mechanism of injury, pattern of symptoms, frequency and duration of symptoms, severity (0-10) and effects on activities of daily living (ADL's).

Past health history

Summarize potentially relevant or associated complicating factors from the patient's past: serious illnesses (diabetes, heart conditions, strokes, cancers, hepatitis, infections, etc.), recent hospitalizations/surgeries, general trauma, accidents, injuries, medication use (over-the-counter and prescription), allergies, previous x-rays and chiropractic care, and last physical exam.

Family history

Summarize potentially associated complicating and/or risk factors from the patient's genetic lineage: diabetes, heart conditions, strokes, cancers, hepatitis, infections, congenital anomalies, etc.

Social/Personal history

Summarize potentially associated complicating and/or risk factors from the patient's personal/social history: living situation, occupation, exercise, hobbies, diet, sleep pattern, bowel & bladder habits, alcohol consumption, smoking, recreational drug use, domestic violence, and major stresses in life.

Initial Physical Exam Findings [Date: July 16th, 2003]

Summarize and include all observations, positive findings and pertinent negatives, may be broken down further into the more specific sub-headings (see below) depending on the level of detail performed during the exam.

Ranges of Motion	Ophthalmic Exam
Palpation	Otoscopic Exam
Radiographic Exam	Rhinoscopic Exam
Vascular Exam	Mental Status Exam
Neurological Exam	Other Special Imaging (X-ray, MRI, CT)
Orthopedic Exam	Additional Exam Procedures (blood draw, etc)

Follow-Up Physical Exam [date]

Reevaluate and summarize changes in all original observations, positive findings and pertinent negatives, to confirm effectiveness of care over time (evaluate your outcome markers), once again using the same sub-headings as the initial physical exam.

WORKING DIAGNOSIS

Give a diagnostic summary in one or two lines. Diagnosis should include anatomical lesion, neurological involvement, biomechanical evaluation, complications and ICD-9 codes (standard four part diagnosis).

...Continued →

YOUR LETTERHEAD

address - e-mail - phone - fax

Clinical Impression

Refer to page 58 Clinical Impression.

Treatment Plan

A thorough treatment plan should include the following:

1. Additional diagnostic steps - x-ray, CT, MR, blood draw, nerve conduction studies...
2. Office procedures for acute & rehab. phases - CMT, STM, modalities...
3. Home care for both phases - activity modification, supports, nutrition, exercise...

Also include treatment frequency & duration for acute & rehab. phases. In addition, discuss treatment goals & objective criteria (outcome markers) you will be using to monitor improvement.

Prognosis

Summarize your predicted outcome for this patient. Discuss in terms of excellent, good, fair, guarded, & poor. Always provide a brief explanation for your choice (see prognosis on page 59).

Comments

Keep this portion of your narrative to a minimum; reserve it only for relevant personal conjector. Here is a sample comment:

"Based on the patient's subjective complaints, physical exam findings, & treatment response, it is my professional opinion that [patient's] complaints are consistent with the type of repetitive trauma she reported."

Closing Statement

If we can provide additional information or be of further assistance regarding this case, please contact our clinic.

Sincerely,

 Your name, DC

 Here are some quotes, allegedly taken verbatim from the medical records of a general hospital in a large metropolitan area (enjoy).

- Patient has been married twice, but denies any other serious illnesses.
- History: Patient was shot in the head with .34 caliber rifle. Chief Complaint, Headache.
- Skin somewhat pale but present.
- On the second day the knee was better, & on the third day it had completely disappeared.
- Patient has chest pain if she lies on her left side for over a year.
- She has had no rigors or shaking chills, but her husband states she was very hot in bed last night.
- The patient has been depressed ever since she began seeing me in 1993.
- The patient has no past history of suicides. Exam of genitalia reveals that he is circus sized.
- She is numb from her toes down.
- Patient's past medical history has been remarkably insignificant with only a 40 pound weight gain in the past three days.
- Patient had waffles for breakfast & anorexia for lunch.
- While in the ER, she was examined, X-rated & sent home.
- The skin was moist & dry.
- Occasional, constant, infrequent headaches.
- Patient was alert & unresponsive.
- She stated that she had been constipated for most of her life, until she got a divorce.
- Both breasts are equal & reactive to light & accommodation.
- Rectal exam revealed a normal size thyroid. (*Too Far Up!*)
- Patient has two teenage children, but no other abnormalities.

General

- Skin** Skin color is consistent with genetic background. There is no evidence of pallor or erythema. Skin has good turgor. There are no excoriations or lesions.
- Hair** Color, texture and distribution is normal.
- Nails** Nails are well manicured and slightly curved. Nail surface is regular and smooth, there is no evidence of splitting. Nail plate is translucent, bed is even and pink.

Eyes, Ears, Nose & Throat

- Eyes** Distant vision: 20/20; no correction. Visual fields intact. Parallel corneal light reflex no nystagmus. Eyes symmetrical, brows, lids and lashes intact without deformity, ptosis or lesions. Conjunctive clear, no discharge. Cornea smooth and clear. Pupils equal, round, reactive to light & accomodating (PERLLA). Fundoscopic: full bilateral red light reflex, discs round, cream color, well-defined margins, slightly excavated (as a normal variant). Arteries light red with narrow light reflex and even caliber. Retina uniform red-orange without exudates or lesions.
- Ears** Ear positioning bilaterally-symmetrical; smooth auricles without lesions or discharge. Small amount of light cerumen noted in both external canals. Tympanic membrane intact with slight scarring in the left one; all landmarks clearly identified. Auditory: Watch test equal bilaterally. Rinne - air conduction greater than bone conductions; Weber L = R.

Nose & Throat

Nose: Appears straight with slight deviation of the nasal septum towards the right vestibule, decreasing its opening slightly. Both nostrils patent. Odors properly identified. Nasal mucosa pink, moist with slight clear discharge. No lesions. Sinuses non-tender. Mouth and pharynx: Lips pink, moist, without lesions. Buccal mucosa gingivae, hard and soft palates pink, with no lesions, inflammation, patches or swelling. Teeth: Twenty eight. Firmly seated, with two fillings in the right upper second molar. No debris, staining obvious caries. No inflammation at gingivae. Tongue: midline, symmetrical. No lesions or fasciculations. Floor of mouth without lesions. Uvula slightly left deviated, no swelling or exudates of tonsils. Pharyngeal wall pink, no lesions or swelling. Mouth odor normal.

Thorax & Lungs

- Inspection** The thorax is symmetrical in appearance and expansion. AP diameter is not increased.
- Palpation** Fremitus is normal. Expansion of the chest is symmetric. There are no lesions, auxiliary adenopathy or other lumps. There is no palpatory tenderness.
- Percussion** Diaphragmatic excursion is X cm bilaterally. Lung fields are resonant throughout.
- Auscultation** Breath and voice sounds are normal. There are no rales, rhonchi or rubs noted.

Heart

- Inspection** No abnormal heaves observed.
- Palpation** No thrills detected. APL palpable in 5th left intercostals space medial to mid clavicular line.
- Auscultation** Rate is 80 bpm and regular. Sounds are normal with S1 aortic > S2 pulmonic. No murmurs, gallops or rubs are noted.

Abdomen

- Inspection** Abdomen is flat and symmetric. Skin exhibits no lesions, striations or scars. No hemias or abnormal pulsations are present.
- Auscultation** Bowel sounds are present in all quadrants. No bruits are detected.
- Percussion** Normal abdominal tympany is present. Liver span is 7 cm at right clavicular line. Splenic dullness is present at the 10th intercostals space at the left midaxillary line.
- Palpation** No tenderness or masses are noted. Abdomen is soft. Spleen and kidneys are non palpable. Liver edge is located at the costal margin. Murphy's Sign is negative.

General Flow

1. Greet patient - inquire about current status
2. Orient patient to report of findings
3. Give overview of problem and establish your ability to help
4. Re-assure patient about their condition
5. Explain what caused the chief (and secondary) complaint
6. Briefly review exam findings
7. Briefly review radiographic findings - orient patient to x-ray
8. Explain diagnosis in lay terms
9. Correlate history, PE, x-rays to symptoms and diagnosis
10. Correlate mechanism of injury/etiology to diagnosis
11. Explain components of treatment plan
 - Home care: exercise, nutrition, modification of ADL's, other
 - Office care: STM, CMT, PT, other
12. Establish treatment goals and correlate to symptoms and diagnosis
13. Outline recommended treatment schedule (appt frequency and for how long - e.g. 2 wks)
14. Expectations regarding response to treatment
 - Improvement of symptoms (pain, function, other)
 - Outcome measures that will be used (improved function)
 - Directions to patient if status declines (patient alerted to red flags)
15. Stress importance of patient compliance and address barriers to compliance
16. Give date when you plan to re-examine and evaluate progress
17. Review Procedures, Alternatives, and Risks (PAR) and give opportunity for patient questions
18. Obtain written informed consent to treat
19. Conclude report/give patient written instructions and educational materials

Professionalism

1. Be professional, prepared and competent
2. Attend to patient's comfort
3. Voice should be clearly audible
4. Use language appropriate to patient's level of understanding
5. Communication between doctor and patient should flow easily
6. Use plastic models (and diagrams) for patient's education
7. Use clear explanations that make sense
8. Demonstrate good listening skills
9. Posture should relay openness and confidence
10. Appropriate eye contact to patient comfort
11. Have empathy to patient's concerns
12. Give patient opportunities to ask questions/verbalize concerns

Overall Report

1. Establish rapport with patient
2. Exhibit confidence
3. Effective patient education
4. Be organized
5. Flow of report should follow a logical sequence
6. PAR conference must meet local mandate of Province/State statute

Supine

- 1. Index Pillar**
Rot., Lat. Flexion, Combined, Extension
- 2. Index Atlas**
Rotation, Lateral Flexion, Extension
- 3. Thumb Pillar Posterior**
Rotation, Combined
- 4. Thumb Pillar Anterior**
Rotation, Combined
- 5. Index Spinous**
Rotation, Lateral Flexion, Combined

Sitting Cervical

- 1. Index Pillar**
Rot., Lat. Flexion, Combined, Extension
- 2. Index Atlas**
Rotation, Lateral Flexion, Extension
- 3. Digit Pull**
Rotation, Lateral Flexion, Combined
- 4. Hypothenar Anterolateral Pillar**
Rotation, Combined Rot. & Lateral Flexion
- 5. Index Spinous**
Rotation, Lateral Flexion, Combined

Sitting Thoracocervical

- 1. Index Costal (First Rib)**
- 2. Thumb Spinous (Thumb Move)**
Rotation – Assisted & Resisted
Lateral Flexion, Combined Rot. & Lat. Flexion

Prone Thoracocervical

- 1. Thumb Spinous (Thumb Move) (same & opposite side contacts)**
Rotation - Assisted & Resisted
Lateral Flexion - Combined Rotation
- 2. Hypothenar Transverse (Combo Move)**
Rotation – Neutral & Resisted
Lateral Flexion – Assisted
- 3. Modified Combo Move (opposite side)**
Rotation – Neutral & Resisted
Lateral Flexion - Resisted

Prone Upper Rib

- 1. Index Costal (same & opposite side contacts)**
- 2. Hypothenar Costal (Combination Move)**
- 3. Modified Combo Move (opposite side)**
- 4. Ischial Reinforcement Combination Move**
- 5. Cephalad Stance Moves**
Same side & Opposite Side

Prone Cervical

- 1. Index Pillar**
Rot., Lat. Flexion, Combined, Extension
- 2. Hypothenar Spinous**
Flexion, Extension
- 3. Bilateral Index Pillar**
Flexion, Extension

Supine Occiput

- 1. Supramastoid Groove Contact (Index, Thenar, & Hypothenar contacts)**
Extension, Lateral Flexion, Rotation
- 2. Hypothenar Posteroinferior Mastoid**
Flexion, Lateral Flexion
- 3. Hypothenar Zygomatic (fingers cephalad or caudad)**
Lateral Flexion

Sitting Occiput

- 1. Occipital Lift**
Flexion, Lat. Flexion, Long Axis Distraction
- 2. Supramastoid Groove Contact (Index, Thenar, & Hypothenar contacts)**
Extension, Lateral Flexion, Rotation

Prone Occiput

- 1. Hypothenar Posteroinferior Mastoid**
Flexion, Lateral Flexion
- 2. Bilateral Thenar Occiput**
Flexion/Distraction, Extension

Adapted from Adjustive technique VIII, Dave Peterson, DC, with permission

Prone

- Bilateral Thenar Transverse**
Flexion, Extension, Rotation, Lateral Flexion, Combined Rotation & Lateral Flexion
- Bilateral Hypothenar Transverse (Knife Edge)**
Flexion, Extension, Rotation, Lateral Flexion
- Crossed Bilateral Hypothenar Transverse or Hypothenar/Thenar Transverse**
Rotation, Lateral Flexion, Flexion, Extension
- Unilateral Hypothenar Transverse**
Rotation, Lateral Flexion
- Unilateral Hypothenar Spinous (Midline)**
Flexion
- Unilateral Hypothenar Spinous (Lateral)**
Combined Rotation & Lateral Flexion
- Hypothenar Spinous Thenar Transverse**
Combined Rotation & Lateral Flexion

Supine

- Opposite Side Crossed Arm**
Flexion – Assisted/Resisted
Extension - Resisted
Rotation – Assisted/Resisted
Lateral Flexion – Assisted/Resisted
Combined Rotation & Lateral Flexion
- Same Side Crossed Arm**
Flexion - Assisted/Resisted
Extension - Resisted
Rotation – Assisted/Resisted
Lateral Flexion – Assisted/Resisted
Combined Rotation & Lateral Flexion
- Opposite Side Pump Handle**
Flexion – Assisted/Resisted
Rotation - Assisted
Lateral Flexion - Assisted
Combined Rotation & Lateral Flexion
- Same Side Pump Handle**
Flexion – Assisted/Resisted
Rotation – Assisted
Lateral Flexion - Assisted

Sitting

- Unilateral Hypothenar Transverse**
Rotation, Lateral Flexion
Combined Rotation & Lateral Flexion
- Unilateral Hypothenar Spinous**
Rotation, Lateral Flexion
Combined Rotation & Lateral Flexion

Standing

Same Side Crossed Arm

Costal Adjustments**Prone**

- Unilateral Hypothenar Costal**
Flexion/Extension
- Iliac Hypothenar Costal**
Flexion
- Covered Thumb**
Flexion/Extension
- Bilateral Thenar Costal**
Flexion/ Extension
- Crossed Bilateral Hypothenar Costal**
Flexion/Extension

Supine

- Opposite Side Crossed Arm Thenar Costal**
Flexion/Extension
- Same Side Crossed Arm Thenar Costal**
Flexion/Extension
- Opposite Side Pump Handle**
Flexion/Extension
- Same Side Pump Handle**
Flexion/Extension

Side Posture

- Web Costal**
Bucket Handle Distraction

Standing

- Same Side Crossed Arm Thenar Costal**
Flexion/Extension

Sitting

- Unilateral Hypothenar Costal**
Flexion

Adapted from Adjustive technique VIII, Dave Peterson, DC, with permission

Side Posture**1. Mammillary Push**

- Rotation - neutral & resisted
- Lateral Flexion -assisted
- Combined Rotation & Lateral Flexion
same side rotation & lateral flexion
neutral/assisted
- opposite side rotation & lateral flexion
resisted

2. Spinous Push

- Rotation - assisted
- Lateral Flexion - assisted
- Flexion – assisted & resisted
- Extension – assisted & resisted

3. Spinous Pull

- Short or Long Lever
- Rotation – neutral & resisted
- Combined Opposite Side Rotation &
Lateral Flexion – resisted

4. Spinous Push/Pull

- Short or Long Lever – rotation
counter-resisted
- Combined Opposite Side Rotation & Lateral
Flexion - counter-resisted

Prone**1. Bilateral Thenar Mammillary**

- Flexion - assisted
- Extension – assisted/resisted

2. Unilateral Hypothenar Mammillary

- Rotation, Lateral Flexion, Combined

3. Crossed Bilateral Hypothenar Mammillary

- Rotation, Lateral Flexion, Combined

4. Unilateral Hypothenar Spinous

- Combined Rotation & Lateral Flexion

5. Ilio Mammillary

- Rotation, Lateral Flexion, Combined

6. Costal Mammillary

- Rotation, Lateral Flexion, Combined

Sitting**1. Hypothenar Mammillary**

- Rotation, Lateral Flexion
- Combined Same Side Rotation & Lateral
Flexion

2. Hypothenar Spinous

- Rotation, Lateral Flexion
- Combined Opposite Side Rotation &
Lateral Flexion

Adapted from Adjustive technique VIII, Dave Peterson, DC, with permission

Side Posture

1. Extension Sacroiliac (PI Ilium)

Thigh to Thigh

- Hypothenar-PSIS Contact
- Forearm-PSIS Contact

Straddle Bent Knee

- Hypothenar-PSIS Contact
- Forearm-PSIS Contact

Kick Start

- Hypothenar-PSIS Contact
caudad leg kick
cephalad leg kick

2. Flexion Sacroiliac (AS Ilium)

Hypothenar-Inferior Ischium Contact**Forearm-Inferior Ischium Contact****Various Doctor/Patient Leg Positions**

- Straddle flexed knee (low fencer)
- Straddle thigh
- Double thigh to shin
- Split leg (knee to popliteal fossa)

3. Flexion Sacroiliac (PS Sacrum)

Hypothenar-Sacral Base Contact

- Dysfunctional side up
- Dysfunctional side down

4. Extension Sacroiliac (AI Sacrum)

Hypothenar-Sacral Apex Contact**Forearm-Sacral Apex Contact****Prone**

1. Extension Sacroiliac (PI Ilium)

Bilateral contacts over PSIS & sacral apex**Unilateral contact over PSIS****Genu Ilium**

2. Flexion Sacroiliac (AS Ilium)

Bilateral contacts over inferior ischium &**sacral base**

3. Flexion Sacroiliac (PS Sacrum)

Bilateral contacts over inferior ischium &**sacral base****Unilateral contact over sacral base**

4. Extension Sacroiliac (AI Sacrum)

Bilateral contacts over PSIS & sacral apex

5. Coccyx Adjustments

External**Internal****Supine**1. **Hypothenar Thigh (Superior Pubes)**2. **Hypothenar Pubes (Anterior or Superior Pubes)**3. **Hypothenar Ilium-Ischium (Inferior Pubes)**4. **Pubic Distraction****Pelvic Blocking**1. **Extension Sacroiliac (PI Ilium)**2. **Flexion Sacroiliac (AS Ilium)**

Adapted from Adjustive technique VIII, Dave Peterson, DC, with permission

Indication

- First step in most lumbar stabilization programs
- Good for improving proper biomechanical motion & pelvic stability

Application

1. Pt. supine, seated or standing – rock pelvis back & forth (“pelvic clocking”)
 2. Pt. finds pain free area (“neutral pelvis”), If there is no pain free area – pt. finds area where they feel most stable
 3. Pt. “locks” pelvis by contracting abdominal musculature (“abdominal bracing”)
 4. Pt. performs motions (sitting/bending/twisting & eventually tracts) with abdominal bracing
- Note: only progress to more difficult tasks as endurance & strength increase



POSTERIOR TILT



NEUTRAL



ANTERIOR TILT

Proper Technique

- Breathe & focus on muscles you are working
- Maintain neutral pelvis & do not arch back
- Do movements slowly, if shaking occurs step down a level

Warning: if back pain is aggravated STOP, muscle ‘bum’ is OK, muscle soreness over the next few days is common & normal

Outcome Measure

- Pt. should be able to do 10 contractions with 10 second holds before moving on to next track

Prescription

_____ reps, _____ sets, _____ seconds to hold, _____ times/day or week

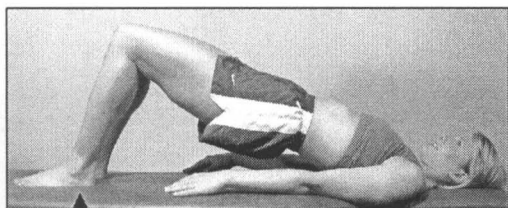
Indication

- Lumbar stabilization & aerobic conditioning
- Weak/inhibited gluteals, hip flexors, abdominals

Application

1. Pt. supine, with knees bent – attempts to raise pelvis & holds for 1 minute (or as long as possible)
2. As endurance increases – pt. lifts one heel off table & holds for 1 minute, then alternates legs
3. As endurance increases – pt. lifts one straight leg off table & hold for 1 minute, then alternates legs

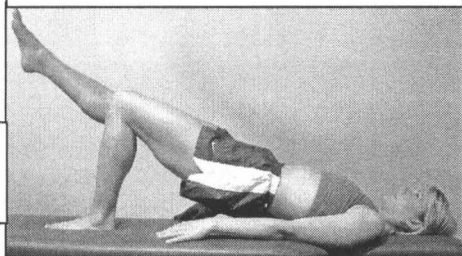
Note: only progress to next level of difficulty as endurance & strength increase



Pt. may lift heels to increase difficulty ("march" in place)

Pt. may add alternating arm motion to increase difficulty ("back stroke")

Maintain neutral pelvis & do not arch back

**Proper Technique**

- Breath & focus on muscles you are working
- Maintain neutral pelvis & do not arch back
- Do movements slowly, if shaking occurs step down a level

Warning: if back pain is aggravated STOP, muscle 'burn' is OK, muscle soreness over the next few days is common & normal

Outcome Measure

- Increased endurance & difficulty of activity
- Patient work up to maintaining activity for up to 2 minutes

Prescription

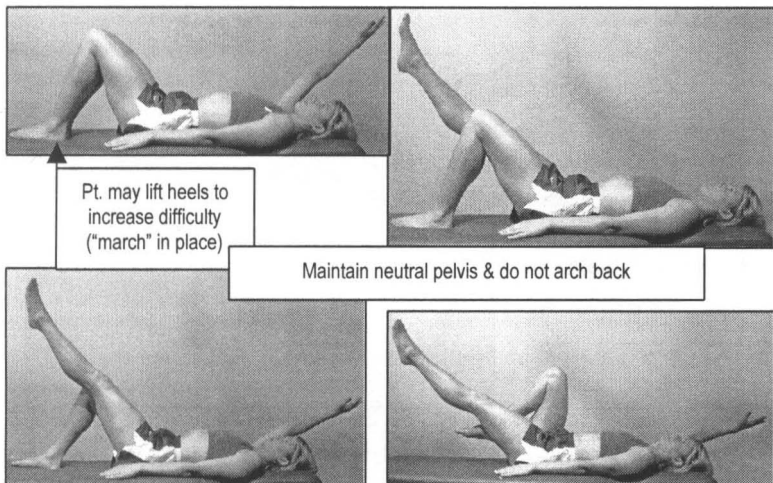
_____ reps, _____ sets, _____ seconds to hold, _____ times/day or week

Indication

- Lumbar stabilization & aerobic conditioning
- Good for patients that cannot do abdominal curls due to pain or other pathologies
- Weak abdominal musculature

Application

1. Pt. supine, with knees bent – raise arm over head
 2. Lift one foot off table, then alternate
 3. Lift one straight leg off table
 4. Lift one straight leg off table & raise opposite arm over head
 5. Lift both legs off table & perform alternating kicks ("bicycling") & alternate arms overhead
- Note: only progress to next level of difficulty as endurance & strength increase

**Proper Technique**

- Breath & focus on muscles you are working
- Maintain neutral pelvis & do not arch back
- Do movements slowly, if shaking occurs step down a level

Warning: if back pain is aggravated STOP, muscle 'burn' is OK, muscle soreness over the next few days is common & normal

Outcome Measure

- Increased endurance & difficulty of activity
- Patient work up to maintaining activity for up to 2 minutes

Prescription

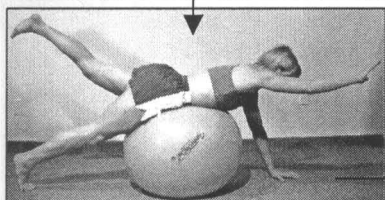
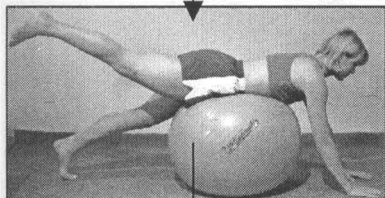
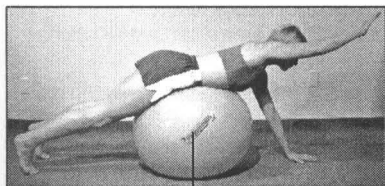
_____ reps, _____ sets, _____ seconds to hold, _____ times/day or week

Indication

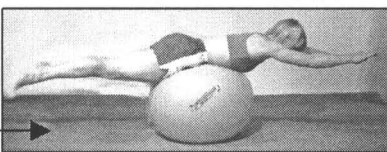
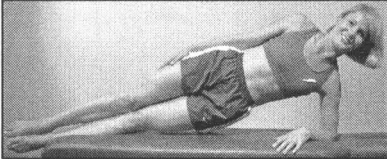
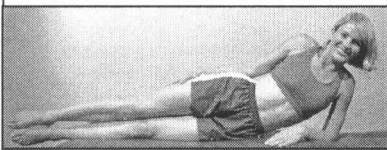
- May be used in place of quadraped track
- Contraindicated in spinal stenosis & acute phase disc herniation

Application

1. Pt. prone (on floor, table, or Swiss-ball)
 2. Pt. raise one arm, then alternate
 3. Pt. raise one leg, then alternate
 4. Pt. raise opposite arm & leg simultaneously, then alternate
- Note: only progress to more difficult tasks as endurance & strength increase

**Side Lying Track****Indications**

Weak quadratus lumborum, glut. med & obliques

**Proper Technique**

- Breath & focus on muscles you are working
- Maintain neutral pelvis & do not arch back
- Do movements slowly, if shaking occurs step down a level

Warning: if back pain is aggravated STOP, muscle 'burn' is OK, muscle soreness over the next few days is common & normal

Outcome Measure

- Pt. should be working toward maintaining 2 minutes of activity

Prescription

_____ reps, _____ sets, _____ seconds to hold, _____ times/day or week

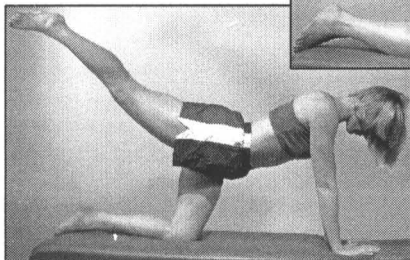
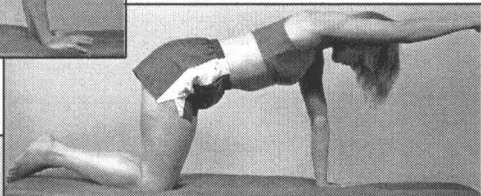
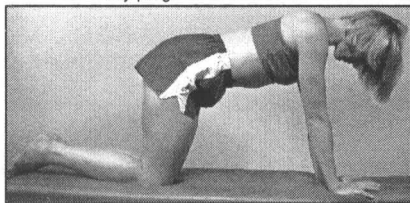
Indication

- Weak gluts & multifidi
- Puts minimal load on spine

Application

1. Pt. prone on hands & knees (on floor or table)
2. Pt. raise one arm, then alternate
3. Pt. raise one leg, then alternate
4. Pt. raise opposite arm & leg simultaneously, then alternate

Note: only progress to more difficult tasks as endurance & strength increase



Proper Technique

- Breath & focus on muscles you are working
- Maintain neutral pelvis & do not arch back
- Do movements slowly, if shaking occurs step down a level

Warning: if back pain is aggravated STOP, muscle 'burn' is OK, muscle soreness over the next few days is common & normal

Outcome Measure

- Pt. should be working toward maintaining 3 minutes of activity or hold positions for 5 seconds

Prescription

_____ reps, _____ sets, _____ seconds to hold, _____ times/day or week

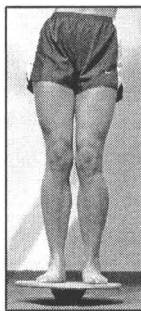
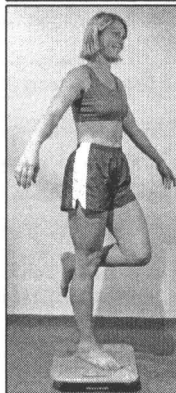
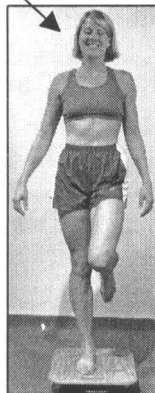
Indication

- Poor balance or jobs that require lots of walking or standing
- Rehabilitation of recurrent ankle sprains & proprioception & muscle endurance improvement

Application

1. Pt. stands on two legs with eyes open/closed
 2. Pt. stands on one leg with eyes open/closed
 3. Change foot angle on board to focus on lateral muscles
 4. Toss ball from hand to hand or back & forth with Dr.
 5. Walk from rocker board to rocker board (advanced)
 6. Try #1 thru #5 on wobble board (advanced)
- Note: only progress to more difficult tasks as endurance & strength increase

Eyes closed

**Proper Technique**

- Barefoot, try on carpet near wall or corner, thicker carpet is easier
- Breath & focus on muscles you are working
- Maintain neutral pelvis & knee slightly bent, good posture
- Do movements slowly, if shaking occurs step down a level

Warning: if ankle, leg or back pain is aggravated STOP, muscle 'burn' is OK, muscle soreness over the next few days is common & normal

Outcome Measure

- Pt. should be working toward maintaining 3 minutes of activity

Prescription

_____ reps, _____ sets, _____ seconds to hold, _____ times/day or week

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Additional Recommended Information Resource:

Refer to the Western States Chiropractic College Clinics - Conservative Care Pathways
Clinical Standards, Protocols, and Education (CSPE)
Order through - <http://www.wschiro.edu/>

III Orthoneuro Tests

A – General	76
A-B – General	77
B – General	78-80
C-D – General	81
D – General	82
E-F – General.....	83
F-H – General	84
H – General.....	85
H-L – General.....	86
L – General	87
L-M – General	88
N-O – General.....	89
O-R – General.....	90
R-S – General	91
S – General	92-93
S-T – General.....	94
T-Y – General.....	95
Wrist.....	96-98
Elbow	99-100
Shoulder Observation	101
Shoulder Screening.....	102
Shoulder.....	103
Shoulder Impingement.....	104
Shoulder Tendonitis	105
Shoulder Labral Tear	106
Ankle	107-108
Knee Screening.....	109
Knee Ligament Stability	110-111
Knee.....	112-113
Knee Patellar Tests.....	114
Knee Meniscal Tests.....	115-116
Hip.....	117
Malingering.....	118
Pathologic Reflexes	119

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 UMNL = upper motor neuron lesion, LMNL = lower motor neuron lesion

Active Neck Flexion

- Used to determine active range of motion
- Patient slowly moves chin to chest

(+) Chin poking → weak deep flexors &/or overactive SCM

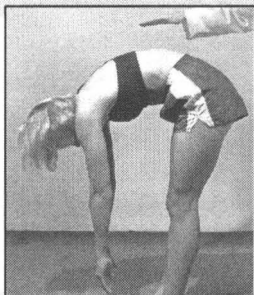
(+) Shaking → poor muscular conditioning



Adam's Test/Sign

- Differentiate functional from structural scoliosis
- Pt. bends forward
- Dr. stands behind patient & observes ribs

(+) Rib hump → structural scoliosis (functional scoliosis usually disappears with changes in position)

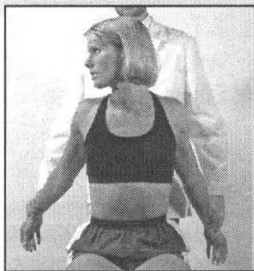


Adson's Test

- Thoracic outlet syndrome test
- Pt. rotates head toward affected side
- Dr. palpates pulse

(+) Decrease/loss in pulse → indicates neurovascular compression (TOS, cervical rib, Anterior scalene syndrome)

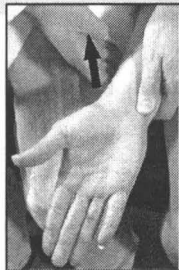
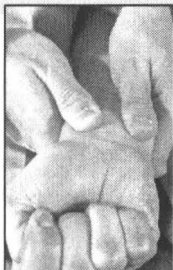
Reverse Adson's see Halstead Maneuver



Allen's Test

- Check vascular competency of hand
- Dr. compresses ulnar & radial arteries & observes vascular refill of hand
- Pt. pumps fist

(+) > 15 seconds → distal artery disease (scleroderma, thrombangiitis obliterans, Raynaud's, vasospastic conditions)



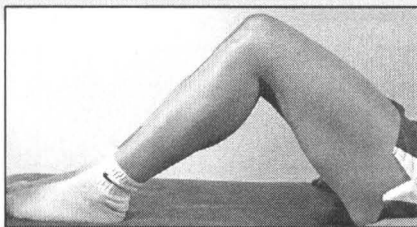
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ORTHONEURO TESTS

Allis' Test

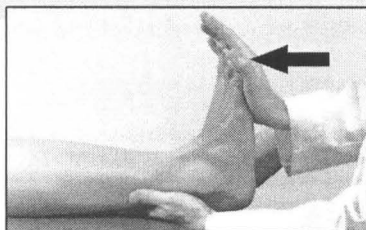
- Used to confirm leg length inequality
- Pt. hip flexed 45°, knees flexed 90°
- Dr. observes

(+) One knee higher than other → possible leg length inequality

**Ankle Clonus**

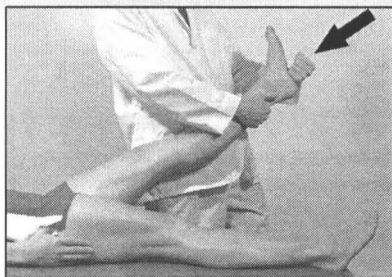
- Dr. rapidly dorsiflexes foot

(+) Multiple beat clonus → strongly suggests upper motor neuron lesion of spinal cord or brain

**Anvil Test**

- Pt. leg straight & hip flexed 30°
- Dr. strikes heel with hand

(+) Hip pain → hip pathology (DJD, arthritis, others)

**Babinski Sign**

- Dr. strokes bottom of foot with mildly noxious stimulus, normal = toe flexion

(+) Toe extension & spreading → possible Upper Motor Neuron Lesion (UMNL)

Chart (-) as "toe going down" or "negative Babinski test"

Note: some pt.'s have hypersensitive feet & may pull away with mild stimulus – so warn patients before test



Negative (normal)

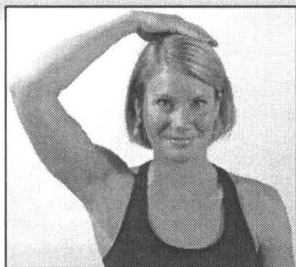


Positive (+)

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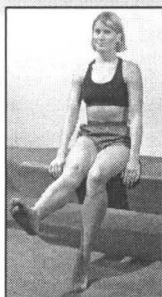
Bakody Sign

- (+) Raised arm over head to reduce tension on nerve roots, spinal nerves & brachial plexus → cervical radiculopathy, nerve tension



Bechterew's Test

- Pt. fully extends knee, one leg at a time
 - With leg pain Dr. passively extends leg to point of pain & dorsiflexes ankle
- (+) Leg pain → electrical or shooting (radiculopathy)



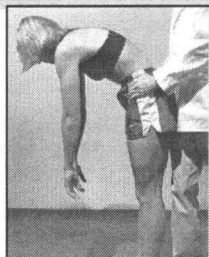
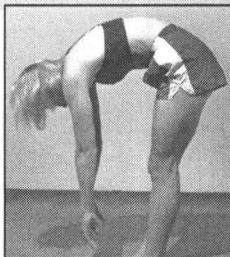
Beevor's Sign

- Pt. flexes neck & trunk
 - Dr. observes umbilicus
- (+) Umbilical deviation → muscle weakness or paralysis (lower thoracic nerve root compression, neurological demyelination or compromise)



Belt Test

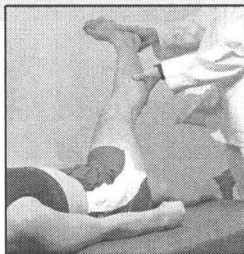
- 1st - Pt. bend forward to touch toes
 - 2nd - Pt. repeats, Dr. holds bilateral ASIS & anchor sacrum to hip to prevent pelvic/sacroiliac (SI) flexion
- (+) Pain with both → lumbar in origin
 (+) Pain without support, but not with support → pelvic/SI in origin



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Bonnet's Test

- Back off SLR pain, Dr. internally rotates & adducts hip
- (+) Pain → action stretches piriformis (If sciatic nerve runs through piriformis may produce sciatica or may reveal local piriformis pain)



Bowstring Test

- Pt passive
- Dr. palpates sciatic nerve & applies traction from proximal to distal
- (+) Leg pain → electrical or shooting (radiculopathy)



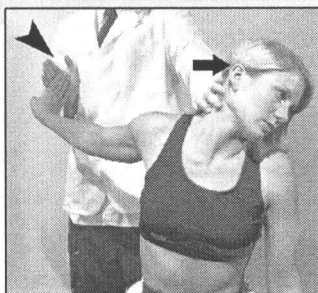
Bracelet Test

- Dr. grips around wrist & squeezes
- (+) Pain → indicated wrist pathology (rheumatoid arthritis, fracture, sprain)



Brachial Stretch Test

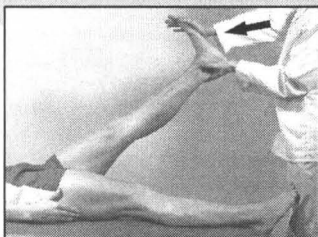
- Dr. passively abducts arm with fingers & wrist in extension, & cervical lateral flexion
- (+) Symptom reproduction → tension problem with brachial plexus



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Braggard's Test

- Back off SLR pain, Dr. dorsiflexes ankle
- (+) Leg pain → nerve root tension (electrical or shooting – compressive radiculopathy)



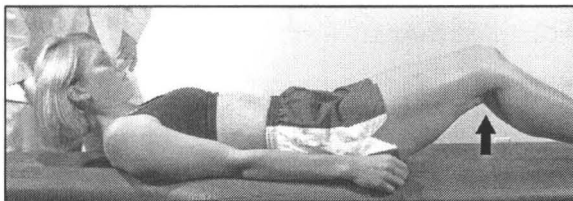
Breig & Troup Test

- Done when SLR is unilaterally limited < 50°
- Back off SLR pain, Dr. dorsiflexes ankle, medially rotates hip, pt. flexes neck
- (+) Leg pain → nerve root tension (electrical or shooting – compressive radiculopathy)



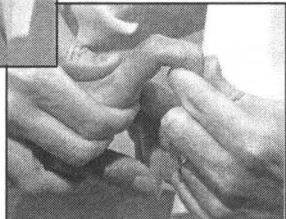
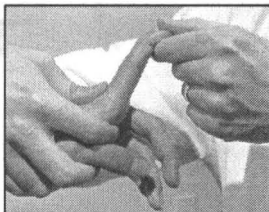
Brudzinski's Sign

- Dr. flexes patients neck
- (+) Knee flexion → indicated meningeal irritation or inflammation (meningitis, arachnoiditis, subarachnoid fibrosis, sciatic radiculopathy)



Bunnel-Littler Test

- 1. Dr. holds metacarpophalangeal joint in extension & flexes distal interphalangeal joint
- 2. Repeated with Dr. attempting to flex proximal interphalangeal

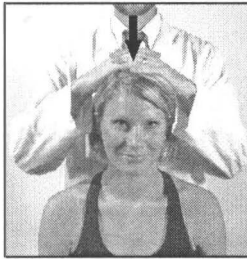


- (+) Lack of joint movement → inflammatory process in fingers (osteoarthritis, rheumatoid arthritis)

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Cervical Compression

- Dr. applies compression on cervical spine
- Maximal compression: Pt. head is rotated, laterally flexed & slightly extended
- (+) Arm pain → nerve root compression or pain referral
- (+) Neck pain → joint & ligament strain



Maximal Cervical Compression

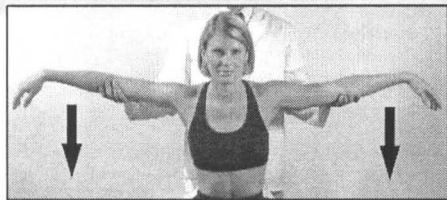
Cervical Distraction

- Dr. lifts patients head
- (+) Decrease in peripheral pain → decreased pressure on nerve roots (IVF encroachment, radiculopathy)
- (+) Increase pain → joint capsule sprain



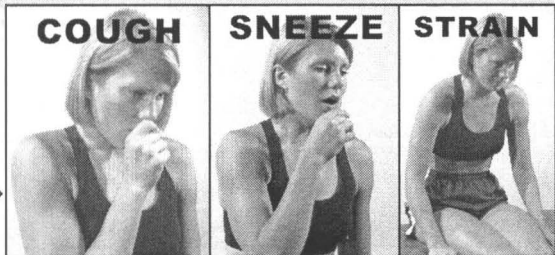
Codman's Arm Drop

- Pt. passive, Dr. drops patients arms
- (+) Pain → rotator cuff tear



DeJeurine's Triad

1. Coughing
 2. Sneezing
 3. Straining (Valsalva)
- All increase intra-abdominal/intrathecal pressure
 - (+) Reproduction of symptoms → Leg pain → nerve root tension
Local pain → sprain/strain



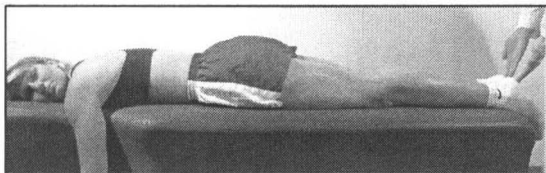
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DeKleyn's Test

- Pt. head in extension & rotation for up to 45 seconds
- (+) Vertigo, blurred vision, nausea, syncope, nystagmus → vertebral artery ischemia on ipsilateral side of rotation

**Derefield Test**

- Pt. prone, turns head 90°
 - Dr. observes for change in leg length
- (+) Change in leg length → possible cervical involvement

**Deyerle Sign**

- Pt. passive
 - Dr. applies tension to sciatic nerve behind knee ("seated Bowstring")
- (+) Leg pain → nerve root tension (radiculopathy)

**Doorbell Sign**

- Dr. compresses nerve roots & other cervical structures
- (+) Arm pain → nerve root tension (radiculopathy)
 (+) Local pain → cervical sprain/strain

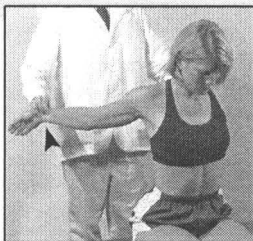


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Eden's Test

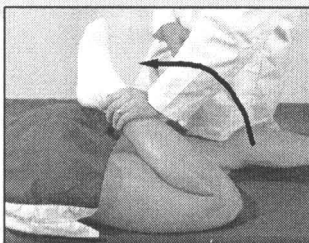
- Dr. palpates radial pulses
- Pt. chest out ("exaggerated military posture")

(+) Diminished pulse → costoclavicular TOS
 (+) arm pain, numbness, tingling → TOS of neurological nature

**Ely's Test**

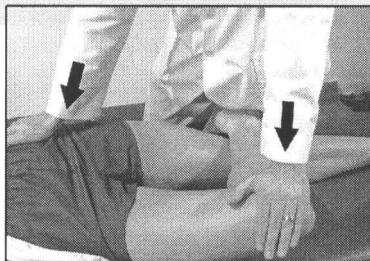
- Dr. flexes foot to contralateral buttock

(+) Decreased motion → rectus femoris or hip flexion contracture

**FABER (Patrick's) Test**

- Pt. "figure four" position
- Dr. applies pressure on ASIS & knee

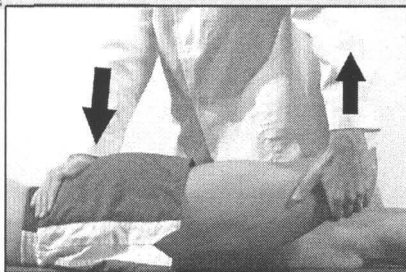
(+) Hip pain → hip pathology

**Femoral Nerve Stretch Test**

- Dr. extends hip & press down on ipsilateral PSIS

(+) Pain/neurologic symptoms into anterior thigh → femoral nerve tension

(+) SI pain → SI sprain/strain (Yeoman's Test)

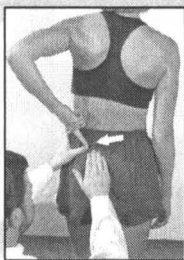


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Fortin Finger Test

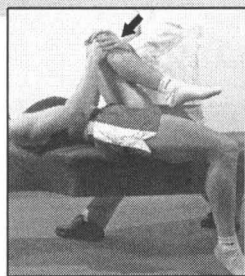
- Pt. point to area of pain

(+) SI pain → SI lesion

**Gaenslen's Test**

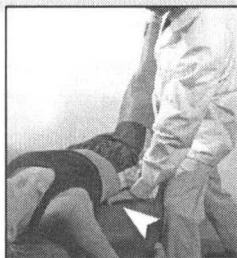
- Pt. brings knee to chest, other leg & buttock completely off table
- Dr. applies over pressure

(+) SI pain or pain down extended thigh → SI lesion (anterior SI ligament sprain, SI inflammation)

**Goldthwaite's Test**

- Dr. performs passive SLR & palpates lumbar spine motion

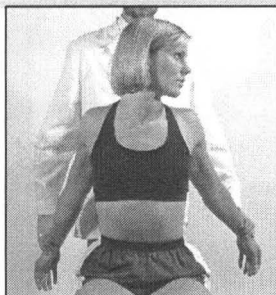
(+) Pain →
 → before lumbar motion → SI lesion
 → after lumbar motion → lumbar lesion

**Halstead Maneuver**

- Thoracic outlet syndrome test
- Pt. rotates head away affected side
- Dr. palpates pulse

(+) Reproduction of signs & symptoms → paresthesias indicate neurovascular compression (TOS, cervical rib, Anterior scalene syndrome)

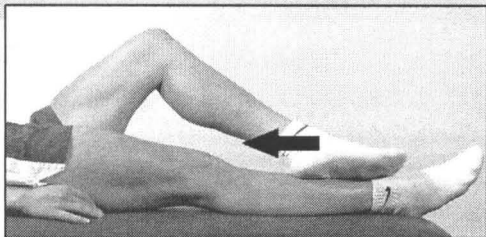
Synonym: Reverse Adson's Test



→ = may indicate/suggests, (+) = positive, (-) = negative, Pt. = patient, DJD = degenerative joint disease
 UMN = upper motor neuron lesion, LMNL = lower motor neuron lesion

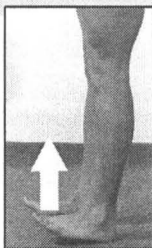
Heel to Shin Test

- Pt. attempts to run heel down shin in a smooth coordinated motion
- (+) Failure to perform or abnormal movements → cerebellar dysfunction



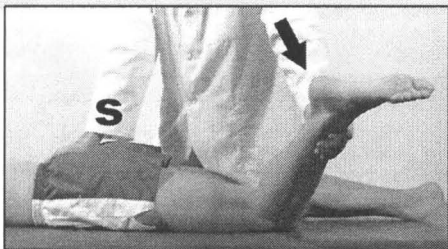
Heel Walk

- Pt. walks on heels for up to 10 steps
- (+) Loss of dorsiflexion → LMNL of L4 or L5 nerve roots, if isolated great toe extension is weak consider L5 level



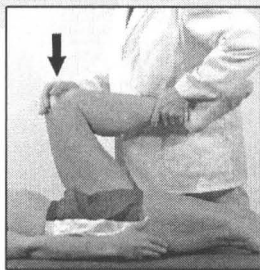
Hibb's Test

- Dr. internally rotates femur & stabilizes pelvis
- (+) SI pain → SI lesion
- (+) Hip pain → hip lesion (sprain)
- (+) Radiating pain down back of leg → piriformis entrapment of sciatic nerve



Hip Circumduction

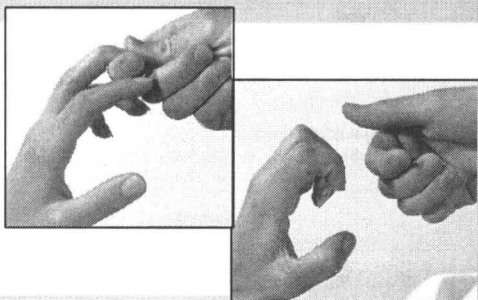
- Dr. moves flexed hip through circular motion
- Repeat with long axis pressure on knee toward hip ("scouring")
- (+) Hip pain → hip lesion (arthritis, inflammation, sprain)



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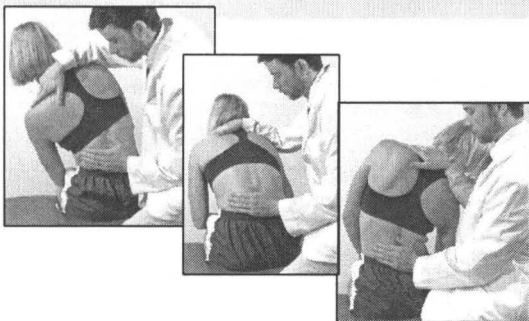
Hoffman's Sign

- Dr. "flicks" or "nips" patient's nail on 3rd finger
- (+) Clawing or gripping of thumb & fingers → upper motor neuron lesion (cervical spondy., multiple sclerosis, spinal cord compression)



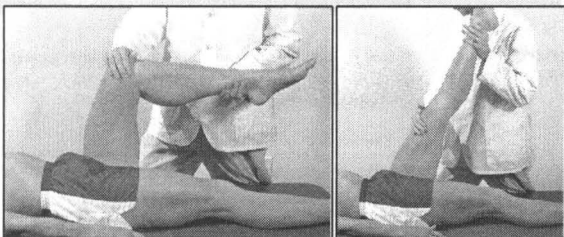
Kemp's Test

- Dr. extends pt back, applies over pressure on shoulder & P→A force with inferior hand
- (+) LBP with leg pain → radiculopathy
- (+) Local pain → local lesion (sprain/strain, facet syndrome, meniscoid entrapment)



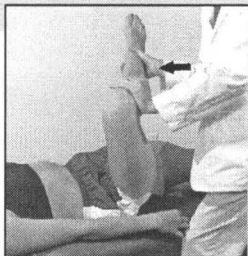
Kernig's Test

- Dr. flexes hip with knee flexed then extends knee
- (+) Leg pain → radiculopathy
- (+) Increased resistance → tight hamstrings



Laguerre's Sign

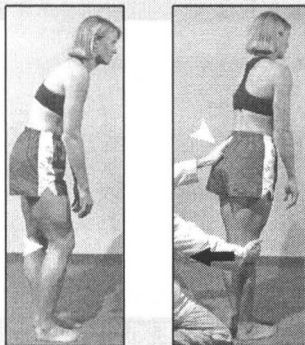
- Dr. flexes hip & knee, externally rotates hip
- (+) SI pain → SI pathology
- (+) Hip pain → hip lesion (arthritis, inflammation, sprain)



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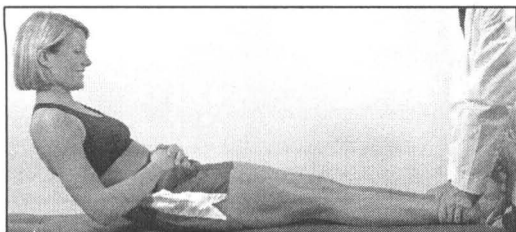
Levin Standing Test

- Dr. stabilize pelvis with one hand & sharply pull on knee into extension
- (+) Pain (with knee snapping back in to flexion) → hamstring spasm, nerve root tension



Levin Supine Test

- Pt. sits up
- Dr. holds legs down
- (+) Inability to perform due to pain (local or radiating) → lumbar arthritis, spondy., sciatica, disc herniation



Levin-Gaenslen Test

- Pt. lies on unaffected side, pulls knee to chest
- Dr. extend opposite leg, while stabilizing over PSIS
- (+) SI pain → SI lesions (sprain/strain, inflammation)



Lhermitte's Sign

- Pt. flexes neck
- Dr. may provide over pressure
- May be performed supine
- (+) Pain (sharp, shooting down spine) → cord tumor, posterior column disease, meningeal adhesions, multiple sclerosis



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Lindner's Sign

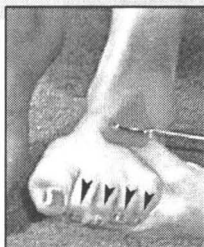
- Pt. supine, Dr. passively flexes patient forward
- May also be done with pt. seated

(+) Pain at lesion level & radicular symptoms →
nerve root compression

**Mendel-Bechterew's Sign**

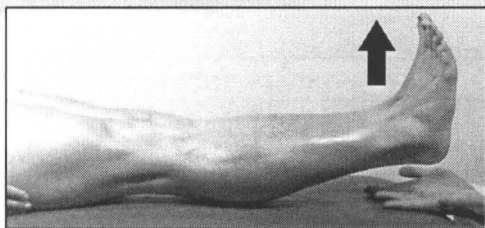
- Pt. supine tap lateral aspect of dorsum of foot

(+) Flexion of lateral 4 toes → UMNL
(corticospinal tract)

**Milgram's Test**

- Pt. supine, instructed to lift legs 5 cm off table & hold

(+) Pain → space occupying lesion
(disc herniation)

**Minor's Sign**

- Pt. rising from seat position, uses hands to "walk" up legs

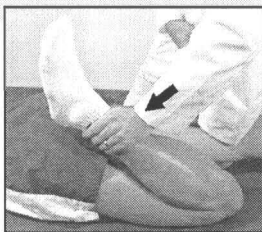
(+) → lumbosacral pathology
(SI/lumbar sprain/strain,
fractures, disc syndrome,
muscular dystrophy,
sciatica)



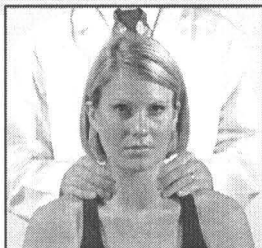
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UMNL = upper motor neuron lesion, LMNL = lower motor neuron lesion

Nachlas' Test

- Dr. passively flexes heel to ipsilateral buttock
- (+) Local pain → SI/lumbar ligament sprain
- (+) Radiating pain → femoral nerve pathology

**Naffzinger's Test**

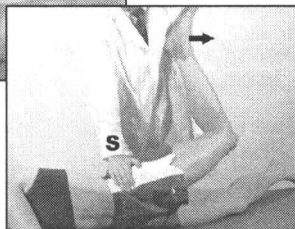
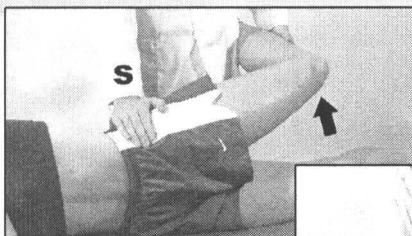
- Dr. compresses jugular veins for 10 seconds
- (+) Sharp pain at level of lesion → spinal compression (test increases intrathecal pressure)

**Neri Bowing Sign**

- As pt. spine flexes forward & knee flexes
- (+) Knee flexion with trunk flexion → nerve root tension, SI/lumbar strain/sprain

Ober's Test

- 1st Dr. abducts leg to tolerance
- 2nd Dr. internally rotates hip
- (+) Hip pain → hip pathology
- (+) Trochanteric pain → trochanteric bursitis

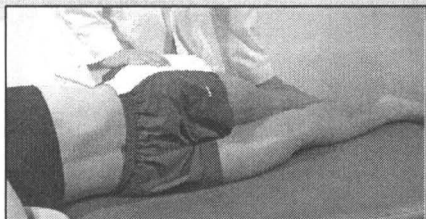


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Ober's Test Modified

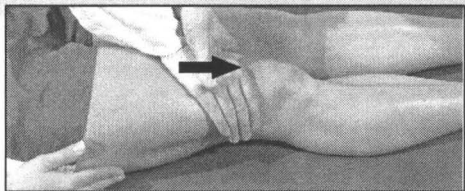
- Dr. passively extends & allows gravity to adduct hip

- (+) Hip pain → hip pathology
- (+) Trochanteric pain → trochanteric bursitis
- (+) Decreased motion → Iliotibial band contracture

**Patellar Clonus**

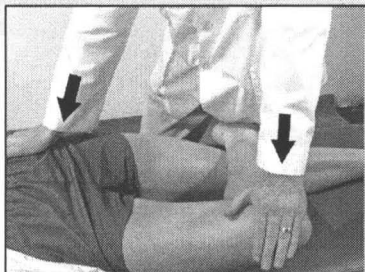
- Dr. applies brisk superior to inferior force above patella

- (+) Multi-beat clonus → UMNL

**Patrick's (FABER) Test**

- Pt "figure four" position
- Dr. applies pressure on ASIS & knee

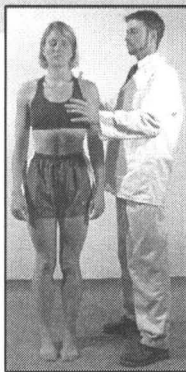
- (+) Hip pain → hip pathology

**Romberg's Test**

- Pt. stands with eyes closed
- Dr. stands near pt. in case they fall

- (+) Swaying/poor balance → posterior column lesion

Note: with cerebellar lesion pt. sways with both eyes open & closed



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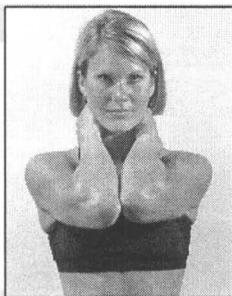
Roo's Test

- TOS test
- Pt. seated, open & closes hands about 2 times per second for up to 3 minutes

(+) inability to maintain → numbness, tingling, or weakness suggest thoracic outlet syndrome

**Rust's Sign**

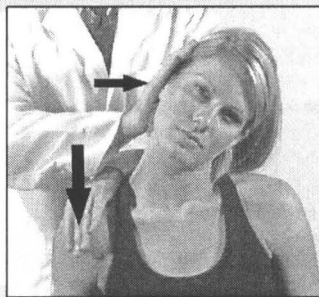
- Pt. presents supporting neck
- (+) → upper cervical fracture, rheumatoid arthritis, severe sprain/strain

**Shoulder Depression**

- Pt. laterally flexes head away from side being tested
- Dr. presses down on shoulder

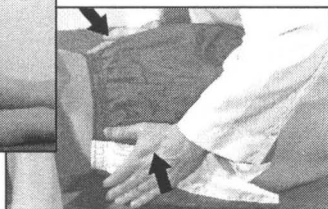
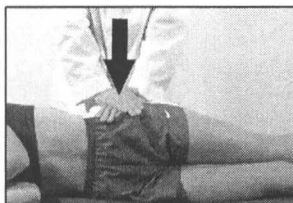
(+) arm pain → radiculopathy

(+) local pain → cervical pathology (sprain/strain)

**Sacroiliac Compression**

- Pt. supine or side lying
- Dr. compresses pelvis

(+) pain → sprain/strain, SI lesion, fracture

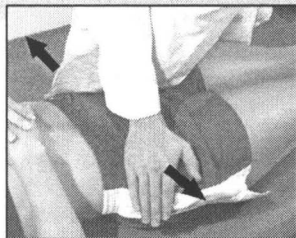


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Sacroiliac Distraction

- Dr. distracts pt.'s pelvis

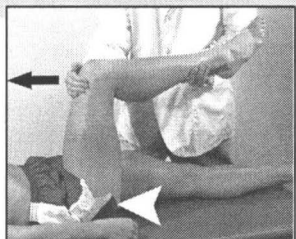
(+) Pain → SI sprain/strain, fracture



Sign of the Buttock Test

- During passive straight leg raise (SLR), pt. experiences pain, leg is flexed to relieve potential nerve root tension hip is moved into additional flexion.

(+) Pain & hip cannot flex beyond the SLR angle → pain in hip or gluteal region, it is said to be a positive sign of the buttock



SLR (straight leg raise)

- Active – Pt. flexes straight leg
- Passive – Dr. flexes straight leg
- Well – Dr. flexes unaffected leg

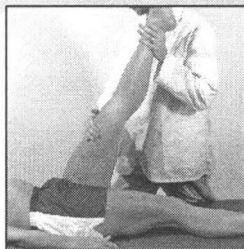
(+) Radicular pain → nerve root tension

(+) Local pain → SI/lumbar sprain/strain

0°-35° → extradural involvement

35°-70° → Disc involvement

70°-90° → Lumbar joint pain

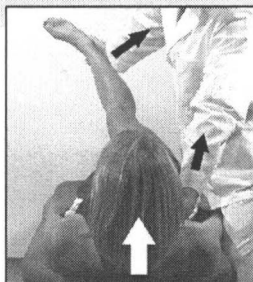


SLR - Maximal

- Passive SLR with leg internal rotation & adduction (Dr. may also dorsiflex foot)
- Neck flexion & Valsalva

(+) Radicular pain → nerve root tension

(+) Local pain → SI/lumbar sprain/strain



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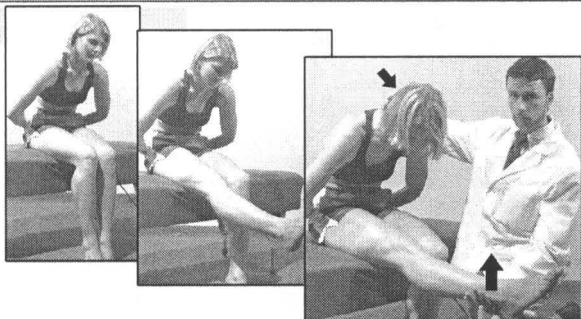
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ORTHONEURO TESTS

Slump Test

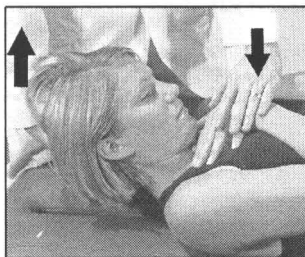
- Pt. slumps forward
- Dr. increases pressure

- (+) Radicular pain → nerve root tension
- (+) Local pain → SI/lumbar sprain/strain

**Soto-Hall Test**

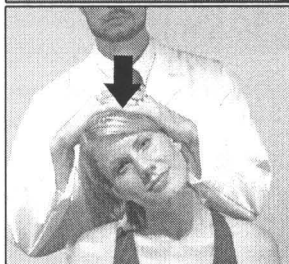
- Dr. passively flexes neck & applies pressure on sternum

- (+) Radicular pain → nerve root tension
- (+) Local pain → cervical sprain/strain

**Spurling Test**

- Dr. laterally flexes neck & applies superior to inferior pressure for up to 60 seconds

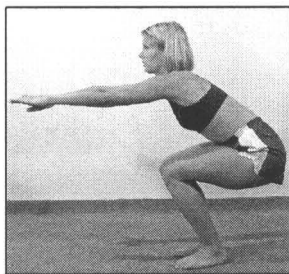
- (+) Radicular pain → nerve root tension
- (+) Local pain → cervical sprain/strain

**Squat & Rise**

- Pt. squats & rises

- (+) Inability to perform → SI/lumbar/hip/knee pathology

Watch for heels lifting of ground → tight calves



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Stork Stand

- Screening test for functional stability
- Compare pt. to standards below

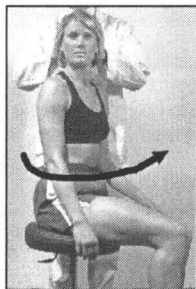
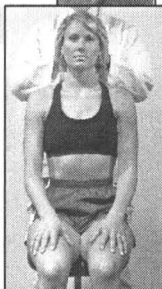
Age	Eyes open (sec)	Eyes closed (sec)
20-59	29 sec	21-28.8 sec
60-69	22.5 sec	10 sec
70-79	14.2 sec	4.3 sec

**Swivel Chair Test**

- Dr. holds pt. head in position
- Pt. twists on rotating chair

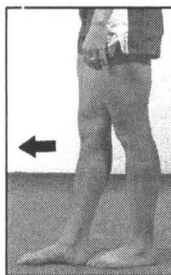
Can be used to differentiate cervicogenic from vestibular vertigo, as the Vestibular apparatus does not move during the test as the cervical spine does

(+) Vertigo → cervical origin

**Tandem Romberg**

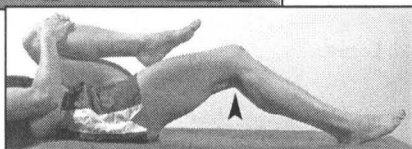
- Pt. walks 3 meters heel to toe with eyes open

(+) Inability to perform (wobbling) → cerebellar lesion, influence of alcohol

**Thomas' Test**

- Pt. flexes one knee to chest, while keep the other leg passive

(+) Elevation of straight leg → hip contracture, tight iliopsoas



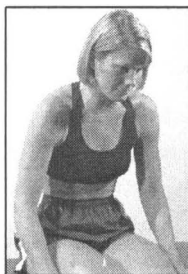
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Trendelenberg

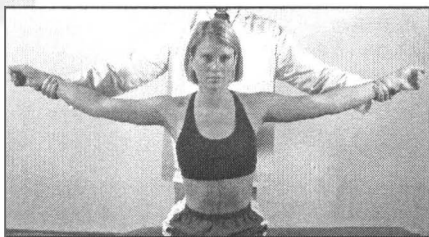
- Pt. stands on one leg
- (+) Pelvis lateral tilting → weak abductor muscles, especially gluteus medius (conditioning or neurological deficit)

**Valsalva Maneuver**

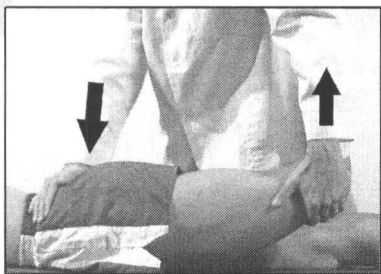
- Pt. "bears down as if straining at stool"
- (+) Increase in symptoms → radicular syndrome (disc bulge or herniation)

**Wright's Test**

- TOS test
- Dr. palpates radial pulses with arm abducted & posterior to scaption plane
- (+) Reproduction of symptoms → numbness, tingling or weakness - TOS

**Yeoman's Test**

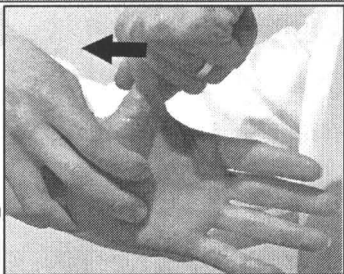
- Dr. extends hip & press down on ipsilateral PSIS
- (+) SI pain → SI sprain/strain
- (+) Pain/neurologic symptoms into anterior thigh → femoral nerve tension



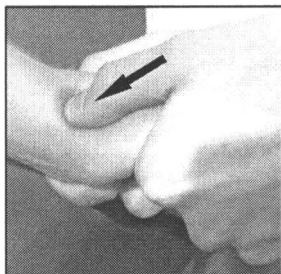
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UMNL = upper motor neuron lesion, LMNL = lower motor neuron lesion

Thumb Abduction Stress Test

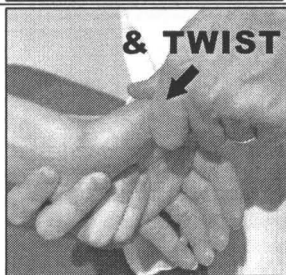
- Dr. grips pt.'s thumb while stabilizing pt.'s M.P. joint
 - Dr. abducts the pt.'s thumb
- (+) Pain over ulnar collateral ligament of thumb → sprain due to hyperabduction, hyperextension injury (Gamekeeper's or Skier's Thumb)
- (+) Empty endfeel &/or excessive motion → severe sprain joint instability, Stener lesion

**Scaphoid Fracture Test**

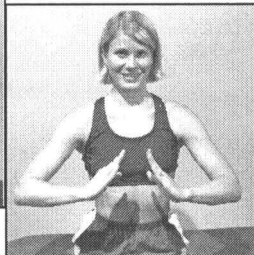
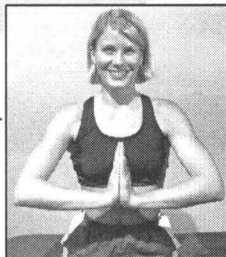
- Dr. grips pt.'s thumb, applies pressure with own thumb in pt.'s anatomical snuffbox (over scaphoid)
- (+) Pain following injury → scaphoid fracture

**Thumb Grinding Test**

- Pt. relaxed
 - Dr. grips & stabilizes pt.'s wrist & thumb/first
 - Dr. applies long axis compression while circumducting thumb
- (+) Pain/crepitis → trapeziometacarpal arthritis

**Wrist Drop Test**

- Pt. places palms together (praying position) & then pulls palms apart
 - Pt. holds hands about 15 cm apart for 1 minute (fully extended at wrist & palms facing)
- (+) Inability to hold hand in extended position → wrist extensor weakness, paralysis due to radial neuropathy



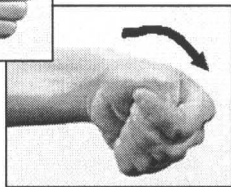
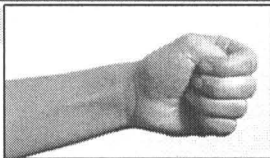
Adapted, with permission, from NMS Lab by MA Carnes, DC. WSCC. 2001.

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UMNL = upper motor neuron lesion, LMNL = lower motor neuron lesion

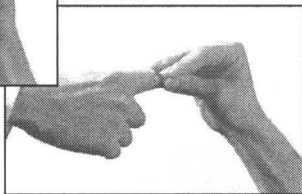
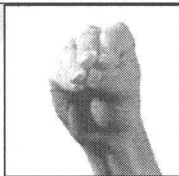
Finklestein's Test

- Pt. makes fist with thumb inside, & ulnar deviate (adduct) wrist
- (+) Pain → de-Quervain's or Hoffman's disease /tenosynovitis
- (+) "Squeaking"/crepitis → Intersection Syndrome (tenonitis of the extensor carpi radialis longus & brevis)



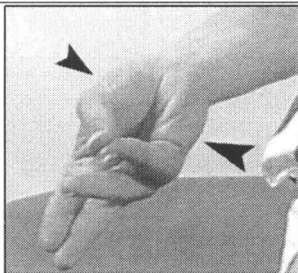
Froment's Test

- Pt. touches all 5 fingers together forming a 'cone'
- (+) Inability to perform → paralysis of palmar interossei due to ulnar neuropathy
- May be done with pt. pinching Dr.'s finger in apex of 'cone'
- (+) Weakness → subtle ulnar palsy



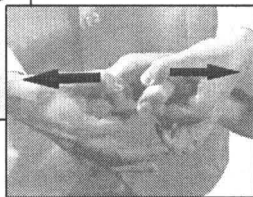
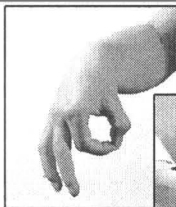
Opposition Test

- Pt. presses thumb to 5th digit
- Dr. can measure strength with pinch diameter, or Dr. can separate thenar & hypothenar
- (+) Weakness → median neuropathy involving opponens pollicis



Pinch Test

- Pt. pinches tip of index finger to tip of thumb while forming a circle
- Dr. pull thumb & finger apart
- (+) Inability to maintain/weak pinch grip → weakness of flexor pollicis longus (anterior interosseous neuropathy - deep branch of median nerve)



Adapted, with permission, from NMS Lab by MA Carnes, DC. WSCC. 2001.

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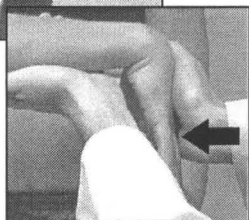
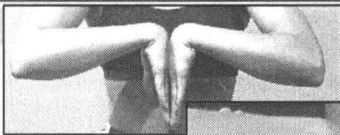
UMNL = upper motor neuron lesion, LMNL = lower motor neuron lesion

Phalen's Test (two versions)

Version 1: Pt. places back of hands together in front of the body so both wrists are fully flexed, maintains position for 1 minute

Version 2: Dr. gently holds involved wrist in sustained flexion for 1 minute

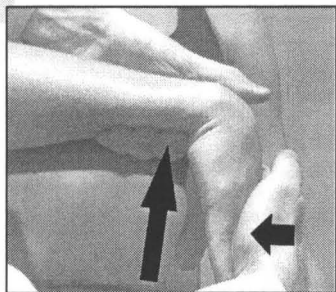
(+) "Numbness" distribution of median nerve, increased anterior wrist pain, & subsequent weakness of thumb opposition → carpal tunnel syndrome

**Modified Phalen's Test**

- Phalen's plus carpal tunnel compression
- Dr. applies pressure with index or middle finger over wrist in full flexion for 1 minute

(+) Same as Phalen's test

Note: this examination procedure is more sensitive than Phalen's test alone

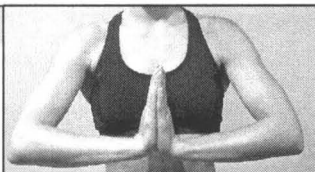
**Reverse Phalen's Test**

Two versions

Version 1: Pt. places palms of together with wrists fully extended (praying position) for 1 minute

Version 2: Dr. gently holds the pt.'s wrist in full extension for 1 minute

(+) Same as Phalen's Test

**Other Wrist/Hand Tests**

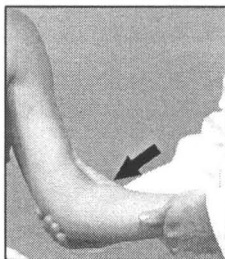
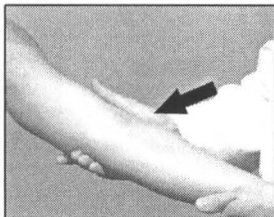
- MP, PIP., and DIP Finger Stress Tests
- Lunotriquetal Ballotment Test
- Scapholunate Ballotment Test
- Tinel's

Adapted, with permission, from NMS Lab by MA Carnes, DC. WSCC. 2001.

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UMNL = upper motor neuron lesion, LMNL = lower motor neuron lesion

Valgus Stress Test

- Dr. applies valgus force
- Performed with elbow fully extended & with elbow flexed 30°, forearm supinated
- Note amount of joint play & location of pain



Varus Stress Test

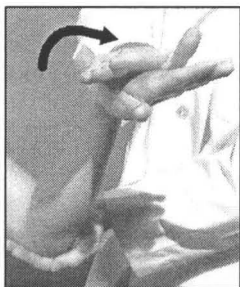
- Dr. applies varus force
- Performed with elbow fully extended & with elbow flexed 30°, forearm supinated
- Note amount of joint play & location of pain



Cozen's "Tennis Elbow" Test

- Pt. forearm pronated & flexed, & wrist extended (waiter's position)
- Dr. contacts dorsum of pt.'s hand & supports elbow
- Pt. then resists while Dr. applies force in the direction of wrist flexion & forearm extension

(+) Pain/weakness → "tennis elbow" (lateral epicondylitis)

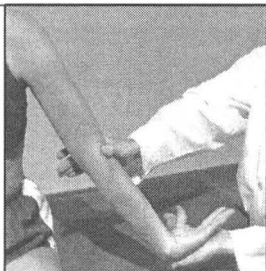


Mills' Test

- Passive stretch test
- Dr. extends & pronates elbow flexing wrist to stretch the common extensor tendon

(+) Lateral elbow pain during this test → lateral epicondylitis

(+) Restricted ROM → arthritis, capsular adhesions to the overlying common tendon, or tendon contracture.



Adapted, with permission, from NMS Lab by MA Carnes, DC. WSCC. 2001.

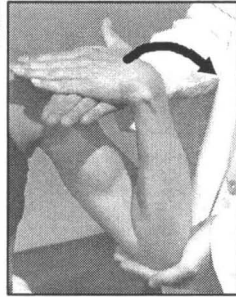
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Reverse Cozen's Test (Golfer's Elbow)

- Pt. elbow flexed 45-90° & supinated, & wrist slightly flexed & ulnar deviated
- Dr. applies pressure on pt.'s palm w/ one hand while stabilizing elbow & palpating medial epicondyle w/ other hand

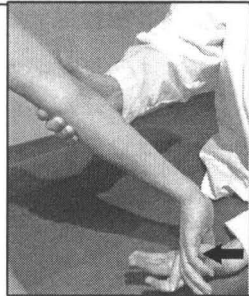
(+) Localized pain at medial epicondyle or distal at common flexor tendon → medial epicondylitis, tendonitis (Golfer's Elbow)



Reverse Mills' Test

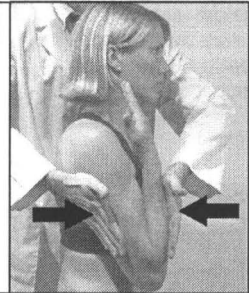
- Dr. extends pt.'s elbow, wrist, & fingers to stretch common flexor tendon at medial epicondyle

(+) Medial elbow pain → medial epicondylitis or tendonitis at the elbow



Elbow Flexion/Hyperflexion Test

- Dr. holds pt.'s forearm fully flexed position for up to 5 minutes while supporting elbow
- Shoulder & wrist are kept in neutral
- Test stretches ulnar nerve around medial epicondyle in cubital tunnel
- Test may produce "carpal tunnel- like" symptoms due to compression of median nerve as it passes through pronator teres



Tinel's Test at the Elbow

- Dr. taps gently over pt.'s cubital tunnel (posterior to medial epicondyle) with pads of fingers several times
- (+) Shooting electrical pain along medial side of forearm to medial hand → ulnar neuropathy at elbow



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ORTHONEURO TESTS

Sulcus Sign

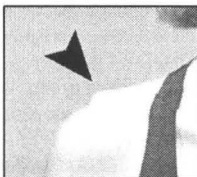
- Pt. sits/stands with arm hanging at side
- Dr. observes from posterolateral

(+) Abnormal prominence of acromion & groove-like depression below acromion → inferior instability (or multidirectional instability), glenohumeral dislocation, atrophy of deltoideus

**Step-off, Step Defect/Deformity**

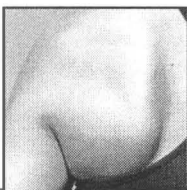
- Pt. sits/stands with arms hanging at the sides
- Dr. observes from anterior

(+) Prominence of distal clavicle in relation to acromion → AC separation

**Scapular Winging**

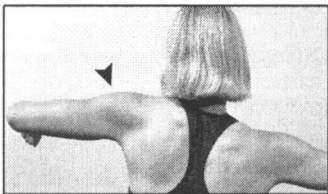
- Pt. does wall "pushup"

(+) = Flaring of scapula/posteromedial winging → paresis/paralysis of serratus anterior
 (+) = Subtle posterolateral winging → paresis/paralysis of trapezius due to spinal accessory (Cn XI) lesion

**Shoulder Hiking** (Scapulohumeral Rhythm)

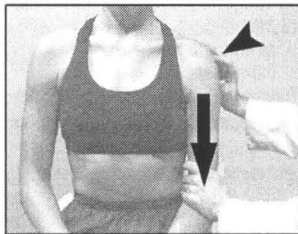
- Pt. sits/stands & attempts to actively abduct arms

(+) Elevation of ipsilateral shoulder girdle & lateral flexion of trunk to opposite side to compensate for inadequate GH mobility or weakness → frozen shoulder, cuff tears, & advanced osteoarthritis
 (+) Subtle hiking → muscle imbalance involving overactive upper trapezius, weakness of rhomboids, lower trapezius, & rotator cuff

**Sulcus Test/Reinforced Sulcus Sign**

- Pt. is standing/sitting with elbow partially flexed & relaxed at side
- Dr. pulls down on elbow while palpating GH joint

(+) Increased motion → dislocation, excessive inferior translation, accentuation of the sulcus sign, inferior or multidirectional instability



Adapted, with permission, from NMS Lab by MA Carnes, DC. WSCC. 2001.

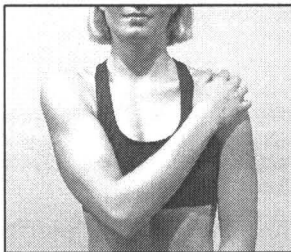
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Dugas' Test

- Pt. reaches across body, place hand on opposite shoulder & pull their elbow against the chest
- Dr. can apply A→P overpressure on flexed elbow

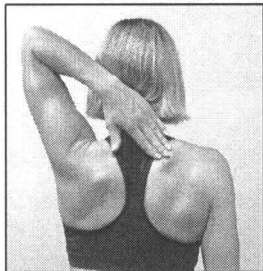
(+) Inability to complete test → anterior GH dislocation



Apley's Superior/Scratch Test

(Apley's I)

- Pt. attempts to touch opposite superior angle of scapula
 - Dr. observes from behind
- (+) Pain → impingement, rotator cuff pathology, AC arthritis, labral pathology, GH arthritis, subacromial bursitis, or GH capsular pathology
- (+) inability to complete maneuver → capsular contracture &/or internal GH rotator tightness

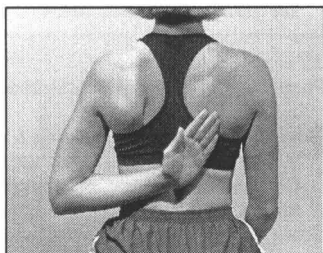


Apley's Inferior (Apley's II)

- Pt. attempts to touch opposite inferior angle of scapula
- Dr. observes from behind

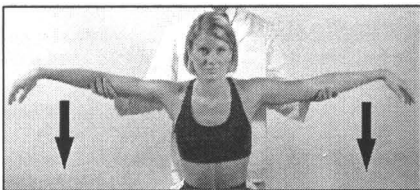
(+) Inability to complete maneuver → external GH rotator tightness or pathology, labral pathology, or capsular contracture

Note that there is 'normally' less flexibility during this procedure on dominant arm



Codman's "Arm Drop" Test

- Pt. standing, Dr. stands behind, abducts the pt.'s arm to 90°, lets go – ask pt. to catch themselves
- (+) Pain/weakness → "painful arc syndrome" (bursitis, rotator cuff strain, tendonitis, or impingement)
- (+) Pt. unable to maintain 90° abducted position against gravity (less than +3/5 muscle strength) → severe injury (grade 3 cuff strain)



Adapted, with permission, from NMS Lab by MA Carnes, DC. WSCC. 2001.

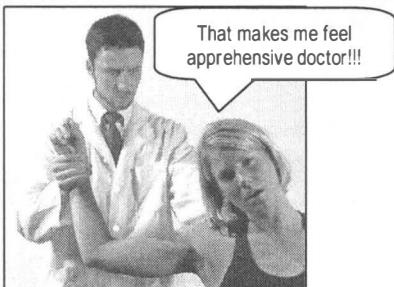
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Anterior Apprehension Test

- Pt. seated/supine
- Dr. raises arm 90° abduction, externally rotates, & applies anterior pressure over posterior deltoid

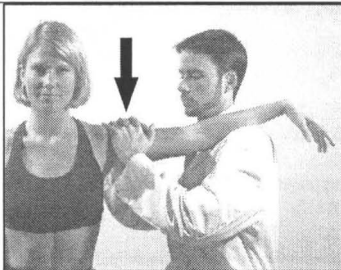
(+) Excessive anterior translation, dislocation, or evidence of pt. apprehension → anterior instability (inferior glenohumeral ligament laxity)

Note: Humor - Pt. shows apprehension, not Dr.

**Faegin's Test**

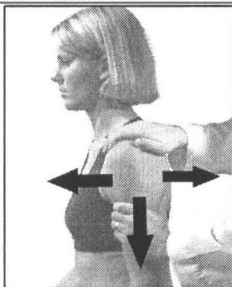
- Pt. seated, arm abducted 90° (palm down)
- Dr. applies downward pressure pt.'s arm

(+) Clunk/excessive inferior translation → inferior or multidirectional instability

**Load & Shift**

- Pt.'s arm in dependent position
- Dr. applies pressure humerus to "load" while stabilizing shoulder
- Dr. moves arm anterior, posterior, inferior

(+) Increased translation (should be < 25% anteriorly, or < 50% posterior) → shoulder instability

**Yergason's Test**

- Pt. seated, elbow flexed 45°-90°, pronated
- Dr. grips forearm & palpates biceps tendon
- Pt. actively flexes & supinates forearm & externally rotates arm ("hitchhiker")
- Dr. palpates over long head biceps tendon, while resisting pt. motion with other hand

(+) Pain &/or weakness → biceps strain/tendonitis
 (+) Snap or pop → subluxating biceps (long head) tendon



Adapted, with permission, from NMS Lab by MA Carnes, DC. WSSC. 2001.

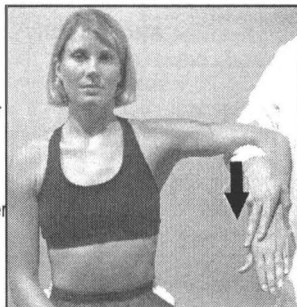
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Hawkins-Kennedy Test

- Pt. seated with elbow 90°
- Dr. flexes pt. shoulder to 90°, & internally rotates shoulder to pinch greater tuberosity of humerus against acromion

(+) Sharp anterolateral shoulder pain → supraspinatus impingement

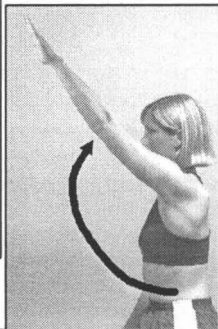
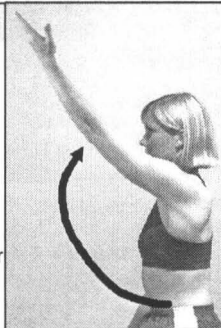


Impingement Sign

- Pt. upper extremity straight, hanging at side
- Pt. actively flexes straight arm
- 1st palm up (externally rotated GH) & 2nd with palm down (internally rotated GH)

(+) Pain during active flexion → shoulder impingement syndrome

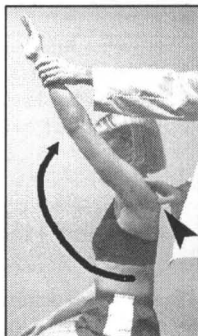
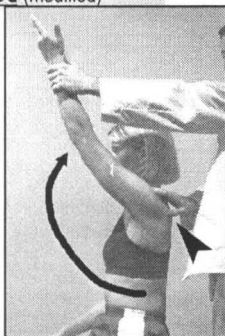
- (+) Pain → Internally rotated - supraspinatus impingement
- External rotation - biceps long head impingement



Neer's Impingement Test (modified)

- Pt. sitting with arms at side
- Dr. raises pt.'s straight-arm through full range of flexion
- 1st with pt.'s arm externally rotated position, repeated with arm internally rotated

(+) Shoulder pain → shoulder impingement syndrome. (supraspinatus/biceps)



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Hyperextension Test

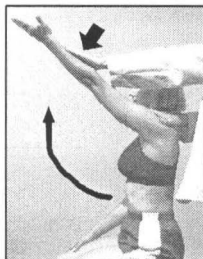
- Pt. flexes elbow fully
- Dr. extends shoulder, straightens pt's arm

(+) Pain in shoulder → biceps tendonitis

**Speed's Test**

- Pt. forearm extended & supinated - arm at side
- Pt. concentrically flexes arm forward to 120°
- Dr. resists (elbow remains extended), palpates bicipital groove

(+) Pain → bicipital tendonitis, may produce pain with S.L.A.P. lesion

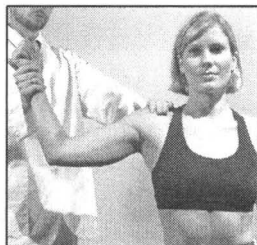
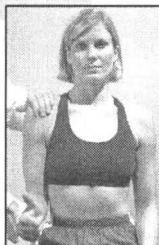
**Bicipital Instability Test** (Modified

Yergason's)

- Active resisted shoulder abduction performed along with external rotation, & forearm pronation & flexion
- When pt. has completed motion arm is abducted 90° & externally rotated 90° (like baseball umpire "you're out")

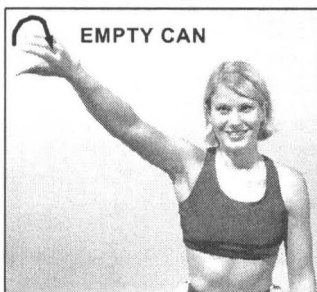
(+) Long tendon of biceps snap or pop out of intertubercular groove

AC crepitus is a common finding during this test

**Empty Can Test**

- 1st-Pt. raises straight arm (palm up) to 120° in scapular (scaption) plane
- 2nd-At apex, pt. internally rotates arm (thumb down - empty the can), then lowers straight arm internally rotated slowly back to body along scapular plane
- Both arms may be done simultaneously

(+) Pain/weakness → injury/lesion of supraspinatus



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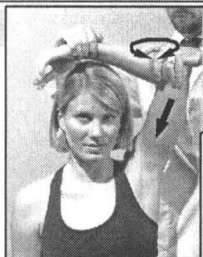
UMNL = upper motor neuron lesion, LMNL = lower motor neuron lesion

Crank Test

- Pt. elbow flexed 90°
- Dr. raises pt.'s arm to 160°-180° in scapular plane & applies long axis compression, rotates humerus externally & internally

(+) Shoulder pain & crepitus (grinding or popping)
→ labral tear

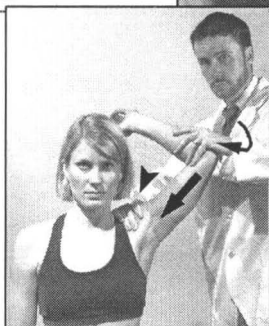
91% Sensitivity & 98% specificity in stable shoulders
90% sensitivity & 85% specificity in unstable shoulders



Clunk Test

- Dr. abducts pt.'s arm overhead, other hand on posterior deltoid
- Dr. rotates arm externally & applies anterior pressure on humeral head

(+) Pain with associated clunk or grinding → labral tear, may also produce apprehension if shoulder is unstable



Obrien's Test

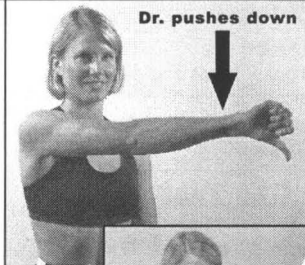
Two-part test:

1. Pt. holds straight arm flexed 90°, adducted 10°-20° & internally rotated (thumb down)
2. Pt. then attempts to raise arm (flexes at shoulder), Dr. resists
3. Resisted muscle test is repeated when pt. attempts to flex the arm while externally rotated (palm up)

(+) GH pain & crepitus & reduced or eliminated during the 2nd part → anterior labral tear

(+) Anterior shoulder pain ↑ with palm up → biceps tendonitis

80% sensitivity & 100% specificity for labral tears

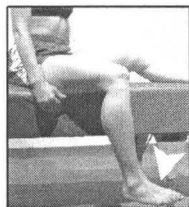
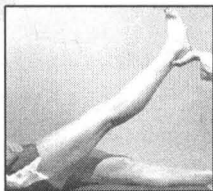


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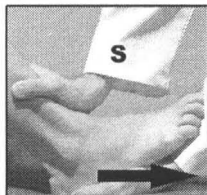
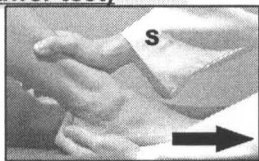
Buerger's Test

- 1st-Lift straight leg to 45° for 3 minutes
 - 2nd-lower leg & have patient sit up
 - Dr. observe for venous & capillary refilling
- (+) Poor arterial circulation → atherosclerosis, chronic compartment syndrome

**Drawer Test (anterior drawer test)**

- Anterior glide of foot relative to tibia
- Done with foot at 90° & plantar flexed

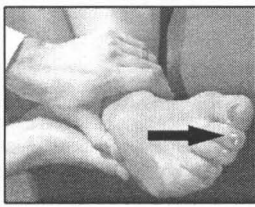
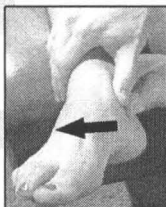
(+) Increased motion → integrity of collateral ligas (ant. talofibular lig.)

**Eversion Talar Tilt**

- Hold feet over talus, evert feet – integrity of deltoid lig.

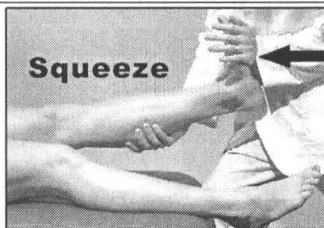
Inversion Talar Tilt

- Hold feet over talus and invert feet – integrity talofibular. ligaments

**Homan's Test**

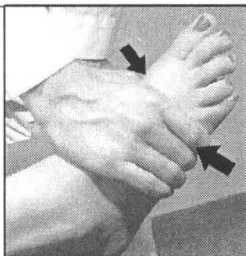
- Raise straight leg 10°, forcefully dorsiflex foot, squeeze calf

(+) Calf pain → thrombophlebitis

**Morton's Test**

- Dr. squeezes foot around metatarsal heads

(+) Pain → Morton's neuroma, fracture of metatarsal head



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Achilles Squeeze Test

- Dr. squeezes tendon 2 cm above insertion

(+) Pain → *peritendinitis*

**Calcaneal Squeeze Tests**

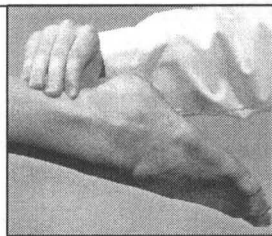
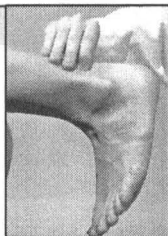
(+) pain →

1. Sides of calcaneus → *fracture*
2. Calcaneal tuberosity → *bursitis, Fx*
3. Medial calcaneal tubercle → *plantar fasciitis*

**Hoffa's Test** (2 parts)

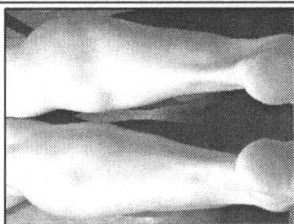
- 1st - Dr. palpate Achilles tendon
 - Pt. actively plantar/dorsi-flexes foot
- (+) If heel pain or less tension of Achilles tendon of involved foot, then
- 2nd - Dr. passively plantar/dorsiflexes foot

(+) Pain → calcaneal fx,

**Simmond's/Thompson's Test**

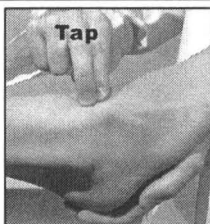
- Look for symmetry
- Dr. squeezes calves bilaterally & observe movement

(+) No plantar flexion of injured leg → Achilles tendon rupture (Simmond's sign)

**Tinel's Sign/Test**

- Tapping over peripheral distribution of a peripheral nerve (may be done at other anatomical sites where peripheral nerves are near surface of skin & bony prominences)

(+) Distal tingling, paresthesia or electrical sensation → nerve compression syndrome



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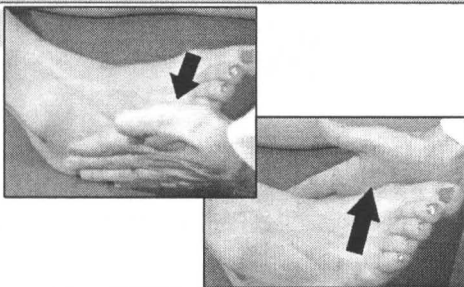
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Torsion Test

- Knee bent 90°, patient pushes against Dr. hand in internal & external rotation

(+) Knee pain → meniscal tear, moderate/severe sprain or fracture

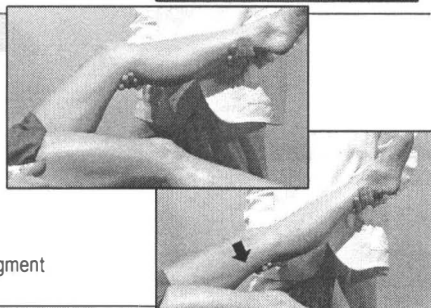
**Bounce Home**

- Lift leg straight, bend knee 20°
- Dr. drop knee – fully extends leg (supported under popliteal fossa)

(+) Joint line pain → meniscal tear

(+) Inability to fully extend:

1. Swelling → spongy end feel
2. Meniscal tear → rubbery end feel
3. Hard end feel → Intra-articular fragment

**Other Screening Tests****Standing Heel to Buttock**

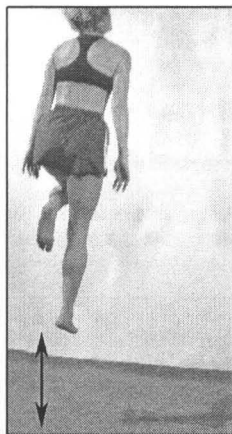
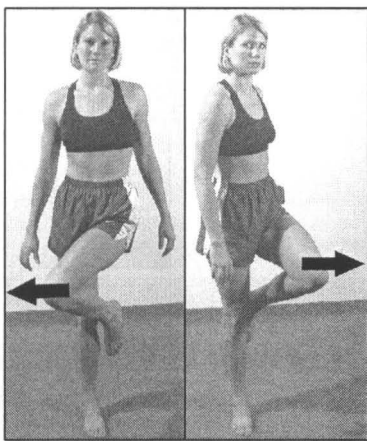
- Pt. flexes leg to buttock

Single Leg Twister (Disco Test)

- Pt. twists on one leg

Single Leg Hop

- Pt. hops in place



Adapted, with permission, from NMS Lab by MA Carnes, DC. WSCC. 2001.

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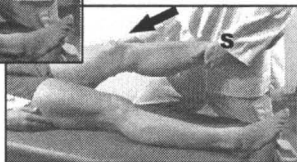
UMNL = upper motor neuron lesion, LMNL = lower motor neuron lesion

Valgus Stress Test

- Pt supine knee straight
- Dr. applies valgus stress to knee extended
- Dr. applies valgus stress to knee flexed (~25°)

(+) Pain → medial collateral ligament strain

(+) Increase motion/gapping → medial collateral rupture

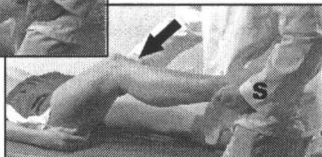
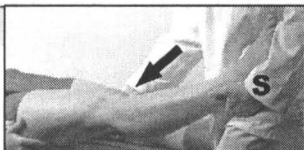


Varus Stress Test

- Same as valgus except Dr. applies varus stress in two positions

(+) Pain → lateral collateral ligament strain

(+) Increase motion/gapping → lateral collateral rupture

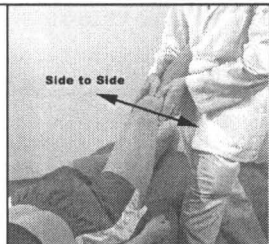


Wobble Test

- Dr supports knee with both hands and 'wobbles' it from side to side (general stabilization screen)

(+) Pain → medial/lateral strain

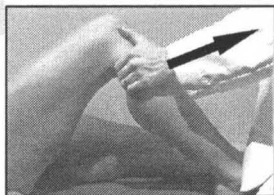
(+) Increase motion/gapping → medial/lateral collateral rupture



Anterior Drawer Test

- Pt supine, knee bent 90°, pull tibia anteriorly

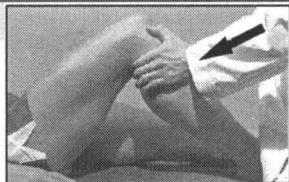
(+) Pain → anterior cruciate ligament sprain
(>6mm translation = ACL tear)



Posterior Drawer Test

- Pt supine, knee bent 90°, push tibia posteriorly

(+) Pain → posterior cruciate sprain (>6mm translation = PCL tear)

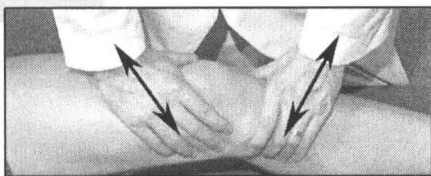


Adapted, with permission, from NMS Lab by MA Carnes, DC. WSCC. 2001.

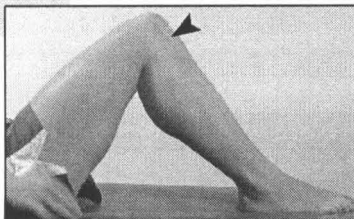
→ = may indicate/suggests, (+) = positive, (-) = negative, Pt. = patient, DJD = degenerative joint disease
UMNL = upper motor neuron lesion, LMNL = lower motor neuron lesion

Lachman's Test

- Gold standard for anterior instability
 - Pt. knee bent 15°-30°
 - Dr. pulls tibia posterior to anterior & vice versa
- (+) Pain w/ normal translation → ACL sprain
 (+) Pain w/ ↑ translation → ACL rupture

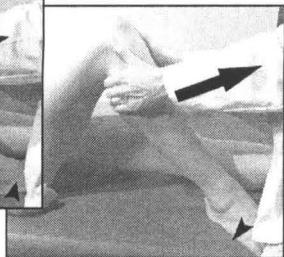
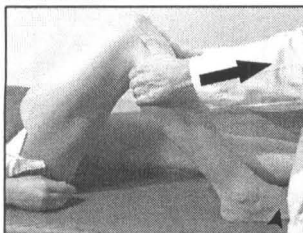
**Posterior Sag Sign**

- Gravitational sag sign
 - Pt. supine knees bent 90°
- (+) Posterior tibia due to gravity → PCL tear

**Slocum's Tests** (2 parts)

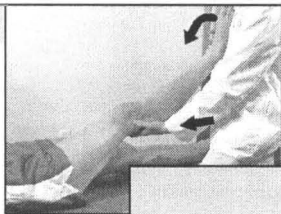
- Same as anterior drawer test except;

1. Tibia externally rotated 15°
(+) Anteromedial instability (MCL, ACL)
2. Tibia internally rotated 30°
(+) Anterolateral instability (LCL, PCL, ITB)

**MacIntosh Pivot Shift Test**

- Pt. supine w/ knees extended
- Dr. while bending knee apply anterior translation, internal rotation & valgus stress

(+) Repeatable 'clunk' → anterolateral rotational instability



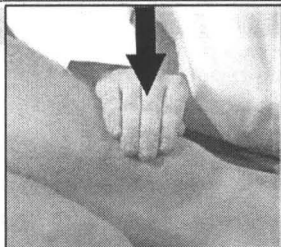
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Ballottement Test

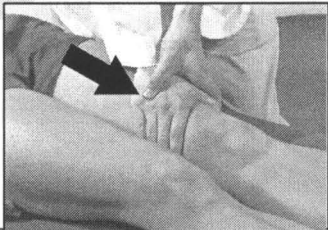
- A→P pressure on patella, normally moves ~1mm
- (+) ↑ Motion → intra-articular swelling



Swelling Tests

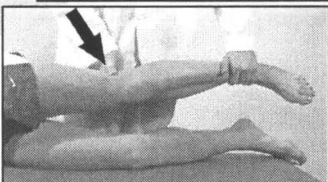
Bulge, Sweep, or Brush Test

- Sweep hand down quadriceps from above suprapatellar bursa in milking motion
- (+) Excess fluid → knee swelling

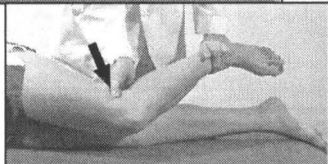


Noble Compression Test

- Pt. supine or on side
- Dr. slowly flexes/extends leg (3-4x), while putting pressure on lateral epicondyle
- Next ↑ pressure on ITB and repeat

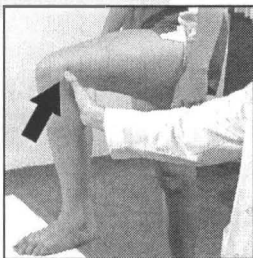


- (+) ↑ Pain/palpable snapping → ITB syndrome



Renne's ITB Test

- Same as Noble's except, standing pt. squats & rises, or steps up on bench
- (+) ↑ Pain/palpable snapping → ITB syndrome



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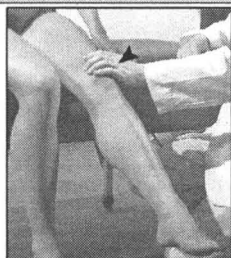
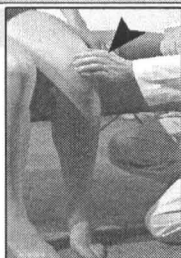
ORTHONEURO TESTS

Iliotibial Band Tests

Plica Stutter Test

- Pt. seated, pt. flexes/extends leg
- Dr. palpates patella

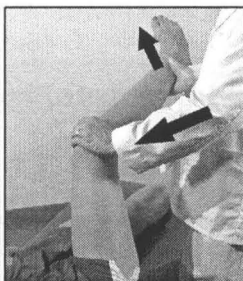
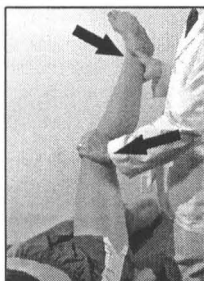
(+) Catching/jumping → symptomatic plica



Hughston's Plica Test

- Pt. supine leg extended
- Dr. palpates patella & passively flexes & extends leg w/ tibia internally rotated, superior hand applies valgus force over knee

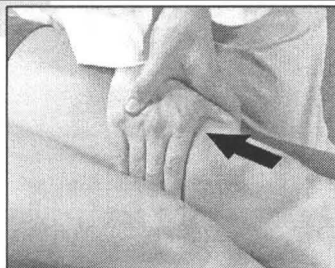
(+) Patella "stutters" → synovial plica syndrome



Modified Clarke's Test

- Dr. stabilizes 2 cm above patella
- Pt. contracts quadriceps

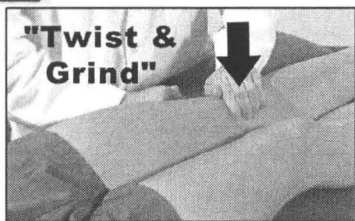
(+) Retropatellar pain → chondromalacia patellae



Patellofemoral Grinding Test

- Dr. cups hand over patella, compress, move patella

(+) Pain &/or crepitis → chondromalacia patella, DJD



"Twist & Grind"

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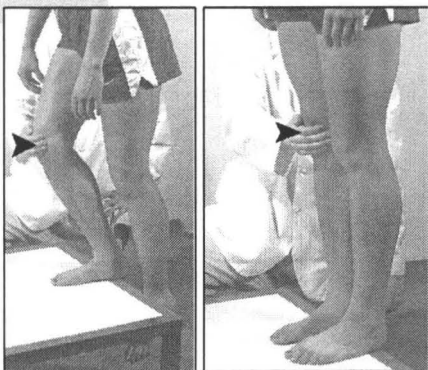
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Step-up Bench Test

- Dr. palpates patella
- Pt. step up on bench

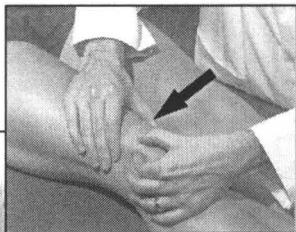
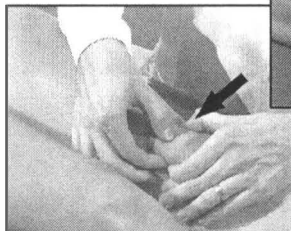
(+) Pain &/or crepitus → arthritis, DJD, sprain/strain



Patella Facet Pinch Test

- Dr. moves patella medially & laterally palpate facets

(+) Facet tenderness → chondromalacia patella



Patellar Apprehension (Fairbanks) Test

- Dr. moves patella laterally, observe pt. for verbal & nonverbal signs of apprehension

(+) Apprehension → patellar instability & potential dislocation

Note: Humor - Pt. shows apprehension, not Dr. 😊



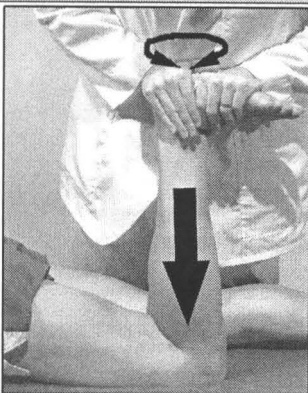
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Apley's Compression

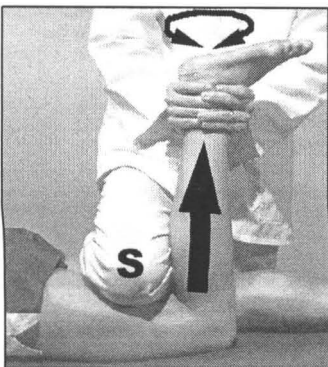
- Pt. prone w/ knee flexed 90°
- Dr. pushes down on foot & rotates internally & externally

(+) Pain compression relieves by distraction → meniscal lesion

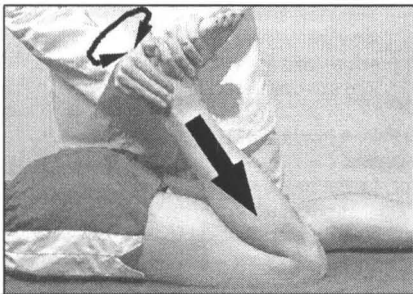
**Apley's Distraction**

- Pt. prone w/ knee flexed 90°
- Dr. puts shin on posterior of pt.'s thigh, pull up on foot, & rotates internally & externally

(+) Pain w/ distraction → capsule/ligament lesion

**Hyperflexion Test**

Same as Apley's compression, except pt. leg flexed to 130°-150°, may find posterior horn tears missed by Apley's compression



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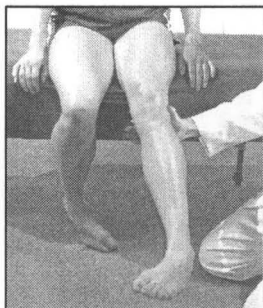
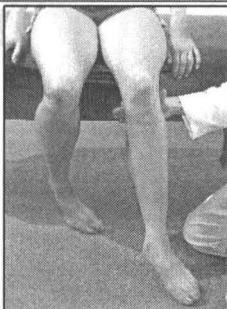
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Wilson's Test

- Pt. w/ knees flexed 90° hanging over end of table, pt. actively extends leg:
1st with tibia internally rotated, then repeat
2nd with tibia externally rotated
- Dr. palpates popliteal fossa

(+) Pain or apprehension → meniscal lesion or Osteochondritis Dessicans (O.D.)



Steinman's Test/Sign

- Pt. supine leg up knee bent ~90°
- Dr. palpates around knee joint line & flexes/extends leg

(+) Pain → meniscal lesion, O.D.

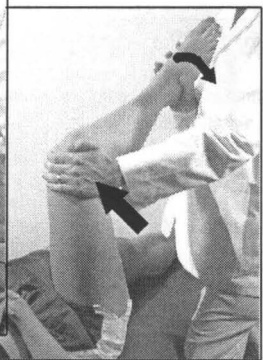
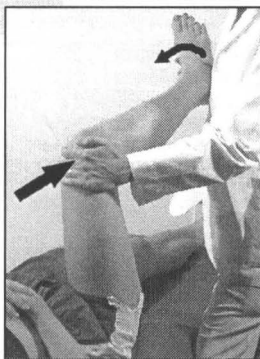


McMurray's Tests

- Dr. rotates tibia internally (with varus stress) & externally (with valgus stress) while applying long axis compression

(+) Pain → meniscal lesion or plica

Lateral meniscus – valgus w/ ext. rot.
Medial meniscus – varus w/ int. rot.



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Allis' Leg Length Check

Pt. supine knees bent 90°. Observe knee height.
 (+) Uneven knee height → long/short femur/tibia,
 pelvic misalignment, poor technique

Anvil Test

Pt. supine w/ knees locked in extension, lift leg
 -10° and heel is struck with increasing force
 3 times
 (+) Pain in ipsilateral hip → DJD or inflammation
 of joint

Braggard's

SLR with dorsiflexion of at ankle
 (+) 'Electrical' 'shooting' pain down back of leg or
 thigh

Gaenslen's Test

Pt. supine or side lying, pulls knee to chest, test is
 intended to provoke SI disorders, but may
 provoke femoral nerve or iliopsoas

Internal Rotation Adduction**Circumduction Test (IRAC)**

Pt. supine w/ knee & hip flexed, Dr. moves pt. leg
 (+) Pain in groin, upper thigh & buttock → hip
 pathology [SCFE, arthritis, transient
 synovitis]
 (+) crepitus → arthritis

Laguerre's Test

"FABER in the air"

Patrick's (FABER) Test

Pt. ends up with leg in figure four position
 (+) Pain/↓ROM → pathology in hip (arthritis,
 contracture, etc)

Rectus Femoris Contracture**Test**

Pt. supine same as Thomas test
 (+) Opposite leg extends → contracture of rectus
 femoris

Scour Test

Same as IRAC except w/ long axis pressure
 applied to femur.

Thomas Test

Pt. supine, pull knee to chest
 (+) Opposite hip flexes → hip flexor contracture

PRONE TESTS**Ely's Test**

Pt. prone, Dr. flexes knee- heel to opposite
 buttock

Hibb's Test

Flex knee and internally rotate leg
 (+) SI pain → may be due to hip or SI pathology

Nachlas' Test

(Femoral nerve stretch test) pt. prone, Dr. flexes
 knee- heel to buttock
 (+) Pain or tightness of quadriceps, or femoral
 neuralgia or L2-L4 radiculopathy

Ober's Test

Pt. side posture, inferior leg flexed, lifts straight leg
 & passively adducts posteriorly
 (+) ↓ Adduction → ITB contracture

Yeoman's Test

Pt. prone, knee flexed to 90°, Dr. lifts bent leg to
 put SI into extension
 (+) Pain → SI, femoral nerve or iliopsoas
 contracture

For pictures refer to the general orthopedics section of this chapter

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Burns Bench Test

- Patient kneeling near edge of table reaches over the edge
 - No sciatic or nerve root traction
- (+) Exaggerated pain response

**Flip Sign**

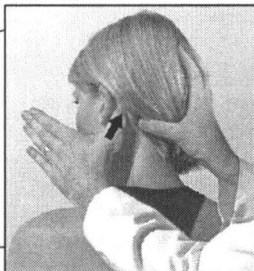
- Pain with SLR, but can sit upright with knees extended

Hoover's Test

- No pressure felt against table with Dr.'s hand under good leg during active SLR

Libman's Test

- Dr. applies pressure on mastoid
 - Test for low pain threshold
- (+) Pain with minimal pressure

**Magnuson's Test**

- Seated patient points to site of pain
 - Dr. distracts patient with other tests, then asks patient to locate pain again
- (+) Inconsistent or vague response constitutes positive test

Mankoff's Maneuver

- Dr. palpates radial pulse while pt. is in pain
- Pulse rate should increase by 10% or more during palpation of true pain

**Waddell Tests**

1. Rotate trunk, spine, pelvis (standing) simultaneously (no spinal stress)
2. Axial loading: Pt. standing, digital compression on head
3. SLR improves when patient distracted
4. (+) Widespread "non-anatomic" tenderness

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Babinski-Like Reflexes

Babinski's Sign: Extension of large toe, with fanning of small toes upon stimulation of plantar surface of foot (plantar reflex).

Chaddock's Toe Sign: Response same as Babinski sign, upon stroking of lateral malleolus.

Schaefer's Sign: Babinski response upon squeezing Achilles tendon.

Gordon's Leg Sign: Babinski response upon squeezing calf muscle.

Oppenheim's Sign: Babinski response elicited by firm downward stroking of tibia & tibialis anterior muscle.

Lower Extremity

Rossolimo's Sign: Flexion of toes upon tapping ball of foot.

Gonda Reflex: Upward movement of big toe, produced by pressing one of other toes downward, then releasing it with a snap.

Mendel-Bechterew Sign: Flexor movement of four outer toes upon striking dorsum of foot over cuboid bone.

Hirschberg's Sign: Adduction & internal rotation of foot upon stroking inner border of foot.

Ankle Clonus: A continued rapid flexion & extension of foot, obtained by forcibly & quickly dorsiflexing foot while leg is held up by examiner's other hand placed under popliteal space. A rapidly exhaustible clonus may be normal.

Patellar Clonus (Trepidation sign): A rapid up-and-down movement of patella, when it is forcibly depressed with a quick movement, with knee extended & thigh relaxed.

Upper Extremity

Chaddock's Wrist Sign: Flexion of wrist with extension & fanning of fingers upon stroking ulnar side of forearm near wrist.

Gordon's Finger Sign: Flexion of fingers, or thumb & index finger, when pressure is exerted over pisiform bone.

Hoffman's Sign: Clawing movement of fingers produced by flicking distal phalanx of index finger. thumb is also clawed.

Other

Bevor's Sign: umbilicus deviation with sit-up, suggests pathology in abdominals (paralysis)

Clinical Finding	Upper MNL	Lower MNL
Weakness	Generalized	Focal
Atrophy	Slight, general	Focal, more extensive
Fasciculations	None	May be present
Clonus	May be present	Never present
Deep Tendon Reflexes	Increased (except in neural shock)	Decreased
Abdominal Reflexes	Diminished	No change
Pathologic Reflexes	Present (except in neural shock)	None
Muscle Tone	Increased – SPASTIC (except in neural shock)	Decreased – FLACCID
EMG	Normal	Abnormal (generally decreased)

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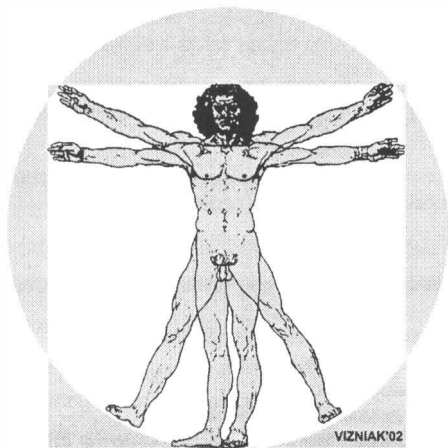
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IV Chiropractic PT

Heat.....	122
Cryotherapy.....	123
Soft Tissue Techniques.....	124
Cross Fiber Massage.....	125
Muscle Energy Technique.....	126
PNF.....	127
Weight Training Protocols.....	128
Key Movement Patterns.....	129
Electrical Modalities.....	130
Motor Points.....	131
High Volt.....	132
IFC & LFAC.....	133
Low Volt Galvanism.....	134
Microcurrent.....	135
Russian Stimulation & TENS..	136
Ultrasound.....	137



General Information

- Mechanism of action - conduction, convection, radiation, conversion
- Law of Van't-Hoff: 10°C - in temp. = $2x$ - $3x$ - of chemical reactions in the body

Indications

- Subacute/chronic trauma/inflammation of joints & muscle
- Indirect heating for peripheral vascular disease / infection
- Promote tissue healing by - blood supply & nutrients

Contraindications

- Acute inflammatory condition, already existing fever
- Malignancies & infection may spread
- Active bleeding, cardiac insufficiency
- Old patients, children under 4 yrs., patients with peripheral vascular disease

Effects

- Vasodilation, decreased blood pressure, perspiration, respiration, pH, heart rate, circulation, increased urine formation.

Hot Pack (60°-77°C/140°F-170°F)

- 15-30 minutes with 6-8 layers of towels (thick terry towels = 2 layers)
- Takes 3-4 minutes to heat up
- Check periodically: skin color pink is OK, red may lead to burn

Paraffin Bath (48°-54°C - 50°C best)

- Mix 6-8:1 (wax:mineral oil), wash body and remove oil
- Dip 6-8 times, wrap with wax paper then towel, sit for 20 minutes follow with massage or exercise
- Indications: RA, OA, DJD; Dupuytren's contractor; Raynaud's Phenomenon
- Contraindications: open wounds; cracks in skin; fungal infection; dermatological conditions

Infrared (superficial heat)

- Lamp is placed 30-50 cm from patient
- 10min-1hr, no towel needed
- Indications: Use when superficial heat is indicated. Provides dry heat
- Contraindications: same as hot packs

Diathermy (microwave)

- Treatment: 10-20 minutes – use towels to absorb surface moisture
- Dose:
 - I-Athermic (non-detectable warmth),
 - II-barely perceivable warmth,
 - III-pleasant warmth,
 - IV - Maximum tolerable warmth
- Contraindications: Metal in area, electrical devices in 20 feet, contact lenses

General Information

- Hunting Reaction: when cooling is extreme (less than 50°F for more than 10 min) the body responds with regular bursts of vasodilatation & then vasoconstriction
- Treatment: 10-20 minutes on and 1 full hour off
- Give patient written home instructions

Indications

- Acute or chronic pain due to muscle spasm
- Muscle spasm, fever reduction, new burns, inhibit bleeding
- Acute injury or inflammation
- Upper Motor Neuron Lesion (UMNL) spasticity

Contraindications

- Patients with cardiac dysfunction, arterial insufficiency
- Open wounds over 48-72hrs. old. Elderly or young
- Patients demonstrating hypersensitivity to cold - Raynaud's, cold urticaria, cold allergy

Effects

- Vasoconstriction
- Decreased local BP followed by 20 minutes dilation
- Increased reflexive vasoconstriction to viscera,
- Decreased nerve conduction velocity
- Decreased perspiration, cell metabolism, glandular activity, muscle tone
- Anesthesia, analgesia

Cold Pack (0°-12°C/32°F-55°F)

- 10-20 minutes
- Single layer of moist towel (1 terry cloth)
- Clinical Pearl: start by using a warm moist towel, then allow cold pack to gradually cool down the area (increases patient comfort)

Ice Massage (CBAN) - to numbness or 5 minutes, whichever comes first.

- Cold
- Burning
- Aching
- Numbness

Contrast Hot/Cold

- Used as a "vascular exercise" causing alternating constriction/dilation

Treatment

- Intensity: Hot: 100°F-112°F, Cold: 50°-65°F
- Time: hot 4-6 min:cold 1-2 min (3:1 or 4:1 ratio of hot:cold)
- Duration: 20-30 minutes

TRIGGER POINT TECHNIQUES

Nimmo's Technique

1. Effleurage applied to remove "satellite trigger points"
2. Muscle is relaxed (origin and insertion approximate)
3. Pressure applied to patient's tolerance, 3-7 sec.
4. Trigger point is released. Others are treated
5. Trigger points are retreated several times per session
6. Patient instructed to move muscles through normal range of motion

Travell's Technique

1. Stretch involved muscle to verge of discomfort
2. Apply sustained tolerable pressure directly to trigger point
3. Increase pressure as discomfort increases
4. Hold up to 20 lbs. for 10 sec. or until trigger point "melts," but, no longer than 60 sec.
5. Area is heated w/ hot pack
6. Patient instructed to move muscles through normal range of motion

MUSCLE STRETCHING TECHNIQUES

Post Isometric Relaxation (PIR)

1. <20% contraction: 5-7 seconds
2. WAIT
3. Feel for new barrier

Uses: over-facilitate muscles, intersegmental dysfunction, trigger points

Hold Relax, Contract Relax

1. 50%-80% contraction: 5-7 seconds
2. Gentle stretch into barrier
3. Patient instructed to resist/push with 10%

Uses: chronic myofascitis, painful myospasm, treatment failure w/ PIR

Post Facilitated

1. 100% contraction: 7-10 seconds
2. Allow muscle to fully relax
3. RAPID stretch: hold 12-15 seconds
4. Wait 20 seconds before repeat
5. Repeat up to 5x a session

Uses: muscle stretching

General Technique

1. Use reinforced thumb or index finger
2. 2-3 cycles per second, for 6-20 minutes
3. Always remain within patient's tolerance
4. As patient tolerance increases, increase pressure used

Frequency

- 2-3x/wk for 6-10 treatments
- Do not do treatment two days in a row (allow time for healing)

After Treatment Considerations

- Ultrasound (5-7 min, 1 W/cm²)
- Ice Massage (up to 7min) - CBAN - cold, burning, achy, numbness
- Warn patients of potential side-effects soreness and mild bruising

Rationale

- May promote optimal healing by increasing circulation & decreasing collagen cross-linking which will decrease adhesions & non-mobile scar formation. The theory is that scar tissue may form in an irregular fashion & may become a nociceptive foci and/or limit flexibility of tissues.

Contraindications

Do NOT use over acutely inflamed tissue due to:

- Trauma
- Open wounds
- Infection
- Inflammatory Arthritis
- Hematomas
- Calcification

More space filling humor for your enjoyment:

Doctor: "I've got very bad news - you've got cancer and Alzheimer's"

Patient: "Well, at least I don't have cancer"

The seven-year old girl told her mom, "A boy in my class asked me to play doctor."

"Oh, dear," the mother nervously sighed. "What happened, honey?"

"Nothing, he made me wait 45 minutes and then double-billed the insurance company."

"Are you an organ donor?", "No, but I once gave an old piano to the Salvation Army."

What is a double-blind study?

Two chiropractors reading an electrocardiogram.

How many physiotherapists does it take to change a light bulb?

None. They just give the dead bulb some exercises to do and hope it will be working a bit better the next time they see it. (This is my personal favorite)

General Technique

1. Dr. gently stretches pt. into direction of restriction/decreased motion
2. Pt. gently (10% of maximum) contracts in exact opposite motion
3. Pt. holds contraction for 3-7 seconds & completely relaxes
4. On relaxation, Dr. moves to new resistive barrier
5. Repeat 3-5 times & re-assess

Benefits

- Improves joint mobility in very specific manner, tone of muscles, blood flow to muscles around joint, range of motion
- Reduces edema & Improves lymphatic drainage
- Is non-traumatic to pt. Many pt.s simply do not like ir spines to be rapidly adjusted & look for Dr.s who use non-thrusting techniques
- Can be safely used on pt.s who are physiologically hypermobile (instability, over-adjusted chiropractic students, etc.)
- Can be used earlier in a traumatic injury than thrusting techniques

Indications

- Vertebral subluxation complex. May be preferential to thrusting techniques when re exists a boggy end-feel
- Postural distortion
- Facet Syndrome
- Acute Torticollis

CONTRAINDICATIONS

- Fracture, infection, neoplasm, etc.

Precautions

- May not be appropriate if pt. is unable to attain treatment position due to damage, arthritis or hypomobility in one or more of leveraged joints. e.g., arthritic hip joint when treating sacroiliac joints
- Go lightly in hypermobile pt.s. Must be very specific in locating area of relative hypomobility

To be Successful

- Pt. is told to contract a muscle in a certain direction at a certain intensity for 3-7 seconds while Dr. holds a joint(s) in a particular position
- Dr. allows no movement during contraction
- Following contraction, pt. totally relaxes & Dr., on feeling this relaxation, moves to a new barrier

Common Errors

- Pt. contracts too hard. Generally 10-20% of maximum is sufficient
- Pt. contracts in wrong direction or for too short a time
- Pt. does not relax appropriately
- Dr. does not position joint correctly
- Dr. gives poor directions to pt.
- Dr. allows limb to move during contraction
- Dr. moves limb too quickly, before pt. really relaxes or Dr. moves limb too far into resistance barrier. Limb should be moved only to point where Dr. first feels resistance. If s/he goes too far an increase in hypertonicity will result. opposite of desired effect

Note: It is not unusual for pt. to be mildly sore 24 - 36 hours post treatment due to working of muscles not used to working. It's always best to let pt.s know that it may happen & that it is a good sign. You may recommend loading up on Vitamin C & also increase water intake

Adapted, with permission, from Ron LeFebvre, DC

PNF = Proprioceptive Neuromuscular Facilitation

- Exercise technique based on diagonal patterns of extremity & spine movement.
- ROM may be done as a passive technique or as resistive for strength and coordination.
- The motion should be performed at a slow and steady pace.
- The doctor's goal is not to overpower patient, but to provide enough resistance to make activity mildly demanding

Repetitions

- 3-10 per side of body – increasing number and resistance as patient strength & coordination improve.

Basic procedure

- Treat stronger side first; goals:
 1. To teach patient
 2. To give patient success & positive feedback
 3. To influence problem areas
- Use all senses to integrate motion (kinesthetic, visual, auditory, touch - manual contacts)
- Always communicate with patient, tell them what's going on & offer positive reinforcement

Upper Extremity

Pattern #1	Starting Position	Ending Position
Shoulder	Flexion, Abduction, Ext. Rotation	Extension, Abduction, Int. Rotation
Elbow	Flexion	Extension
Forearm	Supination	Pronation
Wrist/hand	Extension	Flexion

Pattern #2

Shoulder	Flexion, Abduction, Ext. Rotation	Extension, Abduction, Int. Rotation
Elbow	Flexion	Extension
Forearm	Supination	Pronation
Wrist/hand	Flexion	Extension

Lower Extremity

Pattern #1	Starting Position	Ending Position
Hip	Flexion, Abduction, Int. Rotation	Extension, Adduction, Ext. Rotation
Knee	Flexion	Extension
Ankle/Foot	Dorsiflexion, Eversion	Plantar flexion, Inversion

Pattern #2

Hip	Flexion, Abduction, Ext. Rotation	Extension, Adduction, Int. Rotation
Knee	Flexion	Extension
Ankle/Foot	Dorsiflexion, Eversion	Plantar flexion, Inversion

These are only sample patterns of motion to challenge patients; create your own to help improve each patient's specific areas of difficulty and/or lack of coordination.

RM*	<2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	>20
TRAINING GOAL	STRENGTH				Strength				strength				strength						
	POWER				Power				power				power						
	Hypertrophy				HYPERTROPHY				Hypertrophy				hypertrophy						
	Muscle Endurance				Muscle Endurance				MUSCLE ENDURANCE										

Progressive Resistance Exercise (PRE - DeLorme)

SET	REPETITIONS	% of Repetition Maximum
1	10	50 % of 10 RM
2	10	75% of 10 RM
3	10	100% of 10 RM

Oxford Protocol

SET	REPETITIONS	% of Repetition Maximum
1	10	100% of 10 RM
2	10	75% of 10 RM
3	10	50% of 10 RM

Berger

SET	REPETITIONS	% of Repetition Maximum
1	6	100% of 6 RM
2	6	100% of 6 RM
3	6	100% of 6 RM

Daily Adjustable Progressive Resistive Exercise (DAPRE) – Part I

SET	REPETITIONS	% of Repetition Maximum
1	10	50% of 6 RM
2	6	75% of 6 RM
3	maximum	100% of 6 RM
4	maximum	**adjusted working weight

DAPRE Part II

Number of repetitions performed during 3 rd set	**Adjusted working weight for 4 th set	**Adjusted working weight for next exercise session
0-2	Decrease 5-10 lb	Decrease 5-10 lb
3-4	Decrease 0-5 lb	Keep weight the same
5-7	Keep weight the same	Increase 5-10 lb
8-11	Increase 5-10 lb	Increase 5-15 lb
13 or more	Increase 10-15 lb	Increase 10-20 lb

*RM = Repetition Maximum (the most weight that can be done for one rep)

10 RM = maximum weight that can be done for 10 complete repetitions

**Adjusted working weight for the fourth set is based on total number of repetitions of full working weight performed during third set

Always remember patient safety, endurance, rehabilitation and strengthening are your main goals with any type of resistive training. Therefore, be sure to give patients detailed instructions on when, what, why and how to do specific exercises to help better facilitate your treatment goals and thus decrease the chance of further injury, patient discomfort or delayed healing time.

Main Strategies for Correcting Abnormal Key Movement Patterns (KMP)

Refer to pages 48-57 for specific patterns

Observation

1. Observe KMP visually
2. Observe KMP through palpation (especially if visual observation is inconclusive)
3. Know your anatomy (agonists, antagonists, synergists, stabilizers)
4. Investigate abnormal KMP by evaluating list of potential causes
 - Local biomechanical and/or regional problems
 - Postural and/or regional problems
 - Biomechanical problems away from the KMP area
 - Tight antagonist(s)
 - Tight/overactive synergist(s)
 - Tight/overactive stabilizer(s)
 - Slow proprioceptive ("sleepy") agonist
 - Weak agonist
5. Evaluate all above potential causes one after another & record findings
6. CORRECTIONS: After evaluation of all potential causes, start with biomechanical abnormalities first & apply therapy. Check KMP after therapy before moving on to the next.

Doctor Teaching Sequence

1. Doctor describes to patient what is to be done
2. Doctor demonstrates to the patient what is to be done
3. Patient demonstrates to doctor how it is done
4. Doctor monitors patient's progress by observing how patient performs activity on subsequent visits

Home Care

1. Give patient specific stretches or strengthening exercises (tracks)
2. Give patient posture exercises when needed
3. Once KMP starts improving give patient mental & proprioceptive retraining exercises – to practice KMP through whatever range of motion they can perform while maintaining proper movement form/pattern
4. Teach friend/spouse/etc. how to help patient by monitoring KMP

Adapted, with permission, from Ron LeFebvre, DC

General Considerations**Sensory**

- 1-10 Hz edema; tissue healing; chronic pain (3-5 Hz)
- 80-120 Hz acute pain; enkephalins (short lasting)

Motor

- 1-10 Hz chronic pain (3-5 Hz); endorphins; twitch; pumps edema; joint fluids
- 40-60 Hz contraindication w/o fatigue for strength or rehab (50Hz)
- 80-120 Hz contraindication with fatigue for spasm

Nociception

- 80-120 Hz chronic and acute pain

Contraindications

1. Pacemaker
2. Over carotid sinus
3. Simultaneous use of different frequency
4. Circulatory impairment
5. Mental impairment

Precautions

1. Pregnancy
2. Over the eyes
3. Through the heart
4. Through the brain
5. Sensory impairment
6. Hemorrhage, Infection, Malignancy (HIM)

Low Frequency Modalities (UP TO 1000Hz)

1. Low Volt Galvanism (LVG)
2. High Voltage Therapy (HVT)
3. Low Frequency Alternating Current (LFAC)
4. Transcutaneous Electrical Nerve Stimulation (TENS)
5. Microcurrent (MENS)

Medium Frequency Modalities (1000Hz – 10 000Hz)

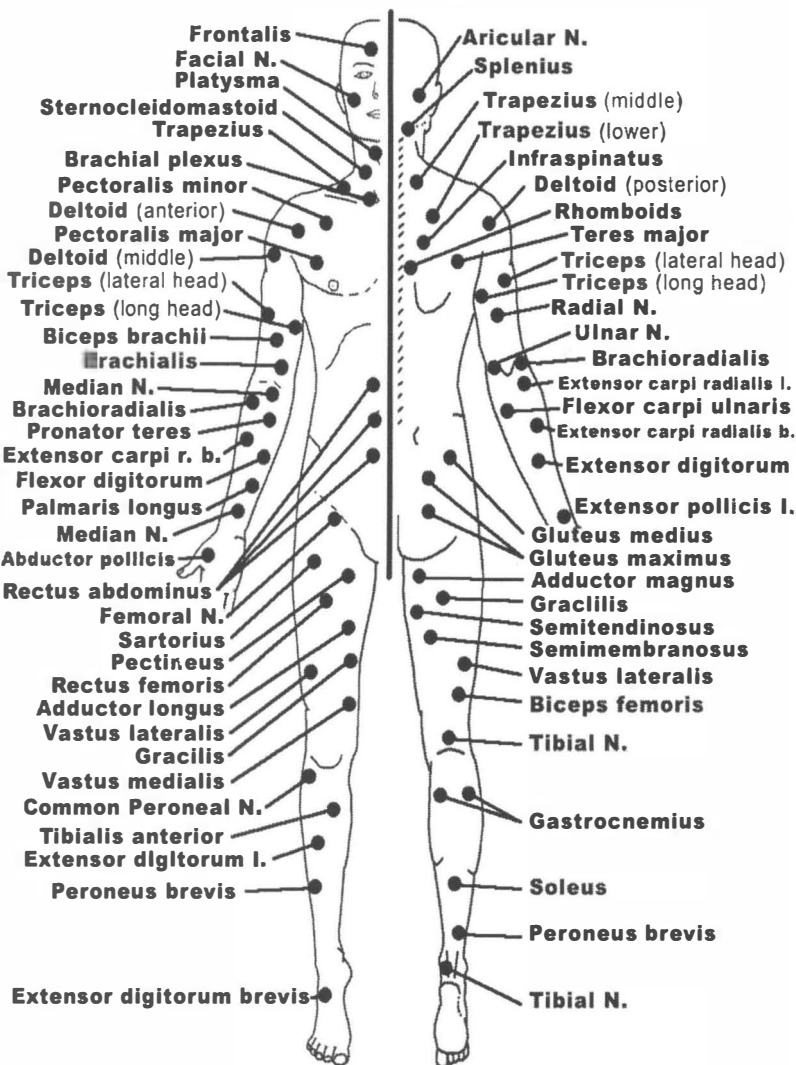
1. Interferential Current (IFC) – quadpolar
2. Interferential Current (IFC) – bipolar (premodulated)
3. Russian Stimulation (rehab.) – burst modulation

High Frequency Modalities (> 1 MILLION Hz)

1. Short Wave Diathermy (SWD)
2. Microwave Diathermy (MWD)
3. Ultrasound (US)

The following are common motor points for the electrical stimulation of muscles and nerves, and thus are also potential pad placement sites for electrical modalities.

Anterior]----[Posterior



High Volt Therapy (= High Volt Galvanism/DC)**General Information**

Negligible polar effects due to low amperage (~0.5-2 mA)

Indication

Muscle spasm, pain, swelling, weakness, tissue healing, muscle re-education

Contraindication

Same as other electrical modalities

Treatment Technique

Monopolar – 1 dispersive pad & 1-4 active pads

- Dispersive pad may not be necessary due to low amperage & therefore, minor polar effects

Bipolar – new machines just use 2 pads

Time

10-20 minutes

Intensity	Pulse Rate	Clinical Effect
Sensory	3-5 Hz	Endorphin release, lasting analgesia (chronic pain)
	1-10 Hz	CT healing, decreased joint effusion & interstitial edema
	80-120 Hz	Enkephalin release, analgesia (acute pain)
Motor	1-10 Hz	Endorphin release, CT healing, fluid pump
	40-60 Hz	Muscle tetany w/o fatigue (strength & exercise)
	80-120 Hz	Muscle tetany with fatigue (decrease muscle spasm)
Nociception	80-120 Hz	Chronic Pain

note: Frequency = pulse rate

General Information

Requires "carrier frequency" to overcome skin resistance (4000 Hz)

Beat Frequency: 1-150 Hz (same as variable frequency)

Sweep frequency will help prevent accommodation

Indications

1. Pain relief
2. Muscle spasm
3. Edema reduction
4. Increase tissue healing

Contraindications

1. Same as other electrical modalities
2. Do not use within 20 feet of an active diathermy machine or radio

Effects

1. Analgesia (acute: 80-120 Hz, chronic: 3-5 Hz)
2. Edema reduction (1-15 Hz), Muscle contraction (10-50 Hz)
3. Increase tissue healing

Treatment (Bipolar, Quadpolar, Scan, Target, Sweep)

Acute	Pain:	intensity: sensory, frequency: 80-120 Hz, time: 10 min
	Swelling:	intensity: sensory, frequency: 1-10 Hz, time: 10-15 min
Subacute	Healing:	intensity: sensory, frequency: 80-120 Hz (5 min) then, 1-10 Hz (5 min)
Chronic	Healing:	intensity: motor, frequency: 1-10 Hz, time: 10-15 min
	Swelling:	intensity: motor, frequency: 1-10 Hz, time: 10-20 min
	Pain:	intensity: sensory, frequency: 5 Hz, time: 20 min

Low Frequency Alternating Current (LFAC) = Sine wave

(EMS on Richmar machines)

Indications

Muscle spasm, myofascial trigger points (MFTP), arthritic conditions

Contraindications

Same as other electrical modalities

Treatment

Frequency: 1-150 Hz

Technique: Apply on pad over muscle motor point other pad over nerve root or muscle

Duration: exercise or spasm fatigue – 10-15 minutes, Chronic pain – 20 minutes

Surging Sine: exercise muscle

Reciprocate: electrodes on agonist & antagonistic muscles

Low Volt Galvanism (LVG) = Low Volt DC

General Information

An electrochemical reaction occurs due to electron flow & pads attracting both positive and negative ions from the patient's tissues

Indications/Contraindications

Same as other electrical modalities

1. Stimulation of Denervated Muscle

Use interrupted low voltage current (pulsed/probe)

Active (smaller) electrode over motor point of muscle or nerve root level

Treatment:

Time: 20-30 min

Frequency: 1-40 Hz

Intensity: motor level

2. Medical or Surgical Galvanism

1 active (small) pad, 1 dispersive (large) pad

NOTE: dispersive pad should be at least 2x larger than active pad & amperage must not exceed 1 mA per square inch of active electrode

Indications:

Medical: sprain, strain, adhesions, fibrosis, scarring, contusion

Surgical: hair removal, cyst removal, hemorrhoids, varicose veins

POLAR EFFECTS:

Positive Pole (Anode) = Acute (+)

- a. Dehydrates & tightens tissue
- b. Vasoconstriction
- c. Germicidal

Negative Pole (Cathode) = Chronic (-)

- a. Liquefies & softens tissues
- b. Vasodilatation
- c. Loosens fibrotic tissue

Treatment

Initial treatment: 3-4 min (red skin for 24hrs is normal)

Time: 10-20 min after initial

Maximum: 1mA/inch² of active (small) pad

3. Iontophoresis

ION	ACTION(S)	INDICATIONS
(+) Calcium	Stabilizes irritability threshold	Adhesive capsulitis
(+) Copper	Caustic, antiseptic, astringent	Fungal infection
(+) Magnesium	Antispasmodic, analgesic	Spasm, acute pain
(+) Zinc	Caustic, antiseptic	ENT & skin disorders
(-) Chlorine	Sclerolytic	Adhesions, scar tissue
(-) Salicylate	Analgesic, decongestive	Back pain, Rheumatoid arthritis

MENS = Microcurrent**General Information**

Microcurrent uses a secondary conduction system – “sub-sensory”, therefore patients do not feel any sensation (sensory, motor or nociceptive)

Amperage: 0-600 mA

Frequency: 0.1-900 Hz

Indications/Contraindications

Same as other electric modalities

Effects

1. pain relief
2. tissue healing
3. edema reduction
4. muscle re-education.
5. Increase: RNA, ATP, protein synthesis, cell membrane transport

Treatment Settings**1. Tissue healing**

Biphasic (tsunami - alternating current)

Frequency: 0.3-0.5 Hz

Intensity: 20-50 mA

Duration: 30-60 minutes with pads

2. Pain (DC current)

Acute (+)/Chronic (-):

Frequency: 3 or 30 Hz

Intensity: 25-100 mA

Duration: 5-15 minutes with pads

3. Edema

Biphasic (tsunami - alternating current)

Frequency: 20-40 Hz

Intensity: 20 mA

Duration: 5-10 minutes with pads

Russian Stimulation/EMS (Electrical Muscle Stimulation)

Indications

1. Muscle strength
2. Muscle spasm/rehabilitation
3. Possibly scoliosis

Contraindications

1. Same as other electric modalities, pad placement over motor points
2. Fractures, osteoporosis, Rickets, osteomalacia, Pott's disease

Effects

1. Increased: circulation, muscle strength/speed/endurance
2. Decreased: edema, muscle spasm, pain

Treatment

Pad placement: over motor point of muscle

Frequency: 50 Hz, 10 sec on 50 sec off (10/50)

Intensity: strong motor

Repetitions: 10-25 per session (5 consecutive days/week, 2 days rest)

Ramp Times:

Early rehabilitation - strength: 1-2 sec

Late rehabilitation - power: 0.5-1 sec

Note: Patient performs at least 50% maximum isometric contraction with stimulation

TENS = Transcutaneous Electrical Nerve Stimulation

Indications

Pain

Contraindications

Same as other electrical modalities

Treatment

Pads may be placed over acupuncture, trigger or motor points (see page 131)

Also associated with nerve root dermatomes.

Time:

In office: 10-15 minutes

Portable: 2-8 hours

Treatment Parameters

MODE	INDICATION	SETTINGS
Conventional	acute pain	85 Hz, 75 ms, 10 mA (sensory level)
Low Frequency	deep, chronic pain	5 Hz, 200 ms, 40 mA (mild motor)
Brief Intense	temporary analgesia	100 Hz, 250 ms, 40 mA (strong motor)
Burst	reduce nerve accommodation	
Modulation	reduce nerve accommodation	

General Information

Frequency: 0.8-3.0 Mhz – 1 MHz (more penetration up to 5 cm), 3 MHz (more superficial 1-3 cm)

Indications

1. Soft tissue shortening
 - a. Joint contracture, scarring, adhesive capsulitis, Dupuytren's contracture
2. Subacute & chronic inflammation
3. Muscle guarding, MFTP, sprain / strain, bursitis, tendonitis
4. Tissue healing
5. Edema reduction

Contraindications

1. Epiphyseal growth centers (children)
2. Cancer, infection, bleeding
3. Acute joint inflammation
4. Directly over: eyes, spinal cord, brain, carotid sinus, heart
5. In the presence of a pacemaker, deep vein thrombosis, tuberculosis
6. Over fractures or ischemic areas

Treatment (Settings for a 5 inch x 5 inch area)**Direct technique** (contact with gel)

Acute: 0.5-1.5 W/cm²

Chronic: 1.0-2.5 W/cm²

Indirect technique (underwater – add 0.5 W, stay 0.5 inch from body part)

Acute: 0.5-2 W/cm²

Chronic: 1.5-2.5 W/cm²

Average treatment intensity: 1.5 W/cm²

Duration

Acute: 3-5 min

Chronic: 5-10 min

Continuous ultrasound: patient may feel pleasant warmth

Note: Ultrasound may be used to possibly diagnose fracture (similar to a tuning fork).

Physiological Effects**Thermal** (continuous at > 1 W/cm²)

1. Increased local - temperature, metabolism, & blood flow
2. Muscle relaxation & pain decrease
3. Decrease local: adhesion formation & nerve conduction velocity
4. Increase connective tissue elasticity

Non-thermal (pulsed 20-25% duty cycle or continuous <0.8 W/cm²)

1. Mechanical

Increase: cellular diffusion, membrane permeability, collagen synthesis, CT elasticity

2. Chemical (continuous or pulsed)

Increase: enzyme activity, ATP activity, cell membrane permeability, tissue repair

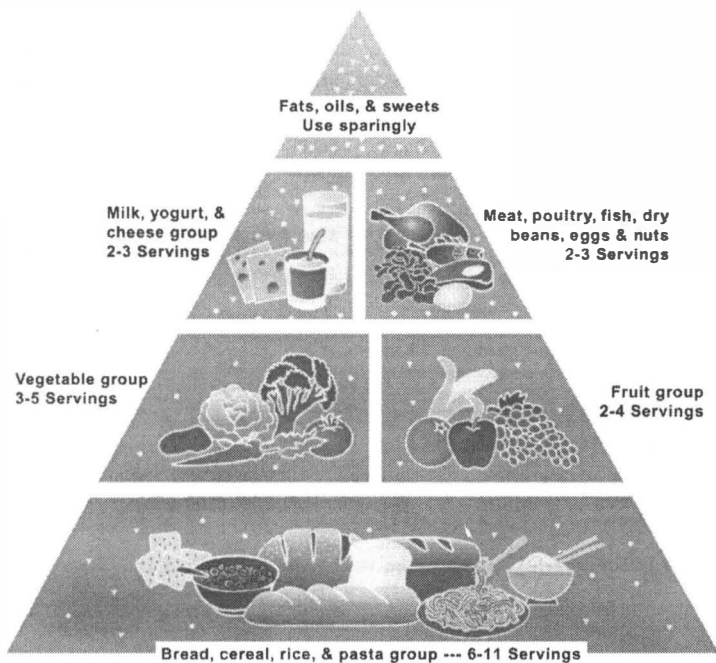
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V Nutrition

Food Pyramid & Servings	140
Calories	141
Carbohydrates & Fiber	142
Protein	143
Lipids	144
Lipoproteins & Eicosanoids	145
Vitamin A	146
Vitamin D	147
Vitamin E	148
Vitamin K	149
Vitamin B1	150
Vitamin B2	151
Vitamin B3	152
Vitamin B5	153
Vitamin B6	154
Folic Acid	155
Vitamin B12	156
Biotin.....	157
Vitamin C	158
Glucosamine & Chondroitin	159
Calcium.....	160
Calcium Metabolism	161
Minerals	162-163
Musculoskeletal Trauma.....	164
Tissue Healing Phases.....	165
Nutrient/Nutrient Interactions	166
Nutrient/Medication Interactions	167
Women Height/Weight Tables	168
Men Height/Weight Tables	169

Food Pyramid



Source: U.S. Department of Agriculture/U.S. Department of Health & Human Services

Food Guide Pyramid Servings (2800 & 3600 Calorie diets)

Food Group	2800 kcal	3600 kcal
Bread, cereal, etc	11	14
Vegetables	5	7
Fruit	4	5
Milk, yogurt, cheese	3	4
Meat, fish, nuts	198g (7oz)	255 g (9 oz)
Added fat	32 g	42 g
Added sugar	78 mg	104 mg
Carbohydrate	360 g (50%)	465 g (50%)
Protein	115 g (20%)	155 g (20%)
Fats	95 g (30%)	120 g (30%)

Energy requirements

Men 2900 kcal/d or 37-40 kcal/kg of body weight
 Women 2200 kcal/d or 36-38 kcal/kg body weight

Energy Sources

In human tissue

- Fat (9 kcal/g)
- Carbohydrates (4 kcal/g)
- Glycogen
- Glucose & monosaccharides
- Protein (4 kcal/g)
- Amino Acids
- Ethanol & other alcohols (7 kcal/g)
- Ketones

In food

Calorie density

*Empty calorie foods are high in calorie density
 but low in nutritional quality

- High added fat foods
- Fried foods, high fat meats
- High added sugar foods
- Alcoholic beverages

Influencing Factors**Metabolic Rate**

Predisposition increased by:

1. Thyroid, adrenal, other hormones
2. Enlarged body mass
3. Aerobic exercise

Decreased by:

1. Starvation
2. hypoparathyroidism, other diseases

Thermogenic effect

- Diet induced thermogenesis

Physical activity measurement

- Basal Metabolic Rate (BMR)
- Basal body temperature
- Physical activity

Estimating total energy requirement

Resting metabolic rate (RMR) (estimate) = (men) Ideal body weight (IBW) x 0.9 x 24
 = (women) IBW x 1.0 x 24

Divide 24 hrs into hours spent at specific activities

1. Resting - RMR x 1.0 x (hours/24)
 2. Sedentary activity (driving, typing) - RMR x 1.5 x (hours/24)
 3. Light activity (slow walking, light work) - RMR x 2.5 x (hours/24)
 4. Moderate activity (load carrying, dancing) - RMR x 5.0 x (hours/24)
 5. Heavy activity (heavy manual labor or exercise) - RMR x 7.0 x (hours/24)
- Add total of each category for estimated total daily requirement

Energy Balance

Measurement

Growth charts

Weight

1. Adjust for age, gender, height, etc.
2. Insurance tables
3. Body mass index (BMI)

Body Composition – lean vs. fatty tissue

1. Skinfold calipers
2. Hydrostatic weighing
3. Bioelectric impedance

Normal body fat:

- 10-18% male, 20-25% female

Body Fat distribution

1. Waist/hip ratio-ponderosity index
 - Low risk: <0.9 men, <0.8 women
2. Waist circumference
 - Low risk: <103 cm (41in) male
 - <89 cm (35in) female

Disturbances

Deficiency – underweight causes

1. Poverty/famine
2. Malabsorption
3. Catabolic disease
4. Food restriction

Consequences

1. Debilitation
2. Nutrient deficiencies
3. bone loss

Excess – Obesity

- Adds many risk factors
- Hypertension, diabetes, etc

Diet & Eating disorders

- Over 90% diets fail to achieve long term weight loss
- Society induced eating disorders

Recommended Intake = 45%-55% of total caloric intake (4 kcal/g)

Basic Metabolism

Digestive enzymes - amylase, maltase, sucrase, lactase, isomaltase

Storage forms - ribose, fructose, glucose, galactose, glycogen, cellulose & amylose (plants)

Glycemic Index - measure of how fast blood glucose levels change after eating

Simple Sugars

Natural - fruit (sucrose, glucose, fructose), dairy products (lactose)

Added sugars - table sugar (sucrose), corn sweetener (glucose & fructose), fructose, honey (glucose & fructose), corn syrup (glucose), natural fruit sweeteners

Non-cariogenic sugar substitutes - Xylitol, Sorbitol

Non-caloric sugar substitutes - Saccharin, Aspartame (Nutrisweet), Acesulfame K (Sunee)

Health Issues

Oral health disorders - dental caries, periodontal disease

Lactose intolerance - effects mostly non-Caucasians

- Symptoms – gastrointestinal distress (gas, bloating, cramps, diarrhea)
- Relieved by decreased lactose levels in GI tract, low lactose dairy, powder lactase enzymes, lactase enzyme tablets

Cardiovascular disease - sensitive adults sugar may increase triglyceride levels & atherosclerosis

Complex Carbohydrates (CC)

Main Sources - Grains, legumes (beans, peas), roots (carrots), tubers (potatoes), gourds (squash), training supplements

Health Issue

- High CC, low fat diets associated w/ decreased risk of many degenerative diseases
- High CC diet supplements provide athletes with a high energy source to sustain intense training regimens

FIBER

Requirements - authorities recommend 25-35 g/day

Insoluble Fiber – typically 75% of dietary fiber

Physiological effects – mostly local & mechanical

Best sources - wheat bran, seeds, dried fruits, whole grains, most fibrous fruits & vegetables

Health Issues - prevents constipation & diverticulosis; dilutes potential carcinogens and other toxins; increased speed of intestinal transit, decreased risk of colon cancer

Supplementation sources - wheat bran, cellulose, psyllium (Metamucil)

Soluble Fiber – typically 25% of dietary fiber

Physiological effects (systemic & metabolic) - slows digestion & absorption of carbohydrates; prevents absorption of some fats & related substances

Best Source - oat Bran, oat products, legumes, dried fruit

Health Issues - **reduce serum cholesterol**; may improve glucose tolerance;

Supplementation sources - psyllium, pectin, guar gum, Glucomanna, Chitosan

Precautions - water intake to prevent constipation; temporary intestinal gas, etc; contraindication in intestinal obstruction; soluble fiber may decrease mineral absorption

Protein RDA (average) = men 54 g/d, women 45 g/d (15-20% of total calories)

- 0.8 g/day per kg of idea body weight
- 0.37 g/day per pound of ideal weight
- Athletes may require up to twice RDA

Factors affecting protein requirements - protein quality, calorie intake, growth & repair, lean body mass, exercise intensity, illness & chronic disease

Protein Quality - based on digestibility, absorbability, & amino acid (a.a.) balance; animal proteins are higher quality than plant protein

Basic Metabolism

Digestion highlights - hydrochloric acid & pepsin; pancreatic & intestinal proteases

Protein Metabolism

1. Absorption
2. Amino Acid Pool (estimated average requirement in *mg/lb of body weight*)
 - Essential a.a. - histidine, isoleucine (5.5 mg/lb), leucine (7.3 mg/lb), lysine (5.5 mg/lb), methionine (4.5 mg/lb), phenylalanine (7.3 mg/lb), threonine, tryptophan (1.4 mg/lb), valine (7.3 mg/lb)
 - Non-essential a.a. - alanine, arginine, asparagine, cysteine (4.5 mg/lb), glutamic acid, glutamine, glycine, proline, serine, tyrosine (7.3 mg/lb)
3. Protein synthesis
4. Degradation to urea
5. Excess stored as fat

Sources - meat, fish, poultry, eggs, dairy, legumes (soy)

Health Issues

Deficiency

- Rare in healthy people if calorie intake is normal
- Symptoms: muscle wasting, edema, hair loss

High Protein diets for glucose intolerance, weight loss

- May help 25% of population w/ glucose intolerance
- Emphasize plant protein – fewer health risks

Excess Risk Factors

- Aggravated liver or kidney disease
- Increased cancer risk
- Increased calcium loss in urine (20 mg calcium/g of protein)
- Toxic byproducts

Supplementation Issues

1. High protein vs. carbohydrate formulas for body building
2. Single amino acids used in alternative medicine
Tryptophan, 5-hydroxytryptophan (5-HTP), serotonin (5-HT) = anti-depressants

Clinical Measurement

- Serum albumin (long-term monitor), short term monitors: transferrin & prealbumin
- Urinary nitrogen may reflect amino acid breakdown

Recommended Intake - < 30% of daily caloric intake**Basic Metabolism**

Dietary Lipids

- Triglycerides (TG/TAG) 90% of fat in body diet
- Cholesterol 5%
- Phospholipids 4%
- Fat soluble vitamins- A, D, E, K

Digestion Highlights - pancreatic lipase, bile acids, micelle formation

Fat & Oil Sources

Saturated (bad) - meat & poultry fat, dairy fat (butter), tropical oils (coconut, palm), hydrogenated oils (margarine)

Monounsaturated (good) - abundant in many fats, olive, avocado, canola, "oleic" oils

Polyunsaturated (good)

- Omega-6 - sunflower, com, soybean oils
- Omega-3 - fish oils, flaxseed oils

High Fat Foods

- Fried foods, natural foods w/ high oil content (nuts, coconut)
- Foods high in regular or high-fat dairy products
- Animal flesh with visible fat

Fat Percentages In Common FATS

Source	%Saturated Fat	% Monosaturated	% Polyunsaturated
Coconut Oil	87%	11%	2%
Beef fat	50%	46%	4%
Pork fat	39%	50%	11%
Olive oil	13%	79%	8%
Canola oil	6%	62%	32%

Cholesterol

Recommended intake - < 300 mg/day

Sources (mg/serving) - organ meats (liver-372 mg), eggs (215 mg), shrimp (150 mg), other shellfish (100 mg), other animal products (dairy)

Health Issues - Hyperlipidemia

- Genetic causes - decreased lipoprotein lipase, decreased LDL receptor function, others?
- Dietary causes - high saturated fat diet, high cholesterol diet

Clinical measurement - <200 mg/dL, HDL >35 mg/dL

Phospholipids**Basic Metabolism**

Phospholipids are similar to triglycerides except that they have either a choline or inositol, with a phosphate; in place of one of the fatty acid chains

Cell membrane structure, liver function, neurotransmitter synthesis - acetylcholine

Sources

Food - daily intake: 300 mg choline, - animal & plant foods

Supplements - commercial soy lecithin, phosphatidyl choline, pharmaceutical lecithin, choline compounds, inositol, phosphatidyl serine

LIPOPROTEINS

Chylomicron

Largest lipoprotein, produced in intestinal cells, contains all dietary lipids

Transports free fatty acids to peripheral tissues

- requires donation apoproteins from HDL
- requires action of tissue enzyme: Lipoprotein Lipase

Very Low Density Lipoprotein (VLDL)

Produced in liver, contains TAG's produced in liver from excess dietary carbohydrates, contain dietary cholesterol, phospholipids, and fat soluble nutrients from Chylomicron remnant, contains additional cholesterol & phospholipids synthesized in liver

Transports free fatty acids to peripheral tissues

- requires donation apoproteins from HDL
- requires action of tissue enzyme: Lipoprotein Lipase

Remnant is converted in serum to LDL - requires exchange of lipids with HDL

Low Density Lipoprotein (LDL)

Produced in circulation, contains all cholesterol from diet & liver synthesis, contains fat soluble nutrients

Transports cholesterol, fat-soluble nutrients to peripheral tissues

- requires uptake & degradation of LDL particle by tissue

High Density Lipoprotein

Produced in liver, exchanges apoproteins with other circulating lipoproteins, exchanges lipids with VLDL remnant, scavenges excess tissue cholesterol → redistributed to other lipoproteins and liver

ICOSANOIDS

Participate in regulation of

- inflammatory response (chronic)
- platelet aggregation
- smooth muscle irritability
- immune function

Eicosanoid nomenclature

- Prostaglandins (PG)
- Thromboxanes (TX)
- Leukotrienes (LT)

Precursors**1. Arachidonic Acid (AA)**

- produced from other omega-6 precursors
- precursor of 2-series PG & TX
- precursor of 4-series LT
- often associated w/ pathologic condition

2. Eicosapentaenoic acid (EPA)

- found only in marine life – fish oils
- precursor of 3-series PG & TX
- precursor of 5-series LT

3. Dihomo-gammalinolenic acid (DGLA)

- no natural sources
- precursor to 1-series PG & TX
- precursor to 5-series LT

ICOSANOID SYNTHESIS

Fatty acid precursors are stored in membrane phospholipids

Precursor released by phospholipase inhibited by corticosteroids

Released precursors acted on by:

Cyclo-oxygenase - produce PG and TX, inhibited by aspirin, NSAID's

Lipoxygenase - produces leukotrienes (LT), not inhibited by NSAID's

omega-6 arachidonic

omega-3 EPA

CYCLO-OXYGENASE

inhibited by
corticosteroids & NSAIDs

TxA₁

PGI₂

PGE₂

TxA₃

PGI₂

PGE₂

Dosage

RDI = 2-6 mg, usual therapeutic range 15-45 mg/day

Supplements derived from natural sources, containing a mixture of carotenoids (lutein, alpha-carotene, lycopene), are considered better sources.

1 retinol equivalent (RE) = 6 mg of beta-carotene = 3.3 IU (international units) of Vitamin A

RDI for Vitamin A (retinol equivalents)

Adult Men 1000 (USA RDA – 1989)

Adult Women* 800 (USA RDA – 1989)

*Women planning or in pregnancy should not exceed 2500 RE/day (risk of birth defects)

Dietary Sources

Vitamin A is found in two forms: retinol (in animals) and carotenoids (plants)

Retinol	Serving size	mcg	Carotenoids	Serving size	mcg
Beef liver	100 g	9100	Carrot	1 large	810
Cod liver oil	10 g	2550	Sweet potato	1 large	920
Egg	1 whole	110	Spinach	100 mg	460
Butter	10 g	59	Apricots	3	290

Functions of Vitamin A

Vision – plays a central role in the retina for the conversion of light energy into nerve impulses

Immune system – improves antibody production, increases activity of T-cells & natural killer cells

Skin & mucus membranes – promotes healthy epithelial growth

Hormone synthesis – required for steroid hormone synthesis (corticosteroids, androgens, & estrogens)

Red blood cells – helps to mobilize iron stores in the production of new RBC's

Nervous system – helps maintain myelin sheath around nerves

Skeletal system – participates in bone formation, growth and fracture healing

Deficiency and Toxicity Signs & Symptoms

Deficiency	Toxicity
<ul style="list-style-type: none"> • Dryness and itching of conjunctiva • Poor night or low light vision (xerophthalmia) • Dry, rough, itchy skin with rash • Dry, brittle hair and nails • Loss of appetite, sense of smell/taste • Fatigue, anemia, poor growth 	<ul style="list-style-type: none"> • Bone pain & joint swelling • Nausea, vomiting & diarrhea • Headaches, blurred vision • Dermatitis, hair loss, dry skin • Liver damage, high blood calcium

Increased deficiency risk may be associated with the following:

1. Decreased absorption (alcoholics, liver/biliary disorders, Crohn's, cystic fibrosis)
2. Poor beta-carotene conversion to vitamin A (diabetics and hypothyroid)
3. Increased utilization (smokers, increased stress, diabetes, infection, surgery)

Therapeutic Research

Musculoskeletal trauma - Vitamin A plays a major role in wound and bony fracture healing

Cancer prevention effects (15,000 IU/d)

Improved immune function (shown with short term dose of 300,000 IU/d)

Menstrual pain modification (has been demonstrated 50,000 IU/d retinol for 2 weeks)

Skin and scalp conditions (oral and topical application)

Gastric ulcer healing improvement

Dosage

RDI = 200 IU/d (5mcg/d), 1 mcg = 40 IU, actual need depends on sun exposure

Vitamin D is synthesized in the skin from 7-hydroxycholesterol with ultraviolet radiation. It is the only vitamin that is biologically active in the form of a hormone (vitamin D3). Sun exposure of 10-30 minutes several times a week should provide adequate vitamin D production.

RDI for Vitamin D (mcg)

Adult Men 5-15 (USA DRI - 1997)

Adult Women* 5-15 (USA DRI - 1997)

* Large doses are contraindicated in pregnancy due to potential teratogenic effects.

Dietary Sources

Source	Serving size	mcg
Salmon	100 g	16
Fortified milk*	1 qt	10
Tuna	100 g	5
Egg	1 (medium)	1
Butter	10 mg	0.1

*Fortification may use synthetic vitamin D2 (ergocalciferol)
 Note: vitamin D3 is the preferred form for humans as its bioavailability is twice that of vitamin D2.

Functions of Vitamin D

Calcium metabolism - regulation of blood calcium levels

Skeletal health - bone growth during childhood, strength and density during adulthood

Cell growth - regulator of cell development throughout body (especially epithelial cells)

Immune function - cell development, activity and response of white blood cells

Deficiency and Toxicity Signs & Symptoms

Deficiency	Toxicity (>100-1000 mcg/day)
<ul style="list-style-type: none"> • Rickets (children), Osteomalacia (adults) • Poorly formed tooth enamel (children) • Increased risk of osteoporosis & fractures • Impaired immune response • Muscle weakness (esp. around hip/pelvis) 	<ul style="list-style-type: none"> • Hypercalcemia • Calcium deposition into soft tissues • Renal calcification - potential kidney stones

Increased deficiency risk may be associated with the following:

1. Lack of sun exposure (confined persons, premature infants, regular use of sunscreens)
2. Persons with fat malabsorption syndromes, long-term corticosteroid medication use
3. Strict vegetarians, elderly (much higher requirements), diabetes, kidney disease

Therapeutic Research

Bone disorders - treatment of rickets, with calcium can slow/prevent bone loss

Psoriasis - can reduce hyperproliferation of skin cells (due to regulatory effects)

Immune response - can stimulate white blood cells and increase resistance to infection

Cancer prevention - may reduce risk of colorectal and breast cancer

Clinical Measurement

Serum vitamin D - reflects intake and synthesis, not level of active form

Serum 1,25-dihydroxycholecalciferol (1,25-DHCC), reflects active form

Due to the relationship with vitamin D, serum calcium should also be monitored

Dosage

RDA = 10 mg/d, therapeutic range 100 mg-2500 mg

Vitamin E is a general term for a group of compounds with varying degrees of vitamin E activity.

10mg/d alpha-tocopherol = 10 IU/d d-alpha-tocopherol

Vitamin E form (relative activity)

Alpha-tocopherol (100), Beta-tocopherol (50), Gamma-tocopherol (10-30), Delta-tocopherol (1)

RDI for Vitamin E (mg)

Adult Men 15 (USA DRI – 2000)

Adult Women 15 (USA DRI – 2000)

Dietary Sources

Source	Serving size	mg
Sunflower seeds	100 g	21
Wheat germ	100 g	12
Sweet potato	1 (average size)	7
Shrimp	100 g	3.5
Salmon	100 g	3.5

Functions of Vitamin E

Antioxidant – lipid soluble free radical scavenger (works with glutathione peroxidase & vitamin C)

ischemia – Protects cellular proteins from oxidative damage during ischemic events (MI, angina)

Antithrombotic – can slow action of thrombin & reduces platelet aggregation

Deficiency and Toxicity Signs & Symptoms

Deficiency	Toxicity (>2000 IU/day)
<ul style="list-style-type: none"> Hemolytic anemia – decreased RBC membrane integrity Neurological disorders – degeneration of neurons Atrophy & weakness of skeletal muscle Potential increased cancer risk 	<ul style="list-style-type: none"> Temporary gastric upset Delay in wound healing <p>Vitamin E is contraindicated with anticoagulant medication as it may increase demand on vitamin K</p>

Increased deficiency risk may be associated with the following:

- Persons exposed to high levels of free radicals (smokers, urban centers, radiation)
- Persons with high polyunsaturated fat intakes, high iron, excessive aspirin intake
- Fat malabsorption syndromes

Therapeutic Research

Cardiovascular disease – 300-1600 IU/d for 3 months

Excessive clotting – 100-400 IU/d

Immune response – improvement 800 IU/d

Premenstrual syndrome – reduce symptoms 400 IU/d

Parkinson's disease – may slow progression 400-3200 IU/d

Rheumatic disorders – may be beneficial for osteoarthritis & rheumatoid arthritis

Skin conditions – applied topically reduces scar formation & healing time

Diabetes - may reduce oxidative damage & enhance the action of insulin

Dosage

RDA = 80 mcg/d (1 mcg/kg body weight), therapeutic range 30-100mcg

Intestinal bacteria synthesize up to ½ of daily requirement for vitamin K.

Vitamin K has two principal forms K1 (phyloquinone) from plants and K2 (menaquinone) derived from animals & bacteria

RDI for VitamK (mcg)

Adult Men 60-80 (USA RDA - 1989)

Adult Women 60-80 (USA RDA - 1989)

Dietary Sources

Source	Serving size	mcg
Spinach	100 g	415
Broccoli	100 g	175
Beef liver	100 g	92
Tea, green	10 g	71
Eggs	1 (average size)	11

Note: vitamin K is not included in most vitamin supplements.

Functions of Vitamin K

Blood coagulation – essential cofactor in thrombus formation

Bone metabolism – cofactor in bone protein regulation (osteocalcin)

Deficiency and Toxicity Signs & Symptoms

Deficiency	Toxicity
<ul style="list-style-type: none"> • Tendency toward prolonged bleeding time, easy bruising and hemorrhagic disease • Impaired bone mineralization, and possible bone loss in the elderly 	<ul style="list-style-type: none"> • Doses over 500 mg/d have caused allergic-like symptoms <p>Note that this dose is orders of magnitude larger than the RDI</p>

Increased deficiency risk may be associated with the following:

1. Liver damage (alcoholics, cirrhosis, hepatitis)
2. Drug interactions (antibiotics, cholestyramine, antacids, coumarin, phenytoin)
3. Poor fat absorption (biliary disease, Crohn's, sprue, pancreatitis, cystic fibrosis)
4. Megadoses of vitamin E

Therapeutic Research

Anticoagulant overdose – to reverse deficiency or possibly counteract overdose

Osteoporosis – may help optimize bone mineralization & remodeling

Dosage

RDA = 0.5 mg/ 1000 kcal (minimum of 1 mg/day), therapeutic range 10 mg-1500 mg/day
 Most of the body's thiamine is located in muscle, as it plays a central role in energy production. Once absorbed from the diet, thiamine is rapidly transformed into its active form thiamine pyrophosphate (TPP).

RDI for vitamin B1 (mg)

Adult Men	1.2 (USA DRI - 1998)
Adult Women	1.1 (USA DRI - 1998)

Dietary Sources

Source	Serving size	mg
Brewer's yeast	10 g	1.2
Pork chop	100 g	0.85
Oatmeal	100 g	0.65
Sunflower seeds	30 g	0.6
Potato	1, average	0.24

Functions of Vitamin B1

- Energy metabolism** – vital coenzyme (with magnesium) in the production of energy in cells
- Nervous system** – major role at PNS & CNS synapse, & metabolism of neurotransmitters
- Protein synthesis** – key role in collagen synthesis

Deficiency and Toxicity Signs & Symptoms

Deficiency	Toxicity
<ul style="list-style-type: none"> Impaired reflexes, movement & sensation in extremities (peripheral paresthesias) Muscle tenderness (esp. calf muscles) & weakness Mental confusion, depression, anorexia Impaired collagen synthesis (poor wound healing) Eventually cardiac failure and encephalopathy (beri-beri) 	<ul style="list-style-type: none"> None reported at 500 mg/d for 1 month Megadoses may cause drowsiness in some people

Increased deficiency risk may be associated with the following:

- Heavy alcohol consumption, fat malabsorption syndromes, chronic liver disease
- Medication interactions – diuretics (furosemide) and heart meds (digoxin)
- High intake of – raw seafood, tea, coffee,
- High physical activity with high carbohydrate intake
- Folate deficiency impairs thiamine absorption

Therapeutic Research

- Chronic alcoholics** – treat deficiency (100 mg/d)
- Nervous system** – may ease chronic pain, trigeminal neuralgia, diabetic neuropathy
- CNS disorders** – may benefit Alzheimer's disease, anxiety and depression
- Anemia** – rare thiamine anemia may respond to dose of 100 mg/d
- Myocardial infarction** – intravenous TPP may improve outcome of MI

Clinical Measurement

- Urinary thiamine reflects recent intake
- Erythrocyte transketolase activity measures tissue saturation & enzyme cofactor requirements

Dosage

RDA = 0.6 mg/ 1000 kcal (minimum of 1.2 mg/day), therapeutic range 10 mg-400 mg/day

RDI for Vitamin B2 (mg)

Adult Men 1.3 (USA DRI - 1998)
 Adult Women 1.1 (USA DRI - 1998)

Dietary Sources

Source	Serving size	mg
Calf liver	50 g	1.1
Mushrooms	100 g	0.45
Spinach	100 g	0.2
Milk	1 large glass	0.18
Cheddar cheese	30 g	0.15

Functions of Vitamin B2

Energy metabolism – essential part of FMN & FAD molecules which act as hydrogen ion carriers for Krebs's cycle, electron transport system, fatty acid and amino acid oxidation

Antioxidant – cofactor with glutathione reductase

Deficiency and Toxicity Signs & Symptoms

Deficiency	Toxicity
<ul style="list-style-type: none"> • Cheilosis – painful fissures & cracks around mouth • Dermatitis – red, scaly, painful & itchy patches of skin • Slow wound healing • Lethargy, depression, personality changes 	<ul style="list-style-type: none"> • None reported, absorption is inefficient at high doses

Increased deficiency risk may be associated with the following:

1. Increased demand – childhood & adolescent growth, pregnancy & lactation
2. Poor absorption – GI or biliary obstruction, chronic diarrhea, irritable bowel syndrome
3. Medication interactions – thyroid hormones, oral contraceptives, barbiturates
4. Heavy alcohol consumption
5. Increased protein breakdown – fever, cancer, injury, chronic illness

Therapeutic Research

Cataracts – ample intake may reduce risk of developing cataracts

Skin & mucous membranes – maintains healthy skin & may help stomatitis & cheilosis

Fatigue & depression – may help if symptoms are due to riboflavin deficiency

Antioxidant – riboflavin helps maintain the bodies supply of glutathione reductase

Clinical Measurement

Urinary riboflavin reflects recent intake

Erythrocyte reductase activity measures tissue saturation and enzyme cofactor requirements

Dosage

RDA = 6.6 mg/1000 kcal (minimum of 13 mg/day), therapeutic range 100 mg-4500 mg/day
 1 niacin equivalent (NE) = 1 mg niacin = 60 mg of tryptophan. The amino acid tryptophan can be converted into niacin by the liver, and is thus another source for niacin. There are two main forms of niacin found in food: nicotinic acid & niacinamide.

RDI for Vitamin B3 (mg)

Adult Men	16 (USA DRI - 1998)
Adult Women	14 (USA DRI - 1998)

Dietary Sources

Source	Serving size	mg NE
Peanuts	100 g	14
Tuna	100 g	10.5
Chicken breast	100 g	10.5
Mushrooms	100 g	4.7

Functions of Vitamin B3

Cell metabolism – supports the health of skin, mucus membranes, nervous & digestive system

Energy metabolism – essential part of NAD & NADPH molecules which act as hydrogen ion carriers for Krebs cycle, electron transport system, fatty acid synthesis, glycolysis, cholesterol synthesis (niacin is required for the function of over 200 enzymes throughout the body)

DNA replication – synthesis of histones (proteins bound to DNA)

Blood sugar – regulation as a component of glucose tolerance factor (GTF)

Fat/Cholesterol metabolism – lower levels of blood cholesterol and LDL's, & increases HDL's

Deficiency and Toxicity Signs & Symptoms

Deficiency	Toxicity
<ul style="list-style-type: none"> • Pellagra – dermatitis, diarrhea, dementia • Inflamed painful swollen tongue • Depression, paranoia, anxiety 	<ul style="list-style-type: none"> • Nicotinic acid (>500mg) can cause tingling & flushing of skin • >2.5 mg/d can produce hypotension & dizziness, liver dysfunction, gastric irritation, & increased blood sugar • By 2 weeks most side-effects resolve as the body adapts

Increased deficiency risk may be associated with the following:

1. Poor absorption – inflammatory bowel disease, heavy alcohol consumption
2. Low intake of proteins with tryptophan
3. Vitamin B2 & B6 deficiency may impair conversion of tryptophan to niacin

Therapeutic Research

Atherosclerosis – 1200-6000 mg/d lower LDL (15%-30%), & serum triglycerides (up to 50%) and raises HDL (up to 33%).

Diabetes – may slow the development of diabetic neuropathy

Headaches – may help prevent headaches associated with PMS & migraine

Arthritis – niacin may be beneficial for osteoarthritis (particularly involving the knee)

Clinical Measurement

Urinary methylnicotinamide reflects recent intake

Dosage

RDA = 4-7 mg/d, therapeutic range 50 mg-1000 mg/day

Pantothenic acid is biologically active form is coenzyme A (CoA), & it is required in over 100 metabolic pathways.

RDI for Vitamin B5 (mg)

Adult Men	5 (USA DRI - 1998)
Adult Women	5 (USA DRI - 1998)

Dietary Sources

Source	Serving size	mg
Calf liver	100 g	7.9
Peas	100 g	2.1
Brown rice	100 g	1.7
Lobster	100 g	1.7

Functions of Vitamin B5

Energy metabolism – CoA transfers carbon groups from fatty acid & sugar metabolism

Biochemical synthesis – CoA is required for the synthesis of fatty acids (particularly in cell membranes), cholesterol, steroid hormones, and vitamins A & D. As well as the synthesis of the following proteins & amino acids: leucine, arginine, methionine, hemoglobin, & cytochrome proteins (proteins involved in the electron transport system in mitochondria)

Neurotransmitter – pantothenic acid is required for the synthesis of acetylcholine

Deficiency and Toxicity Signs & Symptoms

Deficiency	Toxicity
<ul style="list-style-type: none"> Fatigue, headaches, depression, anemia Insomnia, muscle aches, joint aches Numbness & burning in lower legs & feet 	<ul style="list-style-type: none"> Extremely low risk of toxicity > 20 g/d may cause diarrhea

Risk of deficiency is extremely rare due to the wide prevalence of pantothenic acid in foods.

Subclinical deficiency may be associated with other B-vitamin deficiencies in conjunction with heavy alcohol consumption, chronic illness, or low calorie dieting and weight loss.

Therapeutic Research

Arthritis – may reduce morning stiffness in both rheumatoid & osteoarthritis (500-2000mg/d)

Dyslipidemia – 600-1200 mg/d may reduce serum cholesterol (15%) & triglycerides (30%)

Microcytic anemia – through its role in hemoglobin synthesis & in conjunction with iron

Fatigue – subclinical deficiency of B5 may produce fatigue, supplementation may be beneficial

Improved wound healing – after trauma or surgery

Clinical Measurement

Urinary levels reflect recent intake

Dosage

RDA = 2 mg/d, therapeutic range 10 mg-1500 mg/day

Vitamin B6 is converted into pyridoxal-5-phosphate (PLP) which is involved in over 100 metabolic reactions in the body, including transamination and the urea cycle.

Recommended Daily Intake Vitamin B6 (mg)

Adult Men	1.3-1.7 (USA DRI - 1998)
Adult Women	1.3-1.5 (USA DRI - 1998)

Dietary Sources

Source	Serving size	mg
Calf liver	100 g	0.9
Potatoes	1 (average size)	0.7
Banana	1 (average size)	0.6
Brewer's yeast	10 g	0.44

Functions of Vitamin B6

Protein synthesis – central role in conversion of amino acids into proteins, collagen & hemoglobin synthesis

Niacin formation – PLP is essential for the conversion of tryptophan to niacin

Lipid metabolism – PLP is vital to fat metabolism, myelin sheath formation & cell membrane lipid production

Neurotransmitter synthesis – PLP is essential for synthesis of serotonin (from tryptophan), dopamine, & norepinephrine

Deficiency and Toxicity Signs & Symptoms

Deficiency	Toxicity
<ul style="list-style-type: none"> Anemia (sideroblastic) Depression, anxiety, confusion Peripheral nerve dysfunction Immune suppression 	<ul style="list-style-type: none"> >1000 mg/d for 1 year may produce neurological disturbances (numbness & tingling) in hands & feet B6 inactivate L-dopa medication in GI tract, thus it is contraindicated for Parkinson's patients being treated with these meds.

Increased deficiency risk may be associated with the following:

1. Increased demand – alcohol consumption, smoking, high protein intake, coffee
2. Medication interactions – oral contraceptives, estrogen, antihypertensive meds
3. Chronic disease – asthma, coronary heart disease, diabetes, rheumatoid arthritis

Therapeutic Research

Peripheral neuropathy – including carpal tunnel syndrome (100-200 mg/d for up to 3 months)

Premenstrual syndrome – may reduce mood swings, edema, acne (500 mg/d)

Atherosclerosis – reduces platelet clumping, lowers LDL & blood homocysteine, raises HDL

Anemia – reduction of symptoms alone or in conjunction with iron & vitamin A

Arthritis – may reduce inflammation & swelling of joints of fingers as well as tenosynovitis

Clinical Measurement

Urinary levels reflects recent intake

Erythrocyte aminotransferase activity measures tissue saturation

Dosage

RDA = 3 mcg/kg of body weight, therapeutic range 400 mcg-75 000 mcg/day

Diets high in processed food are low in folate, as most of the folate is removed through processing.

Folate deficiency is one of the most common vitamin deficiencies.

Folate is absorbed & converted to its active form tetrahydrofolate (THF) and stored in the liver.

Recommended Daily Intake Folic Acid (mcg)

Adult Men 400 (USA DRI - 1998)

Adult Women 400 (USA DRI - 1998)

Dietary Sources

Source	Serving size	mcg
Brewer's yeast	1 Tlbs	300
Kidney beans	100 g	250
Spinach	100 g	134
Broccoli	100 g	105
Egg	1 (average size)	100

Functions of Folic Acid

Protein synthesis – essential role in amino acid conversions & synthesis of structural & functional proteins

Cell growth – essential for the production of DNA & RNA

Fetal development – required for normal development (particularly for central nervous system)

Deficiency and Toxicity Signs & Symptoms

Deficiency	Toxicity
<ul style="list-style-type: none"> • Anemia (megaloblastic) • Glossitis, GI irritation • Depressor, irritability, hostility • Birth defects (neural tube) 	<ul style="list-style-type: none"> • Extremely non-toxic • Doses >300 mcg may reduce zinc absorption • Large doses are contraindicated for epileptics on anticonvulsant medication

Increased deficiency risk may be associated with the following:

1. Decreased absorption – alcoholics, low fresh food diets, malabsorption syndromes
2. Rapid growth during pregnancy
3. Medication interactions – aspirin, antacids, oral contraceptives, & antibiotics
4. Folate & B12 deficiency have many similar features & may mask each other

Therapeutic Research

Pregnancy – decreases premature birth, cleft lip & palate, & neural tube defects

Atherosclerosis – folate lowers homocysteine levels

Cancer – folate with vitamin A may reduce risk of cervical dysplasia (10 mg/d for 3 months)

Diabetics – may improve circulation & visual acuity in elderly diabetics (5 mg/d)

Dosage

RDA = 2 mcg/d, therapeutic range 10 mcg-2000 mcg/day

Vitamin B12 is found in many forms: naturally as methylcobalamin (methyl-B12) & 5-deoxyadenosylcobalamin (coenzyme-B12) and synthetically as hydroxycobalamin and cyanocobalamin (both of which do not occur naturally). ~90% of B12 is stored in the liver.

Recommended Daily Intake Vitamin B12 (mcg)

Adult Men	2.4 (USA DRI - 1998)
Adult Women	2.4 (USA DRI - 1998)

Dietary Sources

Source	Serving size	mcg
Liver	100 g	60
Salmon	100 g	3
Beef, filet	100 g	2
Egg	1 (average size)	1

Functions of Vitamin B12

Folate metabolism – B12 is required for the activation of folate into THF (its active form)

Cell growth – along with folate, essential for the production of DNA & RNA

Fat metabolism – required for conversion of methylmalonate to succinate, & for fat metabolism

Amino acid metabolism – required for conversion of homocysteine to methionine

Nervous system – required for synthesis of myelin in peripheral & spinal nerves & in the brain

Deficiency and Toxicity Signs & Symptoms

Deficiency	Toxicity
<ul style="list-style-type: none"> • Pernicious anemia (megaloblastic) • GI irritation (gastritis) • Sensory, motor & cognitive impairment • Constipation, anorexia, weight loss 	<ul style="list-style-type: none"> • No reports of toxicity at doses >10 mg/day

Increased deficiency risk may be associated with the following:

1. Pernicious anemia is due to a lack of intrinsic factor (IF), achlorhydria (low stomach acid)
2. Low intake/higher demand – strict vegetarians, pregnancy, elderly, smoking, alcoholics
3. Medication interactions – para-aminosalicylic (PASA), choline, neomycin, oral contraceptives

Therapeutic Research

Pernicious anemia – 1000 mcg/d prevents deficiency due to 1-3% absorption with no intrinsic factor

Peripheral nerve disorders – may reduce pain/symptoms of postherpetic & trigeminal neuralgia, may accelerate healing time in nerve injuries, & may be beneficial in diabetic neuropathy

Atherosclerosis – with folate, may prevent conditions associated with blood homocysteine

Psychiatric/nervous disorders – may reduce dementia & confusion in elderly

Clinical Measurement

Serum B12 reflects tissue stores & bioavailability

Deoxyuridine suppression test differentiates folate from B12 deficiency

Dosage

RDA = 30-100 mcg/d, therapeutic range 300 mcg-16000 mcg/day

Biotin is required for many reactions involving the transfer of CO₂ groups between molecules in the metabolism of carbohydrates, lipids & amino acids.

Recommended Daily Intake Biotin (mcg)

Adult Men	30 (USA DRI - 1998)
Adult Women	30 (USA DRI - 1998)

Dietary Sources

Source	Serving size	mcg
Liver	100 g	75
Brewer's yeast	30 g	30
Oatmeal	100 g	20
Egg	1 (average)	12

Functions of Biotin

Glucose synthesis – initial step in gluconeogenesis requires biotin

Fat metabolism – essential for fatty acid synthesis & breakdown

Amino acid metabolism – required for breakdown of amino acids such as threonine, isoleucine, & methionine for energy use

Cell metabolism – required for DNA synthesis

Deficiency and Toxicity Signs & Symptoms

Deficiency	Toxicity
<ul style="list-style-type: none"> • Deficiency is rare • Anorexia, nausea, muscle aches • Hair loss, scaly dermatitis 	<ul style="list-style-type: none"> • Non toxic even at oral doses over 60 mg/day

Increased deficiency risk may be associated with the following:

1. Increased demand – pregnancy, lactation growth during childhood
2. Low calorie diets, chronic use of antibiotics
3. Achlorhydria
4. Consumption of large amounts of raw egg white – (avidin substance that can cause deficiency)

Therapeutic Research

Seborrheic dermatitis – may be reversed with supplementation (5 mg/day)

Diabetes – may help control blood glucose

Hair & nail disorders – dry, brittle hair & nails may benefit from biotin supplementation

Clinical Measurement

Serum biotin reflects total absorbed vitamin

Dosage

RDA = 60 mg/d, therapeutic range 1000 mg-20000 mg/day

Vitamin C plays a key role in the body's ability to handle physiologic stresses during infections, injury, chronic diseases, & environmental toxins.

Recommended Daily Intake: Vitamin C (mg)

Adult Men	90 (USA DRI - 2000)
Adult Women	75 (USA DRI - 2000)

Dietary Sources

Source	Serving size	mg
Papaya	1 (medium)	195
Broccoli	100 g	115
Orange	1 (medium)	70
Strawberries	100 g	65

Functions of Vitamin C

Antioxidant – body's primary water soluble antioxidant

Collagen synthesis – essential for collagen production & repair

Neurotransmitter synthesis – required for the production of norepinephrine & serotonin

Increased iron absorption – increases absorption of non-heme iron in diet

Camitine synthesis, Improved immunocompetence, cholesterol breakdown, hormone production

Deficiency and Toxicity Signs & Symptoms

Deficiency	Toxicity
<ul style="list-style-type: none"> • Easy bruising • Scurvy (bleeding swollen gums) • Impaired wound healing • Neuropsychiatric changes 	<ul style="list-style-type: none"> • Doses >5-10 g/d for years have shown few side effects • Potential GI irritation, diarrhea • May increase risk of kidney stone formation

Increased deficiency risk may be associated with the following:

1. Increased physical stress – smoking, injury, surgery, chronic illness, RA, diabetes
2. Increased demand – rapid growth, above reasons

Note: Vitamin C is contraindicated with aspirin (GI bleeding), and vitamin C interferes with laboratory tests for glucose (false negative/positive) & occult blood (false negative)

Therapeutic Research

Immune response – megadoses may increase immune response

Cancer prevention – may help prevent carcinogen & cancer formation (90mg/d-1000mg/d)

Wound healing – improved healing time (500 mg-1000 mg/day)

Atherosclerosis – can lower cholesterol, triglycerides & raise HDL cholesterol

Periodontal disease – can reduce gum inflammation & promote healing

Iron deficiency – vitamin C enhances iron absorption from meals & supplements

Cataracts – antioxidant action may prevent cataract formation

Clinical Measurement

Serum ascorbic acid reflects dietary intake

Leukocyte ascorbate reflects tissue saturation

DOSE = 1500 mg/day (500 mg tid)

General Information

- In addition to collagen, cartilage is composed of proteoglycans. Proteoglycans are composed of amino sugars called glycosaminoglycans. Glycosaminoglycans are long polysaccharide chains composed of uronic acid and hexosamines like glucosamine or galactosamine. The polysaccharide chains are usually bound to a protein core forming a proteoglycan. These molecules interact with collagen, are very hydrophilic and can bind a huge number of cations due to a great degree of sulfation. Examples include heparin sulfate, chondroitin sulfate, hyaluronic acid and keratin sulfate.
- Glucosamine supplements are typically prepared from chitin, extracted from shellfish. Most of the human studies have used Glucosamine sulfate and it is generally recommended. Glucosamine HCl has may have poor absorption. Most of these studies have shown a positive effect with a low chance for side effects. Generally, pain improvement is slower than it is in patients using NSAIDs, but the effects last longer.

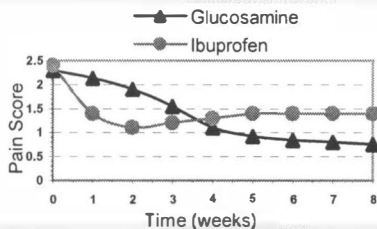
Mechanism of Action

Not fully understood, however:

- In vitro studies suggest that:
 - Stimulates GAG synthesis and increases sulfate uptake by cartilage.
 - Has anti-inflammatory and antioxidant effects.
- Glucosamine and N-acetylglucosamine inhibit formation of nitric oxide in response to pro-inflammatory agents by human chondrocytes.
- Inhibits cyclooxygenase-2 (COX-2), a pro-inflammatory agent. Does not inhibit COX-1.
- In vitro effects required higher concentrations of both agents than the usual dosage of 1500 mg.

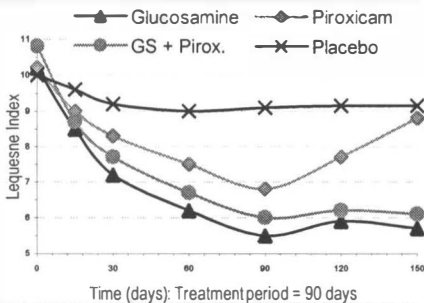
Glucosamine Sulfate vs Ibuprofen

- Double blinded trial on 40 patients with unilateral osteoarthritis of the knee
- Compared oral treatment with 1.5 mg glucosamine sulfate or 1.2 g ibuprofen daily for 8 weeks
- Pain scores decreased faster with ibuprofen initially, long-term glucosamine provided better relief
- Source: Muller-Fassbender H, et al. Glucosamine sulfate compared to ibuprofen in osteoarthritis of the knee. *Osteoarthritis Cartilage*. 2:61-9, 1994.



Glucosamine Sulfate vs Piroxicam

- Double blinded trial on 329 patients with unilateral osteoarthritis of knee
- Compare efficacy & tolerance of oral treatment with 1.5 g glucosamine sulfate, 20 mg piroxicam, GS + Pirox., & placebo
- Incidence of side effects(dropouts): Placebo 24.4%(3); Glucosamine 14.8%(0); Pirox. 40.9%(20), Glucosamine+Pirox 35.9%(3)
- Source: Rovati LC, et al. A large, randomized, placebo controlled, double-blinded study of glucosamine sulfate vs piroxicam and vs their association on the kinetics of symptomatic effect on knee osteoarthritis. *Osteoarthritis Cartilage* 2(suppl.1):56, 1994



Toxicity & Side-effects

- Most studies have found no significant adverse reactions to glucosamine, it is much safer than NSAIDs use for osteoarthritis
- Caution warranted in people who are allergic to seafood, have active peptic ulcers and those using diuretics

Dosage

RDA (1989) = 800 mg/d, therapeutic range – 1000 mg-3000 mg

Recommended Daily Intake: Calcium (mg)

Adult Men	1000-1200 (USA DRI - 1997)
Adult Women	1000-1200 (USA DRI - 1997)

Dietary Sources

Source	mg/serving
Tofu (w/ calcium)	600 mg
Sardines	400 mg
Milk/cheese	300 mg
Dark green vegetables	75 mg

Functions of Calcium

Bone and tooth structure, blood clotting, muscle contraction, nerve transmission

Deficiency and Toxicity Signs & Symptoms

Deficiency	Toxicity
<ul style="list-style-type: none"> • Osteoporosis • Poor quality tooth enamel • Muscle cramps & spasm • Increased nerve cell irritability • Prolonged bleeding times 	<ul style="list-style-type: none"> • Doses >2 g/d do not have significant side effects • High doses may be contraindicated with hyperparathyroidism & predisposition to form calcium oxalate kidney stones

Increased deficiency risk may be associated with the following:

1. Genetics – small framed Caucasian & oriental women with long post-menopause life
2. Medication interactions – antacids, laxatives, & steroids
3. Poor absorption/increased secretion – low vitamin D, high phosphate intake, kidney disease, protein intake >20% of total calories, coffee, black tea, alcohol, fat malabsorption diseases

Therapeutic Research

Osteoporosis – National Institutes of Health recommendations

1. 1000 mg/d premenopausal women
2. 1500 mg/d postmenopausal women
3. 1000 mg/d men over 40 yrs

Blood pressure – reduce hypertension (10%-20%) in some patients (1000-2000 mg/d)

Colon cancer – increased intake (with vitamin D) may reduce risk of colon cancer

Clinical Measurement

Serum calcium, bone density scan

Thyroid gland

Calcitonin

C-cells (parafollicular) make calcitonin

stimulated by ↑ serum [Ca²⁺]

stimulated by ↑ serum [Ca²⁺]

Acts on bone

↓ osteoclast activity

↑ osteoblast activity



Parathyroid gland

Parathyroid Hormone (PTH)

chief cells make PTH

peptide hormone (∴ surface r/c)

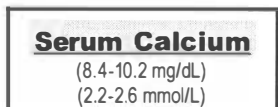
stimulated by ↓ serum [Ca²⁺]

PTH Effects

Bone: ↑ mobilize Ca²⁺

Kidney: ↑ resorption Ca²⁺

GI Tract: ↑ absorption Ca²⁺



PTH

Calcitonin

Bone

Osteocytes (anabolic/catabolic)

PTH effects:

osteocytic osteolysis

↑ Ca²⁺ pump activity

Osteoblasts (anabolic)

synthesize collagen & GAG's mineralization

Alkaline Phosphatase - marker for osteoblast activity

Osteoclasts (catabolic)

PTH effects:

new protein synthesis

↑ lysosomal enzymes

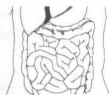
(collagenase)

↑ **Hydroxyproline** in urine

marker for collagen break-down

GI tract

Ca²⁺ absorbed in small intestine



1,25-DHCC

Effects on GI lining cells:

↑ Ca²⁺ binding proteins

↑ Ca²⁺ ATPase

↑ Alkaline Phosphatase

Kidney

PTH effects:

↑ Ca²⁺ resorption

↑ PO₄²⁻ excretion

↑ 1,25-DHCC production

1,25-DHCC (steroid)

D₃-OH (25-HCC)

Liver

D₃-OH (25-HCC)

Skin

Cholesterol

UV light

Vitamin D₃



Chromium

RDI = 50-200 mcg (USA ESADDI 1989), therapeutic range 200-3000 mcg

Functions – Aids glucose metabolism, lipid & protein metabolism

Sources – brewer's yeast, raw oysters, peanuts, wine, mushrooms, apples

Deficiency – impaired insulin function & glucose tolerance, elevated cholesterol

Toxicity – none at doses >2000 mcg/d for three months

Therapeutic research – improved glucose tolerance (200 mcg/d), reduced serum cholesterol (200 mcg/d), may increase lean body mass during weight training (200 mcg/d)

Copper

RDI = 1.5-3 mg (USA ESADDI 1989), therapeutic range 2-10 mg

Functions – iron metabolism, energy production, connective tissue synthesis, pigment production, antioxidant protection, metabolism of hormones & neurotransmitters

Sources – liver, shellfish, nuts, seeds, dried fruit, fortified breakfast cereal

Deficiency – iron deficiency anemia, poor connective tissue synthesis, dyslipidemia, osteoporosis

Toxicity – non-toxic <5 mg/d, doses >7 mg/d may cause nausea, vomiting, diarrhea; Wilson's disease (hepatolenticular degeneration) (affecting 1:200 000 people) is a copper storage disorder

Therapeutic research – may reduce symptoms of rheumatoid arthritis & certain anemias

Iodine

RDI = 150 mcg (USA RDA 1989), therapeutic range 100-2300 mcg

Functions – thyroid hormone synthesis – helps regulate growth, development & energy metabolism

Sources – iodized salt, salt water fish, seaweed, seafood

Deficiency – goiter, hypothyroidism, cretinism in children

Toxicity – non-toxic <100-500 mcg/d, >1-2 mg/d may impair thyroid function, may aggravate acne

Therapeutic research – main use is to reduce/prevent iodine deficiency & hypothyroid disorders

Iron

RDI = 10 mg (USA RDA 1989), 15 mg/d for premenopausal adult females

Functions – required for hemoglobin (oxygen transport), muscle function, energy production

Sources – liver, beef, lamb, pork, fortified cereal, brewer's yeast, nuts, beans

Deficiency – microcytic hypochromic anemia, fatigue, impaired mental & motor function

Toxicity – iron poisoning in children can be fatal (lethal dose = 2-2.5 g in a 10 kg child), doses up to 30 mg-60 mg can be given to treat iron deficiency anemia – may cause abdominal pain, nausea & vomiting. Iron supplementation is contraindicated in patients with hemochromatosis. There may be an increased risk in free radical pathology with excess iron

Therapeutic research – main use is to reduce/prevent iron deficiency anemia

Magnesium

RDI = 310-420 mg (USA RDA 1997), 4.5 mg/kg of body weight (1989 RDA)

Functions – energy metabolism (carbs, fats, proteins), bone/teeth structure, regulates calcium channels in the heart, skeletal muscle & nerves

Sources – soy flour, fortified cereal, lentils, spinach, walnuts, peanuts, almonds, seafood

Deficiency – muscle weakness, tremors, hypocalcemia, hypokalemia

Toxicity – doses up to 1 g/day have no side effects. It is contraindicated in patients with impaired kidney function or heart blocks without artificial pacemakers

Therapeutic research – Diabetes mellitus, kidney stones prevention, reduce risk of heart disease & hypertension, reduce muscle cramps, migraine headaches, and osteoporosis

Manganese

RDI = 2-5 mg (ESADDI 1989)

Functions – carbohydrate & protein metabolism, insulin production, bone & cartilage synthesis, antioxidant

Sources – oatmeal, soy flour, wheat germ, rice bran, peanuts, pecans, mussels, bananas

Deficiency – impaired insulin secretion & bone production, poor wound healing

Toxicity – doses 2-50 mg/d appear to be safe for healthy adults, toxicity can produce CNS effects

Therapeutic research – osteoporosis, diabetes mellitus, 50-300 mg/d may improve wound healing

PHOSPHORUS

RDI = 800 mg (RDA 1989)

Functions – bone & teeth structure, energy metabolism, DNA structure & cell membranes

Sources – cheese, fish, milk, beef, eggs, legumes, nuts, seeds

Deficiency – rare, may occur with alcoholism or some kidney diseases – may cause bone loss

Toxicity – contraindicated in patients with kidney failure

Therapeutic research – 4 g/d may increase endurance performance in some athletes

Potassium

RDI = 2000 mg (1989 estimated adult requirement)

Functions – energy metabolism, membrane excitability & transport in nerves & muscle

Sources – soy flour, lentils, bananas, spinach, potatoes, orange juice, nuts, fish

Deficiency – muscle weakness, bradycardia, hypotension, constipation, cardiac arrhythmias

Toxicity – contraindicated in kidney failure – doses >8 g/d may produce hyperkalemia

Therapeutic research – lowering blood pressure, constipation, cardiac arrhythmias, exercise

Selenium

RDI = 60 mcg (USA DRI 2000), 0.87 mcg/kg of body weight (1989 RDA)

Functions – antioxidant protection, immune function, thyroid hormone metabolism

Sources – tuna, herring, sardines, liver, soy beans, beef, pork, salmon, cod, milk products

Deficiency – free radical pathology, muscle weakness, childhood osteoarthritis (Kashin-Beck disease)

Toxicity – 500 mcg/d appear to be safe, doses >900 mcg/d may cause nausea, vomiting, fatigue peripheral neuropathy

Therapeutic research – cancer prevention, rheumatoid arthritis, immune stimulant, hypothyroidism, childhood osteoarthritis, heavy metal accumulation in the body

Zinc

RDI = 60 mg/d (USA RDA 1989)

Functions – enzyme function (>200 zinc dependant enzymes), protein structure & function, immune function, antioxidant, wound healing

Sources – oysters, liver, beef, poultry, seafood, dairy products, eggs, lentils, oatmeal, corn

Deficiency – growth retardation in children, dermatitis, poor wound healing, white spots on nails, acne, hair thinning & loss, decreased immune response, impaired glucose tolerance, free radical pathology, impaired testicular/ovarian function

Toxicity – doses >150 mg/d may cause nausea, vomiting, & interfere with copper absorption, >300 mg/d may impair immune function & decrease serum HDL cholesterol levels

Therapeutic research – improve immune function (100 mg/d), pustular acne (90-150 mg/d), wound healing (150 mg/d), improve rheumatoid arthritis (100 mg/d)

ACUTE PAIN & INFLAMMATION

Substance	Therapeutic Effects / Contraindications	Dose / Duration
Proteolytic Enzymes Trypsin Chymotrypsin Bromelain	Anti-inflammatory Do NOT give to patients w/ ulcers	Bromelain: 1200 mg/d of 2400 mcu, 1/3 dose between meals, for 5-14 days 3-4 tablets <i>qid</i> between meals
Bioflavonoids Quercetin Hesperdin Rutin	Anti-inflammatory	900-1800 mg/d – may be useful only before peak inflammation 200 mg <i>q2h</i> mixed bioflavonoids
Kava	Sedative effects Anxiety reduction Recent studies suggest hepatotoxicity	100 mg <i>tid</i> standardized kava
Valerian	Sedative effects Treating insomnia	350 mg bid Insomnia: 300-500 mg 1hr before bed

Also consider Herbals: boswellia (400 mg), ginger (300 mg), turmeric (200 mg), cayenne (50 mg)

TISSUE HEALING AND REHABILITATION

Substance	Therapeutic Effects / Contraindications	Dose / Duration
Multivitamins and minerals	Tissue healing and general health	Recommended Daily Allowance (RDA)
Vitamin C		C ~ 1000-3000 mg/d – divided through day
Vitamin E	Tissue healing support	E ~ 200 IU/d (mixed tocopherols)
Calcium	The vitamins provide antioxidant effects as free radical scavengers; Minerals may act as cofactors & catalysts	Calcium ~ 400 mg tid
Copper		Copper ~ 600 µg/d
Iron		Iron ~8-12 mg/d
Manganese		Manganese ~ 4-6 mg/d
Zinc		Zinc ~ up to 50 mg/d
Amino Acids	Tissue healing support	
Glycine, cystine, proline, lysine, etc.	Provide amino acid pool for healing tissue to draw from	300-400mg/d of divided doses
Chondroitin sulfate	Tissue healing support	Chondroitin sulfate ~1200 mg/d
Glucosamine sulfate	Glycosaminoglycans (GAGs)	Glucosamine sulfate ~ 1500 mg/d

bid = 2x/day, tid = 3x/day, qid = 4x/day, qh = every hour, qd = every day,

Phase 1: Acute Inflammatory Phase (Hyperemia or active congestion)

- May last up to 5 days
- Involves both cellular and humoral elements:
 - Homeostasis - vasoconstriction, platelet aggregation, thromboplastin makes clot
 - Inflammation - vasodilation, phagocytosis
- Cardinal Signs - swelling; redness; warmth; pain (chemical/nerve pressure); loss of function

Clinical Objectives: relieve pain; initiate vasoconstriction; disperse fluids; increase circulation; maintain normal muscle tone; maintain normal range of motion

Phase 2: Repair Phase (Stage of consolidation &/or formation of fibrin coagulate)

- May last from 48 hours up to 6 weeks
- Involves synthesis and deposition of collagen
 - Granulation - fibroblasts lay bed of collagen, fills defect & produces new capillaries
 - Contraction - wound edges pull together to reduce defect
 - Epithelialization - cells travel about 3 cm from point of origin in all directions
- Macrophages/phagocytes remove cell debris, erythrocytes, and fibrin clot
- Collagen is not fully oriented in the direction of tensile strength
- The quality of the collagen is inferior to the original

Clinical Objectives: prevent early adhesions; orient repair tissue; relieve pain; maintain normal muscle tone; maintain normal range of motion

Phase 3: Remodeling (Stage of fibroblastic activity & fibrosis)

- May last from 3 weeks to 12 months or more
- Collagen is remodeled to increase the functional capabilities of the tendon or ligament to withstand the stresses imposed upon it.
- Tensile strength of the ligament is greatest in the direction of the forces imposed on it.
 - New collagen forms which increases tensile strength to wounds
 - Scar tissue is only 80 percent as strong as original tissue

Clinical Objectives: proper alignment of repair collagen (type III); increase elasticity of scar tissue; break down fibrotic adhesions; relieve muscle spasms; increase strength; increase range of motion; normalize joint and muscle activity

Factors which SLOW healing

1. Age
2. Malnourishment
3. Corticosteroids/NSAIDs
4. Diabetes
5. Anti-coagulants
6. Prolonged immobilization
7. Rigid fixation
8. Excessive soft tissue gap
9. Excessive motion or stress/repeat injury

Factors which IMPROVE healing

1. Adequate nutrition
2. Calcitonin
3. Vitamin A, C, E
4. Glucosamine
5. Controlled motion/continuous passive motion
6. Anabolic Steroids
7. Electrical stimulation
8. Injectable growth factors
9. Surgical gap closure

Nutrient	Nutrient	Interaction
Calcium	Magnesium	High doses reduce calcium absorption, deficiency produces hypocalcemia
	Phosphorus	High intakes (>2 g/d) increase urinary calcium excretion
	Protein	High intakes increase urinary calcium excretion
	Sodium	Increases urinary calcium excretion
	Vitamin D	Promotes calcium absorption, reduces urinary excretion
Chromium	Calcium	High doses of calcium carbonate reduce chromium absorption
	Iron	Iron deficiency enhances chromium absorption
Folic Acid	Vitamin B12	Deficiency impairs folate utilization and metabolism
	Niacin	Deficiency reduces activation of folate
	Vitamin C	Maintains body stores of folate, reduces urine excretion
Iron	Calcium	Reduces absorption of heme & non-heme iron
	Copper	High doses reduce absorption
	Manganese	Reduces absorption
	Vitamin A	Deficiency impairs mobilization & utilization of body iron; plasma levels of iron drop
	Vitamin C	Sharply increase absorption of iron & overcome inhibition of iron absorption by phenols & phytates
Magnesium	Calcium	High doses reduce magnesium absorption
	Iron, manganese	Reduce magnesium absorption
Niacin	Tryptophan	Precursor in niacin synthesis
	Riboflavin, vitamin B6	Essential cofactor in niacin synthesis from tryptophan
Potassium	Magnesium	Deficiency increases urinary excretion
Selenium	Vitamin C	Deficiency impairs selenium utilization
	Vitamin E	Deficiency increases selenium requirements
Thiamine	Magnesium	Deficiency impairs activation of thiamin to TPP
	Vitamin C	Protects thiamin from inactivation in GI tract
	Folic Acid	Deficiency reduces absorption of thiamin
Vitamin A	Vitamin C	May reduce vitamin A toxicity
	Vitamin E	Enhances absorption, use & storage of vitamin A
Vitamin B6	Niacin	Important in activation of vitamin B6
	Zinc	Important in conversion of B6 to active form
Vitamin B12	Potassium	Extended release potassium fluoride tablets reduce B12 absorption
	Folic acid	Large doses may hide hematologic signs of deficiency
Vitamin C	Iron	Large doses reduce blood levels through oxidation
Vitamin D	Calcium	Hypocalcemia stimulates vit. D conversion to active form
Vitamin E	Iron, Copper	Large doses increase vitamin E requirements
Vitamin K	Calcium	High doses of calcium may impair vitamin K status
	Vitamin E	> 1200 mg/d may reduce vitamin K absorption
Zinc	Calcium	High doses reduce zinc absorption
	Copper, folic acid, iron	Reduce zinc absorption
	Cysteine, Histidine,	Enhance zinc absorption
	Vitamin A, B6	
	Vitamin E	Deficiency reduces zinc plasma levels & may worsen zinc deficiency

Drug	Micronutrient	Interaction
Alcohol	B & fat soluble vitamins	Reduces absorption & impairs metabolism
	Magnesium	Increases urinary magnesium excretion
	Zinc	Reduces zinc absorption & increase urinary excretion
Antacids	B-vitamins, choline, vitamin A, C, calcium, phosphorus, iron, zinc, fluoride	Reduces vitamin & mineral absorption
Antibiotics	Vitamin K, biotin	Reduces vitamin production by colonic bacteria
Anticoagulants (warfarins)	Vitamin K	Antagonizes action, high doses of vitamin K reduce activity of coumarins
	Vitamin E & C	High doses of these vitamin may potentate anticoagulant action
Atropine	Iron	Reduces iron absorption
Barbiturates	Biotin, vitamin B6, B12, riboflavin, folate, calcium	Impairs vitamin metabolism & decrease serum levels
	Vitamin D, K	Reduces Calcium absorption
	Folate	Increase vitamin breakdown & biliary excretion
		High doses may reduce anticonvulsant effects
Beta-blockers	Niacin	High doses of niacin may enhance hypotensive action
Cholesterol lowering drugs	Vitamin A, D, E, K	Reduced vitamin & mineral absorption
	Calcium	Increased urinary calcium excretion
Corticosteroids	Vitamin C	Increases vitamin C turnover & urinary excretion
	Vitamin D	Increase vitamin D requirement
	Calcium, phosphorus	Reduces mineral absorption & increase urinary excretion
Digitalis	Potassium, Magnesium	Increases urinary mineral excretion
Fiber (psyllium)	Beta-carotene, zinc, riboflavin, iron, zinc	Reduces vitamin & mineral absorption
Laxatives	Most vitamin & minerals	Reduced vitamin & mineral absorption due to accelerated transit time
L-dopa	Vitamin B6	Decreases L-dopa activity
Phenytoin	Folate	Reduces absorption & impairs metabolism, high does of folate may antagonize effects
	Magnesium	Decreases serum magnesium levels
	Calcium	Reduces calcium absorption
Salicylates	Vitamin A, vitamin B6, Vitamin C	Reduces vitamin clearance
		Reduces vitamin C absorption, decreases uptake into leukocytes & plasma, increases urinary excretion
	Vitamin K	Impairs vitamin K metabolism
	Iron	Increases loss from the digestive tract
	Folate	Reduces serum folate levels

Sources:

Handbook on Drug and Nutrient Interactions. American Dietetic Association. 1994
 Thomas, JA. Drug-nutrient interactions. Nutr Rev. 1995;53:271

Height Feet Inches	Small Frame	Medium Frame	Large Frame
4' 10"	102-111	109-121	118-131
4' 11"	103-113	111-123	120-134
5' 0"	104-115	113-126	122-137
5' 1"	106-118	115-129	125-140
5' 2"	108-121	118-132	128-143
5' 3"	111-124	121-135	131-147
5' 4"	114-127	124-138	134-151
5' 5"	117-130	127-141	137-155
5' 6"	120-133	130-144	140-159
5' 7"	123-136	133-147	143-163
5' 8"	126-139	136-150	146-167
5' 9"	129-142	139-153	149-170
5' 10"	132-145	142-156	152-173
5' 11"	135-148	145-159	155-176
6' 0"	138-151	148-162	158-179

Weights at ages 25-59 based on lowest mortality.

Weight in pounds according to frame

In indoor clothing weighing 5 lbs.; shoes with 1" heels.

Elbow Measurements for a Medium Frame (Women)

HEIGHT	BREADTH
4'10"-4'11"	2 ¹ / ₄ "-2 ¹ / ₂ "
5'0"-5'3"	2 ¹ / ₄ "-2 ¹ / ₂ "
5'4"-5'7"	2 ³ / ₈ "-2 ⁵ / ₈ "
5'8"-5'11"	2 ³ / ₈ "-2 ⁵ / ₈ "
6'0"	2 ¹ / ₂ "-2 ³ / ₄ "

Conversions - 1" = 2.54 cm; 1 lbs = 0.45 kg

Height Feet Inches	Small Frame	Medium Frame	Large Frame
5' 2"	128-134	131-141	138-150
5' 3"	130-136	133-143	140-153
5' 4"	132-138	135-145	142-156
5' 5"	134-140	137-148	144-160
5' 6"	136-142	139-151	146-164
5' 7"	138-145	142-154	149-168
5' 8"	140-148	145-157	152-172
5' 9"	142-151	148-160	155-176
5' 10"	144-154	151-163	158-180
5' 11"	146-157	154-166	161-184
6' 0"	149-160	157-170	164-188
6' 1"	152-164	160-174	168-192
6' 2"	155-168	164-178	172-197
6' 3"	158-172	167-182	176-202
6' 4"	162-176	171-187	181-207

Weights at ages 25-59 based on lowest mortality.

Weight in pounds according to frame

In indoor clothing weighing 5 lbs.; shoes with 1" heels.

Elbow Measurements for a Medium Frame (Men)

HEIGHT	BREADTH
5'2"-5'3"	2 ¹ / ₂ "-2 ⁷ / ₈ "
5'4"-5'7"	2 ⁵ / ₈ "-2 ⁷ / ₈ "
5'8"-5'11"	2 ³ / ₄ "-3"
6'0"-6'3"	2 ³ / ₄ "-3 ¹ / ₈ "
6'4"	2 ⁷ / ₈ "-3 ¹ / ₄ "

Conversions - 1" = 2.54 cm; 1 lbs = 0.45 kg

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Western States Chiropractic College

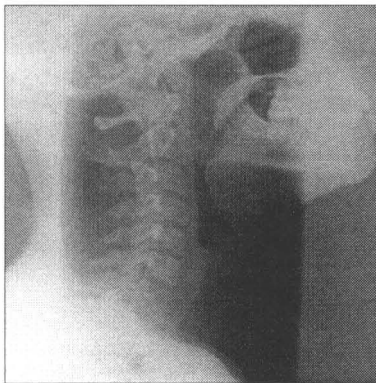
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Additional Recommended Information Resource:

Refer to the Western States Chiropractic College Clinics - Conservative Care Pathways
Clinical Standards, Protocols, and Education (CSPE)
Order through - <http://www.wschiro.edu/>

VI Radiology

Imaging Decisions in LBP	172-173
Radiographic Exam Flow	174
Standard Radiographic Views	175
Cervical Views	176
Thoracic Views	177
Lumbar Views	178
Pelvic Views	179
Specialty Views	180
Technique Changes	181-182
Radiographic Quality	183
Radiographic Report	184
Cervical Film Report	185
Thoracic Film Report	186
Lumbar Film Report	187
Chest Film Report	188
Shoulder Film Report	189
Radiographic Measurements	190-193
Selected Fractures	194-195
Selected Differentials	196-197
Primary Benign Bone Tumors	198-199
Primary Malignant Bone Tumors	200-201



Imaging Decisions

- Cost effectiveness
- Potential benefits weighed against potential risks of each exam

Basic Concepts

- Determine diagnostic value of various imaging techniques
- Role of conventional plain film radiography in low back pain
- Appropriate selection of advanced imaging procedures:
 - Computed tomography (CT)
 - Myelography
 - CT-myelography
 - Discography
 - Magnetic resonance imaging (MRI)
 - Radionuclide bone scanning

General Concepts

- Few patients with low back pain require plain film radiographs, even fewer require special imaging
- Considerations in selecting appropriate imaging examination for individual patients with low back pain:
 - Inherent risk of examination to patient
 - Likelihood that examination will be of benefit in establishing or refuting a diagnosis
 - Potential risk of liability if examination is requested or not requested
- Patient selection (those who require or do not require diagnostic testing)
 - Indicated by findings obtained by patient's history & physical examination
 - Is diagnostic study going to help confirm a diagnosis & if so how much?
 - Will study information change diagnostic thinking, significantly changing choice of treatment?
 - Order diagnostic imaging only if there is high likelihood that information will lead to a change in treatment.
 - Two major patient categories: (high risk & low risk)
- **High risk** - patients with clinical indications (history & exam findings):
 - History:** significant trauma, > 50 years old, neuromotor deficits, unexplained weight loss, ankylosing spondylitis, drug or alcohol abuse, history of cancer, corticosteroid use, fever > 100°F, no improvement in condition
 - Exam:** cachexia, deformity & immobility, scars (surgical, accidental), lymphadenopathy, motor or sensory deficit, elevated ESR or ALP, (+) RH factor, (+) HLA-B27 antigen, serum gammopathy
- **Low risk** - patients that fail to exhibit any of high-risk signs of symptoms
 - These patients seldom exhibit significant abnormalities on radiographs & therefore findings will not alter treatment

Plain Film Radiography in Low Back Pain: When is it reasonable?**Pathologic Diagnosis**

- To establish or confirm a clinical (pathologic) diagnosis
- High risk patients most probable of pathology radiograph on initial visit

Continued →

Pathologic Diagnosis continued

- Low risk patients (absence of neurologic deficit) radiographs are contradicted during first week of acute episode of low back pain & probably are unnecessary unless symptoms persist for a 7-week period (Quebec Task Force on Spinal Disorders)
- Frontal & lateral views are indicated at time of initial examination for high risk patients
- Special views are indicated in high risk patients only when frontal & lateral films are insufficient or equivocal
- Plain film radiographs are typically used as first imaging procedure in patients requiring imaging because: accessible, inexpensive, comfortable, convenient for patient, & involves only minimal radiation exposure
- Sensitivity for plain film = 90% for many conditions
- For bone destruction (ie. malignancy, infection) 30-50% destruction must be present to view on plain film; 3-5% bone destruction necessary on radionuclide bone scans (more sensitive/less specific)
- Plain film is insensitive to many diagnoses: spinal stenosis, herniated nucleus pulposus, intraspinal neoplasms~ require more expensive imaging methods

Biomechanics & Posture

- The role of radiography in evaluating biomechanics & posture is controversial
- **Scoliosis:** full spine radiographic evaluation of patients with scoliosis is an effective diagnostic & analytic procedure with an effective risk/benefit ratio
- **Spino-graphic analysis:** with exception of disc space narrowing it is an unreliable predictor of present or prior history of low back complainants; with exception of scoliosis there is no clinical justification for taking radiographs exclusively for spino-graphic analysis
- **Functional radiography:** functional or "stress" radiography has been used extensively in chiropractic in an attempt to identify & explain biomechanical abnormalities that might contribute to low back pain
- Lateral bending or flexion/extension studies
- Generally excepted that greater than 3 mm of translational movement & greater than 10° angular motion (L1-L4) represents instability
- Greater than 4 mm & 20° (L5-S1) represent instability

Identification of Anomalies

- Lumbosacral anomalies (tropism, transitional vertebrae, spina bifida, & Schmorl's nodes) reveal no higher incidence of back pain than in patients without these abnormalities
- Leg length inequality studies may have an increased incidence of back pain
- Radiographic findings of vertebral anomalies & pelvic tilt may mislead clinician & patient & they frequently lead to inappropriate diagnoses

Contraindication Screening

- Use of radiographic screening to identify contraindications to chiropractic care is unjustified
- Most conditions that contraindicate spinal manipulation are evident via history and/or physical examination (high risk patients)~ imaging or other diagnostic methods

Monitoring Degenerative Processes

- Radiographs are almost always contraindicated because treatment will not be altered
- Exceptions are: progressive scoliosis, unstable degenerative spondylolisthesis or severe degenerative spinal stenosis (CT, MRI) or flexion-extension studies

Adapted from: Taylor, J. & Resnick, D. *Imaging Decisions in the Management of Low Back Pain. Advances in Chiropractic*, vol. 1. Mosby, 1994

Outside X-ray Suite

- Great patient
- Explain exam to patient
- 28 Day Rule
 1. Before examination of an area where uterus is within or close to irradiated area is conducted, ask the patient if there is any possibility of pregnancy
 2. If patient answers 'no,' then ask date last menstrual period
 3. If menstrual cycle is overdue, then examination may be postponed.
- 10 day rule - restrict high dose procedures to 1st ten days of the menstrual cycle
 1. Signature of patient
- Signature of attending physician (if required)
- Prepare patient in appropriate area
 1. Remove metallic objects – jewelry, hairpins, brazier, manzier/bro (Seinfeld humor), glasses, etc.
 2. Have patient gown up
- Escort patient to x-ray suite

Inside X-ray Suite

- Introduce patient to radiographic technician
- Measure all views & write down or measure as you go
- Set panel for 1st view
- Set x-ray tube
 1. SID, tube angle, align vertical crosshairs to film
- Insert cassette into holder or bucky
- Bring patient into field
- Patient protection - lead apron if necessary
- Position approximately
- Alignment
 1. Center to landmark/film to center or,
 2. Center to film
- Position precisely (double check)
- Collimate to area of interest
- Place marker (double check)
- Patient protection – place shielding
- Give patient breathing instructions (as required)
- Expose while watching patient for movement
- Inform patient when they can relax

Next View

- Change cassette!
- Reposition patient, markers, shielding, etc.

After Exam

- Ensure darkroom door is securely closed
- Process films with identification & reload cassettes
- Ensure film drawer is closed before opening door and turning on lights
- Take film to radiologist for consultation (be prepared to relay impressions)
- Student Interns: do not discuss findings with patient until consulting attending physician & radiologist
- Escort patient back to treatment room and explain findings

Anatomy	Minimal Dx Series	Additional Views
Cervical spine	AP, APOM, lateral	Flexion, extension, oblique, pillar
Thoracic spine	AP, lateral	Swimmer's
Lumbar spine	AP, lateral	PA, oblique, lateral spot, frontal spot, flexion, extension, traction, compression (20kg vest)
Sacrum or coccyx	AP, lateral	PA
Upper Body		
Finger	PA, oblique, lateral	
Hand	PA, oblique, lateral	Reverse oblique, ball catcher's
Wrist	PA, oblique, lateral	Ulnar flexion, radial flexion
Forearm	AP, lateral	Oblique
Elbow	AP, lateral	Radial head, Jones, gunsight
Humerus	AP, lateral	Transthoracic
Shoulder/GH joint	Int.& ext rotation	"Y" view, Grashey, transthoracic, axillary
AC joints	AP	Weight bearing (20 lbs held in each hand)
Clavicle	AP, angled view	
Scapula	AP, lateral	
Chest	PA, left lateral	Right lateral, apical lordotic, decubitus, oblique
Lower Body		
Toes	AP, oblique, lateral	
Calcaneus	Tangential, lateral	
Foot	AP, med. oblique, lat.	Lateral oblique, sesamoid views
Ankle	AP, lateral, oblique	
Leg (tib/fib)	AP, lateral	Oblique
Knee & Patella	AP, lateral	PA, intercondylar, sun-rise, oblique, tangential patellar, weight bearing
Femur	AP, lateral	
Hip	AP, lateral (frog-leg)	
Pelvis	AP	Oblique ilium
SI joints	AP, spot view	Oblique
Abdomen	AP (supine)	AP standing

Table adapted from: Harger, H, Taylor, J. & Peterson, C. *Radiographic Report Writing Guideline*. WSCC. 1994.
ext.= external, int. = internal, med = medial, lat. = lateral.

Special Imaging

☆☆☆ = excellent, ☆☆ = good, ☆ = fair

Condition	Plain Film	CT	MRI	Bone Scan
Spondylolisthesis	☆☆☆	☆		☆ (acute)
Trauma	☆☆	☆☆☆ bone	☆☆☆ soft tissue	
Disc Herniation		☆☆	☆☆☆	
Inflam. Arthropathy	☆☆☆	☆		
Neoplasm	☆	☆☆	☆☆☆	☆☆
Infection		☆☆	☆☆☆	☆☆
Stenosis		☆☆☆	☆☆	
Instability	☆☆☆			

Table adapted from: Taylor, J. & Resnick, D. *Imaging Decisions in the Management of Low Back Pain*. *Advances in Chiropractic*, vol. 1. Mosby. 1994

Diagnostic ultrasound – mainly used to detect abdominal aortic aneurysm, genitourinary abnormalities

Video fluoroscopy – limited use in LBP, may be used in flexion/extension functional studies, high radiation exposure – thus of little clinical use

View Cassette, SID	Central Ray Tube ang., Grid Collimation, F. spot	Measure Marker Shielding	Breathing Misc.
AP 8x10, 40"	C4 up 15°, yes 8" x skin, small	C4 @15° ear lobe shadow ½ apron, eye, breast	susp. Center to thyroid Wedge behind head
APOM 8x10, 40"	corner of mouth 0°, yes tips-to-lips, small collimation corners of mouth, upper & lower lips	AP + 4kVp. ear lobe shadow ½ apron, eye, breast, thyroid	susp. 15° sponge
Lateral 8x10, 72"	C4 0°, optional < film, small	C4 Occipital area ½ apron, eye, breast, thyroid	susp. ex. may use Air gap method weights, non-grid holder
Lat. Ext. 8x10, 72"	C4 0°, optional < film, small	C4 extension marker ½ apron, eye, breast, thyroid	susp. ex. may use Air gap method weights, non-grid holder
Lat. Flex. 8x10, 72"	C4 0°, optional < film, small	C4 flexion marker ½ apron, eye, breast, thyroid	susp. ex. may use Air gap method weights, non-grid holder
Oblique 8x10, 72"	C4 Ant. 15° down Post: 15° up optional < film, small	C4 IVF side of interest ½ apron, eye, breast	susp. ex. may be done seated mAs ↑30-50% from lateral "ASS - POOP" rule ASS - Anterior oblique = Same Side IVF POOP - Post Oblique = OPposite side IVF

susp. = suspended, ex. = expiration, F. spot = Focal Spot, Cr. = central ray,
IVF = Intervertebral foramen, SID = Source Image Distance (inches)

Adapted, with permission, from Hank Hirsh, RT(R), (ARRT), LRT

View	Central Ray Tube ang., Grid Collimation, F. spot	Measure Marker Shielding	Breathing Misc.
Cassette, SID			
Swimmers 10x12, 40"	C7-T1 0°, yes < film, small	thru neck & axilla $\frac{1}{2}$ apron, eye	suspended weight, pole may angle up 5-10°
AP 14x17, 40"	mid-sternum 0°, yes 8x17, small	mid-sternum $\frac{1}{2}$ apron, eye	suspended head under (+)Anode
LATERAL 14x17, 40"	axilla 0°, yes 10x17, small	axilla $\frac{1}{2}$ apron, eye	breathing technique blurs ribs, scatter strip support pole upright low mA/long exposure
Full Spine 14x36, 72"	n/a 0°, yes < film, small	through thickest part eye, thyroid, breast, gonad	suspended only for scoliosis 1 st study is AP, then PA done @ 6 months apart compensation filter

susp. = suspended, ex. = expiration, F. spot = Focal Spot, Cr. = central ray,
IVF = Intervertebral foramen, SID = Source Image Distance (inches)

Adapted, with permission, from Hank Hirsh, RT(R), (ARRT), LRT

View Cassette, SID	Central Ray Tube ang., Grid Collimation, F. spot	Measure Marker Shielding	Breathing Misc.
AP 14x17, 40"	iliac crest 0°, yes 12x17, small	iliac crests gonad, breast	suspended expiration raises diaphragm recumbent, sponges, knees flexed,
Lateral 14x17, 40"	ASIS 0°, yes 10x17, large	iliac crests gonad, breast	suspended expiration scatter strip compensation filter – for wide hips & narrow waist
Lat. Spot L ₅ /S ₁ 8x10, 40"	ASIS 0°, yes 5x5, large	L ₅ /S ₁ gonad	suspended scatter strip, sponge ↑kVp 10% from lateral good for spondy view
AP Axial 10x12, 35"	ASIS 25°, yes 10x8, large	ASIS @25° gonad, breast	suspended knees elevated
Oblique 10x12, 40"	iliac crest @ 45° 0°, yes < film	iliac crests @ 45° gonad, breast	susp. ex. posterior oblique – show same side IVF pt. prone good to see Z-joints and pars nearest film

susp. = suspended, ex. = expiration, F. spot = Focal Spot, Cr. = central ray,
IVF = Intervertebral foramen, SID = Source Image Distance (inches)

Adapted, with permission, from Hank Hirsh, RT(R), (ARRT), LRT

View	Central Ray Tube ang., Grid Collimation, F. spot	Measure Marker Shielding	Breathing Misc.	
Cassette, SID				
SACRUM	AP (axial) 10x12, 40"	sacrum up 15°, yes <film, small	sacrum up 15° anatomically gonad, breast	susp. cushion under knees
	Lateral 10x12, 40"	ASIS (slightly below) 0°, yes <film, small	mid-sacrum anatomically gonad, breast	susp. scatter strip on table if pain in general area – include coccyx & sacrum in one film
COCCYX	AP 8x10, 40"	symphysis pubis 10° down (caudad) 10° caudad, yes tightly to coccyx, small	symphysis pubis 10° down anatomically breast, gonad, (place accurately)	susp. scatter strip foam wedge Lower kVp for ↑contrast
	Lateral 8x10, 40"	symphysis pubis 0°, yes tightly to coccyx, small	symphysis pubis anatomically breast, gonad, (place accurately)	susp. scatter strip Lower kVp for ↑contrast
SACROILIAC	AP (RPO/LPC) 8x10, 40 "	Mid SI @25°-30° 0°, yes < film, small	Mid SI @25°-30° anatomical – side of interest gonadal	susp. 25°-30° is less than oblique always bilateral study aim central ray 1" medial to the up (superior) ASIS
	PA (RAO/LAO) 8x10, 40"	Mid SI @25°-30° 0°, yes < film, small	Mid SI @25°-30° anatomical – side of interest gonadal	susp. support the body with wedge knee flexed, arm behind pt. aim central ray to PSIS

susp. = suspended, ex. = expiration, F. spot = Focal Spot, Cr. = central ray,
IVF = Intervertebral foramen, SID = Source Image Distance (inches)

Adapted, with permission, from Hank Hirsh, RT(R), (ARRT), LRT

View <i>Cassette, SID</i>	Central Ray Tube ang., Grid Collimation, F. spot	Measure Marker Shielding	Breathing Misc.
Full Spine 14x36, 72"	mid thoracics 0°, yes <film, small	through thickest part anatomical eye, thyroid, breast, gonad	suspended Only for scoliosis at WSCC 1 st study AP – bony detail PA following studies every ~6mo Compensation filter in thoracics
Traction 10x12, 40"	ASIS 0°, yes <film, large	ASIS anatomical gonad, breast	suspended expiration pt hangs from a bar with toes barely touching floor Set central ray while pt. hanging
Compression 10x12, 40"	ASIS 0°, yes <film, large	ASIS anatomical gonad, breast	suspended expiration pt with 40lbs (20kg) vest, arms holding pole for support Do after traction – less strenuous
Flexion 10x12, 40"	ASIS 0°, yes <film, large	ASIS anatomical gonad, breast	suspended expiration Compression belt Stabilizing device or chair with back for support Use pelvis as a fulcrum
Extension 10x12, 40"	ASIS 0°, yes <film, large	ASIS anatomical gonad, breast	suspended expiration
Scanogram 10x12, 40"	Ankle, Knee, Hip 0°, yes to target, small	See regional anatomical apron, except for hip	All 3 exposures on one film mask film with lead rubber strips Pt. supine or weight bearing Order (A, K, H) w/o rotation

susp. = suspended, ex. = expiration, F. spot = Focal Spot, Cr. = central ray,

IVF = Intervertebral foramen, SID = Source Image Distance (inches), A = ankle, K = knee, H = hip

Adapted, with permission, from Hank Hirsh, RT(R), (ARRT), LRT

Milliamperage (mA) & Exposure Time (s) = mA x s = mAs

Reasons for changing mA:

1. Change focal spot size
2. Adjust tube load
3. Lengthening or shortening exposure time

As long as the original mAs is preserved, any combination of mA and time that result in the same original mAs, should produce the same radiographic density

Kilovoltage (KV or kVp)

Reasons for changing kilovoltage

1. Change the scale of contrast
2. Reduce exposure time
3. Reduce patient radiation dose (\uparrow kVp)

15% Rule – When kVp is increased by 15% & mAs is divided by 2, radiographic density will remain roughly the same, but contrast & patient dose will be reduced

12% Rule – When kVp is decreased by 12% & mAs is multiplied by 2, radiographic density will remain roughly the same, but contrast & patient dose will be increased

Optimum kVp Ranges with Grid or-Bucky

Spine			
Cervical	AP, lateral, oblique		70-80 kVp
	AP open mouth		74-86 kVp
Thoracic			80-90 kVp
Lumbar	AP, oblique		78-88 kVp
	lateral		85-100 kVp
Extremities			
femur, knee			72-84 kVp
humerus, shoulder			70-80 kVp
Chest			
PA, lateral	heart, lungs, mediastinum		110-130 kVp
Ribs above diaphragm			58-68 kVp
Ribs below diaphragm			66-76 kVp

Optimum kVp Ranges Non-grid/Non-Bucky

Spine			
Cervical, lateral			70-80 kVp
Extremities			
Small	fingers, hand, wrist, toes, foot		54-58 kVp
Medium	forearm, elbow, ankle, heel		60-66 kVp
Large	lower leg, knee, humerus, shoulder		64-70 kVp
Chest			
PA	heart, lungs, mediastinum		70-80 kVp
Lateral	heart, lungs, mediastinum		76-86 kVp
Ribs above diaphragm			60-68 kVp

Note: Lower end of kVp range produces greater contrast (therefore more mAs & patient dose)

Adapted, with permission, from R. Ann Ehrlich, RT(R), (ARRT), LRT

Source Image Distance (SID)

Reasons for changing SID

1. Increase radiographic definition
2. Change in tube angle
3. Grid radius

The following formula is used to compensate for distance changes:

$$\frac{\text{Original mAs}}{\text{New mAs}} = \frac{(\text{Original SID})^2}{(\text{New SID})^2}$$

Clinical Short Cut:

A change from 72" to 40" SID" may be compensated by dividing mAs by 3

A change from 40" to 70" SID" may be compensated by multiplying mAs by 3

Technique for Air-Gap Usage

View	Thickness	kVp	mAs	SID	Grid
AP	10 cm	80 kVp	10 mAs	40"	8:1
Lateral	10 cm	80 kVp	32.4 mAs	72"	8:1
Lateral	10 cm	80 kVp	8.1 mAs	72"	NO GRID

- Most necks are the same measurement through the C4 level, and slightly thicker through C7
- Changes in mAs require 20°-30° to visualize change
- The same technique used at 40" with grid, can be used at 72" without grid

Compensation for Tube Angulation

- 1" of every 5° of angle greater than 15°
- No compensation from 0° to 15°
- Beyond 15°, include initial 15°

Grids & Buckys

Grids reduce the amount of radiation reaching the film, thus exposure factors (kVp and/or mAs) must be adjusted to compensate

- When going from non-grid to grid technique: add kVp or multiply mAs
- When going from grid to non-grid technique: minus kVp or divide mAs

GRID RATIO	(+) or (-) kVp	OR	(x) or (÷) mAs by
6:1	10		1.5
8:1	12		2
10:1	14		2.5
12:1	16		3
16:1	20		4

Note: These figures are approximations; Buckys usually require slightly more exposure than grids.

Speed of Film/Screen Combinations

A change in film and/or screen speed requires a change in mAs. Use the following formula:

$$\frac{\text{Relative Speed (original)}}{\text{Relative Speed (new)}} \times \text{Original mAs} = \text{New mAs}$$

Size of Patient Anatomy

kVp - In ranges from 65-85 kVp - 2 KV will compensate for 1 cm change in thickness, < 65 KV - less change is required, > 85 kVp - use 3 KV per cm change in thickness

mAs - 30% increase in mAs will compensate for 2 cm increase in thickness, 20% reduction in mAs will compensate for a 2 cm decrease in thickness

Adapted, with permission, from R. Ann Ertlich, RT(R), (ARRT), LRT

Radiographic Density

- Over-all blackness of the radiograph
- Density is primarily controlled by mAs, other factors affecting radiographic density:

Factor	Change	Radiographic Density
Milliamperage (mA)	Increase	Increase
Kilovoltage (kVp)	Increase	Increase
Exposure Time (s)	Increase	Increase
Source Image Distance (SID)	Increase	Decrease
Film Speed	Increase	Increase
Screen Speed	Increase	Increase
Patient/Anatomy Thickness	Increase	Decrease
Tissue Density	Increase	Decrease
Grid/Grid Ratio	Increase or addition of	Decrease

Radiographic Contrast

1. Relative difference in radiographic density between various parts of the radiographic image
2. Primarily controlled by kilovoltage (kVp)
3. Contrast is also affected by:
 - Radiographic density - film too dark or too light decreases contrast
 - Subject contrast - relative differences in tissue density, increased subject contrast will increase radiographic contrast
 - Secondary radiation control - decreased secondary/scatter radiation increases contrast
 - Grid/grid ratio - addition of a grid or increase in ratio increases contrast
 - Reduction in field size (collimation) increases contrast
4. Film processing
 - Developing time too long or too short decreases contrast
 - Too short - blacks don't develop completely
 - Too long - chemical fog turns white areas gray
 - Developer too hot or too strong - chemical fog turns white areas gray

Radiographic Distortion - Variation between subject & image with respect to size and shape

1. Magnification distortion (image enlargement)

Factor	Change	Magnification
Source Image Distance (SID)	↑	↓
Object Image Distance (OID)	↑	↑

2. True distortion is due to malalignment of tube, anatomy & film. Less distortion occurs when the plane of the subject is parallel to the film & the central ray is centered perpendicularly to both film & anatomy

Radiographic Definition (Sharpness) - Measured in line pairs per millimeter (LP/mm).

1. Geometric factors
 - Focal Spot Size (FSS) & Object Image Distance (OID) increase causes definition decrease
 - Source Image Distance (SID) increase causes definition Increase
2. Crystal factors -Film & intensifying screens
 - Faster films & screens will have larger crystals, increased crystal size decreases definition
3. Other factors:
 - Film/screen contact - poor contact decreases definition
 - Motion - Motion of patient, table, tube or film during exposure decreases definition
 - Parallax - definition will be sharpest at the center of the radiation field & less sharp as the x-ray beam diverges due to increased parallax effect of diverging rays passing through multiple film & screen layers

Adapted, with permission, from R. Ann Etrilch, RT(R), (ARRT), LRT

Top Notch Chiropractic Clinic

110% NE Excellence Avenue, Happy Town, USA, 97230

Doctor: _____ Patient: _____ Age/Sex: _____
 X-ray #: _____ Exam Date: _____ DOB: _____
 History: Keep it brief, but cover all pertinent points (onset, trauma, location & duration).
 Examination: Area radiographed. Views: Radiographic views obtained.

Radiographic Findings

This section should be consistent, orderly, descriptive and in paragraph form. It consists of a narrative of the interpretation of the radiograph. One way to ensure consistency and accuracy is to report the findings using the ABCS format:

A = Alignment

- Analyze spinal curves and posture
- Result of various measurements
- Misalignments (e.g. anterolisthesis, retrolisthesis, laterolisthesis.)

B = Bone

- Fractures
 1. Evaluate film for fractures and dislocations
 2. State in the report if no fractures/dislocations were found using a negative statement like "No evidence of fracture or dislocation is noted"
 3. If a fracture/dislocation is evident, explain and describe it thoroughly. Include the following:
 - Age, angulation, location and direction of fracture line
 - Note apposition and alignment
 - Fracture type (simple/comminuted, open/closed, etc)
 - Soft tissue and/or articular involvement
- Evaluate and describe variations in cortices, medullary and subchondral bone, density, shape, size, trabecular patterns and relationship of osseous arrangements. Again, if no abnormalities are noted report this as a negative statement such as: "Osseous structures are normal in contour, density and internal architecture"

C = Cartilage

- Inspect the intervertebral disc by examining the space between vertebral bodies. Examine articular spaces for any abnormalities. Pay attention to symmetry, continuity, widening or loss of joint space and calcification of cartilage

S = Soft Tissue

- Evaluate soft tissues and note any abnormalities. Look for unusual calcifications, including in blood vessels, masses, displaced fascial lines and unusual gas distribution. Use a negative statement if none are found

Conclusions

- Conclusions should be listed in order of descending importance or significance
- Statements should be brief and to the point. The use of standard terminology helps make the report more reader friendly

Signature: _____

Adapted from: Harger, H, Taylor, J. & Peterson, C. Radiographic Report Writing Guideline. WSCC. 2002.

Top Notch Chiropractic Clinic

110% NE Excellence Avenue, Happy Town, USA, 97230

Doctor: _____ Patient: _____ Age/Sex: _____
 X-ray #: _____ Exam Date: _____ DOB: _____
 History: Keep it brief, but cover all pertinent points (onset, trauma, location & duration).
 Examination: Cervical Spine. Views: APOM, AP, Lateral.

Report

There is mild reversal of cervical curve with apex at C4-C5. A moderate degree of osteopenia is noted. A loss of disc space is noted at C5-C6 along with marked facet arthrosis, more pronounced on right side.

No evidence of fracture or prevertebral swelling.

Conclusion

1. Degenerative disc disease at C5-6 level
2. Facet arthrosis at C5-6 most marked on right side
3. Mild reversal of cervical curve with apex at C4-C5
4. Moderate osteopenia at all levels

Signature: _____

Cervical Spine Radiographic Analysis

- Sagittal curve:
 1. Ensure that loss of curve is not due to poor positioning or hyperplastic articular pillars.
 2. If it is a true loss of curve, then measure angle of cervical lordosis (normal 35-45°)
- Other cervical spine measurements:
 1. Chamberlain or McGregor's lines evaluate for basilar impression (only mention if positive)
 2. Evaluate atlantodental interspace (ADI) (3 mm adults or 5 mm children). Especially following trauma or in rheumatologic patients
 3. In high risk patients, mention if it is normal, otherwise report only if abnormal
 4. Check for sella turcica enlargement. (12 mm vertical x 16 mm horizontal maximum)
 5. Draw Georges line & evaluate for antero or retrolisthesis
 6. Check for disruption of posterior cervical line (spinous-lamina junction line)
 7. Measure sagittal aspect of cervical spinal canal (spinal stenosis less than 12 mm)
 8. Examine prevertebral soft tissue line
 - C2 vertebral body = retropharyngeal (should be less than 6 mm)
 - C6 vertebral body = retrotracheal (should be less than 22 mm)
- Variants & anomalies:
 1. Occipitalization, spinabifida occulta, posterior ponticulum, C1 posterior arch agenesis, odontoid pseudofracture, odontoid agenesis, thyroid cartilage calcification, cervical ribs

Adapted from: Harger, H, Taylor, J. & Peterson, C. Radiographic Report Writing Guideline. WSCC. 2002.

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Doctor: _____ Patient: _____ Age/Sex: _____
 X-ray #: _____ Exam Date: _____ DOB: _____
 History: Keep it brief, but cover all pertinent points (onset, trauma, location & duration).
 Examination: Thoracic Spine, Views: AP and Lateral.

Report

Right scoliotic curve is present extending from T5 to T12, with apex at T8, and no vertebral rotation noted. Angle of curvature is 14° using Cobb's method of scoliosis evaluation.

No fractures are noted

Intervertebral disc spaces are within normal limits, and no soft tissue abnormalities are noted.

Conclusion

1. 14° right scoliosis from T5-T12
2. Negative for fracture, osseous pathology or significant degenerative disease

Recommendation

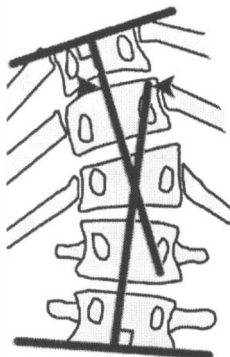
1. Follow-up radiograph in 2 months to evaluate progression of curve

Signature: _____

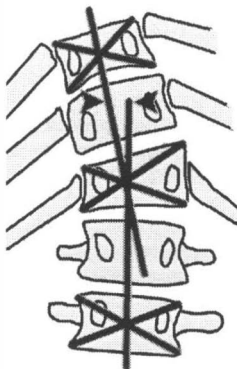
Variants & Anomalies:

1. Block vertebra, hemivertebra, butterfly vertebra, Schmorl's nodes, rhomboid fossa, costal cartilage calcification, venous clefts of Hahn's

Cobb's Method



Risser-Ferguson Method



Note: Cobb's method is the preferred method of scoliosis evaluation, and gives a value approximately 25% greater than Risser-Ferguson. Curves less than 10° are considered within normal limits.

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Doctor: _____ Patient: _____ Age/Sex: _____

X-ray #: _____ Exam Date: _____ DOB: _____

History: Keep it brief, but cover all pertinent points (onset, trauma, location & duration).Examination: Lumbosacral Spine, Views: AP and Lateral.**Report:**

No fractures are visible. Bone density, trabecular markings and cortical margins are within normal limits.

The left femoral head is projected approximately 12 mm superior to the right. The left iliac crest also projected superior relative to the right. The lumbosacral disc and sacral base angles measure 16° and 60°, respectively. No significant anterolisthesis or retrolisthesis are seen on stress films.

No significant degenerative changes are noted in the facet joints, sacroiliac joints or hip joints. Moderate decrease of anterior L5-S1 intervertebral disc space is noted. Further investigation for possible disc disease may be warranted. Other visualized disc spaces are within normal limits.

No soft tissue abnormalities are noted.

Impression:

1. Moderate decrease of L5-S1 disc space (may be secondary to disc disease)
2. Short right lower extremity, approximately 12 mm
3. Negative for recent fracture

Signature: _____

Lumbar Spine

1. Angle & lines to check
 - Lumbosacral disc
 - Lumbar lordosis
 - Sacral base angle
 - Gravitational line
 - Evaluate stress studies for instability - displacement of more than 4mm may indicate instability (flexion/extension or weight/non-weight bearing)
 - Antero or retro -listhesis - evaluate the amount of translation
 - Give answer in millimeters of motion or percentage of shift
 - Spinal canal measurement
 - Eisenstein's method for sagittal canal
2. Always examine for presence of abdominal aortic aneurysms and other soft tissue abnormalities
3. Variants & Anomalies
 - Clasp knife deformity, nuclear impression, transitional segments, facet tropism, lumbar ribs, paraglenoid sulcus, limbus bone, Risser's sign, block vertebra

Adapted from: Harger, H, Taylor, J. & Peterson, C. Radiographic Report Writing Guideline. WSCC. 2002.

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Doctor: _____ Patient: _____ Age/Sex: _____
 X-ray #: _____ Exam Date: _____ DOB: _____
 History: Keep it brief, but cover all pertinent points (onset, trauma, location & duration).
 Examination: Chest Film. Views: PA and Lateral.

Report:

Lung fields are well aerated without evidence of infiltrative disease.

Costophrenic angles are clear and sharply defined without evidence of pleural effusion.

Cardiac/mediastinal silhouette appear normal. The tracheal shadow is in mid-line without noted displacement.

Visualized osseous structures are within normal limits.

There is no evidence of disease on abdominal structures viewed.

Impression:

1. Normal radiographic chest examination.

Signature: _____

Chest condition mnemonics**Interstitial lung disease**

Sarcoidosis
 Histiocytosis X
 Idiopathic Pulmonary Fibrosis
 Tumor (Lymphangitic)
 Failure
 Asbestosis (and other dusts)
 Collagen Vascular Disease
 Environmental dusts (organic - farmer's lung, inorganic - silica, coal)

Causes of unilateral lung disease (PEARL)

Pneumonia
 Edema
 Aspiration
 Radiation
 Lymphangitic Tumor

Cardiophrenic angle mass (Fat PAD)

Fat
 Pericardial cyst
 Adenopathy/Aneurysm
 Diaphragmatic Hernia

Honeycomb lung (BIG HIPS)

Bleomycin
 Idiopathic
 Granulomas
 Histiocytosis X
 Interstitial pneumonia
 Pneumoconiosis
 Sarcoidosis

Interstitial lung disease & hyperinflation (LN SEX)

Lymphangiomyomatosis
 Neurofibromatosis
 Sarcoidosis
 Emphysema
 X, histiocytosis

Chronic airspace disease (BALLS)

Bronchoalveolar carcinoma
 Aspiration
 Alveolar proteinosis
 Lipoid pneumonia
 Lymphoma
 Sarcoid (alveolar)

Apical Lung Disease (SET CAP)

Sarcoidosis
 Eosinophilic pneumonia
 Tuberculosis
 Cystic Fibrosis
 Ankylosing spondylitis
 Pneumoconiosis

Basilar lung disease (R-BADS)

Rheumatoid
 Bronchiectasis
 Asbestosis
 Drugs
 Scleroderma

Top Notch Chiropractic Clinic

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Doctor: _____ Patient: _____ Age/Sex: _____
 X-ray #: _____ Exam Date: _____ DOB: _____
 History: Keep it brief, but cover all pertinent points (onset, trauma, location & duration).
 Examination: Right Shoulder. Views: AP external and External rotation.

Report:

Amorphous calcification visualized adjacent to the superior articular surface of the right humerus (measuring 20mm x 4mm). Finding is consistent with calcific tendinitis or hydroxyapatite deposition disease (HADD) of supraspinatus tendon.

No fractures are visible. Osseous structures are normal in contour, alignment, and internal architecture.

Articular spacing is within normal limits.

No other soft tissue abnormalities are visualized.

Impression:

1. Calcific tendinitis or HADD, right rotator cuff (supraspinatus).

Signature: _____

Extremity films

Note the presence of fat-pad signs ('sail sign') or soft tissue edema

Shoulder anatomical variants & anomalies

- Enlarged conoid tubercle
- Pseudotumor of humerus – radiolucency visible on internal rotation views

Elbow anatomical variants & anomalies

- Pseudoperiarthritis – calcification of interosseus membrane between radius & ulna
- Supracondylar process – exostosis on anteriomedial humeral metaphysis

Wrist anatomical variants & anomalies

- Madelung's deformity – shortened radius
- Negative ulnar variants – shortened ulna (often associated with Keinboch's disease)
- Navicular tubercle – bump on radial side of navicular

Hip anatomical variants & anomalies

- Os acetabuli – accessory ossicle on superior rim of acetabulum
- Pits pit of femoral neck – radiolucency in femoral neck

Knee anatomical variants & anomalies

- Bipartite or multipartite patella – unfused apophysis of patella
- Os fabella – sesamoid bone in lateral head of gastrocnemius
- Pellegrini-Stieda disease – post traumatic ossification of medial collateral ligament

Ankle anatomical variants & anomalies

- Os perineum – accessory ossicle inferior to cuboid
- Os supranavicular - accessory ossicle superior to navicular
- Os trigonum - accessory ossicle posterior to talus or superior to posterior calcaneus

Selected Named Avascular Necrosis Conditions

Blount's Dz – AVN of medial femoral condyle

Chandler's Dz – AVN adult femoral head

Freiberg's Dz – AVN of metatarsal head

Keinboch's Dz – AVN of lunata

Kohler's Dz – AVN of navicular (tarsal)

Legg-Calve-Perthe's Dz – AVN of femoral head

Osgood-Schlatter's Dz – tibial tubercle

Panner's Dz – AVN of capitellum

Preisser's Dz – AVN of scaphoid

Scheurmann's Dz – AVN of vertebral end-plates

Dz = disease, AVN = avascular necrosis

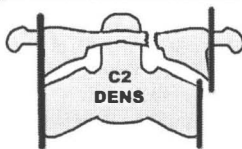
Atlantodental Interspace

Normal: children – 1-5 mm, adults – 1-3 mm
 Interpretation: trauma, occipitalization, Down's syndrome, pharyngeal infection, ankylosing spondylitis, RA, psoriatic arthritis, Reiter's syndrome



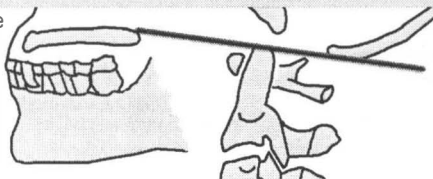
Atlanto-axial Alignment

Normal: lateral margins of C1 & C2 should line up
 Interpretation: Jefferson's fracture (C1 burst Fx), odontoid fracture, alar ligament instability
 Children up to 4yrs, bilateral overhang of atlas may be normal



McGregor's Line

Normal: dens apex < 8 mm males, 10 mm female line
 Interpretation: platybasia, atlas occipitalization, rheumatoid arthritis, Paget's disease, osteomalacia



Most accurate way to measure basal impression

Cervical Lines

- All bony lines should be smooth & continuous
- Proper alignment indicates NO fractures, dislocation, or ligament laxity
- Antero/retro-listhesis; may indicate instability due to fracture, dislocation, ligamentous laxity, DJD

1. Prevertebral Soft-Tissue Line

- Use rule of 6's & 2's. (6mm at C2 & 22mm at C6)
- Soft tissue mass may increase measurements including: posttraumatic hematoma, retropharyngeal abscess, or neoplasm from adjacent bone & soft tissue structures.

2. Anterior Vertebral Body Line

3. Posterior Vertebral Body Line

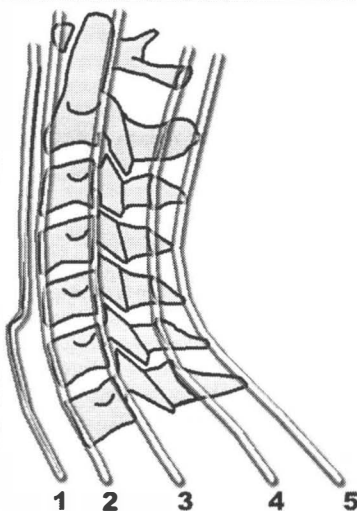
(George's Line)

4. Spinolaminar Junction Line

- Line is useful in detecting subtle odontoid fractures & atlantoaxial subluxation

5. Spinous Process Line

- Line useful in detecting spinous process fractures



Meyerding's Grading Method in Spondylolisthesis

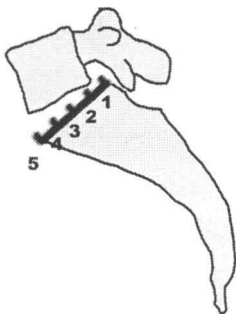
Method used to grade spondylolisthesis

Measure from the posterior inferior corner of L5 over sacral base

(note: grade 1 is shown on illustration)

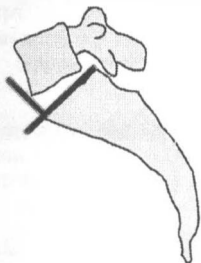
Interpretation:

1. Grade 1 = < 25% translation
2. Grade 2 = < 50% translation
3. Grade 3 = < 75% translation
4. Grade 4 = < 100% translation
5. Grade 5 = spondyloptosis (vertebral body completely slipped off sacral promontory)

**Ullmann's Line**

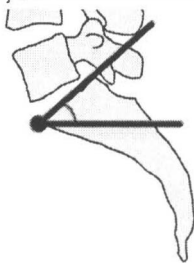
Normal: L5 body behind line

Interpretation: L5 vertebral body anterior to line indicates anteriolisthesis (spondylolisthesis)

**Lumbosacral Angle**

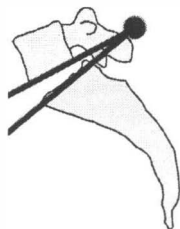
Normal: 26°-57°

Implication: ↑ angle may cause LBP by ↑ stress on posterior lumbosacral joints

**Lumbosacral Disc Angle**

Normal range 10°-15°

Interpretation: increased angle may be associated with low back pain caused by facet impact

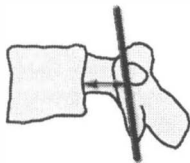
**Eisenstein's Method for Sagittal Canal Measurement**

Line: connects sup. & inf. articular processes

Normal: always greater than 15 mm

Interpretation: < 15 mm → spinal stenosis

Note: best plain film way to evaluate for stenosis

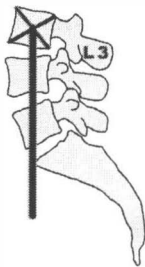
**Lumbar Gravity (Ferguson's) Line**

Normal: line should intersect anterior sacral base

Interpretation:

Line anterior to sacral base > 10 mm → ↑ shear stress anteriorly on lumbosacral zygapophyseal joints (z-joints)

Line posterior on sacral base → ↑ weight bearing on z-joints & possibly cause LBP



< = less than, > = greater than, → may indicate, ↑ = increase, sup. = superior, inf. = inferior

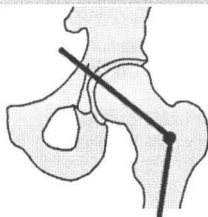
Femoral Angle

Normal: 120° - 130°

Interpretation:

- $< 120^{\circ}$ = coxa vara
- $> 130^{\circ}$ = coxa valga

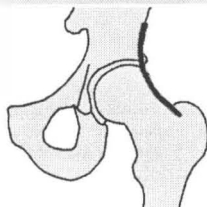
Note: radiograph should be taken with thigh internally rotated 15°



Iliofemoral Line

Normal: smooth, bilaterally symmetrical line

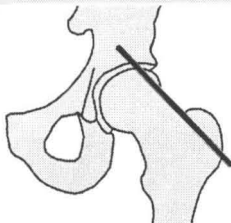
Interpretation: disruption in line \rightarrow congenital dysplasia, slipped capital femoral epiphysis (SCFE), dislocation, fracture



Klein's Line

Normal: compare bilaterally, should be the same amount of overlap side to side over femoral head

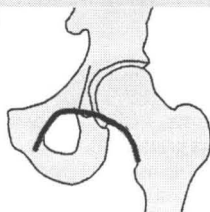
Interpretation: failure of femoral head overlap in relation to line or asymmetry \rightarrow SCFE



Shenton's Line

Normal: smooth, continuous bilaterally symmetrical line

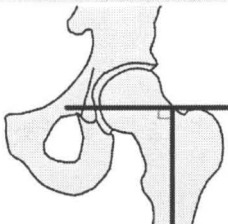
Interpretation: disruption of line \rightarrow hip dislocation, femoral neck fracture, slipped femoral capital epiphysis



Skinner's Line

Normal: fovea capitis above or at level of the line

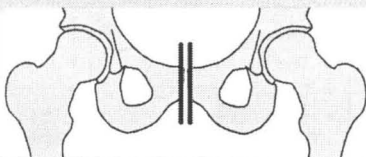
Interpretation: if fovea is below line \rightarrow superior displacement femur \rightarrow fracture, conditions causing coxa vara



Symphysis Pubis Width

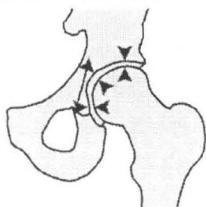
Normal: female 3.8-6 mm, male 4.8-7.2 mm

Interpretation: increased width → cleidocranial dysplasia, hyperparathyroidism, posttraumatic diastasis, ankylosing spondylitis, osteitis pubis, gout

**Hip Joint Space Width**

Normal: Superior (3-6 mm), Axial (3-7mm), Medial (4-13 mm)

Interpretation: ↓ superior space → osteoarthritis
 ↓ axial space → DJD, RA
 ↓ medial space → DJD, RA
 ↑ medial space → hip joint effusion or lateral shift of femur (Waldenström's sign)

**Acromioclavicular Joint Space**

Normal: female (2.1-3.7 mm), male (2.5-4.1 mm), compare bilaterally

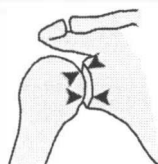
Interpretation: ↓ joint space → DJD
 ↑ joint space → AC separation, osteolysis in hyperparathyroidism, or RA following trauma

**Glenohumeral Joint Space**

Normal: 4-5 mm

Interpretation: decreased joint space → DJD, calcium pyrophosphate dihydrate crystal disease (CPPD), & posttraumatic arthritis

Increased joint space → acromegaly & posterior humeral dislocation

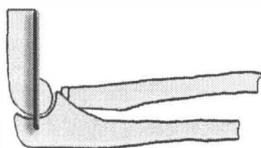
**Anterior Humeral Line**

Normal: line should pass through capitellum

Interpretation: posterior displacement of capitellum → fracture

Good for detecting supracondylar fractures

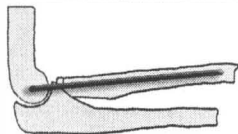
Note the presence of fat pads ('sail sign') due to edema, as fracture lines are often not visible

**Radiocapitellar Line**

Normal: line should pass through center of capitellum

Interpretation: line does not pass through capitellum → radial head subluxation (pulled elbow) or dislocation

Note the presence of fat pads ('sail sign') due to edema



Fracture Complications

Immediate concerns	Short-term concerns	Long-term concerns
<ul style="list-style-type: none"> • Vascular damage • Compartment syndrome • Fat embolism • Thrombus formation • Gas gangrene 	<ul style="list-style-type: none"> • Refracture • Synostosis • Delayed union • Osteomyelitis • Reflex sympathetic dystrophy • Myositis ossificans 	<ul style="list-style-type: none"> • Osteonecrosis • Nonunion • Malunion • DJD • Osteoporosis

Fracture Types

Avulsion Fx - separated bone fragment from a muscle, tendon or ligament

Occult Fx - non-visualized fracture, often diagnosed through soft tissue swelling (fat pad signs), or advanced imaging

Closed Fx - bone does not penetrate skin

Open Fx - fracture penetrates through skin

Comminuted Fx - >2 bony fragments

Pathologic Fx - fracture through diseased bone



Green Stick Fx - buckled trabeculae

Spiral Fx - fracture circumferential & longitudinal to long axis of bone



Impaction (compression) Fx

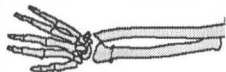
- decreased bone size from trabecular compression



Stress (fatigue) Fx - microfracture due to repetitive stress

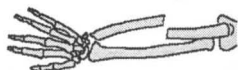
Insufficiency Fx - stress fracture through diseased bone (pathologic)

Torus Fx - buckled trabeculae & cortical bulge



Oblique Fx - fracture ~45° to long axis of bone

Transverse Fx - fracture ~90° to long axis of bone



Salter-Harris Classification Types



Growth plate
E.G. - SCFE



Most common
Growth plate & Metaphysis



Growth plate & Epiphysis

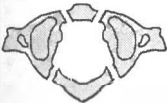
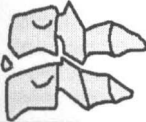





Growth plate
Metaphysis & Epiphysis









Compression of
Growth plate




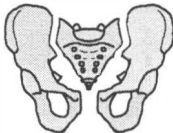



Selected Vertebra Fractures

<p>Jefferson (C1-burst)</p> 	<p>Odontoid Fractures</p>		
<p>Teardrop/Chip Fx</p> 	<p>Type I</p> 	<p>Type II</p> 	<p>Type III</p> 
		<p>X-ray findings of recent compression fracture</p> <ol style="list-style-type: none"> 1. Wedge deformity 2. Linear zone of condensation 3. Step defect (cortical offset) = end-plate displacement 4. Paraspinal swelling (edema) 5. Abdominal ileus (small intestine) 	

Selected Hand & Wrist Fractures

<p>Bennet's Fx</p> 	<p>Boxer/Barroom Fx</p> 	<p>Smith Fx</p> <p>Anterior Displacement</p> 	<p>Colley Fx</p> <p>Posterior Displacement</p> 
<p>Monteggia's Fx</p> <p>ULNA broken, RADIUS dislocated</p> 		<p>Galleazzi's Fx</p> <p>RADIUS broken, ULNA dislocated</p> 	

Selected Pelvic & Lower Extremity Fractures

<p>Malgaigne Fx</p> 	<p>Bucket-Handle Fx</p> 	<p>Straddle Fx</p> 	<p>Sprung Pelvis</p> 
<p>Proximal Femur Fractures</p> <p>Extracapsular</p> <ul style="list-style-type: none"> Intertrochanteric Trochanteric Subtrochanteric <p>Intracapsular</p> <ul style="list-style-type: none"> Subcapital Midcervical Basicervical 		<p>Slipped Capital Femoral Epiphysis</p> 	<p>Pott's Fx</p> 

Major Causes of Metastasis

- Breast/Prostate Cancer**
 - Breast CA is usually lytic, "cookie bite" lesion
 - Prostate CA is most commonly blastic
 - "Winking" pedicle sign
- Lung Cancer = bronchogenic carcinoma**
 - Will metastasize anywhere, but most commonly to the proximal long bones, pelvis, lumbo-thoracic spine
 - Most common cause of acral metastasis
- Kidney & Thyroid Cancer**
 - Most common causes of *blow-out metastasis* = expansile, very rapid, quickly destructive

Differential Lists

↑ IVF size	Sacrum Cancer	Subchondral Cancer
Pedicle agenesis Metastasis Neurofibromatosis	Chordoma Chondrosarcoma Osteosarcoma Fibrosarcoma	Giant Cell Tumor Chondroblastoma Aneurysmal Bone Cyst

Painful Scoliosis DDx

- ABC
- GCT
- Osteoid osteoma** - appears sclerotic i.e. may cause a sclerotic pedicle
- Osteoblastoma**
 - Look for signs of these lesions near the apex of the scoliosis
 - 1,2,4 are all expansile, painful lesions of the posterior elements
 - 1,4 are typically younger pt (<25 y.o.)
 - 2,3 are more common in pts over 25 y.o.

Ivory Vertebra DDx (IHOP)

- Idiopathic
- Hodgkin's lymphoma** - anterior scalloping due to lymphadenopathy (causing pressure on the vertebral body)
- Osteoblastic metastasis** - most common
- Paget's disease** - displays a picture frame vertebra, expansile

Ossified Soft Tissue Mass DDx

- Myositis ossificans**
 - In pts. with a history of trauma in the location, trabeculae form on the periphery (OUT → IN ossification)
 - Cleavage plane is often visible (not connected to bone)
- Osteosarcoma**
 - Primarily occurs in young pts. common around knee
 - Trabeculae form centrally (IN → OUT ossification)
 - No cleavage plane is seen, is connected to bone
 - DDx of a calcified vs. an ossified soft tissue mass
 - Calcified = stippled (cloudy), can't clearly see trabeculae of cortical bone
 - Ossified = can see trabeculae

Lesion Characteristics

Benign	Malignant (primary)	Metastatic
<ul style="list-style-type: none"> • Patient usually < 30 yrs. • Lesion < 6 cm • Monostotic (1 bone) lesion • No cortical destruction • Solid periosteal response • Some laminated or Codman's triangle • Not speculated • Geographic lytic destruction • Sharp margination • No soft tissue mass 	<ul style="list-style-type: none"> • All ages (see specific lesion) • Lesion > 6 cm • Monostotic (usually) • Cortical destruction • Spiculated periosteal resp. • Some laminated or Codman's triangle • Motheaten or permeative lytic lesion • Indistinct margins • Soft tissue mass 	<ul style="list-style-type: none"> • Patient usually > 40 yrs. • Polystotic lesion (> 1 bone) • Cortical destruction • No periosteal response • Motheaten or permeative lytic lesions • Indistinct margins • Occasional soft tissue mass

Cancer Region Differentials

Epiphysis

1. Differentiate from arthritic lesions (OA, RA)
2. Chondroblastoma (young - epiphyseal)
3. Giant Cell Tumor (old - subchondral)

Epiphyseal-Metaphyseal

1. Aneurysmal bone cyst - only benign lesion to cross growth plate
2. Giant Cell Tumor

Metaphyseal

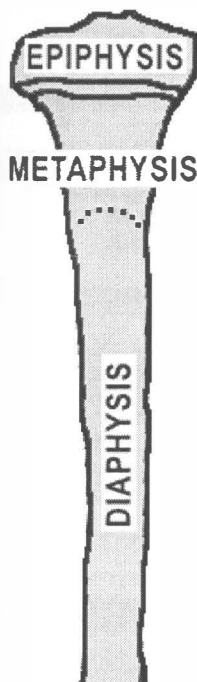
- | | |
|----------------------------|---------------------|
| 1. Bone island | 6. Osteochondroma |
| 2. Enchondroma | 7. Simple bone cyst |
| 3. Fibrous cortical defect | 8. Chondrosarcoma |
| 4. Nonossifying fibroma | 9. Fibrosarcoma |
| 5. Osteoid Osteoma | 10. Osteosarcoma |

Metaphyseal-Diaphyseal

- | | |
|---------------------|--------------------------|
| 1. Chondrosarcoma | 4. Osteoid osteoma |
| 2. Osteosarcoma | 5. Nonossifying fibroma |
| 3. Multiple Myeloma | 6. Chondromyxoid fibroma |

Diaphyseal

1. Multiple Myeloma
2. Ewing's sarcoma
3. Non-Hodgkin's lymphoma



CONDITION	AGE SKELETAL SITE	RADIOGRAPHIC FINDINGS	MISCELLANEOUS
OSTEOCHONDROMA			
	Young: 0-20 metaphysis (eccentric) femur, humerus, tibia, pelvis, ribs	Pattern: exostosis sessile & pedunculated, coat hanger exostosis, grow away from joint, 'cauliflower'	1% chance of malignant degeneration, if solitary M/C benign tumor of skeleton
Hereditary Multiple Exostosis (HME)	Young: 2-10 neural arch	may cause 'bayonet deformity'	20% chance of malignant degeneration
HEMANGIOMA			
	Middle: 40+ 75% in spine & skull	Pattern: lytic coarse vertical trabeculae, radiating sunburst look of skull, normal cortex	DDx: Paget's, Osteoporosis M/C benign tumor of spine Associated w/ Maffucci's Syndrome
OSTEOMA			
	middle: 15-45 membranous bone; skull, sinuses	Pattern: sclerotic homogenously opaque surface lesion	Gardner's Syndrome 1. multiple osteomas 2. colonic polyps 3. soft tissue fibroma
ENOSTOMA (Bone Island)			
	Any age metaphysis, epiphysis femoral neck, ischial tuberosity	Pattern: blastic round sclerotic lesions, brush border, along lines of stress, 'thorn' projections	DDx: blastic METS, osteoma
OSTEOID OSTEOOMA			
	Age: 10-25 diaphyseal growth plates, eccentric 50% femur, tibia, 10% in neural arch	Pattern: lytic (NIDUS) - reactive sclerosis, Nidus surrounded by reactive sclerosis, painful scoliosis	DDx: Brodie's Abscess, (nidus >2cm), osteoblastoma severe night pain, ↓ by ASA Pain referred to close joint
OSTEOBLASTOMA			
	Age: 3-78 metaphysis, diaphysis central 50% neural arch, 50% long tubular bones	Pattern: lytic, expansile painful scoliosis	DDx: aneurysmal bone cyst, osteoid osteoma mild pain, no night pain

ASA = aspirin, METS = metastasis, GCT = Giant Cell Tumor, M/C = most common

CONDITION	AGE SKELETAL SITE	RADIOGRAPHIC FINDINGS	MISCELLANEOUS
ENCHONDROMA			
	Age: 10-30 metaphysis, central 50% hands & feet	Pattern: lytic geographic, expansile stippled endosteal scaloping	DDx: chondrosarcoma, bone infarct Malignant degeneration: 1% solitary, 50% Ollier's, 50% Maffuci's M/C benign tumor of hand
CHONDROBLASTOMA			
	Age: 10-25 epiphysis before closure trochanters, tuberosity of humerus, knee	Pattern: lytic oval/round lesion, cotton wool calcification of matrix sharp zone of transition	DDx: Giant Cell Tumor (GCT) mild pain, ↓ by ASA 'Codman's' Tumor
SIMPLE BONE CYST			
	Age: young 3-14 metaphysis, central 75% in proximal humerus & femur	Pattern: lytic fallen fragment sign pathologic fracture expansile, geographic	DDx: enchondroma 2/3 may pathological fracture
ANEURYSMAL BONE CYST			
	Age: young 5-20 metaphysis, eccentric neural arch of thoracic & lumbar spine, long tubular bones	Pattern: lytic only benign tumor to cross epiphyseal plate thinned cortex periosteal buttressing	DDx: osteoblastoma, GCT
FIBROUS XANTHOMA			
	Age: 8-20 metaphysis, eccentric	Pattern: lytic solitary, radiolucent, ovoid, bubbly cortical expansion	Non-ossifying Fibroma
	Age: 4-8 metaphysis, eccentric		Fibrous Cortical Defect
CHONDROMYXOID FIBROMA			
	Age: 10-30 metaphysis, eccentric tibia	Pattern: lytic soap bubbly	Often associated with local pain
INTRAOSSIOUS LIPOMA			
	Age: <30 metaphysis calcaneus, tibia	Pattern: lytic well defined sclerotic border, target or doughnut shaped sequestrum	Very rare

ASA = aspirin, METS = metastasis, GCT = Giant Cell Tumor, M/C = most common

CONDITION	AGE SKELETAL SITE	RADIOGRAPHIC FINDINGS	MISCELLANEOUS
MULTIPLE MYELOMA (27%)			
	Age: old, 50-70 diaphysis spine, pelvis, skull, ribs	Pattern: lytic (97%) osteoporosis, punched out lesions, rain drop skull, pedicle preservation	DDx: METS Pain relieved by rest Bence-Jones proteins M-spike on electrophoresis N/N anemia, Rouleaux formations pain relieved by rest
Plasmacytoma	Age: 50% before 50 above and mandible		
OSTEOSARCOMA (20%)			
	Age: young, 10-25 metaphysis distal femur, proximal tibia & humerus	Pattern: 50% blastic, 25% lytic, 25% mixed ivory medullar lesions speculated, codman's triangle, ST mass: 'cumulus cloud'	DDx: Myositis Ossificans Pain with swelling, "cannon ball" metastasis to lung
CHONDROSARCOMA (10%)			
	Age: old, 40-60 metaphysis, diaphysis pelvis, proximal femur & humerus, ribs, proximal tibia, fingers	Pattern: lytic endosteal scalloping, laminated periosteum, popcorn matrix	DDx: enchondroma, bone infarct metastasis to lung late pain with swelling slow but aggressive
EWING'S SARCOMA (7%)			
	Age: young, 10-25 diaphysis long bones of extremities, flat bones; ribs, scapula	Pattern: lytic permeative lesion "onion skin", cortical saucerization	DDx: osteosarcoma, infection local pain, warm, mimics infection, dilated veins
FIBROSARCOMA (2%)			
	Age: 30-50 metaphysis, eccentric knee, tibia & femur	Pattern: lytic cortical disruption, large ST mass, "ground glass" appearance, no periosteal response	pain & swelling METS to lung, liver, lymph system aggressive with no distinguishing characteristics

METS = metastasis, ST = soft tissue, DDx = differential diagnosis

CONDITION	AGE SKELETAL SITE	RADIOGRAPHIC FINDINGS	MISCELLANEOUS
CHORDOMA			
	Age: 40-70 central, spine: C2-sacrum	Pattern: lytic lytic destruction with ST mass amorphous calcification expansion disk destruction	DDx: lytic METS, infection, chondrosarcoma, GCT, plasmacytoma Pain – due to growth into other structures
NON-HODGKIN'S LYMPHOMA			
	Age: 20-50 metaphysis, diaphysis femur, tibia, humerus, pelvis, ribs, scapula, vertebra	Pattern: lytic permeative, minimal periosteal response ST mass cortical disruption	dull pain not relieved by rest
HODGKIN'S LYMPHOMA			
	Age: 20-35 vertebral body	Pattern: lytic (75%) ivory body with anterior scalloping	DDx: Paget's, blastic METS Pain!!!
SYNOVIAL SARCOMA			
	Age: 30-50 knee, hip, ankle	soft tissue mass	DDx: Osteosarcoma pain Follow up MRI for soft tissue signal
GIANT CELL TUMOR (GCT) - quasimalignant			
	Age: 20-40 epiphysis after closure eccentric distal femur & radius, proximal tibia, humerus, sacrum, neural arch	Pattern: lytic (60%) subarticular radiolucent, ovoid soap bubble appearance	DDx: chondroblastoma, chondrosarcoma, chordoma local intermittent pain ~20% potential for malignant degeneration

METS = metastasis, ST = soft tissue, DDx = differential diagnosis

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VII Selected Conditions

NMS Treatment Parameters ...	204
NMS Considerations & DDx ...	205
Selected NMS DDx	206
Abdominal Pain	207
Anemia	208-209
BPPV	210
Concussion	211
Constipation	212
"Cross Syndrome"	213
Diarrhea	214
Disc Herniation	215
Dizziness Differentials	216
Facet Syndrome	217
Fatigue	218
Fever	219
Headache Differentials	220
Headache Pathologic	221
Hypertension	222
Instability	223
Lung Pathology DDx	224
Recurrent Chest Pain DDx	225
Rhinitis	226
Sacroiliac Syndrome	227
Scoliosis	228
Sprain/Strain	229
Stenosis	230
Thoracic Outlet Syndrome	231
Urinary Stones	232
Weight Gain & Loss	233

The following treatment parameters are to be used only as guidelines. These are estimates of treatment and/or healing time for commonly encountered categories of neuromusculoskeletal conditions.

Category I**0-6 Weeks of Treatment**

- Mild-moderate strain.
- Mild sprain
- Mechanical/joint dysfunction (uncomplicated)
- Subluxation (uncomplicated)
- Acute facet syndrome
- Contusion
- Mild-moderate tendinitis, capsulitis, bursitis, synovitis
- Mild sacroiliac syndrome
- Acute myofascial pain syndrome
- Mild symptomatic degenerative joint disease
- Headaches: vertebrogenic, muscle contraction, migraine, vascular
- Torticollis (acquired)

Category III**1-6 Months of Treatment**

- Chronic facet syndrome associated with clinical vertebral instability
- Marked strain associated with post traumatic myofibrosis and/or joint dysfunction
- Marked sprain with associated instability/dysfunction
- Thoracic outlet syndromes
- Moderate inter-vertebral disc syndrome w/o myelopathy
- Peripheral neurovascular entrapment syndromes
- Moderate to marked temporomandibular joint dysfunction
- Adhesive capsulitis (frozen joint)
- Partial or complete dislocation

Category II**2-12 Weeks of Treatment**

- Moderate-marked strain
- Moderate sprain
- Post traumatic mild-moderate myofibrosis
- Post traumatic periarticular fibrosis and joint dysfunction with marked tendinitis, bursitis, capsulitis, synovitis
- Chronic tendinitis, bursitis, capsulitis, synovitis
- Chronic facet syndrome
- Moderate sacroiliac syndrome
- Chronic sacroiliac syndrome with marked myofascial pain syndrome
- Chronic myofascial pain syndrome
- Mechanical/joint dysfunction (complicated)
- Subluxation (complicated)
- Moderate symptomatic degenerative joint disease
- Mild inter-vertebral disc syndrome w/o myelopathy
- Chronic headaches: vertebrogenic, muscle contraction, migraine, vascular
- Mild temporomandibular joint dysfunction
- Symptomatic spondylolisthesis
- Mild clinical joint instability

Category IV**2-12 Months of Treatment**

- Marked inter-vertebral disc syndrome w/o myelopathy, with or without radiculopathy
- Lateral recess syndrome
- Intermittent neurogenic claudication
- Acceleration/deceleration injuries of the spine with myofascial complications (whiplash)
- Cervicobrachial sympathetic syndromes
- Sympathetic dystrophies
- Severe strain/sprain of cervical spine with myoligamentous complications

Adapted from: Oregon Chiropractic Practices and Utilization Guidelines. Volume 1. 1997.

Common Underlying Causes**Factors within Patient's Body**

- Subluxations elsewhere in the spine
- Classic muscle imbalances
- Faults in posture and gait
- Leg length inequality
- Improper pattern in the sequence of muscles firing in standard motions
- Poor proprioceptive information
- Disease

Factors within Patient's Lifestyle

- Poor ergonomics
- Diet
- Mental/emotional status
- Allergy/environmental insult
- Especially with children, is there a behavioral component?

Various Mechanism of Injury**Traumatic**

1. Torsion (disc when combined with flexion, facet)
2. Compression (vertebral body – end plate fracture or compression fracture, facet)

Postural Overloading

1. Torsion – (same as for traumatic)
2. Compression – (facet)
3. Extrinsic (what the body does) – holding a sustained position voluntarily
4. Intrinsic (how the body is balanced) – anatomical (short leg) or physiologic (hyperlordosis associated with muscle imbalance)

Repetitive Stress (overuse, microtrauma)

1. Torsion (low back) – (same as for traumatic)
2. Compression (low back) – (facet)
3. Extrinsic - work-related or recreational
4. Intrinsic - tight hamstrings disrupt lumbopelvic rhythm

Radicular Pain Syndrome

Potential Causes – disc herniation, SOL, stenosis, nerve root adhesions, traction injury

Signs & Symptoms

- Dermatomal pain distribution
- Nerve tension signs – SLR, Bragar's Bowstring, XSLR, brachial stretch sign
- Nerve compression signs – atrophy, weakness, decreased DTR's and sensation
- Other associated SSx – i.e. Valsalva
- Radicular pain may move below knee with SLR
- Radicular pain may move below elbow with brachial stretch test

Advanced Testing Procedures – nerve conduction study, electromyography, x-rays, CT, MRI

Deep Referred Pain Syndrome

Very common, generally not as serious as radicular pain syndromes (better prognosis)

Potential Causes – facet syndrome, disc sprain, generalized sprian/strain, Maigne's syndrome

Signs & Symptoms

- Diffuse (sclerogenous) pain
- Absence of nerve compression signs
- Absence of nerve stretch signs
- Orthopedic tests may reproduce the pain

Advanced Testing Procedures – usually (-)

Common causes of Radiculopathy (lumbar and cervical)

1. Disc Herniation
2. Lateral stenosis
3. Central stenosis
4. SOL (space occupying lesion)
5. Traction injury – whiplash
6. Nerve root adhesions
7. Mild cases may be due to subluxations
8. Spondylolisthesis

Cervical Radiculopathy

1. Neck pain &/or injury
2. Neck / Trap. Pain
3. Aggravate extensors
4. Pain referred past elbow
5. (+) Cervical compression
6. Neck tenderness
7. Limited neck movement
8. Neck muscle testing provocative
9. (+) Bakody/Valsalva
10. (+) Neuro SSx
11. (+) Conduction studies
12. (+) Neck x-ray/MRI findings

Rotator Cuff Syndrome

1. GH &/or AC injury
2. Deltoid / lateral shoulder pain
3. Aggravated by overhead activities
4. Referred lateral arm/elbow pain
5. (+) Codman's/Apleys/Empty can
6. Cuff tendonitis
7. ↓ Abduction & internal rotation
8. Shoulder cuff weakness with provocative tests
9. (-) Bakody/intrathecal test
10. (-) Neuro SSx
11. (-) Conduction studies
12. (+) Shoulder x-ray/MRI findings

Postural Fatigue

1. Pain – diffuse/Achy/ non-electrical
2. No true weakness
3. No external paresis
4. Vague tenderness on percussion
5. Neck pain with ROM
6. (-) Neuro SSx
7. Cervical compression – local SSx
8. Cervical distraction +/- neck pain
9. Local neck spasm
10. (-) x-ray/MRI

C5 Radiculopathy

1. Pain – stabbing/electrical
2. Dermatomal numbness
3. Muscle weakness – shoulder/elbow flexors
4. Shooting electrical pain on percussion
5. Shooting electrical neck pain with cervical ROM
6. (+) NEURO SSX
7. Cervical compression – radicular SSx
8. Cervical distraction - ↓ pain
9. Upper extremity spasms
10. (+/-) X-ray/MRI

Thoracic Outlet Syndrome

1. Neck/shoulder pain
2. Provoked with neck pain
3. Postural predisposition
4. Ulnar distribution
5. (+) TOS tests
 - a. Roo's
 - b. Wright's
 - c. Eden's
 - d. Adson's

Ulnar Neuropathy

1. Elbow pain / (-) neck pain
2. Provoked by elbow/wrist
3. Elbow deformity
4. Isolated to ulnar distribution
5. (+) Tinel's at elbow/wrist
6. (+) Hyperflexion
7. ↑ SSx with hamate pressure
8. (+) SSx with carpal tunnel tests

Findings suggestive of Neoplasm

1. Previous HISTORY
2. Unexplained weight loss
3. Pain unrelated to activity
4. Malaise / fatigue
5. Blood (hemoptysis/rectal)
6. Chronic productive cough
7. Injury not consistent with cause (pathologic Fx.)
8. Chronic (productive) cough
9. SMOKER
10. Pain – deep, gnawing, unremitting
11. Abnormal pigmentation (melanoma)
12. Indurated, fixed, painless node (Leukemia)
13. Anemia (Leukemia)
14. X-ray (METS, pathologic Fx.)
15. Night pain
16. Lab findings

Adapted, with permission, from Biomechanics 2 by MA Carnes, DC

'Abdominal pain is the most common complaint that brings a patient to a physician's office'

- Repeated examinations over time are diagnostically valuable
- 40% of acute cases have no definitive Dx

Causes of Abdominal Pain

1. Hemorrhage
 - Can occur w/ or w/o rupture
2. Rupture
 - Tearing pain of rapid onset
3. Perforation
 - Usually sudden sharp pain
4. Inflammation
 - Slow, gradual onset of pain
 - May change from visceral to parietal

Timing of Pain/Duration

Very abrupt onset or suddenly worse

1. Rupture, perforation, obstruction, hemorrhage
- Gradual onset or progressive worsening
2. Inflammatory process or obstruction

Associated Symptoms

Diarrhea - gastroenteritis

1. Constipation - structural obstruction, neurologic disease, iatrogenic, metabolic
2. Urinary symptoms - UTI
3. Pelvic symptoms - PID, pregnancy
4. Vomiting, anorexia
5. High fevers & chills - infection

Do NOT miss the Following:

- Very abrupt onset of severe pain
- Shock
- Peritoneal signs
- Abdominal distension
- Palpable mass

Patient Management

- 'Shock' - stabilize & call 911
- Peritoneal signs - immediate emergency care
- Obstruction - immediate emergency care
- Severe pain but unimpressive examination
- Manage, carefully monitor & re-exam

Location of Pain

Visceral/midline

- Diffuse, deep, dull
- Colicky, intermittent
- Not affected by movement / palpation

Location

- Epigastric - thorax, stomach, duodenum, pancreas, liver, gallbladder
- Periumbilical - small intestine, cecum
- Hypogastric - large intestine, pelvic organs, urinary system

Parietal

- Sharp, constant
- Lateralizes to a quadrant
- Worse w/ movement, palpation, & increases in abdominal pressure
- Localized w/in a quadrant

Location - see below

Parietal Pain Review

Right Upper Quadrant

1. Pleurisy
2. Hepatitis
3. Cholecystitis
4. Perforated duodenal ulcer
5. Appendicitis
6. Perforated colon
7. Fallopian tube (rupture)

Right Lower Quadrant

1. Appendicitis
2. Acute Crohn's disease
3. Pelvic inflammatory disease
4. Perforated duodenal ulcer
5. Acute cholecystitis
6. Inguinal hernia
7. Leaking aortic aneurysm

Left Upper Quadrant

1. Pleurisy
2. Splenic rupture or infarct
3. Perforated gastric ulcer
4. Pancreatitis
5. Diverticulitis
6. Perforated colon (cancer)
7. Fallopian tube (pregnancy abscess)

Left Lower Quadrant

1. Sigmoid diverticulitis
2. Pelvic inflammatory disease
3. Sigmoid carcinoma
4. Gastric ulcer
5. Inguinal hernia
6. Leaking aortic aneurysm

Iron Deficiency Anemia**1. Signs & symptoms**

- Pallor, fatigue, angular cheilosis, koilonychias (spoon nails), Pica

2. CBC

- ↓ RBC count, ↓ [Hb], ↓ HCT, ↓ MCV, ↓ MCH, ↓ MCHC, ↑ RDW

3. Serum iron panel

- ↓ Serum Iron (SI)
- ↓ % saturation
- ↓ Serum Ferritin (SF)
 - Most important (see low SF before SI)
- ↑ TIBC (total iron binding capacity)

4. (+) GUIAC if GI bleeding**Thalassemia (α and β) – CBC****1. Serum iron panel, may need electrophoresis**

- **Alpha Thalassemias** (cannot synthesize α chain of Hemoglobin)
 - *Alpha Thalassemia* – silent carrier, 1 gene deletion, slight microcytosis
 - *Alpha Thal. Minor* – 2 gene deletion, micro/hypo RBC's, possible mild anemia
 - *Hemoglobin H disease* – 3 gene deletion, moderate micro/hypo anemia, target cells, Heinz bodies
 - *Barts Hydrops Fetalis* – 4 gene deletion, fatal before birth, Hb-Portland
- **Beta Thalassemia** (cannot synthesize β -chain of hemoglobin)
 - *Beta Thal. Minor* –
 - *Beta Thal Intermedia* - ↑RBC's, Target cells, anisocytosis/poikilocytosis
 - *Beta Thal. Major* (Cooley's Anemia) – severe anemia, target cells, ↑HbF

Sideroblastic Anemia – CBC

1. Rare disorder in which iron is not properly inserted into the porphyrin ring, resulting in iron laden mitochondria encircling the nucleus of the rubriblast
2. Serum iron panel
 - ↑ SI
 - ↑ % saturation
 - Normal TIBC
3. Bone marrow biopsy – required for diagnosis

SF = serum ferritin, SI = serum iron, TIBC = total iron binding capacity,
RBC = red blood cell, Hb = hemoglobin

Normocytic Normochromic Anemia

Hemolytic (depletion) anemia

1. Extracorpuscular

- Parasites
- Toxins
- Trauma
- Hypersplenism
- Immuno-hemolytic anemias

2. Intracorpuscular

- **Abnormal hemoglobin**
 - Thalassemias
 - Sickle cell trait
 - Sickle cell disease
- **Abnormal membrane**
 - Hereditary spherocytosis
- **Abnormal enzymes**
 - Glucose-6-phosphate dehydrogenase deficiency
- **Hypoplastic bone marrow (pancytopenia)**
 - Myelofibrosis
 - Aplastic anemia
- **Anemia of chronic diseases**
 - Renal disease
 - Liver disease
 - Inflammatory disease
 - Infectious disease
 - Rheumatoid disease
 - Malignancy
 - Endocrinopathy

Macrocytic (Megaloblastic) Anemias

The three most common causes are:

1. Folic Acid deficiency (most common)

- Test serum folic acid or RBC folic acid

2. Vitamin B12 deficiency

- Test serum B12 assay

3. Intrinsic Factor (IF) deficiency

- Pernicious anemia
- Schilling test to DDx
- Can also use serum homocysteine or methylmalonate

Benign Paroxysmal Positional Vertigo (BPPV)

- Distinguished by a periodic spinning sensation of sudden onset initiated by change in position
- Disorder believed to be caused by a movement of debris that has lodged in the lower portion of the posterior semicircular canal of the inner ear

Differential Diagnosis

- Vestibular neuronitis
- Menière's disease
- Brain damage
- Migraines

Refer to page 216 Dizziness Differentials

Diagnosing BPPV involves variations of the Dix-Hallpike and Epley maneuvers

Dix-Hallpike Maneuver

- Patient starts in sitting position
- Rapidly lie patient backward
 1. Neck extended
 2. Head turned to LEFT
- Sit patient up
- Rapidly lie patient backward
 3. Neck extended
 4. Head turned to RIGHT
- Observe
 5. Nystagmus
 6. Vertiginous symptoms

Epley Maneuver

- Used to treat BPPV
- Successful in the first treatment in nearly 90% of patients

Procedure:

- Pt is supine with head rotated 45° toward affected side and 30° sub horizontal.
- Maintain position until symptoms subside
- Very slowly, rotate head away from affected side. (Approx. 1 minute)
- Continue rotating head & body until pt is face down, may provoke Sx, wait until they subside
- Slowly bring pt. up
- Repeat until asymptomatic
- Give home care instructions

Home Care

- Remain upright for 24 to 48 hours, at the least do not recline for 24 hours after procedure
- Sleep in a recliner chair if necessary
- Pt's can rotate their heads or put their chins to their chests during this time

Common Signs of Concussion

1. Vacant stare
2. Delayed visual & motor responses (slow to answer questions/follow instructions)
3. Confusion & poor ability to focus attention
4. Disorientation
5. Slurred or incoherent speech
6. Incoordination
7. Memory deficits
8. Loss of consciousness (LOC)

Evaluation & Management

Perform a neurological exam (see *Neurological Exam page 23*)

Sideline Evaluation

Mental Status – *Orientation:* time, place, person & situation

Concentration: count backwards, month in a year backwards

Memory: name teams in prior contest, 3 word recall

Exercertional Provocation – 40 m sprint, 5 push-ups, 5 sit-ups, 5 knee bends

Neurological Tests – strength, coordination, sensation

	Grade 1	Grade 2	Grade 3
FINDINGS	<ul style="list-style-type: none"> • No LOC • Transient confusion • Symptoms found upon exam resolve in less than 15 minutes 	<ul style="list-style-type: none"> • No LOC • Transient confusion • Symptoms found upon exam last more than 15 minutes 	<ul style="list-style-type: none"> • Any Loss of consciousness <ul style="list-style-type: none"> ○ Brief (seconds) ○ Prolonged (minutes)
MANAGEMENT	<ul style="list-style-type: none"> • Remove from event • Examine immediately & at 5 minute intervals • May return to event if symptoms/mental status abate within 15 minutes 	<ul style="list-style-type: none"> • Remove from event • Examine on site • Re-examine next day • May not return to event until neurological exam is performed by physician, following one full asymptomatic week 	<ul style="list-style-type: none"> • Transport patient to nearest emergency department (with cervical immobilization if indicated) • Emergency neuro-exam & imaging as indicated • May be admitted to hospital

Sports Concussion – When to return to play?

Grade of Concussion	Return to Play (Only after asymptomatic neurological assessment at rest & with exercise)
Grade 1	15 minutes or less
Multiple Grade 1	1 week
Grade 2	1 week
Multiple Grade 2	2 weeks
Grade 3 (brief LOC)	1 week
Grade 3 (prolonged LOC)	2 weeks
Multiple Grade 3	1 month or more, based on decision of evaluating physician

Normal Colon Function

1. 1 liter/day of undigested material passes through colon (200 g/day; 60%-80% H₂O)
2. **Detailed drug history is essential when evaluating constipation & diarrhea**
3. Bowel habits vary greatly between normal healthy individuals (3x/day to 1x/2-3days)
4. Constipation & diarrhea should be **evaluated relative to the degree of change** from the individual's normal habits, and note that emotional state/physiological stress can often alter bowel function

Hoyer's Rule

*"If one eats every day,
one should defecate every day."*

Patient Complaint

- Infrequent
- Incomplete
- Hard
- Straining during defecation
- Does not defecate every day

Constipation of Functional Origin

1. Depression
2. Medication (antidepressants, etc)

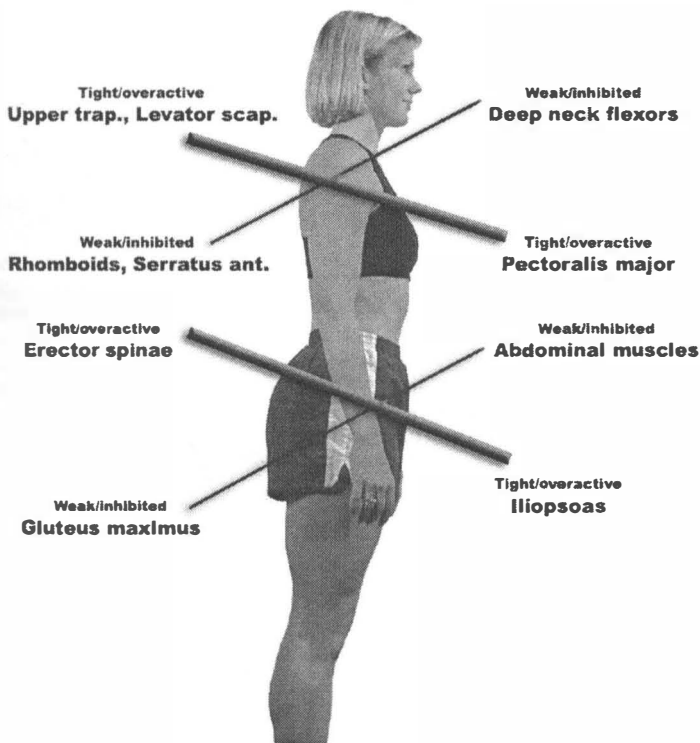
Constipation of Organic Origin

1. Painful Defecation
 - Hemorrhoids
 - Anal Fissures
 - Perianal Abscess
2. Spinal cord injuries
3. Scleroderma
4. Hirschsprung's disease

Treatment Considerations

1. ↑ H₂O (~6-8 glasses/day)
2. Prunes – juice or fruit
3. Regular exercise
4. Adequate fiber
 - Fresh fruits
 - Vegetables
 - Whole grain cereals
5. Bran
6. Psyllium fiber (stool bulking agent)
7. Develop healthy bowel habits
 - Training, relaxation
 - Same time every day
 - Go when you feel the urge
8. Aloe gel capsules
9. Consider bowel stimulant/laxatives
10. Lumbar chiropractic manipulation
11. Abdominal massage

Warning: If patients suddenly become constipated or can't even pass gas and have abdominal pain and/or cramping, they may have developed an obstruction that could require immediate emergency medical attention.

Upper & Lower Cross SyndromeUpper Cross Syndrome

Patient presents with:

- Internally rotated shoulders
- Kyphotic thoracic spine
- Protracted scapulae

Lower Cross Syndrome

Patient presents with:

- Hyperlorditic lumbar spine
- "Abdominal expansion"
- Tight hamstrings

Treatment

1. Should be directed towards stretching short, tight overactive muscles (heat & stretch)
2. Strengthen and facilitate weak or inhibited muscles (exercise & rehab.)
3. Posture and activity changes
4. Adjust spine & pelvis to facilitate neuromuscular changes

Types

Secretory: clear non-cellular, ↑ electrolytes due to excess secretion or impaired absorption

- Cholera

Osmotic: clear, non-cellular, ↓ water re-absorption b/c ↑ non-absorbable molecules

- Lactase deficiency
- Magnesium containing cathartics
- Antacids

Exudative: purulent, PMN laden, often bloody, outpouring of necrotic mucosa & electrolytes from an inflamed colon

- Ulcerative Colitis
- Shigellosis
- Amebiasis

Motility Disorder: variable stool characteristics due to ↓ contact time of stool w/ mucosa (↑ peristalsis)

- Hyperthyroidism
- Irritable Bowel Syndrome

Acute Diarrhea

Abrupt onset diarrhea in otherwise healthy individual is due to infection by bacteria, virus or protozoa until proven otherwise.

Associated SSx: fever, headache, anorexia, vomiting, malaise, myalgia

Bacterial Diarrhea:

1. Often associated w/ simultaneous infection
2. Occurs 12 hrs post-meal suggests exotoxin
3. Staphylococcus
4. Development after 1-3 days lag suggests contamination by an organism that invades the colon mucosa
 - Salmonella
 - Shigella
 - Campylobacter
 - Vibrio

Viral Diarrhea:

1. Diarrhea considered viral if there are no bacteria or protozoa found in the stool
2. Usually lasts 1-3 days, rarely

Protozoan Diarrhea:

1. Entamoeba histolytica
2. Giardiasis (drinking water contamination)

Non-infection Acute Diarrhea

1. Crohn's disease
2. Ulcerative colitis
3. Diverticulitis
4. Drugs
 - Cholinergic agents, antibiotics, etc
5. Paradoxical diarrhea
 - Fecal impaction leading to explosive diarrhea
 - Observed in elderly & debilitated pts
6. Psychological

Diagnostic Acute Diarrhea**History**

1. Frequency, volume, odor
2. Appearance
 - Blood, oiliness, greasy, consistency

Lab Studies

1. Stool analysis
2. Culture
3. Ova & parasites
4. GUIAC tests for occult blood

Chronic Diarrhea

"Persisting for weeks or months"

Diarrhea w/ palpatory abdominal tenderness & possible fever indicating inflammation.

1. Ulcerative colitis
2. Crohn's disease
3. Amebiasis
4. Diverticulitis

Diarrhea w/o inflam. indicating malabsorption

1. Sprue
2. Pancreatic insufficiency
3. Scleroderma
4. Diabetic visceral neuropathy

Endocrine disorders

1. Thyrotoxicosis
2. Diabetes mellitus
3. Adrenal insufficiency
4. Hypoparathyroidism
5. Zollinger-Ellison's syndrome

Consider habitual use of cathartics

General

- Usually occurs between the ages of 20 to 40, as nucleus palposus is most hydrated (M>F)
- Note: due to spinal canal stenosis with age, small disc herniations in elderly may have effects
- Pain is described as sharp, shooting, or electrical in a dermatomal pattern (radicular)
- Associated local and/or referred pain, patient presents antalgic
- Pain is worse at night, pain is increased with flexion

History & Exam**LUMBAR**

- Patient complains of low back pain (LBP) & leg pain below the knee, often of sudden onset
- Frequently associated with a bending and/or twisting maneuver
- Dermatomal paresthesias
- Pain w/ forward flexion, coughing & sneezing
- Pain with extension, recumbent positions (knees flexed)
- A herniation will hurt more for the patient to be sitting, especially for long periods
- The pain usually goes below the knee or elbow
- Possible atrophy of associated muscles with chronicity
- X-ray signs – AP, lateral wedge sign
- Orthopedic
 - (+) SLR
 - (+) WLR
 - (+) Dejerine's triad (cough, sneeze Valsalva)
 - (+) Kemp's for radiculopathy

CERVICAL

- Motor SSx: weakness of biceps and/or wrist extensors
- Sensory SSx: sensory loss to the lateral forearm & hand & into the thumb
- May be hypesthesia (loss of light touch) or hypalgesia (loss of pain)
- Reflexes: brachioradialis, biceps, triceps – may be hyper or hypo
- Central anterior herniation causes contralateral interscapular pain
- Anterior lateral herniation causes scapular vertebral border pain
- Posterolateral herniation causes scapular axillary pain
- Orthopedic
 - (+) compression
 - (-) distraction – decreased SSx
 - (+) shoulder drop
 - (+) brachial stretch test
 - (+) Dejerine's triad
 - (+) Soto-Hall

Differential Diagnosis facet syndrome w/ referred pain, myofascial pain syndrome, cauda equina syndrome, lateral stenosis

Herniated Disc Follow-up

- MRI or CT to see if in fact there is a herniated nucleus or space occupying lesion (SOL)
- EMG & nerve conduction study to see if there is any nerve damage secondary to this lesion

Contraindications to Adjusting

- Peripheralization of symptoms
- If the lesion occurs above L1-L2 disk space, the possibility of UMNL signs exist, signs include:
- Saddle anaesthesia, tonic bladder, (+) Babinski's reflex, examine for sphincter incontinence and bowel and bladder dysfunction. Warning: bowel and bladder dysfunction are red flags for immediate referral! – Cauda Equina Syndrome

Treatment

- Centralization of symptoms, Cox flexion-distraction, Mackenzie exercises, extension lumbar adjustments, IFC, TENS, heat/ice, rest, temporary immobilization, STM
- Patient education, aerobic conditioning, proprioceptive training, activity modifications, neutral pelvis, abdominal/low back tracks, exercise ball, proper nutrition

A detailed history will reveal the type of dizziness in most cases.

Vertigo

Disequilibrium

Patient complaint

"My head is spinning...the room is whirling..."

Patient complaint (common in elderly)

"My balance is off...I might fall..."

Usual cause: vestibular disorders

Usual cause: sensory/neurologic dysfunction

DDx:

- Benign Positional Vertigo (BPV)
- Otitis media
- Meniere's syndrome
- Labyrinthitis
- Acoustic neuroma
- Ototoxic & salt-retaining medications
- Brainstem dysfunction

DDx:

- Multiple sensory deficits
- Hyperventilation/anxiety disorders
- Vestibular disorders
- Drug induced
- Parkinsonism
- Alcoholic
- Painful ambulation
- Senile Gait

(pre) – Syncope

Lightheadedness

Patient complaint

"...I might pass out...I feel faint..."

Patient complaint

"...I'm just dizzy..."

Usual cause: decreased cerebral perfusion

Usual cause: anxiety/depression

DDx:

- Orthostatic hypotension
- Vasovagal
- Unknown (25%)
- Cardiac
- Neurological
- Situational
- Psychogenic (hyperventilation, hysteria)
- Metabolic & drug

DDx:

- Acute hyperventilation
- Panic disorder
- Hypoglycemia
- Pheochromocytoma
- Drug withdrawal/induced
- Epilepsy (temporal lobe)
- Mitral valve prolapse
- Cardiac arrhythmia

Test

Orthostatic Blood Pressure	Measure of blood flow during postural change
Hyperventilation - 3 min	Determine if hyperventilation is cause of dizziness
Nylan-Barany	Maneuver to help reduce inner ear caused dizziness
Gait observation (esp. turning)	Vestibular cause
Caloric Test (COWS)	Water in ear (Cold Opposite side, Warm Same side)
Swivel Chair	Differentiate cervical spine for other source
Carotid Sinus Stimulation	Blood pressure measure

General

- The facet (zygapophyseal joint) and/or its capsule are the source of the pain

History & Exam

- Dull, achy pain although may be sharp during acute episodes
- Pain is better localized, patient can pinpoint pain
- More pain on extension than flexion (+) Kemp's test – for back pain, NOT radiculopathy
- Pain does not radiate much, sclerodermal referral of pain
- Antalgia is typically away from facet in acute patients, resulting in a slight flexion and lateral flexion position
- Possible muscle splinting and guarded motions
- Look for postural and/or activity induced predispositions to extension motions
- No neurological deficits, negative nerve root tension signs
- Consider mioscoid entrapment, discogenic pain, & sprain/strain as potential differentials

Cervical Facet Syndrome

- Pain upon lateral bending with extension, cervical compression
- ↓ Pain with cervical distraction test
- May be caused by whiplash injury

Lumbar Facet Syndrome

- Patient antalgic, laterally bent away from the side of the lesion
- Pain increases with movement & extension
- Sclerodermal referral of pain
- X-ray – lateral bending study, may see decreased sacral base angle

Treatment

- Facet syndromes respond extremely well to chiropractic adjustments
- Standard Chiropractic Physical Therapy protocol – rest, heat, modalities, etc.
- Conditioning & proprioceptive retraining

Etiology*Children/Adolescents*

Acute fatigue – rare in children

Suspect acute infection

Chronic fatigue

Suspect infectious mononucleosis, **drug abuse**, hepatitis, depression, anxiety

Organic causes

Cancer, chronic lung disease, heart disease

Adults

Acute fatigue – suspect acute infection

Suspect – depression &/or anxiety

Organic causes

Anemia, cancer, endocrine disorders

Background

Organic Origin: short duration, worse with exertion, not present on arising, ↑ as day progresses, relieved by rest

Functional Origin: longer duration, present and often worse in morning, improves as day progresses, not related to exertion

Associated Symptoms

Dyspnea – suspect infectious condition

GI & dermatological SSx

Suspect chronic pain syndromes

Restlessness, irritability, sweating, paresthesia

Suspect anxiety

Breathlessness, anorexia, weight loss, pallor

Suspect anemia (find underlying cause)

Exacerbation Factors

Onset or progression associated with...

1. Psychosocial problems
Suspect anxiety or stress
2. Medications
Check medication dose/side effects
3. Increased work load
Suspect work related fatigue
4. Loss of job or family problems
Consider counseling

Relieving Factors

Reduced by rest – physiologic fatigue

Improves on weekend/vacation – job related

Improves w/ discontinued medication – pharmacological fatigue

Diagnostic Protocols

History

- Onset
- Relationship to exertion
- Family/social circumstances
- Medications
- Antihistamines, tranquilizers, etc.
- Review of systems

Vital Signs

Inspection

- Skin, hair, mucous membranes

EENT

Heart & lungs

Abdominal exam

NMS exam

Lab studies (if necessary)

- CBC w/ differential
- ESR
- Urinalysis
- Biochemistry profile
- Chest radiograph

Treatment

Isolate cause and treat accordingly

Normal Body Temperature

35.8°-37.2° C (+0.5° C rectal) - **37° C**

96.5°-99.3° F (+1.0° F rectal) - **98.6° F**

Diurnal variation – usually +0.5° C in afternoon as compared to evening

Fever

Oral temperature > **37.2° C** (99.3° F)

Background

Fever is a normal body response & most are self-limiting. Children have a greater fever response than adults. Geriatrics may show a decreased or no fever response.

Children

- > **102°F** - give acetaminophen if uncomfortable & monitor temp. every 4 hrs, ↑ fluids.
- > **103°F** - same as above & after 1 hr luke-warm sponge bath for 30 min, recheck temp.

Warning: Do NOT give children < 18-21 yrs ASPIRIN due to the link with REYE'S Syndrome

Reye's syndrome

Characterized by encephalopathy with fatty degeneration of the liver.

Signs & symptoms

- Continuous vomiting following a prodromal flu-like URTI or Varicella (chicken pox)
- Signs of disturbed brain function
 - Drowsiness/delirium/confusion
 - Personality changes
 - Loss of consciousness, disorientation
 - Convulsions
- Elevated ALT/AST usually > 200

Red Flags for Fever

1. **≥ 40°C (104°F)**
2. Acting ill & temperature > 102°F for > 24hrs
3. Neck stiffness: meningeal irritation
4. Febrile seizures
5. Petechial rash
6. Respiratory distress

Chart Notes

"The patient had a fever with a temperature of..."

Note: Humor – do not state "the patient had no temperature" – this would mean they were most likely dead

Metric / Fahrenheit Conversion

Fahrenheit = (x°C)/1.8 + 32

Celsius = (x°F)-32 × 0.556

Important Causes of Fever

Infections (most common by far)

Bacterial, viral, fungal, rickettsial, parasitic

Rheumatic diseases

SLE, PMR, rheumatic fever, Still's disease

CNS disease

Cerebral hemorrhage, tumor, infection

Malignant disease

Primary neoplasms, metastasis

Hematologic disease

Leukemias, lymphoma, hemolytic anemia

Cardiopulmonary diseases

Mycardial infarction, pulmonary embolism

Gastrointestinal disease

IBS, liver abscess, hepatitis

Endocrine disease

Hyperthyroidism, pheochromocytoma

Chemical Agents

Drug reactions, Rx to anesthesia

Fever of Unknown Origin (FUO)

1. Fever (may be intermittent) for 3 weeks
2. Temperature > 38.3°C (101°F)
3. Lack of definitive diagnosis

Common Causes

Infection, Neoplasm, CT disease

Diagnostic Procedures

1. History & physical
2. Review of current medications
3. Blood cultures
4. CBC, ESR, Urinalysis
5. Serologic tests – syphilis, HIV
6. Renal/thyroid function tests
7. Serum liver & muscle enzymes
8. Many, many more

80% of Americans experience some form of headache each year.

50% of these have severe headaches.

10%-20% of these patients consult a physician with a chief complaint of headache.

Tension (muscle contraction) HA

Et: most common type of headache; often confused w/ migraine w/o aura

Hx: Bilateral aching, pressing or tightness

Mild to moderate intensity – **30min-7 days**

Not aggravated by physical activity

PE: Hypertonic suboccipital & cervical muscles

No other findings suggestive of other HA type

Tx: Manipulation, stretching, postural retraining

Edu: Be wary of precip. factors, Tx. spasms

Cluster Headache

Et: M>F - 6:1, Peak age: 20-50yrs.

Hx: Severe pain within or around orbit (unilateral)

Pain may spread to temple or adjacent face

Short duration **15min-2hrs** sudden onset

Occur 1x/day or more over days to months

PE: Blood shot eye, ptosis, photophobia, tearing

Tx: Manipulation, heat, ultrasound

Edu: avoid triggers: ETOH, histamine, stress, glare, hay fever, physical exertion

Migraine without Aura (common)

Et: F>M, 10-30yrs old

Hx: No or vague prodrome

Unilateral (temporal) throbbing pain

Moderate to severe pain – hours to days

Aggravated by physical activity

Accompanied by anorexia, nausea, Photophobia, phonophobia

Occur 1-2x/month

PE: see Hx

Tx: CMT, ice, heat, sleep, refer to MD for Meds

Edu: Stay away from triggers, elimination diet, relaxation techniques

Migraine with Aura (classic)

Et: F>M, 10-30yrs old

Hx: Visual (or neurologic) prodrome

Usually precedes HA by 20-30 minutes

Scintillating scotoma (1 side visual field)

Visual loss, metamorphopsia (bending mirror)

Unilateral throbbing, pulsating pain

Moderate to severe intensity

Worse w/ activity, lasts hours

Accompanied by anorexia, nausea, photophobia, phonophobia

Occur several times per year

PE, Tx, Edu: see migraine without Aura

Cervicogenic

Et: 15-20% of recurrent HA, F>M

Hx: Neck trauma, Sclerogenic pain

↑ pain with motion

PE: ↓ cervical ROM

Myospasm

Tx: CMT (C0-C3), STM, Cervical muscle rehab.

Edu: Posture, muscle strengthening, diet

Other Head Pain DDx

1. Sinus Headache
2. Hypertensive HA
3. Temporal Arteritis
4. Herpes Zoster
5. Neuralgia – trigeminal, occipital, etc.
6. TMJ syndrome
7. Caffeine withdrawal
8. Dental disease
9. Paget's disease of bone
10. Injury
11. Refractive error
12. Drug side effects

Et = etiology, Hx = history, PE = physical exam, Tx = treatment, Edu = education, F = female, M = male

Headache red flags

1. Abrupt onset or very severe
2. New headache in older patient
3. Headache due to trauma
4. Associated neurologic signs/symptoms
5. Cognitive changes
6. Seizures, vomiting without nausea
7. Persistent/progressive headache
8. Nuchal rigidity
9. Anticoagulant therapy
10. Headache with diastolic pressure >115 mmHg
11. Persistent or severe headache in child
12. Suspicion of alcohol or drug dependence
13. Known cancer
14. Signs of papilledema

Cause

CNS infection, tumor, hemorrhage, hematoma, glaucoma, stroke, temporal arteritis

History

Vomiting, nausea, loss of consciousness, slow/insidious onset, abrupt onset of severe nuchal rigidity

Physical exam

Hypertension, abnormal neurological exam, cognitive changes, odd behaviors, altered mental status, nuchal rigidity, fainting, meningeal signs

Diagnosis

Lumbar puncture, MRI, CT, sedimentation rate, rule out infection, blood pressure

Patient Education

Know warning signs – see above

Treatment

Immediate referral to emergency room

VINDICATE mnemonic used for Headache DDx

V	Vascular	Migraine, temporal arteritis
I	Inflammatory/Infection	Sinusitis, abscess, meningitis
N	Neoplastic	Tumor, nasal polyps
D	Degenerative/Dysfunction	Cervical subluxation, spondy.
I	Intoxication	Alcohol hangover, lead poisoning
C	Congenital	Aneurysm, platybasia
A	Autoimmune/Allergy	Lupus, allergic sinusitis, food allergy
T	Trauma	Concussion, fracture, subdural bleed
E	Endocrine/metabolic	Pituitary adenoma, uremia, hypoglycemia

Stage of Hypertension

		Systolic	Diastolic	Follow-up
	Optimal	<120	<80	
	Normal	<130	<85	2 years
Hypertension	High Normal	130-139	85-89	1 year
Stage 1	Mild	140-159	90-99	2 months
Stage 2	Moderate	160-179	100-109	1 month
Stage 3	Severe	180+	110+	1 week

End Organ Targets Symptoms

Retinal	CNS
<ul style="list-style-type: none"> • Blurred vision • Diplopia • Retinal arteriolar constriction • Papilledema • Retinal exudates • Retinal hemorrhages • Dot & flame hemorrhages 	<ul style="list-style-type: none"> • Headache (often severe) • Nausea • Visual changes • Focal weakness of paresthesia • Generalized weakness • Disorientation • Focal neurological deficits • Seizures, coma
Cardiovascular	Renal/Kidney
<ul style="list-style-type: none"> • Left ventricular hypertrophy • Cardiomegaly • Chest, back or abdominal pain • Palpitations • Nausea and vomiting • Dyspnea (difficulty breathing) • Orthopnea - dyspnea that occurs soon after assuming a recumbent position • Wheezes/rales • Abnormal peripheral pulses • Abdominal bruits <p>Lab tests</p> <ul style="list-style-type: none"> • MI enzymes: CKMB for 1st 24 hrs, • SGOT (AST) at 48 hrs, LDH at 72 hrs. 	<ul style="list-style-type: none"> • Nocturia • Hematuria • Oliguria • Urinary frequency • Flank pain, flank tenderness • Renal enlargement • Peripheral edema • Fatigue and/or weakness <p>Lab tests</p> <ul style="list-style-type: none"> • BUN, creatinine, and protein (all ↑) • Also check ECG

Auscultatory Gap

- Rare phenomenon - At some pressure below the systolic pressure, the Korotkoff sounds fade in and out as you are taking auscultatory BP, making it possible to **underestimate systolic BP** and/or **overestimate diastolic BP**
- Determining palpatory systolic on initial visit can avoid problems with "auscultatory gap"

Types of Instability/Hypermobility

Generalized	Segmental	Functional	Structural	Surgical
Multiple joints	"dysfunction"	programming	Ligamentous damage	
May be genetic	compensatory	Unstable mid-range	Unstable end-range	Very unstable
Significance ?	Reversible Hypomobile segments respond well to CMT	Chronic/recurrent. Muscle imbalance – requires conditioning & proprioceptive retraining	Difficult to reverse. May show ↑ROM on x-ray (flex/ext)	Surgery e.g. Grade III Sprain
No major structural damage			Serious damage	

Lumbar**History**

1. Complaints of recurrent LBP. May or may not be accompanied by sciatica (with or without neurological signs). Pain is relieved by rest or by wearing a support, but may recur after an apparently trivial twist or sprain. (Grieve)
2. Pain made worse by maintaining one posture for a long time (standing or sitting). (Maitland)
3. Pain is relieved by mobilization or manipulation with often spectacular relief of leg pain and neurological signs. However, the relief is often temporary, recurring a few days later with no apparent cause.
4. In some, a steadily increasing lumbosacral ache when extremes of spinal movement are sustained for 15-20 seconds (Grieve).
5. Patient may report a painful arc, usually when going into or coming out of flexion. (Maitland)
6. Patient reports a "catch" in the back or even a "locking." (Maitland)

Physical

1. The patient may have trouble bending forward because of pain; flexion or return from flexion may have a visible asymmetry with a painful catch. (Grieve, Maitland)
2. Nerve tension tests may be positive in late stages. (Kirkaldy-Willis)
3. Neurological deficits are usually absent, but may be present in the late stages. (Grieve)
4. Patient may experience pain in the first part of a sit-up arc, but no pain in the last part of the arc (Farfan compression test).
5. In acute instability, patient may be unable to perform active bilateral leg raise.
Joint may palpate hypermobile (Grieve) or even "clunk" during stork test or prone extension.

X-ray

1. Static films simply demonstrate degenerative changes (gas within the disc, spurs, etc.) (Kirkaldy-Willis).
2. Flexion-extension films or compression-distraction films may demonstrate translation of >3-4 mm.

Cervical

1. Increased ROM, increased pain with relaxation of muscles, cervical muscle splinting
2. Step-off defect with palpation, may or may not be painful or incapacitating
3. X-ray – flexion/extension study or traction/compression study – lateral view
4. Abnormal >4mm anterior-posterior translation
5. Lateral view – look for increased curve, increased ADI, disruption of George's line

Treatment

1. Adjust HYPOMOBILE segments, strengthen and rehab. hypermobile segments

Adapted, with permission, from Ron LeFebvre, DC

<p>Pleural Effusion</p> <p>PE:</p> <ul style="list-style-type: none"> Nearly identical to pneumothorax, but percussion note is dull to absent Pleural effusion can be described as compressive atelectasis Fluid accumulation → separation of the visceral and parietal pleura, resulting in collapse of lung tissue 	<p>Asthma</p> <p>PE:</p> <ul style="list-style-type: none"> Normal or symmetrically diminished movement of chest wall Normal or hyper-resonant percussion note Vesicular breath sounds with prolonged expiration Rhonchi, mainly expiratory and high-pitched (wheezes)
<p>Pneumothorax</p> <p>PE:</p> <ul style="list-style-type: none"> Tachypnea Decreased or absent chest movement over involved site (depending on size) Possible tracheal deviation away from site of involvement Possible expansion of intercostal spaces over the site Decreased vibration transmission through affected pleura Decreased or absent breath sounds over the site of involvement Normal or hyperresonant percussion note Pneumothorax can be described as relaxation atelectasis 	<p>Pneumonia (if in consolidation phase)</p> <p>PE:</p> <ul style="list-style-type: none"> Increased fremitus Lack of lung sounds over the area Dullness of percussion High-pitched, bronchial breath sounds Rales and rhonchi in earlier stages (fine rales early, coarse rales later) General fever (non-specific) General malaise (non-specific)
<p>Chronic Bronchitis</p> <p>PE:</p> <ul style="list-style-type: none"> Blue bloater Digital clubbing Moderate barrel chest DOE grade I or II Productive mucoid cough Prolonged inspiration and expiration times Weight gain due to systemic edema Normal movement of chest wall and percussion note 	<p>Emphysema</p> <p>PE:</p> <ul style="list-style-type: none"> Pink puffer Severe barrel chest Severe DOE Grade III or IV Non-productive cough Prolonged expiration times due to diminished elastic recoil Weight loss due to increased effort of respiration Extremely well-developed accessory muscles of respiration Symmetrically diminished movement of chest wall Percussion note is usually hyper-resonant

PE = Physical Exam, DOE = Dyspnea On Exertion, CHF = Congestive Heart Failure

Cardiovascular Disorders

Angina pectoris

Hx: Substernal pressure
Lasts 2-3 min
Exertion/emotional
Relieved: rest/nitroglycerine
PE: Usually normal
Transient s/s

- tachycardia
- hypertension
- systolic murmur

AS: Stress EKG
Coronary arteriogram

Pericarditis

Hx: Substernal Pain
Lasts A Few Seconds
Radiates Left Neck & Arm
↑ Coughing, Lying Down
↓ Sitting Up, Leaning Forward
PE: Pericardial Friction Rub is "Velcro, Scratchy"
Heard Best w/ Expiration
↑ w/ Respiration
AS: ECG, Ultrasound

Mitral Valve Prolapse

Hx: Young F>M, asthenic
Non-exertional
Unpredictable
PE: Mid-systolic click
Late systolic murmur
AS: Echocardiogram

Chest Wall Disorders

Rib fracture:

Hx: Sharp, local pain
Trauma, prolonged cough
PE: Palpable crepitus
Possible edema and or discoloration
Pain with chest motion
AS: X-ray

Breast Disorders

Hx: Tender mass
Family history breast CA
Large breasts
Vague chest wall pain
PE: Palpable mass
Unilateral
Non-supportive bra
AS: Mammogram, Biopsy

Pectoralis Muscles

Hx: Upper sternal/clavicular tenderness
Precipitated by exertion or overuse
PE: Palpable tenderness upper sternal area
Pain with 90° horizontal abduction

Abdominal Disorders

Esophagitis

Hx: Burning, substernal pain
↑ by lying & eating
↓ by antacids
PE: Usually WNL
Possible: thrush or herpetic lesions
AS: CBC, Endoscope Barium swallow

Peptic Ulcer

Hx: Burning, epigastric pain
Dietary indiscretions
↑ by fasting, stress
↓ by food & antacids
PE: Usually WNL
AS: Barium swallow

Cholecystitis/Biliary Colic

Hx: Epigastric ache
Nausea, sweating, vomiting, restlessness
↑ by fatty meals
PE: Usually WNL
AS: Oral cholecystogram
Ultrasonography

Respiratory Disorders

Pleuritis

Hx: Sharp, lateral chest pain
Inspiratory effort
Precipitated by cough relieved by analgesics
PE: Possible: fever, dull percussion, bronchial breath sounds, friction rub
AS: Chest x-ray
CBC, ANA-CT disorders

Bronchitis/Asthma/COPD

Hx: Vague recurrent chest pain
Prolonged coughing
Asthma/infection
PE: Possible: rales, rhonchi, wheezing
↑ w/ chest motion, cough, respiration
AS: Chest x-ray

Other DDX

- Herpes Zoster
Hx: Dermatomal pain
Prolonged duration
PE: Rash
- Thoracic Outlet
- Psychogenic
- Subluxation/Biomechanical

Hx = History

PE = Physical Exam

AS = Ancillary Studies

Etiology

1. Mechanical obstruction
 - Polyps
 - Foreign bodies
2. Rhinitis medicamentosa
 - Stop use of nasal sprays or drops
3. Chronic sinusitis
 - CT
 - Sinus radiograph
4. Seasonal recurrence
 - Pale nasal mucosa
 - Tx: nasal steroids
 - Allergies

Chronic Rhinitis of Uncertain

Etiology

Allergy skin tests

(+) Test results

- Tx: nasal steroids or cromolyn
- Desensitization injections

(-) Test results

- Idiopathic nonallergic rhinitis
- Vasomotor rhinitis

Diagnostic Categories of

Chronic Rhinitis

1. Seasonal allergies
 - Trees in early spring
 - Grasses in late spring
 - Pollens in early fall
2. Perennial allergy
 - Year round, dogs, dust, cats
3. Nonallergic rhinitis w/ eosinophilia syndrome (NARES)
 - Similar to allergic rhinitis
 - Allergen cannot be identified
4. Vasomotor
 - Paroxysmal sneezing & rhinorrhea

Other Considerations

1. Drug induced
 - Cocaine abuse
 - Beta blockers
 - Clonidine
 - Oral Contraceptives

Clinical findings	Allergic	Nonallergic
History		
Seasonal	Common	Uncommon
Other allergic problems	Common	Uncommon
Pruritis	Common	Uncommon
Sneezing	Common	Uncommon
Sensitivity to irritants	Uncommon	Common
Physical Examination		
Nose	Turbinates, swollen Mucosa often pale	Variable swelling Mucosa often red
Laboratory		
Nasal smear	Eosinophils predominate	PMN's & epithelial cells predominate

PMN = polymorph neutrophil

Relevant Anatomy

Extremely strong surrounding ligaments
 Sacral side: concave groove, thick hyaline cartilage
 Iliac side: convex ridge, thinner fibrocartilage
 Grooves/ridges allow locking of joint
 Females generally have increased SI motion

Presentation

Local pain, possible LB & buttock radiation
 Pain may be worse with:

- Weight bearing
- Moving from sitting to standing
- Motion, walking

Relieved by recumbency (↓ weight bearing)

Exam

Focal SI tenderness, ↑ w/ joint challenge
 Leg length inequality (LLI)
 Possible guarded gait
 Myospasm – gluteal/low back
 Palpatory &/or postural signs of misalignment
 Altered SI motion &/or joint play
 Orthopedic tests to consider

- Belt test
- Gaenslen's test
- SLR
- Laguerre
- Patrick's (FABER)
- Hibb's
- Yeoman's
- SI compression/distraction
- Fortin finger test
- Sit-up test, leg length check

Treatment

Adjustments – restore motion & alignment
 PT modalities – reduce edema, ↓ pain
 Trigger point therapy, Soft tissue manipulation

Home Care

Stretching, exercise, heat

Prevention

Heel lift/orthotics
 Patient education
 Environmental factors: sitting posture, leg-crossing, wallet, furniture
 Aerobic conditioning & muscle strength

Static Characteristics of SI lesions**AS (Extension)**

High ilium, PSIS
 Long leg
 Possible lumbar scoliosis to opposite side
 PSIS less pronounced
 ASIS low

PI (Flexion)

Low ilium, PSIS
 Short leg
 Possible lumbar scoliosis to same side
 PSIS more pronounced
 ASIS high

Lift therapy**Purpose**

Reduce spinal scoliosis, lordosis, kyphosis
 Normalize lower extremity weight bearing
 Assist in correction of SI misalignment
 Relieve back pain associated w/ LLI
 Minimize premature degeneration

Application

Anatomical leg length discrepancy >6-10 mm with symptom may require lift
 Adjustments prior to therapy may enhance effect
 Use greater trochanters & iliac crests as markers
 Height of lift should be determined by:

- Age of patient
- Severity of scoliotic curve
- Spinal mobility
- Tibia vs. femur shortening
- Activities of the patient

1:2:4 Rule of Logan

½" heel lift will do the following, ipsilaterally:
 Raise femur head ~ ½"
 Raise sacral base ~ ¼"
 Raise L5 vertebral body ~ ⅛"

Heel lift >10 mm requires a sole lift (2:1 Heel:sole)

Do NOT increase heel lift by >50% at any one time. Watch for changes in relative knee height and let patient symptoms dictate further evaluation.

Definition

- Lateral bending &/or rotary deformation of the spine, named for side of CONVEXITY
- $> 7^\circ$ axial trunk rotation on scoliometer
- Common to have small right scoliosis around heart
- Usually first detected through Adam's test, also perform leg length evaluation

Types of Scoliosis**Non-structural** (functional, non-rigid)

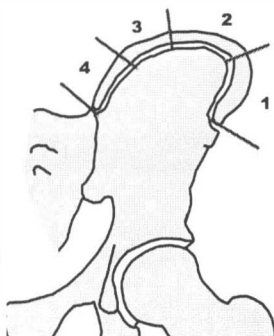
1. Compensatory – leg length inequality, pelvic subluxation, anatomical asymmetry
2. Postural – muscular imbalance, dominant hand, habitual, physiologic (around heart)

Structural (anatomical, rigid)

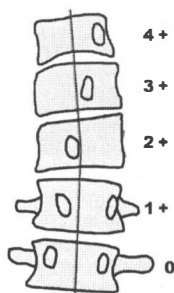
1. Idiopathic (genetic)
 - Infantile (before age 3 – 1%) – male > female, 80-90% resolve spontaneously w/o treatment
 - Juvenile (age 3-10 – 9%)
 - Adolescent (age 10 to skeletal maturity – 90%) – by far most common type
2. Congenital – hemivertebra, Klippel-Feil syndrome, rib synostosis, Sprengel's deformity
3. Neuromuscular – LMNL, UMNL, syringomyelia
4. Mesenchymal disorders – marfan's syndrome, Ehlers-Danlos, dwarfism, osteogenesis imperfecta
5. Trauma – fracture, surgery
6. Vertebral neoplasm – osteoid osteoma, osteoblastoma, giant cell tumor
7. Metabolic – rickets, osteomalacia, osteogenesis imperfecta

AIS (adolescent idiopathic scoliosis)

1. Autosomal dominant pattern – incomplete penetrance, variable expressivity
 - 1 affected parent – 30% chance child affected, 2 affected parents – 40% chance
2. Female > male (6:1)
3. Curve frequency – right thoracic most common, left lumbar 2nd most common
4. Curve progression **increase** risk factors
 - Before menarche – 50% risk of progression, after menarche = < 20% risk
 - Skeletal maturity (Risser < 2)
 - Thoracic major curve, double major curve
 - Early onset, pre-menarche
 - $> 20^\circ$ curve, marked rotation
 - $> 30^\circ$ apical rotation
 - Maternal age > 30 years

**Risser Sign**

Use of secondary ossification center of ilium to measure skeletal maturity
Note: Grade 5 = full skeletal maturity

**Pedicle method**

Used for grading degree of rotation

Treatment

- Evaluate risk factors for progression, follow every 6 month until skeletal maturity
- CMT, PT, STM, motorized flexion-distraction, lift therapy if required
- Exercises – stretch concave side (pillow under side, hang from a bar, Swiss ball)

Sprain = Ligamentous Injury Strain = Muscular Injury

Sprain/Strain is not a sufficient diagnosis; it must be further qualified to the involved structures and given a grade of severity.

Differentiating Strain from Sprain

Action	STRAIN (muscle)	SPRAIN (ligamentous)
Passive ROM	Mild to no pain except at end range (muscle stretched)	Pain Ligaments are stretched
Active ROM	Painful ↓ ROM due to pain	Painful ↓ ROM due to pain
Isometric Contraction	Pain	Mild or no Pain

Grade	Clinical Findings
I	<p>Simple strain/sprain - minimal disruption of adjacent fibers (0%-20% fibers damaged)</p> <ul style="list-style-type: none"> • Minimal pain, splinting, minimal palpatory pain • Trigger points • Some loss of range of motion • Fixation and decreased joint play in spine
II	<p>Moderate strain/sprain - partial tearing of the ligaments or muscle, hemorrhage, marked pain and splinting. (20%-80% fiber damage)</p> <ul style="list-style-type: none"> • Athletic injury, lifting, trauma • Same clinical picture as above but more severe • Sometimes tear is palpable
III	<p>Severe strain/sprain - complete laceration, refer for surgical evaluation (80%-100% fiber damage)</p> <ul style="list-style-type: none"> • Ecchymosis • Marked dysfunction • Palpate tom muscle

Causes

1. Trauma
2. Postural – may be either an intrinsic postural problem (e.g. hyperlordosis or anatomically short leg) or an extrinsic postural problem (e.g. prolonged weird positions, student posture)
3. Repetitive injury or overuse – over hours, days, months of the same motion
4. Sudden unguarded movement of being flexed forward and lifting something with rotation leaves the patient at a biomechanical disadvantage – most of these things lead to a single episode of trauma, however mild it might be at the time

Always Rule Out

1. Hemarthrosis (vascular damage) or Hematoma
2. Stress, avulsion and /or other fractures
3. Dislocations

Treatment

Standard – RICE (Rest, Ice, Compression, Elevation). Consider splints, wraps, supports as dictated & short term NSAID use if required, nutrition for musculoskeletal healing.

Cervical Stenosis

- May see long tract signs – Babinski reflex, upper motor neuron lesions
- Decreased proprioception to lower & upper extremities
- Sensory and motor changes in extremities
- Clumsy gait and/or hands
- Bowel and bladder problems
- (+) Lhermitte's, Soto-Hall
- Can also use the interpeduncular distance on x-ray to evaluate severity

Interpeduncular Distance

Varies with age & spinal level:

C ₃	28 (±3)mm
C ₆	29 (±3)mm
T ₁	24 (±4)mm
T ₇	17 (±3)mm
T ₁₂	23 (±4)mm
L ₁	25 (±4)mm
L ₅	30 (±6)mm

Eisenstein's Method = > 15 mm**Lumbar Stenosis (intermittent neurogenic claudication)**

- Can be central or lateral
- Incidence increases with age
- Both types have inconsistent patterns of leg and back pain, both of which increase with activity
- May resemble the clinical picture of vascular claudication (see DDx)
- SSx may only be evident after exercise
- Use a lateral lumbar film to measure the sagittal diameter of spinal canal
- No single measurement should be less than 15mm (though some have suggested a 14mm minimum); use Eisenstein's method for sagittal canal measurement

SSx for lateral stenosis

- Lateral stenosis has unilateral leg pain
- ROM – limited in extension – increases pain
- Lateral flexion and rotation to the involved side increases pain

SSx for central stenosis

- Central stenosis has bilateral leg pain
- ROM – limited in extension (increases pain), flexion may decrease pain
- Check SLR, Lhermitte's sign

Differentiating Neurogenic from Vascular Claudication

	NEUROGENIC	VASCULAR
Back pain	Yes	No (usually)
Leg pain	Proximal	Distal
Pulse/Blood pressure	Normal	Decreased
Activity	↑ symptoms with extension	Able to perform specific activity before symptoms appear, followed by refractory period
Sensory/Motor	Decreased	Normal
Trophic Changes	Muscle atrophy (maybe)	Skin (hair loss, ulcers)
X-ray	Hypertrophic changes	Potential Arteriosclerosis of vessels

Cauda Equina Syndrome

- Urinary retention (90% sensitivity)
- Incontinence
- Diminished sexual function
- Numbness or paresthesia around perineum, saddle distribution of sensory loss (75% sensitive)
- Loss of anal sphincter tone (60%-80% sensitive)
- Some combination of:

Cauda equina syndrome is a surgical emergency and should be referred out immediately!!!

Unilateral/Bilateral Sciatica, altered SLR, sensory or motor deficits (80% sensitive)

Definition

Compression of neurovascular bundle within thoracic outlet

Types of TOS

1. Anterior scalene syndrome
2. Cervical rib syndrome
3. Costoclavicular syndrome
4. Pectoralis minor syndrome
5. Combination of previous

History & Exam

- Intermittent pain & peripheral nerve paresthesias
- Most commonly on C8-T1 (ulnar) side
- Atrophy/trophic changes may involve sympathetic system
- Possible cyanosis, edema gangrene, ulcerations if severe or prolonged
- Possible decrease in pulse strength & amplitude
- Positive finding is a reproduction of symptoms into extremity, including numbness, paresthesia, tingling, or pain
- Look for reproduction of chief complaint symptoms although there may be a diminished or absent ulnar and/or radial pulse during tests below

Adson's test (supraclavicular)

- For tight anterior scalene or cervical rib (reverse Adson's)
- Typically neurological
- x-ray for cervical ribs & to rule out other possibilities

Eden's test (costoclavicular)

- For clavicle & first rib
- Trauma – has patient ever broken clavicle?
- Postural distortions – scoliosis, backpacking
- Pulsating burning pain
- Cyanosis

Roo's test

- Differentiate between vascular & neurogenic TOS
- Usually performed for 20-60 seconds

Wright's test (infraclavicular)

- For tight pectoralis minor
- Postural distortions – sleeping hyperabducted
- Coracoid process of scapula may be culprit

Key differentials

- Disc herniation
- IVF encroachment – DJD, osteophyte formation
- Pain referral – facet syndrome, myofascial trigger-points etc.
- Trauma – sprain/strain, fracture, dislocation

Treatment

- Postural & activity modifications
- Adjusting, Chiropractic Physical Therapy (CPT), Soft Tissue Manipulation (STM)
- Patient education

Incidence

- 4/5 cases are males
- Peak age for males 35 yrs.
- Peak age for females 30 & 55 yrs.
- 50% recurrence rate

Relieving Factors

Reduced by rest – physiologic fatigue

Improves on weekend/vacation – job related

- Improves w/ discontinued medication – pharmacological fatigue sudden onset
- Travels as stone moves
- Costovertebral tenderness
- NO rebound tenderness
- Write to find comfort (unsuccessful)
- Nonspecific SSx (diaphoresis, nausea, etc.)

Management

- Lab tests
 1. Urine dipstick
 2. UA, culture
 3. CBC
 4. Abdomen plain film
- < 4 mm stone = 85% chance of passing spontaneously
- > 5 mm stone approximately 10% chance of passing spontaneously

Decrease Urinary Calcium

1. Increase fluid intake
2. ↓ dietary protein
3. ↓ sodium intake
4. Stop coffee
5. ↓ sugar
6. Supplement citrate
7. Consider alkaline diet

Increase Urinary Oxalate

1. Avoid megadose Vit. C (>2g)
2. ↓ red meat, fish & poultry
3. ↓ dietary oxalate
4. Avoid Vit. D supplementation
5. ↑ Magnesium, B6

Foods with ↑ Oxalic Acid (>1%)

- Beets, beet greens
- Chocolate, cocoa
- Figs, lime peel, parsley
- Pepper com, ground pepper
- Poppy seeds, rhubarb, spinach
- Tea, coffee

Good Questions

1. Where does it hurt?
2. What type of pain do you have?
3. When did it start? (abrupt, gradual)
4. What makes it better/worse?
5. Pain or trouble urinating?
6. Diarrhea, nausea, vomiting?
7. Fever?
8. Hx of UTI, surgery, gout?

DDx – Abdominal Pain

- Aortic aneurysm
- Appendicitis
- Bowel obstruction
- Cholecystitis
- Cholelithiasis
- Colitis
- Diverticulitis
- Ectopic pregnancy
- Gastroenteritis
- Mesenteric ischemia
- Musculoskeletal pain
- Nerve root pain
- Ovarian Cyst
- Pelvic inflammatory disease
- Peptic ulcer
- Peritonitis
- Pyelonephritis
- Renal cystic disease
- Renal trauma
- Renal tumor
- Renal vein thrombosis
- Sciatica
- Testicular torsion
- Ureteral blood clot
- Urolithiasis

"Changes in body weight that are NOT deliberate are worrisome."

Weight Gain	Weight Loss
Weight gain of Excess Caloric Intake	Non-deliberate Weight Loss
Familial obesity Learned disorder Emotional hyperphagia <ul style="list-style-type: none"> stress, depression, anxiety, etc... 	<ul style="list-style-type: none"> May indicate serious disease
Weight Gain of Fluid Retention	Mechanisms of Weight Loss
Known disorders <ul style="list-style-type: none"> Nephritic syndrome Congestive heart failure cirrhosis of liver Premenstrual edema Salt retaining medications <ul style="list-style-type: none"> steroids, NSAIDS, lithium compounds 	<ul style="list-style-type: none"> Decreased caloric intake Accelerated metabolism Loss of calories in urine or stool
Weight Gain of Endocrine Disorders	Endocrinological Weight Loss
Cushing's syndrome Hypothyroidism	Diabetes mellitus <ul style="list-style-type: none"> Initial weight loss due to osmotic diuresis Later weight loss due to tissue loss Loss of hormonal control and glucose through urine (∴ losing calories)
Weight Gain of Pregnancy	Thyrototoxicosis
Normal physiological response	<ul style="list-style-type: none"> Weight loss due to ↑ metabolic rate and ↑ motor activities
Obesity in Children	Addison's Disease
Consider endocrine and genetic disorders Familial obesity <ul style="list-style-type: none"> Learned disorder/patterning after parents 	<ul style="list-style-type: none"> ↓ cortisol resulting in decreased appetite
Physical Findings	Gastrointestinal Weight Loss
<i>"Normal" obesity usually evenly distributed</i> Endocrine obesity usually has a pattern <i>Cushing's</i> – truncal obesity & buffalo hump <i>Hypothyroidism</i> - ↑ weight, dry hair, etc	Fat Malabsorption <ul style="list-style-type: none"> Sprue, Chronic Pancreatitis, Cystic fibrosis Inflammatory Bowel Disease (IBS) Parasites, Obstructive Disorders
Diagnosis	Infection Associated Weight Loss
<ul style="list-style-type: none"> Biochemical profile with lipoproteins Thyroid function (TSH & Free T4) 24 hour Urine Free Cortisol (UFC) 	Usually occult infection <ul style="list-style-type: none"> Tuberculosis, Systemic mycoses, Parasitic infestation, HIV disease
Treatment	Malignancy Associated Weight Loss
<ul style="list-style-type: none"> Exercise & diet modification Rule out other causes 	<i>Most common cause of weight loss in the absence of major signs & symptoms</i> Mechanism of malignancy induced weight loss <ul style="list-style-type: none"> Anorexia Increased metabolic demand of cancer Side-effects of cancer therapy
See Height/Weight Tables on pages 168-169	Psychological Associated Weight Loss
	<ul style="list-style-type: none"> Anorexia nervosa, Schizophrenia, Conversion disorders, Depression
	Diagnostic Tests
	<ul style="list-style-type: none"> CBC, Urinalysis, ESR Biochemical Profile Two-hour Post-prandial Glucose Thyroid function tests (TSH, free T4) Amylase & lipase (pancreas) Stool Analysis

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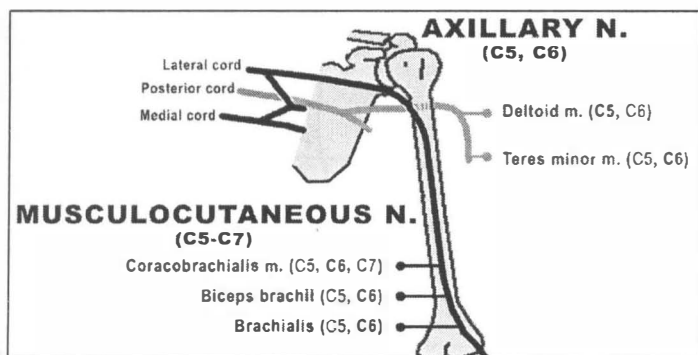
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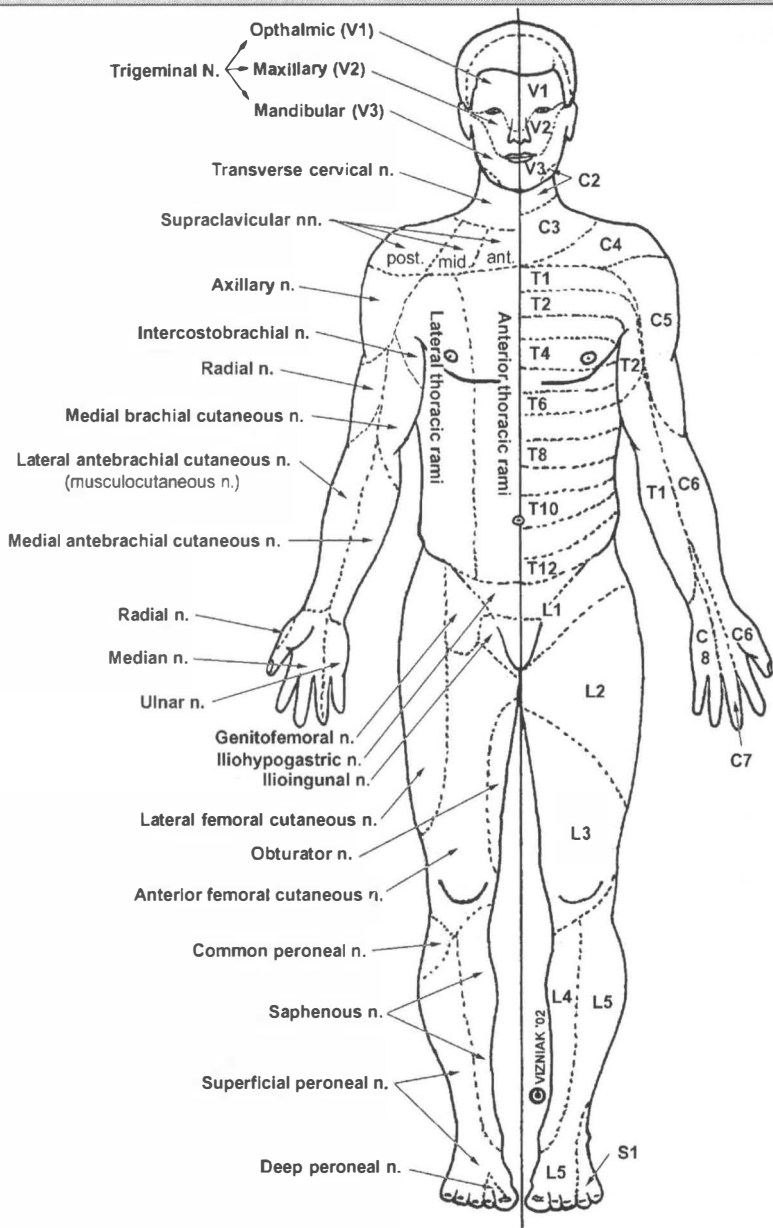
Additional Recommended Information Resource:

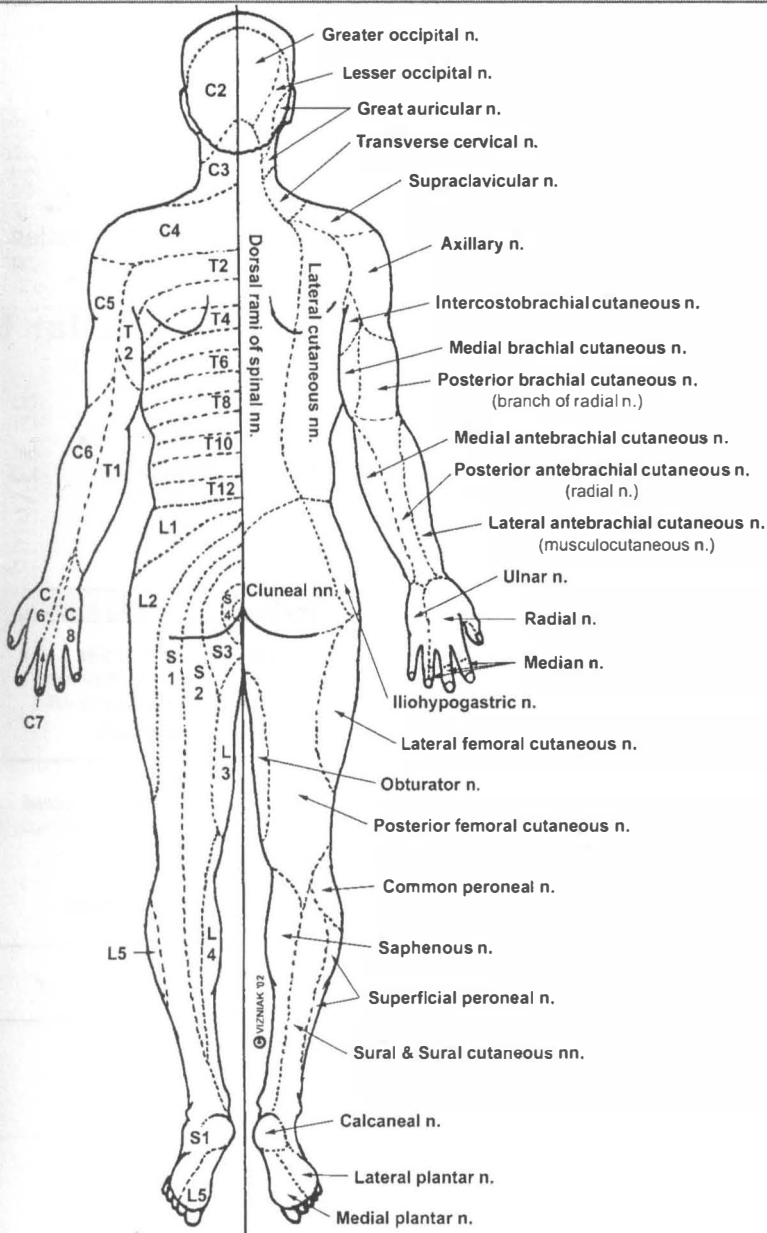
Refer to the Western States Chiropractic College Clinics - Conservative Care Pathways
Clinical Standards, Protocols, and Education (CSPE)
Order through - <http://www.wschiro.edu/>

VIII Neuroanatomy

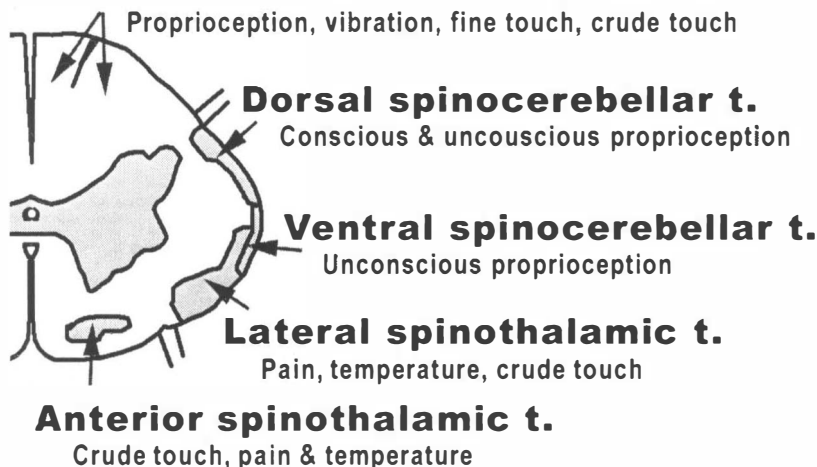
Anterior Dermatomes.....	236
Posterior Dermatomes.....	237
Spinal Tracts.....	238-239
Sensory Loss Patterns	240-241
Cranial Nerves.....	242
Cranial Nerve Exam.....	243
Motor Upper Extremity.....	244
Motor Lower Extremity.....	245
Femoral & Obturator Nerve	246
Sciatic Nerve	247
Axillary & Musculocut. Nerve..	248
Median Nerve	249
Radial Nerve.....	250
Ulnar Nerve	251



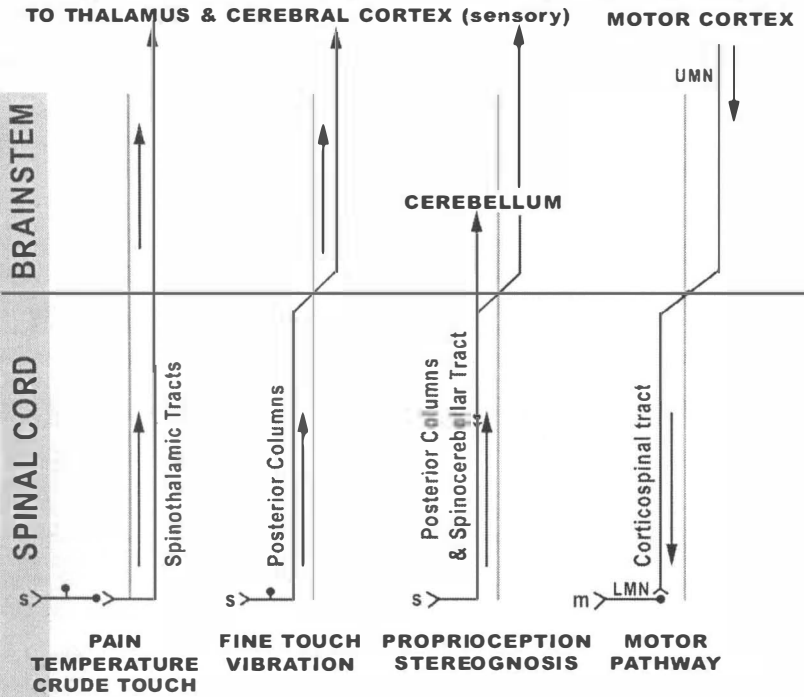




Posterior/dorsal columns



Tract/Region	Function	Test
Cerebellum (spinocerebellar)	Motor Gait	<ul style="list-style-type: none"> • Heel to shin, Finger to nose • Dysdiadochokinesia – rapid alternating movements • Heel to toe (tandem walk)
Posterior Columns	Sensory 2 point discrimination Vibration Position sense	<ul style="list-style-type: none"> • Romberg's, stand with eyes closed • 2 pins, paper clip • 128 Hz tuning fork • Passive toe movement • Stereognosis, graphesthesia
Cortical Spinal	Motor	<ul style="list-style-type: none"> • Muscle tests • Deep Tendon Reflexes
Lateral Spinothalamic & Anterior Spinothalamic	Sensory Pain & Temperature Light touch	<ul style="list-style-type: none"> • Sharp / dull • Hot & cold test tubes
Vestibulospinal	Sensory	<ul style="list-style-type: none"> • Balance reflexes • Weber, Rinne

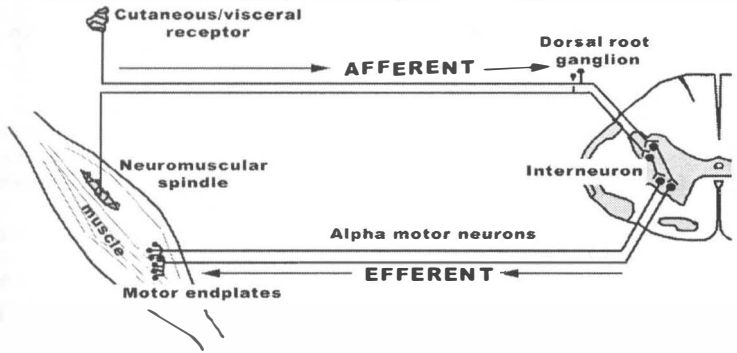


PAIN TEMPERATURE CRUDE TOUCH **FINE TOUCH VIBRATION** **PROPRIOCEPTION STEREOGNOSIS** **MOTOR PATHWAY**

s = sensory receptor, m = muscle

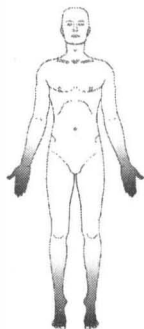
UMN = upper motor neuron, LMN = lower motor neuron

REFLEX LOOP



NEUROANATOMY

Peripheral Neuropathy

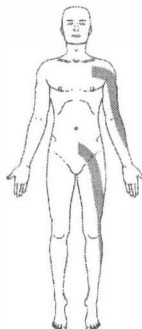


Loss of all sensory modes
More severe distally (feet & hands)
"Glove & stocking" anesthesia
Improved sensation proximally
Anesthesia zone moves into hypoaesthesia, then to normal

Potential causes

Diabetes
Metabolic diseases
Nutritional deficiency
Pernicious anemia

Individual Nerve or Roots

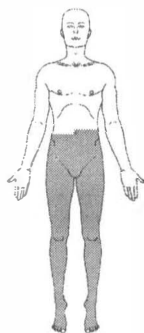


↓ or loss of all sensory modes
Area of sensory loss corresponds to anatomical distribution of nerves (radicular syndrome)

Potential causes

Trauma
Vascular occlusion
Disc herniation
Impingement syndrome

Spinal Cord Hemisection

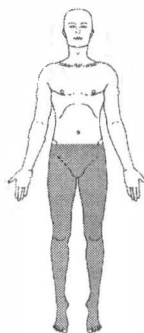


"Brown-Séquard syndrome"
Loss of pain & temperature, contralateral side starting two levels below lesion
Loss of vibration & position sense, spastic paralysis & hyperreflexia on ipsilateral side, below level of lesion

Potential causes

Meningioma
Neurofibroma
Cervical Spondylosis
Multiple Sclerosis

Complete Cord Transection

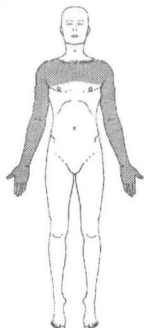


Complete loss of all sensory modes below level of lesion
Associated with spastic paralysis, hyperreflexia & loss of sphincter control

Potential causes

Trauma
Demyelinating disorders
Tumor

Syringomyelia

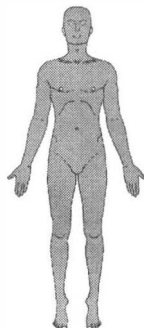


Loss of pain & temperature sense
"shawl-like" distribution
Normal - light touch & proprioception

Potential cause

Syringomyelia - fluid filled cavitation in spinal canal that causes pressure on spinothalamic tract

Amyotrophic Lateral Sclerosis

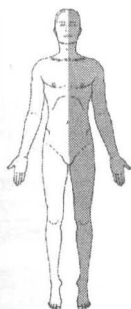


Combination of UMNL & LMNL signs
Usually effects distal extremities first
Muscle atrophy, fasciculations
Hyperreflexia
Normal cognition, oculomotor & sensory function

Potential Cause

ALS (Lou Gehrig's disease) - axonal degeneration

UMNL = upper motor neuron lesion, LMNL = lower motor neuron lesion

Cortex Lesion

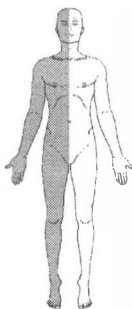
Little loss of pain, vibration & crude touch - these functions are mediated by thalamus

Loss of fine touch, graphesthesia, & stereognosis on contralateral side to lesion

Cognitive deficits

Potential cause

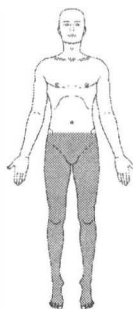
Cerebral cortex trauma
Parietal lobe lesion

Thalamus Lesion

Loss of all sensory modes on face & body on side contralateral side to lesion

Potential cause

Vascular occlusion

Guillain-Barré syn.

Peripheral nerve roots effected

Rapid onset of flaccid paralysis

↓ in all sensory modalities

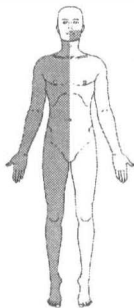
Cause

Demyelination disease

Brainstem Lesions

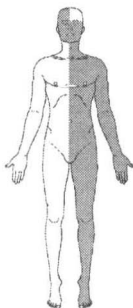
Loss of pain & temperature on ipsilateral face
Loss of pain & temperature on contralateral body

Wallenberg's syndrome - left posterior inferior cerebellar artery occlusion



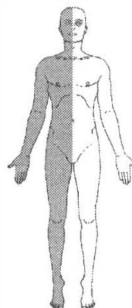
Normal pain & temp. sensation
Ipsilateral side - spastic paralysis, hyperreflexia, ↓ proprioception

Lesion location:
Medulla



Ipsilateral side - weakness of masseter muscle, facial anesthesia
Contralateral - weakness in arm, leg & face muscles

Lesion location:
Pons



Both eyes - cranial nerve 3 paresis
Ipsilateral side - ↓ in all sensory modalities

Lesion location
Midbrain

Name	Function/Structures Innervated	Lesion
I-Olfactory	<i>sensory</i> : smell	anosmia (loss of smell)
II-Optic	<i>sensory</i> : vision	visual field deficits
III-Oculomotor	<i>motor</i> : rectus superior, inferior, medial; inferior oblique, levator palpebra <i>parasympathetic</i> : constrictor pupillae, ciliary muscles (lens shape)	dilated pupil, ptosis, eye turned down & lateral loss of pupillary light reflex on lesion side
IV-Trochlear	<i>motor</i> : superior oblique	inability to look down when eye is adducted
IV-Trigeminal	<i>sensory</i> : V ₁ (ophthalmic), V ₂ (maxillary), V ₃ (mandibular), sensation ant 2/3 tongue <i>motor</i> : V ₃ - masseter, temporalis, lat & med pterygoid, anterior belly digastric, mylohyoid, tensor tympani/veli palatini	paresthesia (pain & touch) mandible deviation to side of lesion when mouth is opened, masseter & temporalis do not contract
VI-Abducens	<i>motor</i> : lateral rectus muscle	no abduction if ipsilateral eye medial strabismus, Diplopia
VII-Facial	<i>sensory</i> : taste – anterior 2/3 of tongue <i>motor</i> : frontalis, occipitalis, orbicularis, buccinator, zygomaticus, mentalis, post. belly digastric, stapedius, stylohyoid <i>parasympathetic</i> : lacrimal, nasal & palatine, sublingual, lingual submandibular, labial	loss of taste anterior 2/3 tongue paralysis of facial muscles, hyperacusis (stapedius paralysis) ↓ salivation, lacrimation
VII-Acoustic (vestibulocochlear)	<i>sensory</i> : hearing and equilibrium	unilateral hearing loss balance problems
IX-Glosso-pharyngeal	<i>sensory</i> : sensation and taste posterior 1/3 of tongue, pharynx, tympanic cavity, carotid baro/chemo receptors <i>motor</i> : stylopharyngeus muscle <i>parasympathetic</i> : parotid gland	loss of taste on posterior 1/3 of tongue loss of sensation on affected side of soft palate ↓ salivation
X-Vagus	<i>sensory</i> : pinna of ear, GI distension <i>motor</i> : muscles of palate, pharynx & larynx <i>parasympathetic</i> : heart, esophagus, up to distal 2/3 of transverse colon	Ipsilateral: uvula deviates to opposite side of lesion, dyspnea, hoarse voice Bilateral: death
XI-Accessory	<i>motor</i> : SCM, Trapezius	paralysis of SCM & superior fibers of trapezius → drooping of shoulder
XII-Hypoglossal	<i>motor</i> : Intrinsic muscle of tongue, genioglossus, styloglossus, hyoglossus	tongue deviates toward side of lesion on protrusion (action of genioglossus)

I. Olfactory

R. Nares L. Nares

Scent #1: _____

Scent #2: _____

II. Optic Nerve

R. eye L. eye

Visual acuity _____

Visual fields _____

(III) pupillary constriction _____

Funduscopic exam _____

III. Oculomotor**IV. Trochlear****VI. Abducens**

Pt. holds head still while tracking 'H' pattern with eye movement only

Dr. observes for smooth tracking & nystagmus

Finish with convergence & observe pupil constriction

V. Trigeminal**Motor:** pterygoids = lateral deviation of the jaw against resistance

masseters = palpation of masseters while patient clenches jaw or pt. 'bites down'

Sensory: sensory perception of the face & buccal mucosa - bilaterally equal?**Sensory:** test afferent fibers of the corneal reflex
Dr. lightly brushes cotton across surface of the patient's cornea**Normal:** lid closure of both eyes when one eye is touched**Abnormal:** V. afferent deficit or VII. efferent deficit

Lid constriction of:

Examples:	Stimulant	R. eye	L. eye
Right V. lesion	R. cornea	no	no
	L. cornea	yes	yes
Right VII. lesion	R. cornea	no	yes
	L. cornea	no	yes

VII. Facial**Motor:** all voluntary & involuntary movements of the face - does not include jaw movements, includes elevation of the eyebrows, wrinkle forehead, smile, frown, grimace, puff out cheeks with air**Sensory:** taste anterior 2/3 of tongue**Note:** VII. also innervates lacrimal glands, submandibular & submaxillary glands; these are not routinely tested, but be aware of presence or absence of saliva & tears.**VIII. Vestibulocochlear (Acoustic)**

Vestibular division tested with Romberg's

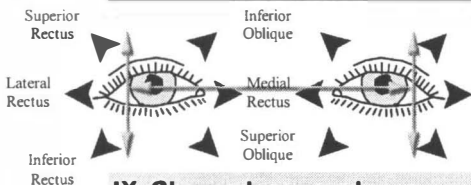
Cochlear division:

R. ear L. ear

Auditory acuity: _____ (watch test)

Weber: _____

Rinne: _____

**IX. Glossopharyngeal**

Often tested with Vagus

Taste to posterior 1/3 of tongue

Gag reflex: general sensation, tonsillar & pharyngeal mucosa**Motor:** stylopharyngeus m.**X. Vagus****Motor:** palate, pharynx contracting muscles

Vagus function: patient says 'Ahhhh'; Dr. checks palate symmetry

Normal: symmetrical elevation of palate & contraction of pharyngeal muscles**Lesion:** palate & uvula deviate to unaffected side**XI. Spinal Accessory****Motor:** Trapezius & SCM strength against slight resistance (muscle tests)**XII. Hypoglossal**

Check for tongue deviation toward affected side with protrusion, fasciculations

Check tongue ROM, with rapid movements

Check muscle tone; patient laterally deviates tongue against cheek, against Dr.'s resistance

Suprascapular Nerve

Supraspinatus (C4, C5)
Infraspinatus (C5, C6)

Long Thoracic Nerve

Serratus anterior

Axillary Nerve

Deltoid (C5, C6)
Teres minor (C5, C6)

Musculocutaneous Nerve

Biceps brachii (C5, C6)
Brachialis (C5, C6)
Coracobrachialis (C5, C6, C7)

Median Nerve

Forearm

Pronator teres (C6, C7)
Flexor carpi radialis (C6, C7)
Palmaris longus (C7, C8)
Flexor digitorum superficialis (C7, C8, T1)
Flexor digitorum profundus (lateral 1/2)
Flexor pollicis longus (C8, T1)
Pronator quadratus (C8, T1)

Hand

Abductor pollicis brevis
Opponens pollicis
Flexor pollicis brevis
Lumbricals I and II

Radial Nerve

Arm

Brachioradialis (C5, C6, C7)
Extensor carpi radialis (C6-C7)
Anconeus (C7, C8, T1)
Triceps (long/lateral/medial head) (C6-C8)

Forearm

Supinator (C5, C6)
Extensor carpi radialis brevis (C7, C8)
Extensor digitorum (C7, C8)
Extensor digiti minimi (C7, C8)
Extensor carpi ulnaris (C7, C8)
Abductor pollicis longus (C7, C8)
Extensor pollicis longus (C7, C8)
Extensor pollicis brevis (C7, C8)
Extensor indicis (C7, C8)

Ulnar Nerve

Forearm

Flexor carpi ulnaris (C7, C8)
Flexor digitorum profundus (medial 1/2) (C8, T1)

Hand

Flexor digiti minimi brevis
Abductor digiti minimi
Opponens digiti minimi
Interossei
Lumbricals III and IV
Adductor pollicis
Flexor pollicis brevis (ulnar portion)

	C₃	C₄	C₅	C₆	C₇	C₈	T₁
Levator scapulae	xxx	xxx	xxx				
Rhomboids		x	xxx				
Shoulder			xxx	xxx			
Pectoralis Major				xxx	xxx	xxx	xxx
Latissimus Dorsi				xxx	xxx	xxx	
Elbow Flexion			xxx	xxx			
Elbow Extension					xxx	xxx	
Supination			xxx	xxx			
Pronation				xxx	xxx	xxx	xxx
Wrist Extensors				xxx	x	x	
Wrist Flexors					xxx	x	
Finger Extension				x	xxx	x	
Finger Flexion					x	xxx	x
Finger Add & Abd						xxx	xxx
Intrinsic Hand						xxx	xxx

x = minor innervation, xxx = major innervation

NEUROANATOMY

Superior Gluteal Nerve

Tensor fasciae latae	(L4, L5)
Gluteus medius	(L5, S1)
Gluteus minimus	(L5, S1)

Inferior Gluteal Nerve

Gluteus maximus	(L5, S1, S2)
-----------------	--------------

Femoral Nerve**Thigh**

Pectineus	(L2, L3)
Sartorius	(L2, L3)
Quadriceps:	
rectus femoris	(L2, L3, L4)
vastus lateralis	(L2, L3, L4)
vastus intermedius	(L2, L3, L4)
vastus medialis	(L2, L3, L4)

Obturator Nerve

Gracilis	(L2, L3)
Adductor longus	(L2, L3, L4)
Adductor brevis	(L2, L3, L4)
Adductor magnus	(L2, L3, L4)
Obturator externus	(L3, L4)

Sciatic Nerve (tibial division)

Popliteus	(L4, L5, S1)
Semitendinosus	(L5, S1, S2)
Semimembranosus	(L5, S1, S2)
Biceps femoris (long head)	(L5, S1, S2)
Gastrocnemius	(S1, S2)
Plantaris	(S1, S2)
Soleus	(S1, S2)

Leg

Tibialis posterior	(L4, L5)
Flexor digitorum longus	(S2, S3)
Flexor hallucis longus	(S2, S3)

Foot

Abductor hallucis	
Abductor digiti minimi	
Dorsal interossei	

Sciatic Nerve (peroneal division)

Biceps femoris (short head)	(L5, S1, S2)
-----------------------------	--------------

Leg (deep peroneal nerve)

Tibialis anterior	(L4, L5)
Extensor hallucis longus	(L5, S1)
Extensor digitorum longus	(L5, S1)
Peroneus tertius	(L5, S1)

Foot (superficial peroneal nerve)

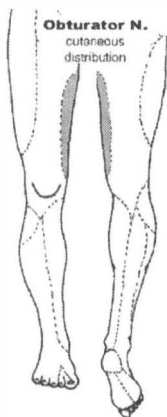
Extensor digitorum brevis	
Peroneus longus	(L5, S1, S2)
Peroneus brevis	(L5, S1, S2)

	L ₁	L ₂	L ₃	L ₄	L ₅	S ₁	S ₂
Evertors				x	x	xxx	
Invertors				xxx	xxx	x	
Dorsiflexors				xxx	xxx	xxx	
Plantar Flexors				x	xxx	xxx	x
Toe Extensors				xxx	xxx	xxx	
Extensor Hallicis				xxx	xxx	xxx	
Knee Extensors		x	xxx	xxx			
Knee Flexors				xxx	xxx	xxx	xxx
Hip Flexors	xxx	xxx	xxx				
Hip Extensors					xxx	xxx	xxx
Hip Abductors				xxx	xxx	xxx	
Hip Add & Internal Rot		xxx	xxx	xxx			
Hip Ext Rotators				x	xxx	xxx	x
Hip Extensor & External Rotators					xxx	xxx	xxx

x = minor innervation, xxx = major innervation

OBTURATOR N.
(L2-4 anterior division)

- Obturator externus m. (L3, L4)
- Adductor brevis m. (L2, L3, L4)
- Adductor longus m. (L2, L3, L4)
- Gracillis m. (L2, L3)
- Adductor magnus m. (L2, L3, L4)



FEMORAL N.
(L2-4 posterior division)

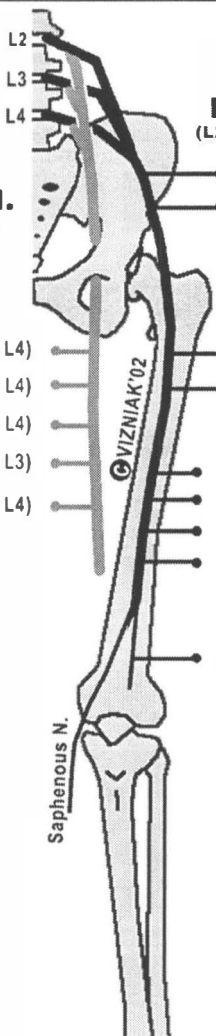
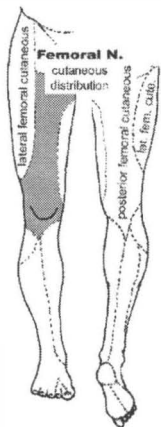
- Psoas m. (L1, L2, L3)
- Iliacus m. (L2, L3)

- Pectineus m. (L2, L3)
- Sartorius m. (L2, L3)

QUADRICEPS

- Rectus femoris m. (L2, L3, L4)
- Vastus medialis m. (L2, L3, L4)
- Vastus lateralis m. (L2, L3, L4)
- Vastus intermedius m. (L2, L3, L4)

- Articularis genu m. (L3, L4)



SCIATIC N.

(L4-S1)

L4
L5
S1

COMMON PERONEAL (FIBULAR) DIVISION

Biceps femoris (L5, S1, S2)
short head

COMMON PERONEAL (FIBULAR) N.

DEEP PERONEAL (FIBULAR) N.

Tibialis anterior m. (L4, L5)
Extensor digitorum longus m. (L5, S1)
Extensor hallucis longus m. (L5, S1)
Peroneus tertius m. (L5, S1)
Extensor digitorum brevis m.
Extensor hallucis brevis m.

SPERFICIAL PERONEAL N.

Peroneus longus m. (L5, S1, S2)
Peroneus brevis m. (L5, S1, S2)

LATERAL PLANTAR N.

All other muscles on sole of foot

TIBIAL DIVISION

Semitendinosus m. (L5, S1, S2)

Semimembranosus m. (L5, S1, S2)

Biceps femoris m. (L5, S1, S2)
long head

TIBIAL N.

Gastrocnemius m. (S1, S2)

Popliteus m. (L4, L5, S1)

Plantaris m. (S1, S2)

Soleus m. (S1, S2)

Tibialis posterior m. (L4, L5)

Flexor digitorum longus m. (S2, S3)

Flexor hallucis longus m. (S2, S3)

MEDIAL PLANTAR N.

Abductor hallucis m.

Flexor digitorum brevis m.

Flexor hallucis brevis m.

Medial Lumbricals

Common peroneal lesion

'Foot drop' - weakness in eversion
Numbness in cutaneous distribution

Tibial nerve lesion

'Claw Foot' - unopposed
action of dorsal flexors

For cutaneous distribution see dermatome / peripheral nerve maps on pages 236-237

AXILLARY N.

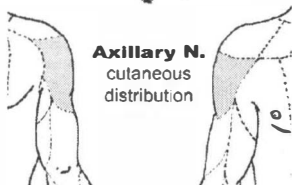
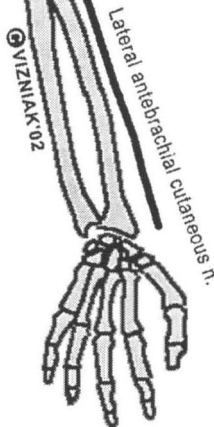
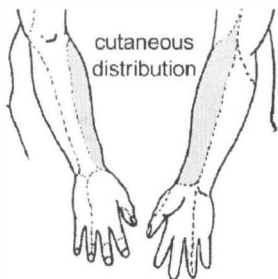
(C5, C6)

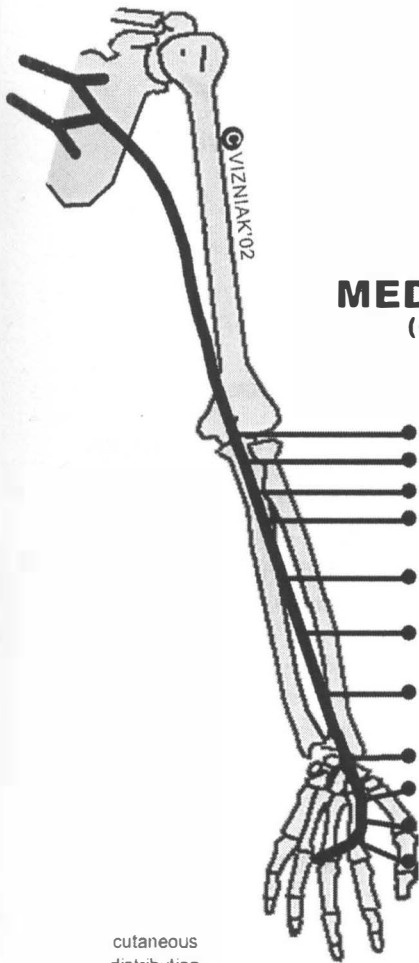


MUSCULOCUTANEOUS N.

(C5-C7)

- Coracobrachialis m. (C5, C6, C7)
- Biceps brachii (C5, C6)
- Brachialis (C5, C6)





MEDIAN N.

(C6-T1)

- Pronator teres m. (C6, C7)
- Palmaris longus m. (C7, C8)
- Flexor carpi radialis m. (C6, C7)
- Flexor digitorum superficialis m.
(C7, C8, T1)
- Flexor digitorum profundus m.
(C8, T1) (lateral 1/2)
- Flexor pollicis longus m.
(C8, T1)
- Pronator quadratus m.
(C8, T1)
- Adductor pollicis brevis m.
- Opponens pollicis m.
- Flexor pollicis brevis m.
- 1st & 2nd Lumbricals

cutaneous
distribution

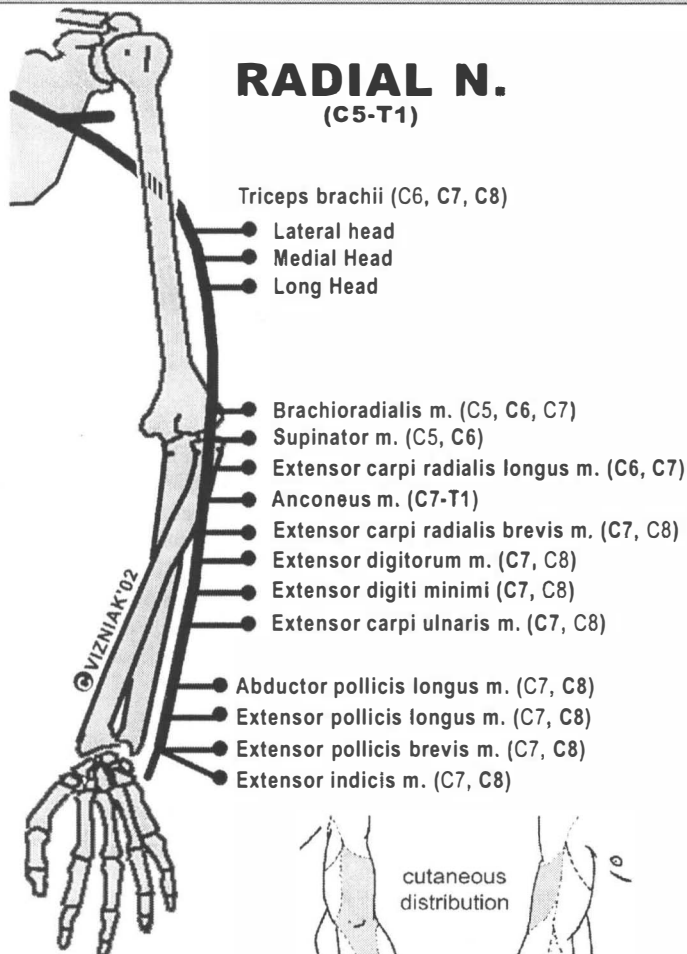


Classic lesion

'Ape hand' – thenar
atrophy & inability to
oppose or flex thumb

RADIAL N.

(C5-T1)

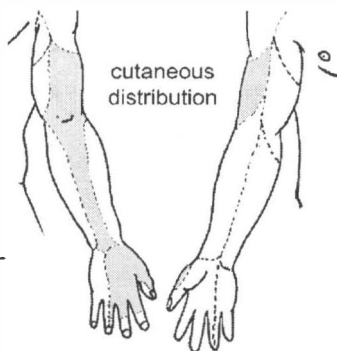


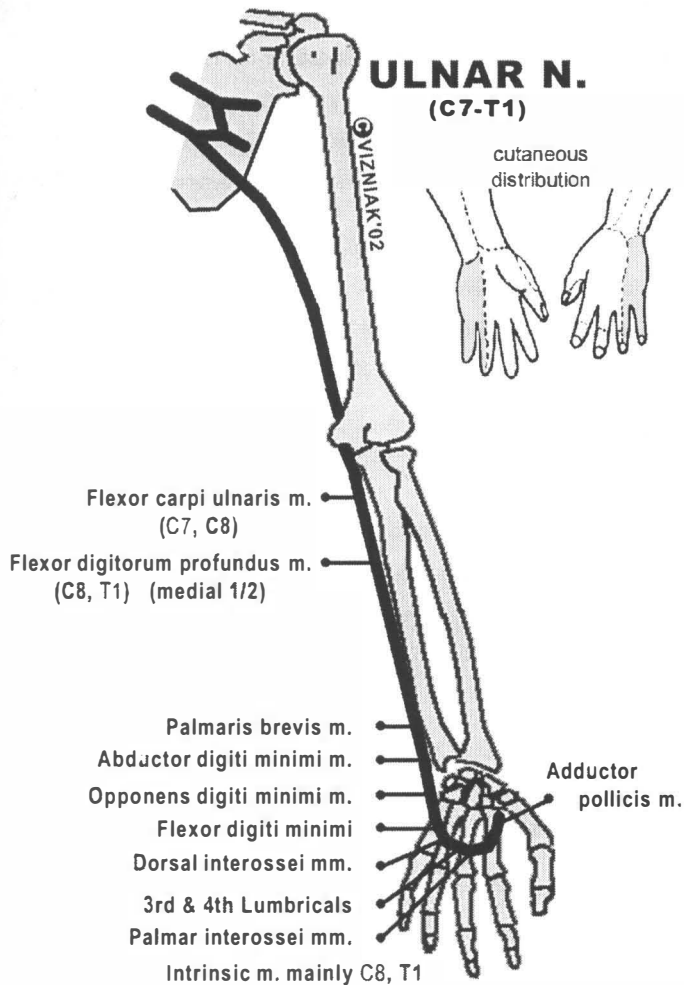
Classic lesions

'Wrist Drop' – in ability to extend wrist

'Saturday Night Palsy' – anesthesia over cutaneous distribution due to pressure on nerve

Note: radial nerve is the most commonly injured peripheral nerve



**Classic lesion**

'Clawhand' – unopposed action of extensor digitorum on the 4th & 5th digits with marked interosseus atrophy

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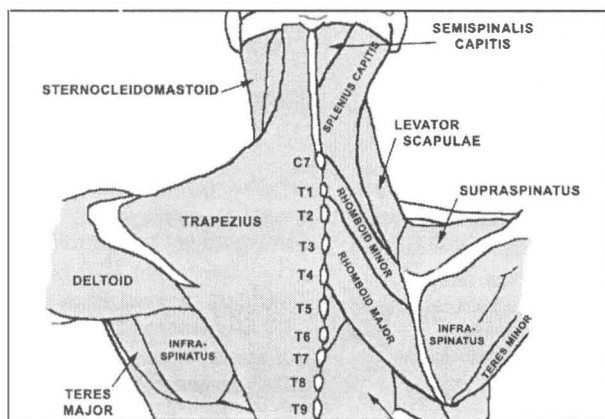
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IX Myology

Back.....	254-255
Neck & deep back	256-257
Shoulder	258
Anterior Chest & Arm.....	259
Anterior Forearm	260
Posterior Forearm.....	261
Torso	262
Gluteal Region.....	263
Middle & Posterior Thigh ..	264
Anterior Thigh.....	265
Posterior Leg	266
Anterior Leg	267
Hand.....	268-269
Foot	270-271



Trapezius

- O: External occipital protuberance (EOP), superior nuchal line, ligamentum nuchae, spines of C7-T12
- I: Spine of scapula, acromion, & lateral third of clavicle
- A: Adducts, rotates, elevates, & depresses scapula
- N: Spinal accessory n. (CN-XI), C3-C4

Latissimus dorsi

- O: Spines of T5-T12, thoracodorsal fascia, iliac crest, ribs 9-12
- I: Floor of bicipital groove of humerus
- A: Adducts, extends, & rotates arm medially
- N: Thoracodorsal n.

Rhomboid minor

- O: Spines of C7-T1
- I: Root of spine of scapula
- A: Adducts scapula
- N: Dorsal scapular n., C5

Rhomboid major

- O: Spines of T2-T5
- I: Medial border of scapula
- A: Adducts scapula
- N: Dorsal scapular n.

Erector spinae (lateral→medial)

- Iliocostalis** – (lumborum, thoracis, cervicis)
- Longissimus** – (thoracis, cervicis, capitis)
- Spinalis** – (thoracis, cervicis, capitis)
- A: chief extensors of the vertebral column, act unilaterally to laterally flex spine
- N: Dorsal primary rami in respective area

Levator scapulae

- O: Transverse processes of C1-C4
- I: Medial border of scapula
- A: Elevates scapula
- N: Nerves to levator scapulae, C3-C4, dorsal scapular n.

Quadratus lumborum

- O: Transverse processes of L3-L5; iliolumbar ligament; iliac crest
- I: Lower border of last rib; transverse processes of L1-L3
- A: Depresses rib 12; flexes trunk laterally
- N: Subcostal n.; L1-L3

Serratus posterior-superior

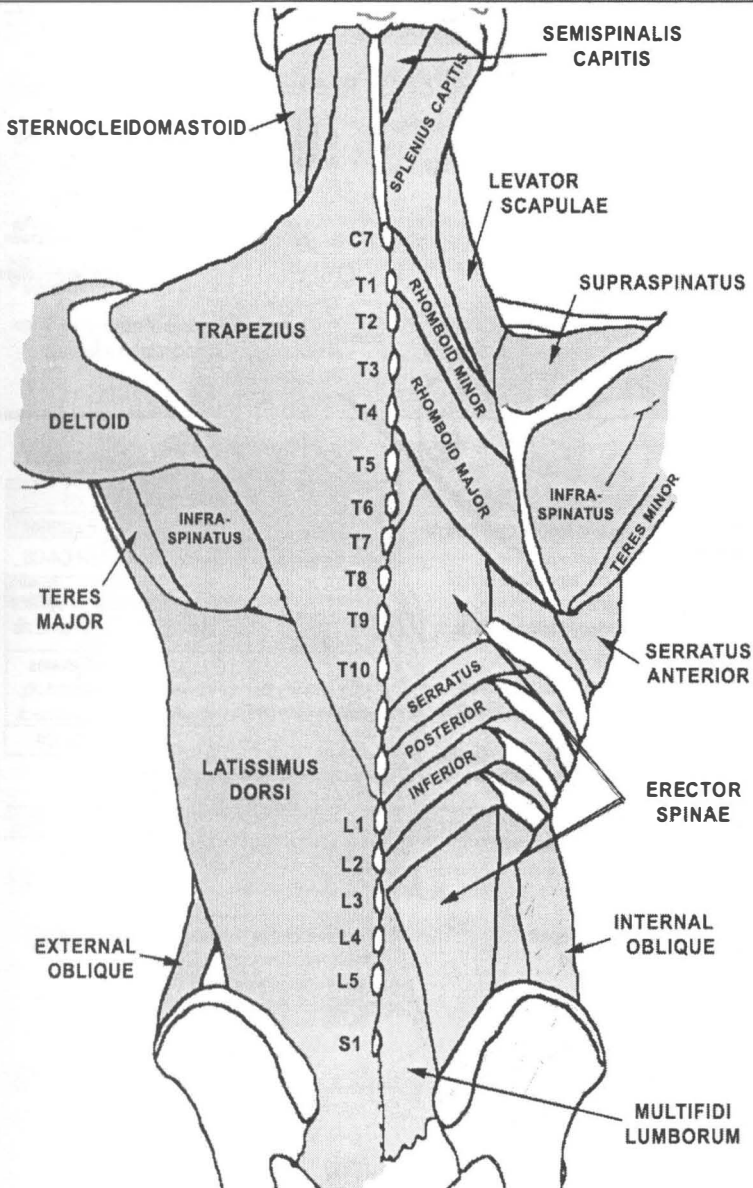
- O: Ligamentum nuchae, supraspinal ligament, & spines of C7-T3
- I: Upper border of ribs 2-5
- A: Elevates ribs
- N: Intercostal n., T1-T4

Serratus posterior-inferior

- O: Supraspinal ligament & spines of T11-L3
- I: Lower border of ribs 9-12
- A: Depresses ribs
- N: Intercostal n., T9-T12

Transversospinalis

- (superficial→deep)
- Semispinalis** – N: dorsal primary rami
- O & I: tranverse from 4-6 vertebral TP→SP
- Multifidus** – N: dorsal primary rami
- O & I: tranverse from 2-4 vertebral TP→SP
- Rotatores** – N: dorsal primary rami
- O & I: tranverse from 2-4 vertebral TP→SP



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Adapted from: Gray, H. Anatomy of the Human Body. Philadelphia. Lea & Febiger, 1918

Suboccipital

Rectus capitis posterior major

- O: Spine of axis
 I: Lateral portion of inferior nuchal line
 A: Extends, rotates, and flexes head laterally
 N: Suboccipital n

Rectus capitis posterior minor

- O: Posterior tubercle of atlas
 I: Occipital bone below inferior nuchal line
 A: Extends and flexes head laterally
 N: Suboccipital n

Obliquus capitis superior

- O: Transverse process of atlas
 I: Occipital bone above inferior nuchal line
 A: Extends, rotates, and flexes head laterally
 N: Suboccipital n.

Obliquus capitis inferior

- O: Spine of axis
 I: Transverse process of atlas
 A: Extends head and rotates it laterally
 N: Suboccipital n

Sternocleidomastoid (SCM)

- O: Manubrium stemi and medial one-third of clavicle
 I: Mastoid process and lateral one-half of superior nuchal line
 A: Singly turns face toward opposite side; together flex head, raise thorax
 N: Spinal accessory n. (CN-XI)

Scalenes

	Anterior	Middle	Posterior
O	TP C3-C6	TP C2-C7	TP C4-C6
I	Scalene tubercle on 1 st rib	Upper surface of first rib	Outer surface of second rib
A	Elevates first rib; bends neck		Elevates second rib; bends neck
N	C5-C8		C6-C8

Anterior Neck

Longus capitis

- O: Transverse processes of C3-C6
 I: Basilar part of occipital bone
 A: Flexes and rotates head
 N: C1-C4

Longus colli (L. cervicis)

- O: Transverse processes and bodies of C3-T3
 I: Anterior tubercle of atlas; bodies of C2-C4; transverse process of C5-C6
 A: Flexes and rotates head
 N: C2-C6

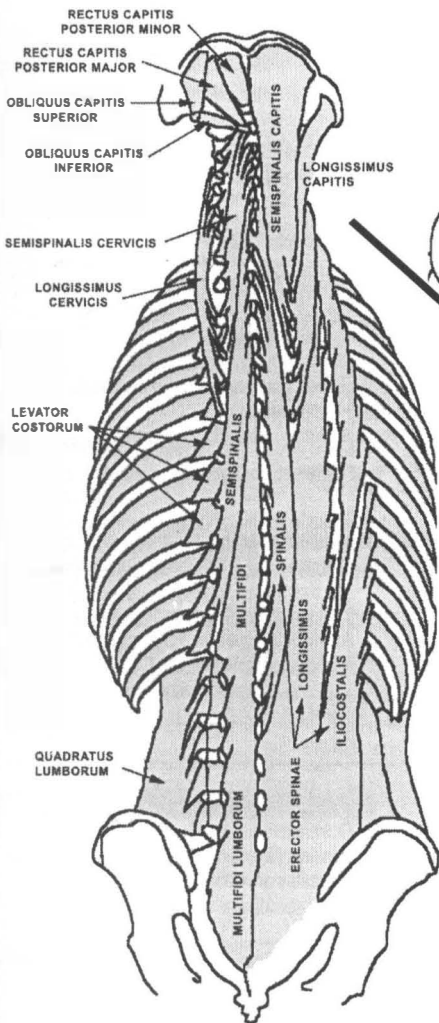
Rectus capitis anterior

- O: Lateral mass of atlas
 I: Basilar part of occipital bone
 A: Flexes and rotates head
 N: C1-C2

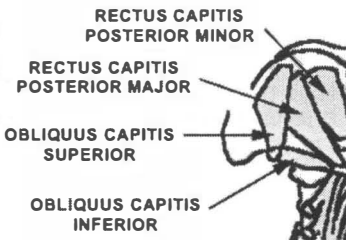
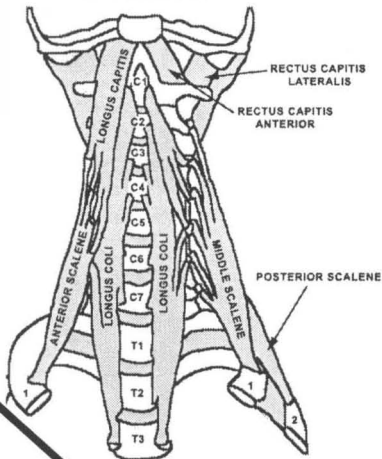
Rectus capitis lateralis

- O: Transverse of atlas
 I: Jugular process of occipital bone
 A: Flexes head laterally
 N: C1-C2

POSTERIOR

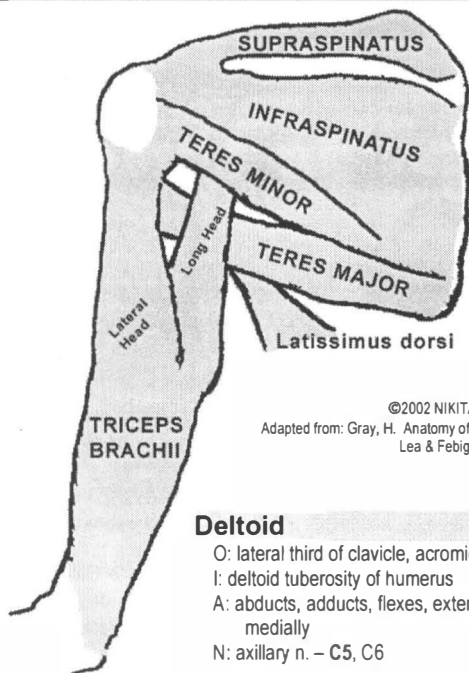


ANTERIOR



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Adapted from: Gray, H. *Anatomy of the Human Body*. Philadelphia. Lea & Febiger, 1918**Deltoid**

- O: lateral third of clavicle, acromion, & spine of scapula
- I: deltoid tuberosity of humerus
- A: abducts, adducts, flexes, extends, & rotates arm medially
- N: axillary n. – C5, C6

Teres major

- O: dorsal surface of inferior angle of scapula
- I: medial lip of intertubercular groove of humerus
- A: adducts & rotates arm medially
- N: lower subscapular n. – C6, C7

Latissimus dorsi

- O: spines of T7-T12 thoracolumbar fascia, iliac crest, ribs 9-12
- I: floor of bicipital groove of humerus
- A: adducts, extends, & rotates arm medially
- N: thoracodorsal n. – C6, C7, C8

Rotator Cuff**Supraspinatus**

- O: supraspinous fossa of scapula
- I: superior facet of greater tubercle of humerus
- A: abducts arm
- N: suprascapular n. – C4, C5

Infraspinatus

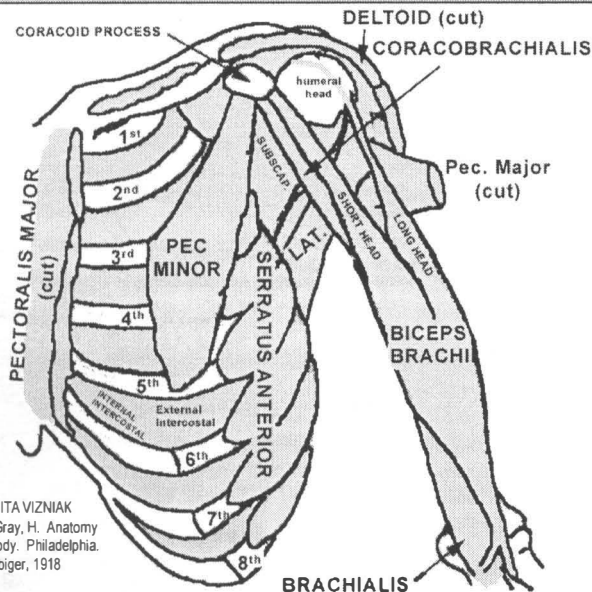
- O: infraspinous fossa
- I: middle facet of greater tubercle of humerus
- A: rotates arm laterally
- N: suprascapular n. – C5, C6

Teres minor

- O: upper portion of lateral border of scapula
- I: lower facet of greater tubercle of humerus
- A: rotates arm laterally
- N: axillary n. – C5, C6

Subscapularis

- O: subscapular fossa
- I: lesser tubercle of humerus
- A: rotates arm medially
- N: upper & lower subscapular n. – C5, C6, C7



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Pectoralis major

- O: clavicular *head*, anterior surface of medial 1/2 of clavicle;
sternocostal head, anterior surface of sternum & superior six costal cartilages
I: lateral lip of intertubercular groove of humerus
A: abducts & medially rotates humerus
N: lateral & medial pectoral nn. - C5, C6, C7, C8, T1

Brachialis

- O: lower anterior surface of humerus
I: coronoid process of ulna & ulnar tuberosity
A: flexes forearm
N: musculocutaneous n. - C5, C6

Coracobrachialis

- O: coracoid process
I: middle third of medial surface of humerus
A: flexes & adducts arm
N: musculocutaneous n. - C5, C6, C7

Anconeus

- O: lateral epicondyle of humerus
I: olecranon & upper posterior surface of ulna
A: extends forearm
N: radial n. - C7, C8, T1

Pectoralis minor

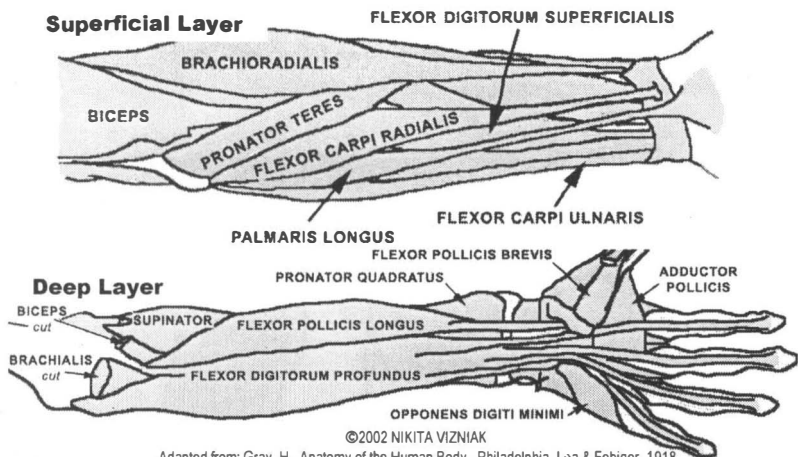
- O: ribs 3-5 near costal cartilage
I: coracoid process of scapula
A: stabilizes scapula by moving it inferiorly & anteriorly against thoracic wall
N: medial pectoral n. - C8, T1

Biceps brachii

- O: *long head*, supraglenoid tubercle;
short head, coracoid process
I: radial tuberosity of radius
A: flexes arm & forearm, supinates forearm
N: musculocutaneous n. - C5, C6

Triceps

- O: *long head*, infraglenoid tubercle;
lateral head superior to radial groove of humerus;
medial head, inferior to radial groove
I: posterior surface of olecranon process of ulna
A: extends forearm
N: radial n. - C6, C7, C8



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Pronator teres

- O: medial epicondyle & coronoid process of ulna
- I: middle of lateral side of radius
- A: pronates forearm
- N: median n. – C6, C7

Palmaris longus

- O: medial epicondyle of humerus
- I: flexor retinaculum, palmar aponeurosis
- A: flexes hand & forearm
- N: median n. – C7, C8

Flexor digitorum superficialis

- O: medial epicondyle, coronoid process, oblique line of radius
- I: middle phalanges of finger
- A: flexes proximal interphalangeal joints, flexes hand & forearm
- N: median n. – C7, C8, T1

Flexor pollicis longus

- O: anterior surface of radius, interosseous membrane, & coronoid process
- I: base of distal phalanx of thumb
- A: flexes thumb
- N: median n. – C8, T1

Flexor carpi radialis

- O: medial epicondyle of humerus
- I: bases of 2nd & 3rd metacarpals
- A: flexes forearm, flexes & abducts hand
- N: median n. – C6, C7

Flexor carpi ulnaris

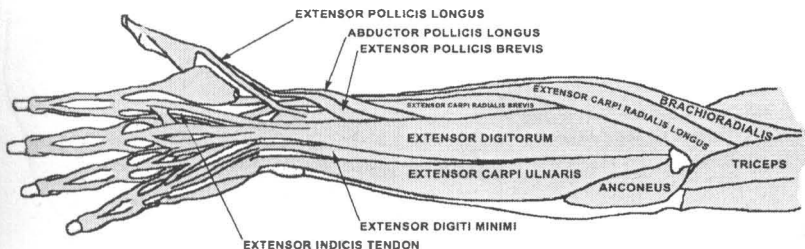
- O: medial epicondyle, medial olecranon, & posterior border of ulna
- I: pisiform, hook of hamate, & base of 5th metacarpal
- A: flexes & adducts hand, flexes forearm
- N: ulnar n. – C7, C8

Flexor digitorum profundus

- O: anteromedial surface of ulna, interosseous membrane
- I: bases of distal phalanges of fingers
- A: flexes distal interphalangeal joints & hand
- N: ulnar & median nn. – C8, T1

Pronator quadratus

- O: anterior surface of distal ulna
- I: anterior surface of distal radius
- A: pronates forearm
- N: median n. – C8, T1



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Brachioradialis

- O: lateral supracondylar ridge of humerus
- I: base of radial styloid process
- A: flexes forearm
- N: radial n. – C5, C6, C7

Extensor carpi radialis longus

- O: lateral supracondylar ridge of humerus
- I: dorsum of base of 2nd metacarpal
- A: extends & abducts hand
- N: radial n. – C6, C7

Extensor digiti minimi

- O: common extensor tendon & interosseous membrane
- I: extensor expansion, base of middle & distal phalanges
- A: extends little finger
- N: radial n. – C7, C8

Abductor pollicis longus

- O: interosseous membrane, middle 3rd of posterior surfaces of radius & ulna
- I: lateral surface of base of 1st metacarpal
- A: abducts thumb & hand
- N: radial n. – C7, C8

Extensor pollicis brevis

- O: interosseous membrane & posterior surface of middle 3rd of radius
- I: base of proximal phalanx of thumb
- A: extends proximal phalanx of thumb & abducts hand
- N: radial n. – C7, C8

Supinator

- O: lateral epicondyle, radial collateral and annular ligaments
- I: lateral side of upper part of radius
- A: supinates forearm
- N: radial n. – C5, C6

Extensor carpi radialis brevis

- O: lateral epicondyle of humerus
- I: posterior base of 3rd metacarpal
- A: extends fingers & abducts hands
- N: radial n. – C7, C8

Extensor carpi ulnaris

- O: lateral epicondyle & posterior surface of ulna
- I: base of 5th metacarpal
- A: extends & adducts hand
- N: radial n. – C7, C8

Extensor digitorum

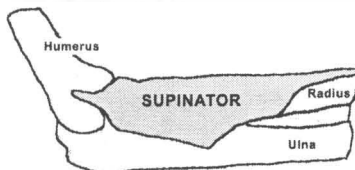
- O: lateral epicondyle of humerus
- I: extensor expansion, base of middle & distal phalanges
- A: extends fingers & hand
- N: radial n. – C7, C8

Extensor pollicis longus

- O: interosseous membrane & middle 3rd of posterior surface of ulna
- I: base of distal phalanx of thumb
- A: extends distal phalanx of thumb & abducts hand
- N: radial n. – C7, C8

Extensor indicis

- O: posterior surface of ulna & interosseous membrane
- I: extensor expansion of index finger
- A: extends index finger
- N: radial n. – C7, C8



Rectus abdominis

- O: pubic crest & pubic symphysis
 I: xiphoid process & costal cartilages 5-7
 A: depresses ribs; flexes trunk
 N: intercostal n. (T7-T11); subcostal n. (T12)

External oblique

- O: external surface of lower eight ribs (5-12)
 I: anterior half of iliac crest; anterior superior iliac spine; pubic tubercle; linea alba
 A: compresses abdomen; flexes trunk; active in forced expiration
 N: intercostal n. (T7-T11); subcostal n. (T12)

Internal oblique

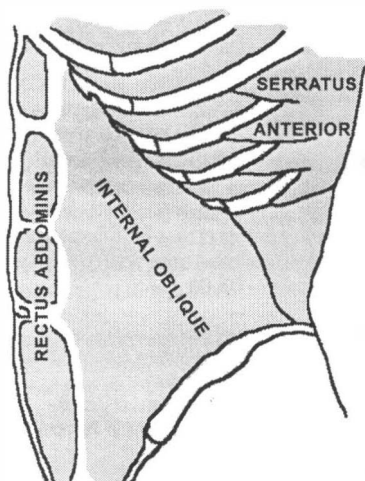
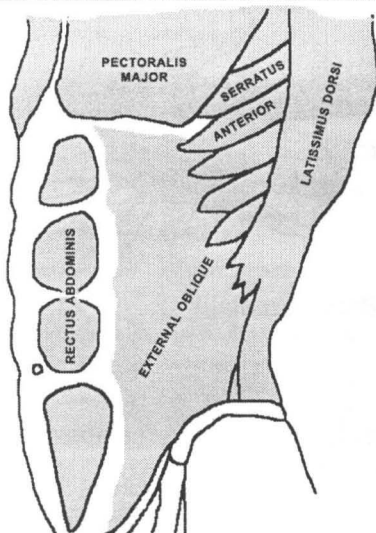
- O: lateral two-thirds of inguinal ligament; iliac crest; thoracolumbar fascia
 I: lower four costal cartilages; linea alba; pubic crest; pectineal line
 A: compresses abdomen; flexes trunk; active in forced expiration
 N: intercostal n. (T7-T11); subcostal n. (T12); iliohypogastric & ilioinguinal nn. (L1)

Transversus abdominis

- O: lateral third of inguinal ligament; iliac crest; thoracolumbar fascia; lower six costal cartilages
 I: linea alba; pubic crest; pectineal line
 A: compresses abdomen; depresses ribs
 N: intercostal n. (T7-T12); subcostal n. (T12); iliohypogastric & ilioinguinal nn. (L1)

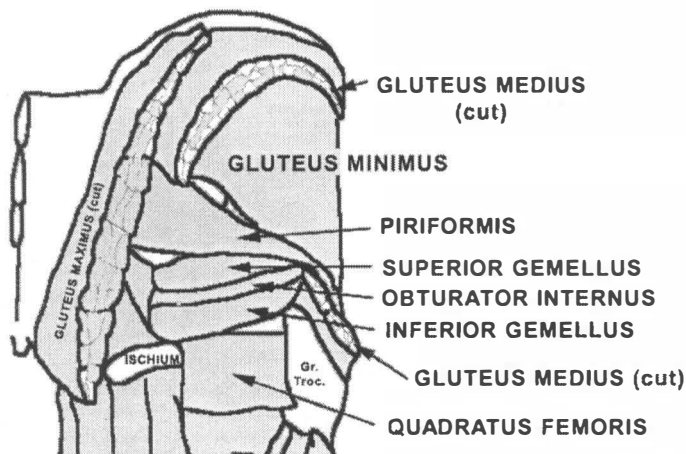
Pyramidalis

- O: pubic body
 I: linea alba
 A: tenses linea alba
 N: subcostal n. (T12)



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Gluteus maximus

- O: ilium; sacrum; coccyx; sacrotuberous ligament
- I: gluteal tuberosity; iliotibial tract
- A: extends & rotates thigh laterally
- N: inferior gluteal n. – L5, S1, S2

Gluteus medius

- O: ilium between iliac crest, & anterior & posterior gluteal lines
- I: greater trochanter
- A: abducts & rotates thigh medially
- N: superior gluteal n. – L5, S1

Gluteus minimus

- O: ilium between anterior & inferior gluteal lines
- I: greater trochanter
- A: abducts & rotates thigh medially
- N: superior gluteal n. – L5, S1

Tensor fasciae latae

- O: iliac crest; anterior-superior iliac spine (ASIS)
- I: iliotibial tract
- A: flexes, abducts, & rotates thigh medially
- N: superior gluteal n. – L4, L5

Quadratus femoris

- O: ischial tuberosity
- I: intertrochanteric crest
- A: rotates thigh laterally
- N: nerve to quadratus femoris – L5, S1

Piriformis

- O: pelvic surface of sacrum; sacrotuberous ligament
- I: upper end of greater trochanter
- A: rotates thigh laterally
- N: sacral n. – S1, S2

Obturator internus

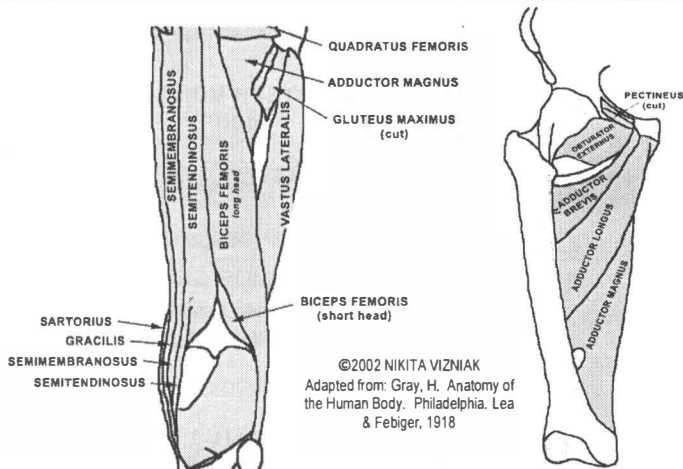
- O: ischiopubic rami; obturator membrane
- I: greater trochanter
- A: abducts & rotates thigh laterally
- N: nerve to obturator internus – L5, S1

Superior gemellus

- O: ischial spine
- I: obturator internus tendon
- A: rotates thigh laterally
- N: nerve to obturator internus – L5, S1

Inferior gemellus

- O: ischial tuberosity
- I: obturator internus tendon
- A: rotates thigh laterally
- N: nerve to quadratus femoris – L5, S1



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Semitendinosus

- O: ischial tuberosity
- I: medial surface of upper part of tibia
- A: extends thigh; flexes/rotates leg medially
- N: tibial portion of sciatic n. – L5, S1, S2

Semimembranosus

- O: ischial tuberosity
- I: medial condyle of tibia
- A: extends thigh; flexes & rotates leg medially
- N: tibial portion of sciatic n. – L5, S1, S2

Biceps femoris

- O: long head from ischial tuberosity; short head from linea aspera & upper supracondylar line
- I: head of fibula
- A: extends thigh; flexes & rotates leg laterally – N: L5, S1, S2
- N: common peroneal (short head) & tibial (long head) divisions of sciatic n.

Obturator externus

- O: margin of obturator foramen & obturator membrane
- I: intertrochanteric fossa of femur
- A: rotates thigh laterally
- N: obturator n. – L3, L4

Adductor longus

- O: body of pubis below its crest
- I: middle 3rd of linea aspera
- A: adducts & flexes thigh
- N: obturator n. – L2, L3, L4

Adductor brevis

- O: body & inferior pubic ramus
- I: pectineal line; upper part of linea aspera
- A: adducts & flexes thigh
- N: obturator n. – L2, L3, L4

Adductor magnus

- O: ischiopubic ramus; ischial tuberosity
- I: linea aspera; medial supracondylar line adductor tubercle
- A: adducts, flexes & extends thigh
- N: obturator & sciatic n. – L2, L3, L4

Gracilis

- O: body & inferior pubic ramus
- I: medial surface of upper quarter of tibia
- A: adducts & flexes thigh; flexes & rotates leg medially
- N: obturator n. – L2, L3

Pectineus

- O: pectineal line of pubis
- I: pectineal line of femur
- A: adducts & flexes thigh
- N: obturator & femoral n. - L2, L3

Psoas major

- O: Transverse processes, intervertebral discs & bodies of T12-L5
 I: Lesser trochanter
 A: Flexes thigh & trunk
 N: L1, L2, L3

Psoas minor

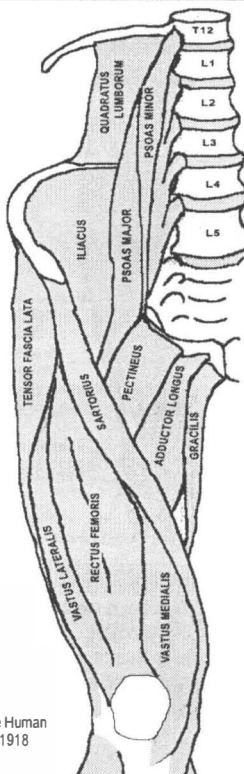
- O: Bodies & intervertebral discs of T12-L1
 I: Pectineal line; iliopectineal eminence
 A: Aids in flexing of trunk
 N: L1

Iliacus

- O: iliac fossa; ala of sacrum
 I: lesser trochanter
 A: flexes & rotates thigh medially (with psoas major)
 N: femoral n. – L2, L3

Sartorius

- O: anterior-superior iliac spine (ASIS)
 I: upper medial side of tibia
 A: flexes & rotates thigh laterally; flexes & rotates leg medially
 N: femoral n. – L2, L3



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Q u a d r i c e p s**Rectus femoris**

- O: anterior-inferior iliac spine; posterior-superior rim of acetabulum
 I: base of patella; tibial tuberosity
 A: flexes thigh; extends leg
 N: femoral n. – L2, L3, L4

Vastus medialis

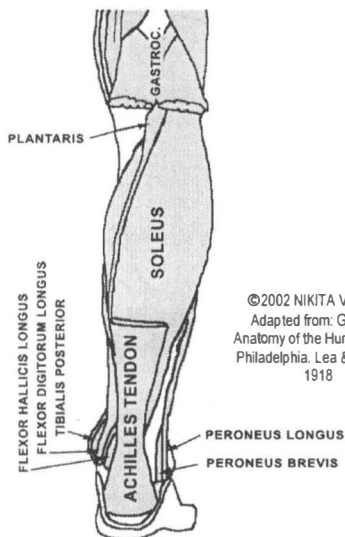
- O: intertrochanteric line; linea aspera; medial intermuscular septum
 I: medial side of patella; tibial tuberosity
 A: extends leg
 N: femoral n. – L2, L3, L4

Vastus lateralis

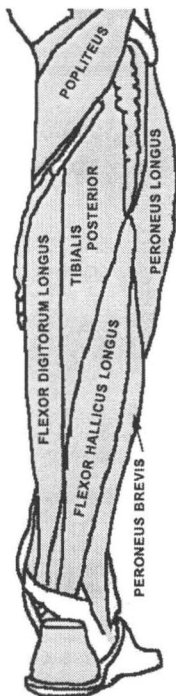
- O: intertrochanteric line; greater trochanter; linea aspera; gluteal tuberosity; lateral intermuscular septum
 I: lateral side of patella; tibial tuberosity
 A: extends leg
 N: femoral n. – L2, L3, L4

Vastus intermedius

- O: upper shaft of femur; lower lateral intermuscular septum
 I: upper border of patella; tibial tuberosity
 A: extends leg
 N: femoral n. – L2, L3, L4



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Gastrocnemius

- O: lateral (lateral head) & medial (medial head) femoral condyles
- I: posterior aspect of calcaneus
- A: flexes knee; plantar flexes foot
- N: tibial n. – S1, S2

Plantaris

- O: lower lateral supracondylar line
- I: posterior surface of calcaneus
- A: flexes & rotates leg medially
- N: tibial n. – S1, S2

Soleus

- O: upper fibula head; soleal line on tibia
- I: posterior aspect of calcaneus
- A: plantar flexes foot
- N: tibial n. – S1, S2

Flexor hallucis longus

- O: lower two-thirds of fibula; interosseous membrane; intermuscular septa
- I: base of distal phalanx of big toe
- A: flexes distal phalanx of big toe
- N: tibial n. – S2, S3

Flexor digitorum longus

- O: middle posterior aspect of tibia
- I: distal phalanges of lateral four toes
- A: flexes lateral four toes; plantar flexes foot
- N: tibial n. – S2, S3

Tibialis posterior

- O: interosseous membrane; upper parts of tibia & fibula
- I: tuberosity of navicular; sustentaculum tali; three cuneiforms; cuboid; bases of metatarsals 2-4
- A: plantar flexes & inverts foot
- N: tibial n. – L4, L5

Popliteus

- O: lateral condyle of femur; popliteal ligament
- I: upper posterior side of tibia
- A: flexes & rotates leg medially
- N: tibial n. – L4, L5, S1

Anterior Compartment

Tibialis anterior

- O: lateral tibial condyle; interosseous membrane
 I: first cuneiform; first metatarsal
 A: dorsiflexes & inverts foot
 N: deep peroneal n. – L4, L5

Extensor digitorum longus

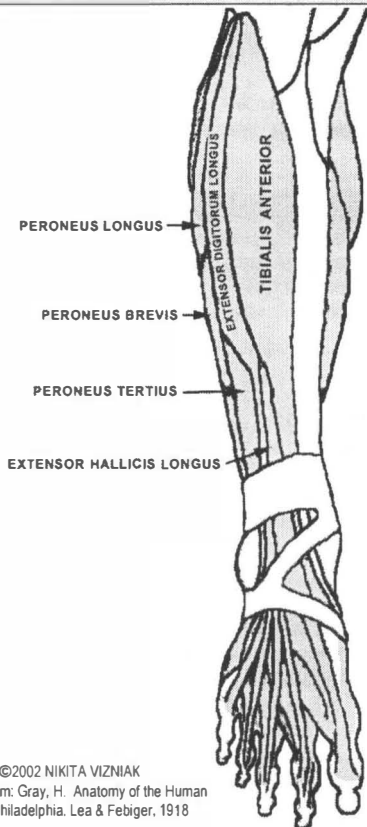
- O: lateral tibial condyle; upper two-thirds of fibula;
 interosseous membrane
 I: bases of middle & distal phalanges
 A: extends toes; dorsiflexes foot
 N: deep peroneal n. – L5, S1

Extensor hallucis longus

- O: middle half of anterior surface of fibula;
 interosseous membrane
 I: base of distal phalanx of big toe
 A: extends big toe; dorsiflexes & inverts foot
 N: deep peroneal n. – L5, S1

Peroneus tertius

- O: distal 3rd of fibula; interosseous membrane
 I: base of fifth metatarsal
 A: dorsiflexes & everts foot
 N: deep peroneal n. – L5, S1



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Lateral Compartment

Peroneus longus

- O: lateral tibial condyle; head & upper lateral side
 of fibula
 I: base of first metatarsal; medial cuneiform
 A: everts & plantar flexes foot
 N: superficial peroneal n. – L5, S1, S2

Peroneus brevis

- O: lower lateral side of fibula; intermuscular
 septa
 I: base of fifth metatarsal
 A: everts & plantar flexes foot
 N: superficial peroneal n. – L5, S1, S2

Abductor pollicis brevis

- O: flexor retinaculum, scaphoid, and trapezium
- I: lateral side of base of proximal phalanx of thumb
- A: abducts thumb
- N: median n.

Opponens pollicis

- O: flexor retinaculum and trapezium
- I: lateral side of first metacarpal
- A: opposes thumb to other digits
- N: median n.

Flexor pollicis brevis

- O: flexor retinaculum and trapezium
- I: base of proximal phalanx of thumb
- A: flexes thumb
- N: median n.

Opponens digiti minimi

- O: flexor retinaculum and hook of halmate
- I: medial side of fifth metacarpal
- A: opposes little finger
- N: ulnar n.

Abductor digiti minimi

- O: pisiform and tendon of flexor carpi ulnaris
- I: medial side of base of proximal phalanx of little finger
- A: abducts little finger
- N: ulnar n.

Flexor digiti minimi brevis

- O: flexor retinaculum and hook of halmate
- I: medial side of base of proximal phalanx of little finger
- A: flexes proximal phalanx of little finger
- N: ulnar n.

Adductor pollicis

- O: capitate and bases of second and third metacarpals (oblique head); palmar surface of third metacarpal (transverse head)
- I: medial side of base of proximal phalanx of the thumb
- A: adducts thumbs
- N: ulnar n.

Dorsal interossei (4)

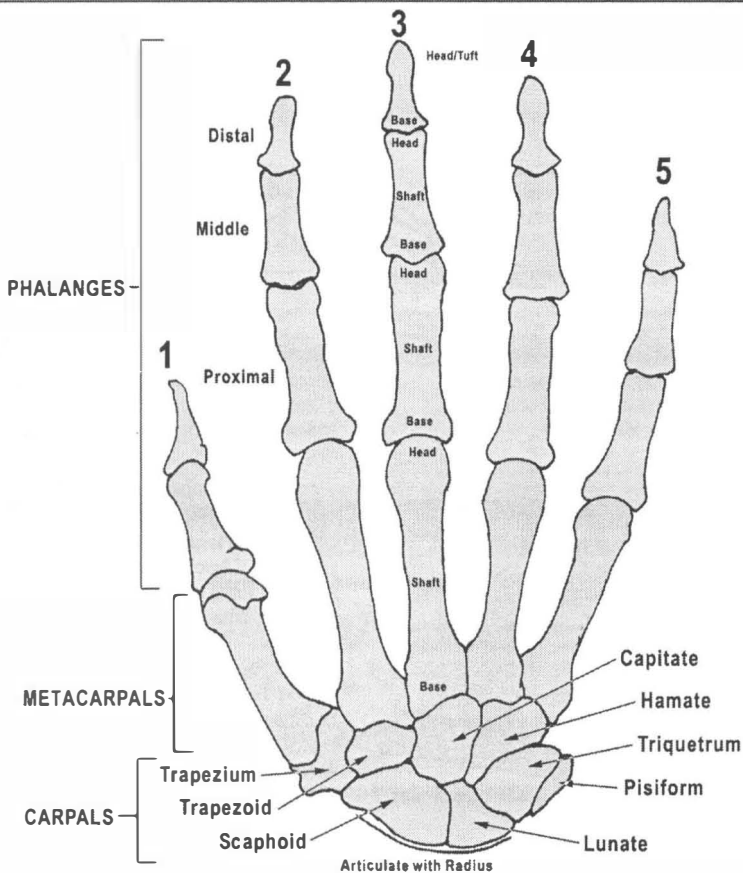
- O: adjacent sides of metacarpal bones
- I: lateral sides of bases of proximal phalanges; extensor expansion
- A: abduct fingers; flex metacarpophalangeal joints; extend interphalangeal joints
- N: ulnar n.

Lumbricals (4)

- O: lateral side of tendons of flexor digitorum profundus
- I: lateral side of extensor expansion
- A: flex metacarpophalangeal joints and extend interphalangeal joints
- N: median (two lateral) and ulnar (two medial)

Palmar interossei (3)

- O: medial side of second metacarpal; lateral sides of fourth and fifth metacarpals
- I: base of proximal phalanges in same sides as their origins; extensor expansion
- A: adduct fingers; flex metacarpophalangeal joints; extend interphalangeal joints
- N: ulnar n.



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Adapted from: Gray, H. *Anatomy of the Human Body*. Philadelphia, Lea & Febiger, 1918**Mnemonic for Carpal Bone Order**

Some
Lovers
Try
Positions
That
They
Can't
Handle

Scaphoid
Lunate
Triquetrum
Pisiform
Trapezium
Trapezoid
Capitate
Hamate

Use for order in anatomical position

Proximal Row – lateral to medial
Scaphoid, Lunate, Triquetrum, Pisiform

Distal Row – lateral to medial
Trapezium, Trapezoid, Capitate, Hamate

Dorsum of Foot

Extensor digitorum brevis

- O: dorsal surface of calcaneus
- I: tendons of extensor digitorum longus
- A: extends toes
- N: deep peroneal n.

Extensor hallucis brevis

- O: dorsal surface of calcaneus
- I: base of proximal phalanx of big toe
- A: extends big toe
- N: deep peroneal n.

Sole of Foot

Abductor hallucis

- O: medial tubercle of calcaneus
- I: base of proximal phalanx of big toe
- A: abducts big toe
- N: medial plantar n.

Flexor digitorum brevis

- O: medial tubercle of calcaneus
- I: middle phalanges of lateral four toes
- A: flexes middle phalanges of lateral four toes
- N: medial plantar n.

Flexor digitorum brevis

- O: medial tubercle of calcaneus
- I: middle phalanges of lateral four toes
- A: flexes middle phalanges of lateral four toes
- N: medial plantar n.

Quadratus plantae

- O: medial and lateral side of calcaneus
- I: tendons of flexor digitorum longus
- A: aids in flexing toes
- N: lateral plantar n.

Lumbricals (4)

- O: tendons of flexor digitorum longus
- I: proximal phalanges; extensor expansion
- A: flexes metatarsophalangeal joints and extend interphalangeal joints
- N: 1st by medial plantar n.; lateral three by lateral plantar n.

Flexor hallucis brevis

- O: cuboid; third cuneiform
- I: proximal phalanx of big toe
- A: flexes big toe
- N: medial plantar n.

Adductor hallucis

- O: oblique head: bases of metatarsals 2-4
transverse head: capsule of lateral four metatarsophalangeal joints
- I: proximal phalanx of big toe
- A: adducts big toe
- N: lateral plantar n.

Flexor digiti minimi brevis

- O: base of metatarsal 5
- I: proximal phalanx of little toe
- A: flexes little toe
- N: lateral plantar n.

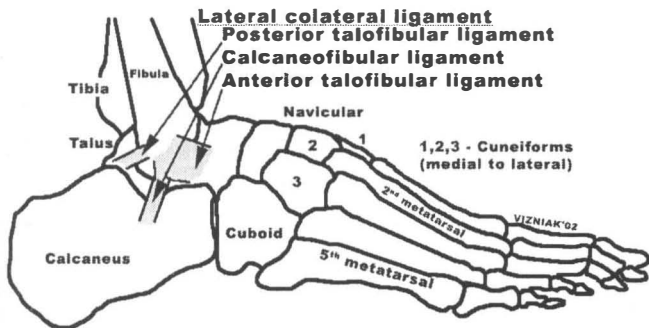
Plantar interossei (3)

- O: medial sides of metatarsals 3-5
- I: medial sides of base of proximal phalanges 3-5
- A: adduct toes; flex proximal and extend distal phalanges
- N: lateral plantar n.

Dorsal interossei (4)

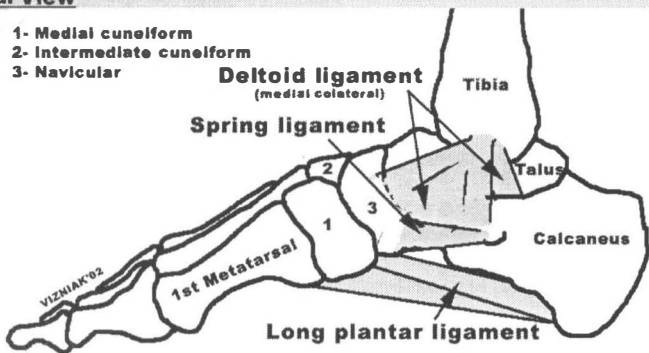
- O: adjacent shafts of metatarsals
- I: proximal phalanges of second toes (medial and lateral sides), and third and fourth toes (lateral sides)
- A: abduct toes; flex proximal, and extend distal phalanges
- N: lateral plantar n.

Lateral View

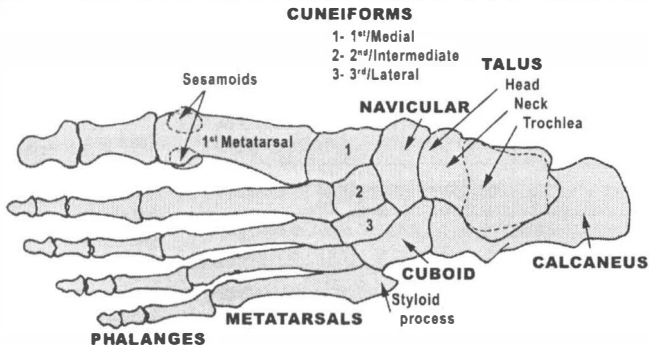


Medial View

- 1- Medial cuneiform
- 2- Intermediate cuneiform
- 3- Navicular



Superior View



©2002 NIKITA VIZNIAK - Adapted from: Gray, H. Anatomy of the Human Body. Philadelphia. Lea & Febiger, 1918

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X Muscle Testing

Ankle	274-276
Ankle & Knee.....	277
Knee & Hip	278-281
Hip.....	282-283
Shoulder.....	284-288
Shoulder & Arm...	289
Arm.....	290
Wrist.....	291

Procedure

General screening – test muscle in mid range of motion (ROM)

Specific muscle testing – approximate origin and insertion of muscle as much as possible

1. Position patient in most pain free and optimal stance for testing
2. Use good doctor position and body mechanics
3. Demonstrate to patient the motion you want them to resist
4. Ask patient to hold position and relax when test is done ("hold, hold, hold, and relax")
 - Typically patient holds position for 3 seconds
 - If there is a high index of suspicion of damage or neurologic compromise
 - Hold for 5 seconds or,
 - Repeat for up to 10 repetitions (e.g. chart as 3/5 at 8x)
 - Test at multiple angles through ROM, eccentrically & concentrically
 - Joint should only be moved approximately 10° or through 10% of range of motion
 - Common error is to move joint too much, thereby testing many different muscle and effecting reliability and validity
 - Consider testing in positions or actions that cause patient the most pain
5. Compare results bilaterally and keep in mind dominant sides

Grading System

Grade		Definition
5	Normal	Complete ROM against gravity w/ full resistance
4	Good*	Complete ROM against gravity w/ some resistance <i>(reduced fine movements and motor control)</i>
3	Fair*	Complete ROM against gravity but no resistance
2	Poor*	Complete ROM w/ gravity eliminated
1	Trace	Evidence of slight contractility; <i>no joint motion or inability to achieve complete ROM w/ gravity eliminated.</i>
0	Zero	No evidence of contractility (flaccid)

ROM = range of motion, *Muscle spasm or contracture may limit ROM. Place question mark after grading a movement that is incomplete from this cause. Chart as a rating out of 5; e.g.: 5/5, 4/5, 3/5, 2/5, 1/5, 0/5

Adapted, with permission, from MA Carnes, DC. *Human Biomechanics & Muscle Testing*. WSCC. 2000.

Peroneus brevis

Patient Position:

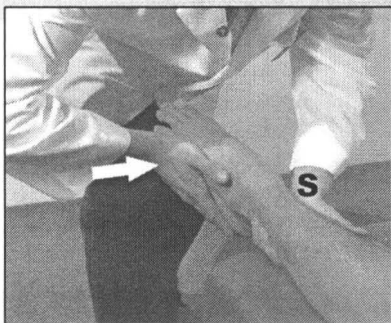
- Plantar flexed & everted
- Pt. supine

Stabilization

- Above ankle joint

Doctor's Force:

- Straight lateral to medial

**Peroneus tertius**

Patient Position:

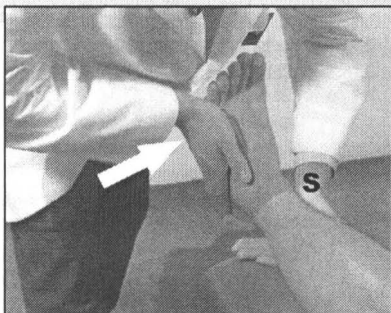
- Dorsiflexed & everted
- Pt. supine

Stabilization

- Above ankle joint

Doctor's Force:

- Diagonal from lateral to medial & towards plantar flexion

**Peroneus longus**

Patient Position:

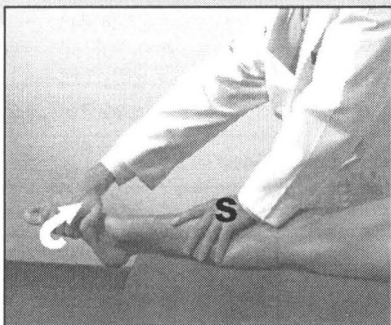
- Plantar flexed & everted
- Pt. supine

Stabilization

- Above ankle joint

Doctor's Force:

- Rotational from medial to lateral & towards dorsiflexion
- "Motor bike" motion



Tibialis anterior

Patient Position:

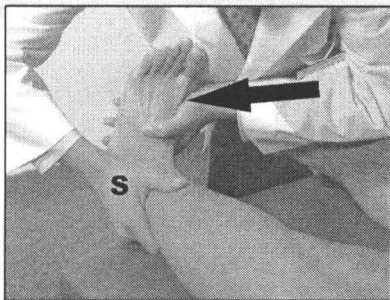
- Dorsiflexed & inverted
- Pt. supine

Stabilization

- Above ankle joint

Doctor's Force:

- Diagonal from medial to lateral & towards plantar flexion

**Extensor hallucis longus**

Patient Position:

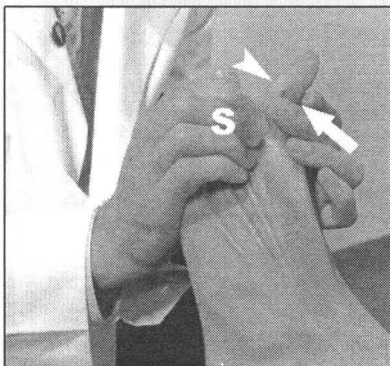
- Great toe extended (O & I approximated)
- Pt. supine, ankle in neutral position

Stabilization

- Over digits 2-5

Doctor's Force:

- Towards flexion of great toe

**Extensor digitorum longus**

Patient Position:

- 2nd-5th toes extended (O & I approximated)
- Pt. supine, ankle in neutral position

Stabilization

- Over great toe (1st digit)

Doctor's Force:

- Towards flexion of 2nd-5th digits



Tibialis posterior

Patient Position:

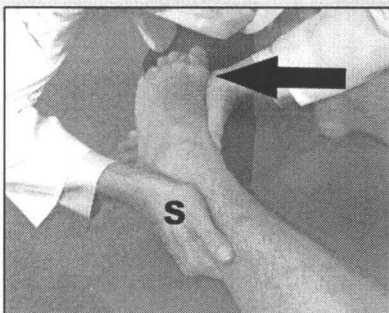
- Plantar flexed & inverted
- Pt. supine

Stabilization

- Above ankle joint

Doctor's Force:

- Diagonal from medial to lateral & towards dorsiflexion

**Flexor hallucis longus**

Patient Position:

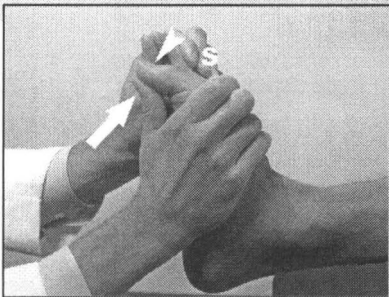
- Great toe flexed (O & I approximated)
- Pt. supine, ankle in neutral position

Stabilization

- Over digits 2-5

Doctor's Force:

- Towards extension of great toe

**Flexor digitorum longus**

Patient Position:

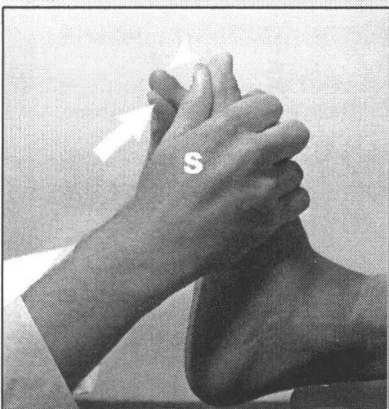
- 2nd-5th toes flexed (O & I approximated)
- Pt. supine, ankle in neutral position

Stabilization

- Over great toe (1st digit)

Doctor's Force:

- Towards extension of 2nd-5th digits



Gastrocnemius

Patient Position:

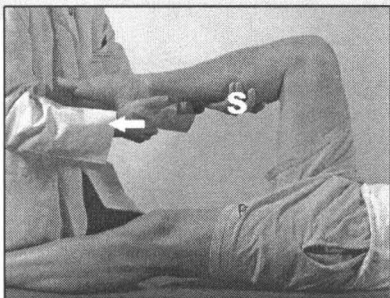
- Plantar flexed
- Pt. supine, knee & hip flexed 90°

Stabilization

- Proximal to ankle joint

Doctor's Force:

- Pull calcaneus towards dorsiflexion

**Soleus**

Patient Position:

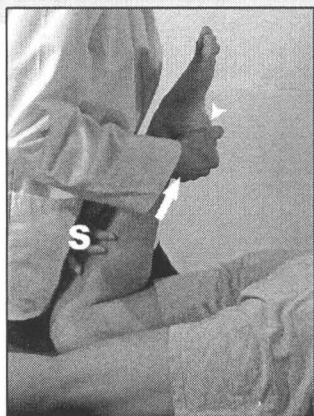
- Plantar flexed
- Pt. prone, knee flexed 110°

Stabilization

- Proximal to ankle joint

Doctor's Force:

- Lift calcaneus towards dorsiflexion

**Popliteus**

Patient Position:

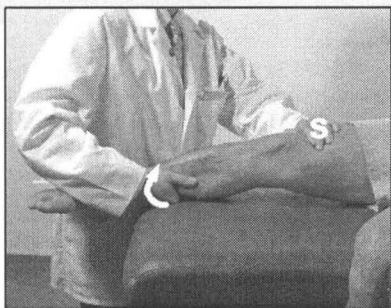
- Leg extended, pt. supine
- Knee slightly flexed 10°-20°

Stabilization

- Proximal to knee joint

Doctor's Force:

- Rotational medial to lateral
(external rotation of tibia)



Medial Hamstrings

Patient Position:

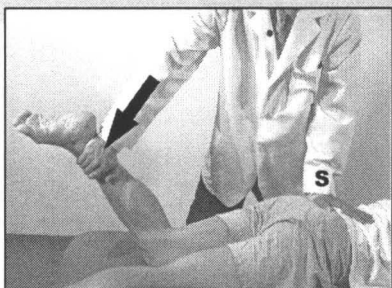
- Knee flexed 60-80°
- Hip adducted slightly
- Leg internally rotated

Stabilization

- Dorsal sacrum

Doctor's Force:

- Towards knee extension

**Lateral Hamstrings**

Patient Position:

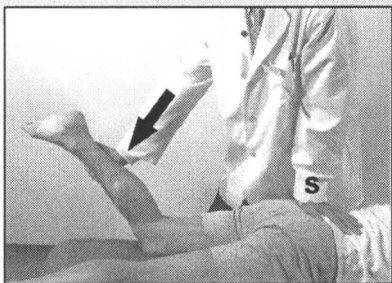
- Knee flexed 60-80°
- Hip abducted slightly
- Leg externally rotated

Stabilization

- Dorsal sacrum

Doctor's Force:

- Towards knee extension

**Pectineus**

Patient Position:

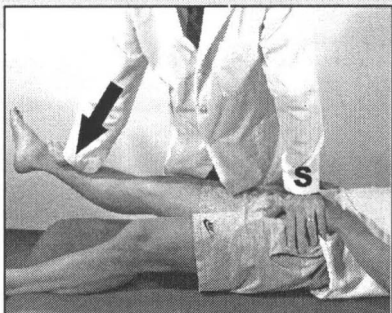
- Hip flexed 20-30°
- Hip abducted slightly
- Leg externally rotated

Stabilization

- Opposite ASIS

Doctor's Force:

- Diagonal towards hip extension & abduction



Gracilis

Patient Position:

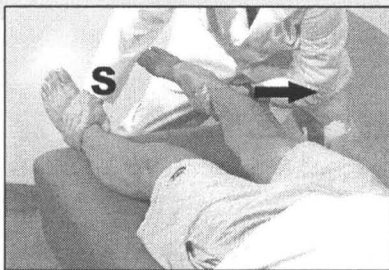
- Leg internally rotated

Stabilization

- Opposite ankle

Doctor's Force:

- Towards abduction

**Adductor longus & brevis**

Patient Position:

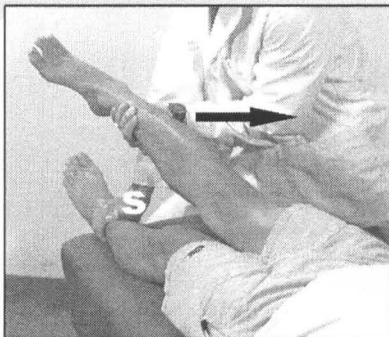
- Leg internally rotated
- Hip flexed 25°

Stabilization

- Opposite ankle

Doctor's Force:

- Towards hip abduction

**Adductor magnus**

Patient Position:

- Leg internally rotated
- Hip flexed 10°

Stabilization

- Opposite ankle

Doctor's Force:

- Diagonal towards hip abduction & flexion



Sartorius

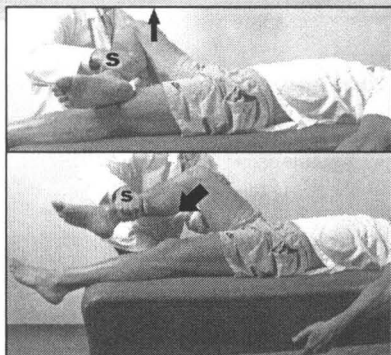
Patient Position:

- Leg in "figure-4" position

Doctor's Force:

- Towards adduction, internal rotation
- Secondly, knee extension, & hip extension

Note: Pt. stabilizes on table



Rectus femoris

Patient Position:

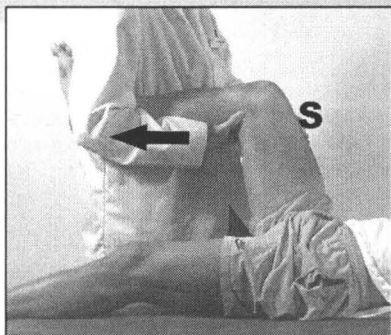
- Hip & knee flexed 90°

Stabilization

- Distal thigh

Doctor's Force:

- Towards hip extension



Vastus intermedius

Patient Position:

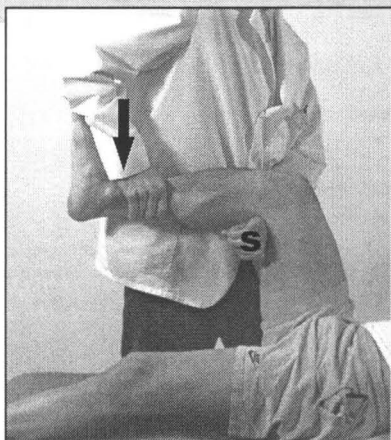
- Hip & knee flexed 90°

Stabilization

- Under knee

Doctor's Force:

- Towards knee flexion



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Vastus lateralis

Patient Position:

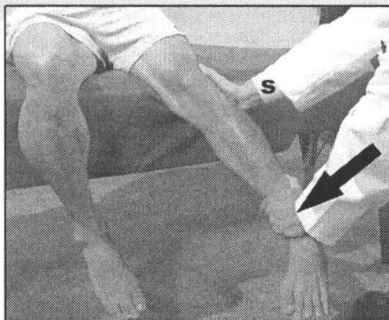
- Knee flexed 30-40°
- Tibia internally rotated

Stabilization

- Over knee gently palpating muscle

Doctor's Force:

- Towards knee flexion

**Vastus medialis**

Patient Position:

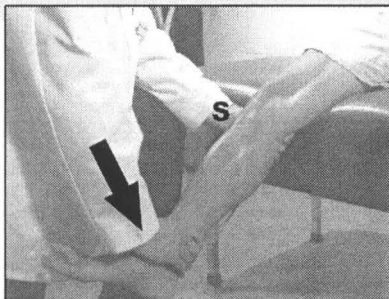
- Knee flexed 10-20°
- Tibia externally rotated

Stabilization

- Under knee

Doctor's Force:

- Towards knee flexion

**Piriformis**

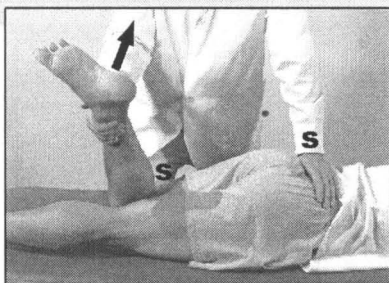
Patient Position:

- Knee flexed 90°
- Femur externally rotated

Stabilization - Knee & PSIS

Doctor's Force:

- Towards internal rotation of femur



Gluteus maximus

Patient Position:

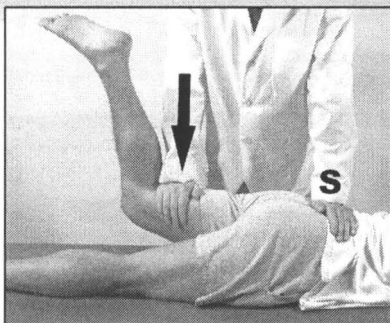
- Knee flexed 90°
- Hip fully extended

Stabilization

- PSIS

Doctor's Force:

- Towards hip flexion

**Psoas major**

Patient Position:

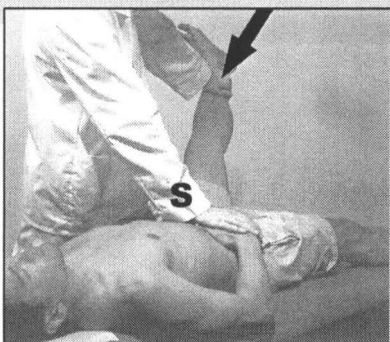
- Hip flexed 60°
- Leg abducted & externally rotated

Stabilization

- ASIS

Doctor's Force:

- Diagonal medial to lateral, towards hip extension

**Iliacus**

Patient Position:

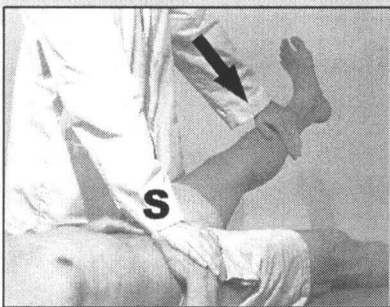
- Hip flexed 30-40°
- Leg externally rotated (not abducted)

Stabilization

- ASIS

Doctor's Force:

- Towards hip extension



Tensor fascia latae

Patient Position:

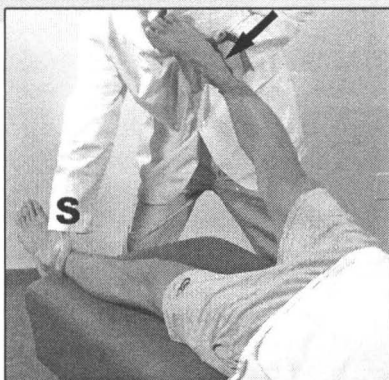
- Hip flexed 45-60°
- Abducted 30°, & internally rotated

Stabilization

- Opposite ankle

Doctor's Force:

- Diagonal towards opposite ankle (adduction & extension of hip)

**Gluteus minimus**

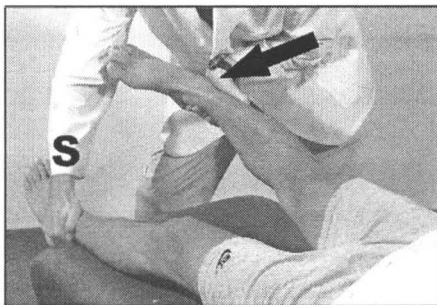
Patient Position:

- Hip flexed 20°
- Slightly abducted & internally rotated

Stabilization - opposite ankle

Doctor's Force:

- Diagonal towards opposite ankle (adduction & extension of hip)

**Gluteus medius**

Patient Position:

- Hip flexed 5°
- Slightly abducted & no rotation

Stabilization - opposite ankle

Doctor's Force:

- Diagonal towards opposite ankle (adduction of hip)



Upper Trapezius

Patient Position:

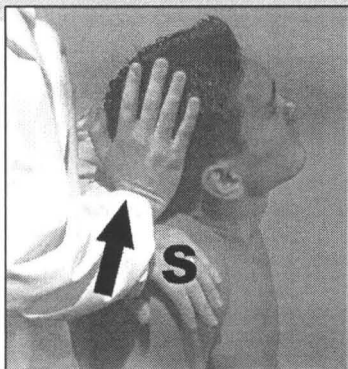
- Head laterally flexed toward, *rotated away*, & slightly extended
- Shoulder elevated

Stabilization

- Shoulder

Doctor's Force:

- Toward 75% opposite lateral flexion & 25% pressure down on shoulder

**Middle Trapezius**

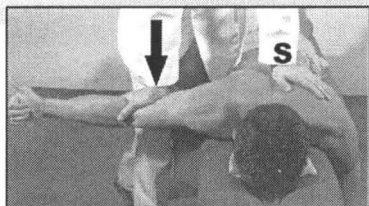
Patient Position:

- Shoulder abducted 90°, arm externally rotated

Stabilization - Opposite scapular region

Doctor's Force:

- Toward floor (horizontal adduction)

**Lower Trapezius**

Patient Position:

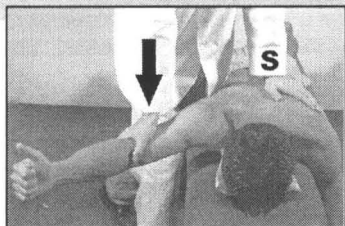
- Shoulder abducted 120°, arm externally rotated

Stabilization

- Opposite scapular region

Doctor's Force:

- Toward floor (horizontal adduction)

**Levator scapulae**

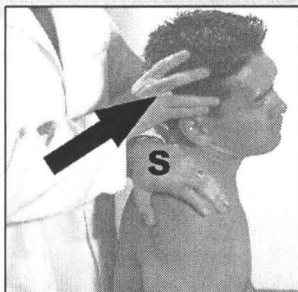
Patient Position:

- Head laterally flexed & *rotated toward*, & slightly extended
- Shoulder elevated

Stabilization - Shoulder

Doctor's Force:

- Toward 75% opposite lateral flexion & flexion, & 25% pressure down on shoulder

Adapted, with permission, from MA Carnes, DC. *Human Biomechanics & Muscle Testing*. WSCC. 2000.

Rhomboid major & minor

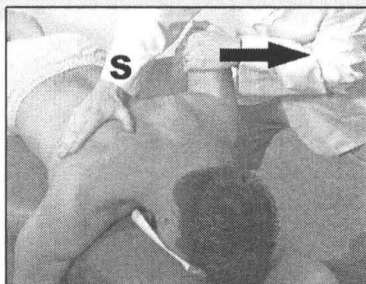
Patient Position:

- Shoulder extended & scapula adducted
- Patients hand resting on table

Stabilization - Opposite scapular region

Doctor's Force:

- Toward abduction of shoulder (straight away from body)

**Serratus anterior**

Patient Position:

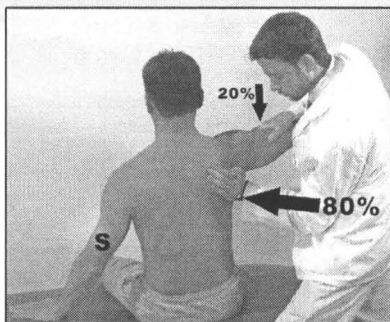
- Shoulder abducted 110°, arm externally rotated

Stabilization

- Patient on hand table

Doctor's Force:

- Toward medial rotation of scapula

**Pectoralis minor**

Patient Position:

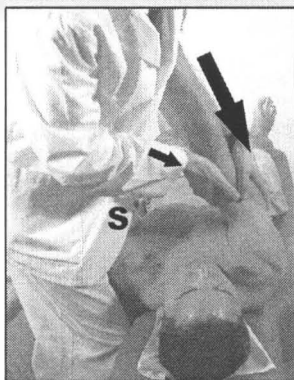
- Shoulder adducted across body
- Hand grips doctors upper arm or shoulder
- Shoulder elevated off table

Stabilization

- Patient may grip table

Doctor's Force:

- Diagonal toward retraction of scapula
- Force is **not** directed through doctor's hands, but through doctor's upper arm or shoulder



Pectoralis major**Sternal fibers**

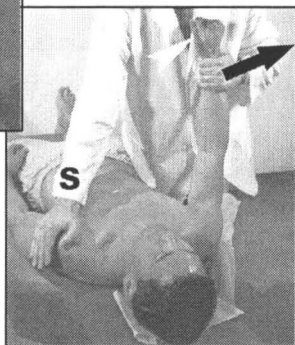
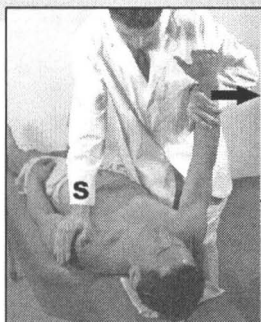
Patient Position:

- 90° internally rotated arm

Stabilization - Opposite shoulder

Doctor's Force:

- Diagonal toward horizontal abduction & slight flexion of shoulder (superiolateral from patient)

**Costal fibers**

Patient Position:

- 45° internally rotated arm

Stabilization - Opposite shoulder

Doctor's Force:

- Diagonal toward horizontal abduction & extension of shoulder

Latissimus dorsi

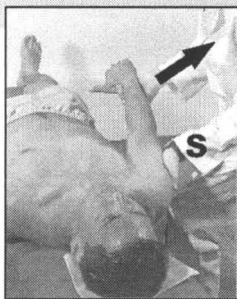
Patient Position:

- Internally rotated arm

Stabilization - Shoulder or upper arm

Doctor's Force:

- Diagonal toward abduction & flexion of shoulder (anteriolateral from patient)

**Subscapularis (lift off test)**

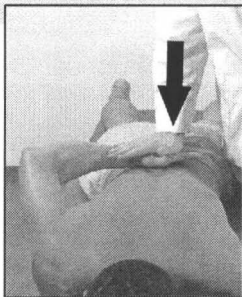
Patient Position:

- Arm behind lower lumbar spine

Stabilization - none required

Doctor's Force:

- Straight posterior to anterior
- Watch patient is lifting arm away from body, *not* extending elbow



Adapted, with permission, from MA Carnes, DC. *Human Biomechanics & Muscle Testing*. WSCC. 2000.

Supraspinatus

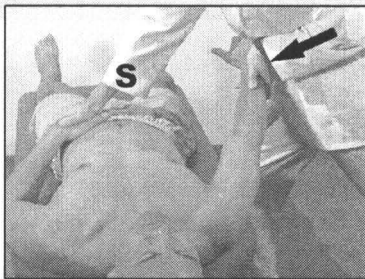
Patient Position:

- Internally rotated arm
- 10° abducted shoulder (scaption plane)

Stabilization - Opposite covered ASIS

Doctor's Force:

- Diagonal toward adduction & slight flexion of shoulder

**External rotators****(Infraspinatus & teres minor)**

Patient Position:

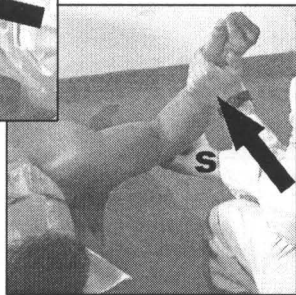
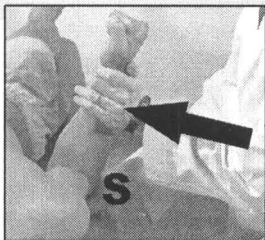
- Slightly externally rotated arm
- 90° flexed elbow

Stabilization - elbow

Doctor's Force:

- Toward internal rotation of arm

Note: Should be tested in two positions with shoulder at 0° & 90°

**Internal rotators****(Subscapularis & pec maj)**

Patient Position:

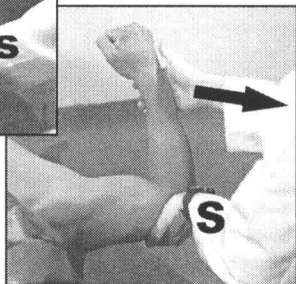
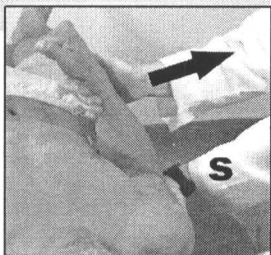
- Slightly internally rotated arm
- 90° flexed elbow

Stabilization - elbow

Doctor's Force:

- Toward external rotation of arm

Note: Should be tested in two positions with shoulder at 0° & 90°



Deltoideus – anterior fibers

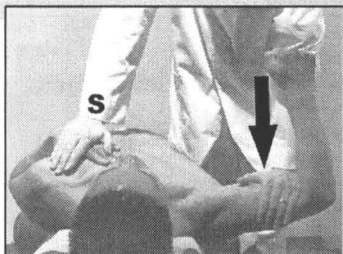
Patient Position:

- Shoulder abducted 90°, elbow flexed 90°

Stabilization – contralateral shoulder

Doctor's Force:

- Toward horizontal abduction (toward floor)

**Deltoideus – middle fibers**

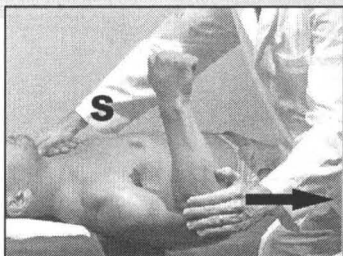
Patient Position:

- Shoulder abducted 90°, elbow flexed 90°

Stabilization – contralateral shoulder

Doctor's Force:

- Toward adduction (toward patient's body)

**Deltoideus – posterior fibers**

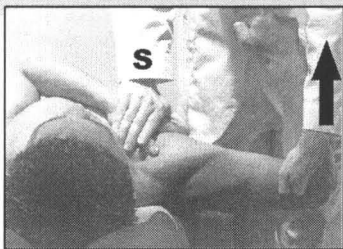
Patient Position:

- Shoulder abducted 90°, elbow flexed 90°

Stabilization – ipsilateral shoulder

Doctor's Force:

- Toward horizontal adduction (toward ceiling)

**Teres major**

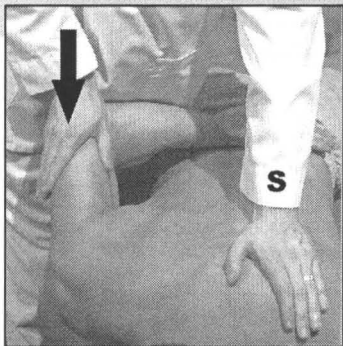
Patient Position:

- Arm behind back, hand over lumbar spine

Stabilization – opposite scapular region

Doctor's Force:

- Toward internal rotation of humerus (toward floor)



Adapted, with permission, from MA Carnes, DC. *Human Biomechanics & Muscle Testing*. WSCC. 2000.

Coracobrachialis

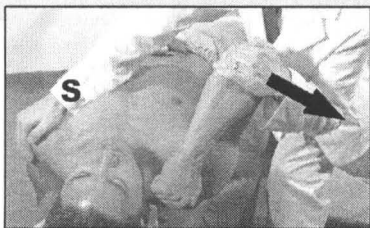
Patient Position:

- Shoulder flexed 45° & abducted 30°
- Arm flexed 150°

Stabilization - Opposite shoulder

Doctor's Force:

- Diagonal toward extension & slight adduction of shoulder

**Biceps brachii**

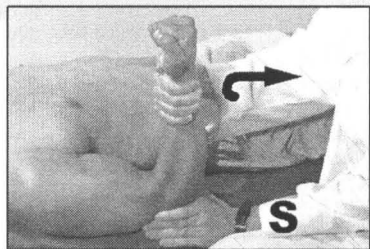
Patient Position:

- Arm flexed 90° & supinated

Stabilization - elbow

Doctor's Force:

- Toward extension of elbow & slight pronation of forearm

**Brachialis**

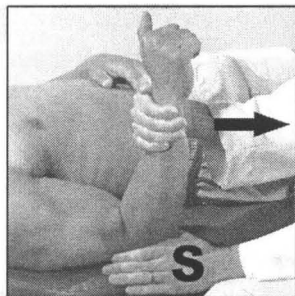
Patient Position:

- Elbow flexed 90°
- Fully pronated

Stabilization - elbow

Doctor's Force:

- Toward extension of elbow

**Brachioradialis**

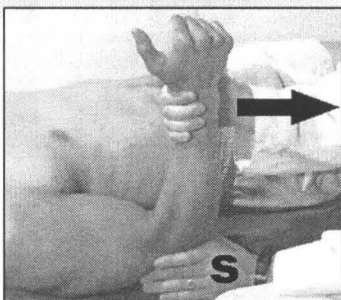
Patient Position:

- Elbow flexed 90° in neutral position

Stabilization - elbow

Doctor's Force:

- Toward extension of elbow
- Also may be done as rapid motion



Triceps

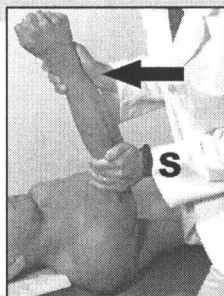
Patient Position:

- Shoulder flexed 80°, elbow slightly flexed

Stabilization - elbow

Doctor's Force:

- Toward flexion of elbow, not flexion of shoulder

**Pronator teres**

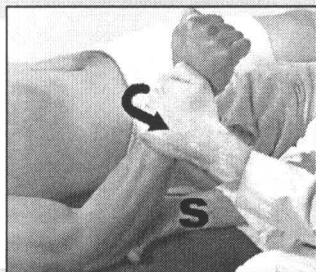
Patient Position:

- Elbow flexed 60°, forearm fully pronated

Stabilization - elbow

Doctor's Force:

- Toward supination

**Pronator quadratus**

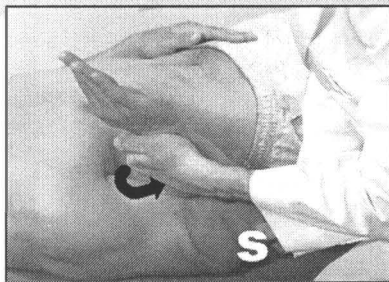
Patient Position:

- Elbow flexed 125°
- Forearm fully pronated

Stabilization - elbow

Doctor's Force:

- Toward supination

**Supinator**

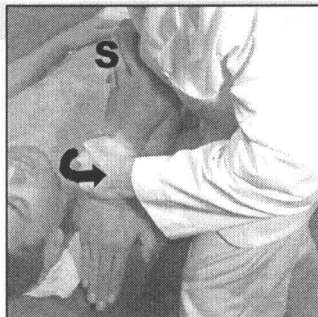
Patient Position:

- Shoulder flexed 90°, elbow flexed 150°
- Forearm fully supinated

Stabilization - elbow

Doctor's Force:

- Toward pronation



Adapted, with permission, from MA Carnes, DC. *Human Biomechanics & Muscle Testing*. WSCC. 2000.

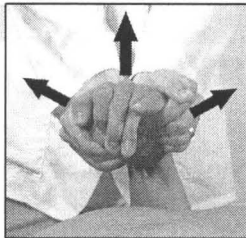
Palmaris longus

Patient Position:

- Supine, elbow flexed 90°, wrist fully flexed
- Thenar & hypothenar eminences apposed
- Make a "beak" with fingers

Doctor's Force - toward extension of wrist &

spreading of thenar & hypothenar eminences

**Flexor carpi radialis**

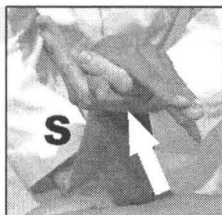
Patient Position:

- Supine, elbow flexed 90°, forearm fully pronated

Stabilization – distal forearm

Doctor's Force:

- Diagonal toward extension & adduction of wrist

**Flexor carpi ulnaris**

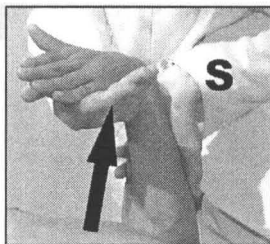
Patient Position:

- Supine, elbow flexed 90°, forearm fully supinated

Stabilization – distal forearm

Doctor's Force:

- Diagonal toward extension & abduction of wrist

**Extensor carpi radialis longus & brevis**

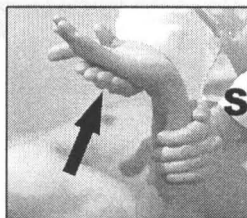
Patient Position:

- Supine, elbow flexed 90°, forearm neutral

Stabilization – distal forearm

Doctor's Force:

- Toward flexion & adduction of wrist

**Extensor carpi ulnaris**

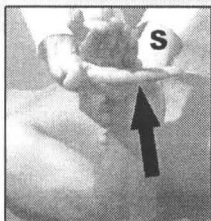
Patient Position:

- Supine, elbow flexed 90°, forearm neutral

Stabilization – distal forearm

Doctor's Force:

- Toward flexion & abduction of wrist

Adapted, with permission, from MA Carnes, DC. *Human Biomechanics & Muscle Testing*. WSCC. 2000.

References

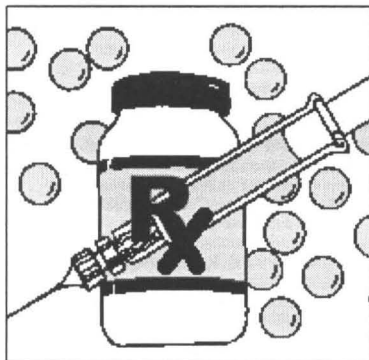
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XI Medications

A.....	294
A-C.....	295
C.....	296
C-D.....	297
D-E.....	298
F-H.....	299
H-K.....	300
K-M.....	301
M-N.....	302
N-O.....	303
O-P.....	304
P-R.....	305
R-S.....	306
S-T.....	307
T-V.....	308
V-Z.....	309
NSAIDs.....	310



Recommended websites for specific medication information

<http://www.rxlist.com/>

<http://www.lotusnet.org/it/reperio/eng/pages/drug.htm>

<http://www.healthsquare.com/drugmain.htm>

- Acarbose** (PRECOSE): oral hypoglycemic, Rx: diabetes mellitus
- ACCOLATE** (zafriukast): bronchospasm inhibitor, Rx: asthma
- ACCUPRIL** (quinapril): ACE inhibitor, Rx: HTN, CHF
- ACCUTANE** (isotretinoin): Rx: severe cystic acne
- Acebutotol** (SECTRAL): β -blocker, Rx: HTM, angina, arrhythmias
- ACEON** (perindopril): ACE inhibitor, Rx: HTN
- Acetaminophen** (TYLENOL): non-narcotic analgesic
- Acetazolamide** (DIAMOX): diuretic / anticonvulsant, Rx: glaucoma, CHF, epilepsy, mountain sickness
- Acetylcysteine** (MUCOSIL): mucolytic, Rx: asthma
- ACHROMYCIN V** (tetracycline): an antibiotic
- AOPHEX** (rabeprazole): inhibits gastric acid secretion, Rx: ulcers
- ACLOVATE** (alcometasone): steroid anti-inflammatory
- Acrivastine** (SEMPREX-D): antihistamine / decongestant
- ACTIFED** (triprolidine + pseudoephedrine): antihistamine / decongestant, Rx: allergies
- ACTIQALL** (ursodiol): bile acid which dissolves gall stones
- ACTOS** (pioglitazone): oral hypoglycemic, Rx: diabetes
- Acyclovir** (ZOVIRAX): antiviral, Rx: herpes, shingles, chicken pox
- ADALAT, ADALAT CC** (nifedipine): Ca⁺⁺-blocker, Rx: angina, HTN
- Adapton** (DIFFERIN): anti-acne, Rx: acne vulgaris
- ADDERALL** (amphetamines): CNS stimulant, Rx: ADD
- ADIPEX-P** (phentermine): appetite suppressant / stimulant
- ADRENALIN** (epinephrine): bronchodilator, Rx: asthma
- ADVIL** (ibuprofen): NSAID analgesic
- AEROBID** (flunisolide): steroid anti-inflammatory inhaler, Rx: asthma, bronchitis
- AEROLATE, AEROLATE III, AEROLATE Jr.**, (theophylline): xanthine bronchodilator, Rx: asthma, COPD
- AGENERASE** (amprenavir): antiretroviral agent, Rx: AIDS, HIV
- AQRYUN** (anagrelide): plateletreducer, Rx: thrombocytopenia
- AH-CHEW** (chlorpheniramine, phenylephrine, methscopolamine): antihistamine / decongestant
- AKINETON** (biperiden): antiparkinsonian, Rx: prophylaxis of EPS
- AKNE-MYCIN** (erythromycin): antibiotic, Rx: infection
- Albendazole** (ALBENZA): anthelmintic, Rx: tapeworm
- ALBENZA** (albendazole): anthelmintic, Rx: tapeworm
- Albuterol** (PROVENTIL): β -2 bronchodilator, Rx: asthma, COPD
- ALDACTAZIDE** (HCTZ, spironolactone): diuretics, Rx: HTN
- ALDACTONE** (spironolactone): potassium-sparing diuretic
- ALDOCHLOR** (methyldopa + chlorothiazide): antihypertensive / diuretic compound
- ALDOMET** (methyldopa): antihypertensive
- ALDORIL** (methyldopa + HCTZ): antihypertensive compound
- ALESSE 21, ALESSE 28** (levonorgestrel, estradiol): oral contraceptive
- ALEVE** (Naproxen): NSAID analgesic
- ALFENTA** (alfentanil): narcotic analgesic / anesthetic
- ALKERAN** (melphalan): anticancer agent, Rx: multiple myeloma, ovarian CA
- ALLEGRA** (fexofenadine): antihistamine, Rx: allergies
- Altopurinol** (ZYLORIM): reduces serum uric acid, Rx: gout
- ALORA** (estradiol): hormone, Rx: menopause
- Alsetron** (Lotronex): antidiarrheal, Rx: irritable bowel syndrome
- Alprazolam** (XANAX): benzodiazepine hypnotic
- ALTACE** (ramipril): ACE inhibitor, Rx: hypertension
- ALUPENT** (metaproterenol): β -2 bronchodilator, Rx: COPD, asthma
- AMARYL** (glimepiride): oral hypoglycemic, Rx: diabetes mellitus
- AMBIEN** (zolpidem): hypnotic, Rx: insomnia
- AMEN** (medroxyprogesterone): hormone, Rx: endometriosis, amenorrhea, uterine bleeding
- AMIKIN** (amikacin): antibiotic
- Amiloride** (MIDAMOR): potassium-sparing diuretic, Rx: CHF, hypertension
- Aminophylline** (MUDRANE): bronchodilator, Rx: COPD, asthma
- Aminosalicic acid** (PASER GRANULES): antibacterial, Rx: TB
- Amisriptyline** (ELAVIL): tricyclic antidepressant
- Amoxapine** (ASENDIN): tricyclic antidepressant
- Amoxicillin** (AMOXIL): antibiotic
- AMOXIL** (amoxicillin): antibiotic
- Amphetamine** (ADDERALL): stimulant, Rx: attention deficit disorder
- AMPHOJEL** (aluminum hydroxide): antacid, Rx: indigestion
- Amphotericin B** (FUNGIZONE): antifungal agent
- Ampicillin** (omnipen): antibiotic
- ANAFRANIL** (clomipramine): tricyclic antidepressant
- ANAPLEX HD** (hydrocodone, phenylephrine, chlorpheniramine): narcotic antitussive / decongestant / antihistamine
- ANAPROX, ANAPROX DS** (naproxen): NSAID analgesic / anti-inflammatory agent
- ANATUSS DM** (guaifenesin, pseudoephedrine, dextromethorphan): expectorant / decongestant / antitussive
- ANATUSS LA** (guaifenesin, pseudoephedrine): expectorant / decongestant
- ANCOBON** (flucytosine): antifungal agent
- ANDROID** (methyltestosterone): androgen / steroid / masculinizing hormone, Rx: hypogonadism
- ANOLOR 300** (butalbital, APAP, caffeine): sedative / analgesic
- ANTABUSE** (disulfiram): inhibits metabolism of alcohol, Rx: alcohol addiction
- ANTIVERT** (meclizine): antinauseant, Rx: vertigo
- ANUSOL HC** (hydrocortisone): steroid anti-inflammatory
- APAP** (acetaminophen): non-narcotic analgesic
- APHRODYNE** (yohimbine): alpha-blocker, Rx: impotence
- APL** (chorionic gonadotropin hormone): growth hormone
- AQUATENSEN** (methyclothiazide): antihypertensive / diuretic
- ARALEN** (chloroquine): antimalarial agent
- ARCO-LASE** (digestive enzymes): Rx: poor digestion
- ARCO-LASE PLUS** (digestive enzymes, hyoscyamine, atropine, phenobarbital): Rx: poor digestion
- ARICEPT** (donepezil): cholinergic enhancer, Rx: Alzheimer's
- ARIMHDEX** (anastrozole): anticancer agent, Rx: breast CA
- ARISTOCORT** (triamcinolone): steroid anti-inflammatory
- ARTANE** (trihexphenidyl): antiparkinsonian, Rx: prophylaxis of EPS
- ASA** (acetylsalicylic acid): aspirin, a NSAID analgesic
- ASACOL** (mesalamine): anti-inflammatory agent, Rx: colitis
- ASTELIN** (azelastine): antihistamine, Rx: allergic rhinitis
- ASTRAMORPH PF** (morphine): narcotic analgesic
- ATAMET** (carbidopa, levodopa): antiparkinsonian, Rx: Parkinson's disease
- ATAPRYL** (selegiline): MAO inhibitor, Rx: Parkinson's disease
- ATARAX** (hydroxyzine): sedative / tranquilizer / antihistamine, Rx: urticaria, anxiety
- Atonolol & Chlorthalidone**: β -blocker, diuretic, Rx: HTN
- Atonolol**: beta blocker, Rx: HTN, arrhythmias
- ATIVAN** (lorazepam): a benzodiazepine hypnotic
- Atovaquone** (MEPRON): antiprotozoal, Rx: pneumonia
- ATROHIST PLUS** (phenylephrine, phenylpropanolamine, chlorpheniramine, hyoscyamine, atropine, scopolamine): decongestant / antihistamine, Rx: allergies, colds
- ATROMID-S** (clofibrate): antilipidemic, Rx: hyperlipidemia
- Atropine**: antispasmodic/antisecretory, Rx: colds, GI irritation
- ATROVENT** (ipratropium): anticholinergic bronchodilator, Rx: COPD

lower case = generic name, UPPER CASE = Brand name, Rx = prescribed for, APAP = acetaminophen, CA = Cancer, CHF = Congestive Heart Failure, COPD = Chronic Obstructive Pulmonary Disease, EPS = Extraparadmal Symptoms (dystonia), HTN = hypertension

AUGMENTIN (amoxicillin, clavulanatepotassium): antibiotic
AURALGAN (antipyrine, benzocaine): ear drop analgesic
AVANDIA (rosiglitazone): oral hypoglycemic, Rx: diabetes
AVONEX (interferon): antiviral, Rx: MS
AXID (nizatidine): Histamine-2 antagonist, which inhibits gastric acid secretion, Rx: ulcers
AXOCET (butalbital, APAP): sedative/analgesic, Rx: tension H/A
AYGESTIN (norethindrone): hormone, Rx: amenorrhea, endometriosis
Azathioprine (RYNATAN) antihistamine/decongestant
Azathioprine (IMURAN): immunosuppressant, Rx: organ transplants, arthritis
AZELEX (azelaic acid): antiacne cream
Azithromycin (ZITHROMAX): antibiotic
AZMACORT (triamcinolone): steroid anti-inflammatory, Rx: asthma, bronchitis
AZT (zidovudine): antiviral agent, Rx: HIV (AIDS) virus
Aztreonam (AZACTAM): antibiotic, Rx: respiratory tract infections
AZULFIDINE-EN (sulfasalazine): anti-infective, anti-inflammatory, Rx: colitis, arthritis

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Baclofen: muscle relaxant, Rx: MS, spinal cord disease
BACTRIM BACTRIM DS (trimethoprim, sulfamethoxazole): antibacterials, Rx: UTI, ear infection, bronchitis
BACTROBAN (mupirocin): topical antibacterial, Rx: skin infections
Balsam Peru (GRANULEX): necrotic tissue debrider, Rx: decubitus and varicose ulcers, sunburn
BASALJEL (aluminum carbonate): antacid, Rx: heartburn, indigestion
BAYCOL (cerivastatin): cholesterol inhibitor
Beclomethasone (BECONASE): steroid anti-inflammatory
BECLOVENT (beclomethasone): steroid anti-inflammatory agent, Rx: COPD, asthma
BECONASE, BECONASE AQ (beclomethasone): steroid anti-inflammatory
BEELETH (magnesium, pyridoxine): magnesium / vitamin B6 supplement
Belladonna (BELLADENAL): antispasmodic, Rx: irritable bowel syndrome
BENADRYL (diphenhydramine): an antihistamine, Rx: allergies
BENEMID (probenecid): Lirocosuric, Rx: gout. Also prolongs effects of penicillin

BENTYL (dicyclomine): GI tract antispasmodic
BENYLIN (diphenhydramine): antihistamine
BENZAC AC (benzoyl peroxide): antibacterial, Rx: acne vulgaris
BENZAMYCIN (erythromycin, benzoyl peroxide): a topical antibiotic /keratolytic compound, Rx: acne
Benzocaine: topical anesthetic
Benzonatate (TESSALON): non-narcotic antitussive, Rx: cough
Benzpropion (COGENTIN): anticholinergic, Rx: Parkinson's disease
Bepiridil (VASCOR): calcium channel blocker, Rx: angina
BEROCCA (multivitamins): nutritional supplement
BEROCCA PLUS (multivitamins, minerals): nutritional supplement
BETALIN (thiamine): vitamin B-1
Betamethasone (CELESTONE): steroid anti-inflammatory
BETAPACE (sotalol): β -blocker, Rx: angina, HTN, arrhythmias
BETASERON (interferon): immunologic, Rx Multiple Sclerosis
Betaxolol (KERLONE): β -blocker, Rx: HTN
Bethanechol (URECHOLINE): vagomimetic agent which increases bladder tone, Rx: urinary retention
BETOPTIC (betaxolol): Beta-1 blocker eyedrops, Rx: glaucoma
BIAXIN (clarithromycin) antibiotic

BICILLIN (penicillin): an antibiotic
BICITRA (sodium citrate, citric acid): urinary alkaliizer, Rx: acidosis
BILTRICIDE (praziquantel): anthelmintic, Rx: schistosomiasis, flukes
BIOHIST-LA (carbinoxamine, pseudoephedrine): antihistamine / decongestant
Biperiden (AKINETON): anticholinergic, Rx: Parkinson's disease, EPS
Bisacodyl (DULCOLAX): laxative, Rx: constipation
Bismuth subsalicylate (PEPTO-BISMOL): antidiarrheal / antinauseant
Bisoprolol (ZEBETA): β -blocker, Rx: HTN
Bitolterol (TORNALATE): β bronchodilator, Rx: asthma
BLEPHAMIDE (sulfacetamide, prednisolone): antibacterial, steroid anti-inflammatory, Rx: ocular infections
BLOCADREN (timolol): β -blocker, Rx: angina, HTN, arrhythmias
BONINE (meclizine): antiemetic, Rx: N&V, vertigo
BONTRIL PDM, BONTRIL Slow Release (phendimetrazine): stimulant, appetite suppressant, Rx: obesity
Botulinum Toxin Type A (BOTOX): paralytic, Rx: strabismus, eyelid spasm
BRETHINE (terbutaline): β -2 bronchodilator, Rx: asthma, COPD
BREVICON: an oral contraceptive
Brimonidine (ALPHAGAN): alpha stimulant, Rx: glaucoma
BROMFED Capsules, PD Capsules: (brompheniramine, pseudoephedrine) antihistamine / decongestant, Rx: allergic rhinitis, nasal congestion
Brompheniramine (BROMFED): antihistamine, Rx: allergies
BRONCHOLATE Syrup (ephedrine, guaifenesin): bronchodilator, expectorant, Rx: colds, bronchitis
Budesonide (RHINOCORT): corticosteroid, Rx: allergic rhinitis
Bumetanide (BUMEX): diuretic, Rx: edema, CHF
BUPAP (butalbital, acetaminophen): sedative/analgesic, Rx: headache
BUPRENEX (buprenorphine): narcotic analgesic
Buprenorphine (BUPRENEX): narcotic analgesic
Bupropion (WELLBUTRIN): antidepressant
BuSpar (buspirone): anti-anxiety agent, Rx: anxiety disorders
Butabarbital (PYRIDIUM): barbiturate sedative/antispasmodic
Butalbal (FIORINAL): barbiturate muscle relaxant/sedative
Butalbital, Acetaminophen, Caffeine: sedative / analgesic, Rx: headache
Butorphanol (STADOL NS): narcotic analgesic

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Cabergoline (DOSTINEX): dopaminergic, Rx: hyperprolactinemia
Caffeine: stimulant, Rx: headache
CALAN, CALAN SR (verapamil): calcium blocker, Rx: angina, hypertension, PSVT prophylaxis, headache
CALCET, CALCET PLUS: calcium supplement
CALCIBIND (cellulose sodium phosphate): binds calcium
CAPITAL w/ Codeine (APAP, codeine): narcotic analgesic
Captopril (CAPOTEN): ACE inhibitor, Rx: HTN, CHF
CARAPATE (sucralate): anti-ulcer agent
Carbamazepine (TEGRETOL): anticonvulsant, Rx: epilepsy
Carbidopa & Levodopa (SINEMET): dopamine precursors, Rx: Parkinson's Disease
CARDENE (nifedipine): calcium blocker, Rx: angina, HTN
CARDIQUIN (quinidine): antiarrhythmic, Rx: cardiac dysrhythmias
CARDIZEM, CARDIZEM CD (diltiazem): calcium blocker, Rx: angina, HTN
CARDURA (doxazosin): alpha blocker, Rx: HTN, prostatic hypertrophy
Carisoprodol (SOMA): muscle relaxant / analgesic

MEDICATIONS

lower case = generic name, UPPER CASE = Brand name, Rx = prescribed for, APAP = acetaminophen, CA = Cancer, CHF = Congestive Heart Failure, COPD = Chronic Obstructive Pulmonary Disease, EPS = Extrapyramidal Symptoms (dystonia), HTN = hypertension

- CARNITOR** (levocarnitine): Rx: carnitine deficiency
- Carteolol** (CARTROL): β -blocker, Rx: HTN, angina
- CARTROL** (carteolol): nonselective β -blocker, Rx: HTN, angina
- CASODEX** (bicalutamide): antiandrogen / anticancer, Rx: prostate CA
- CATAFLAM** (diclofenac): NSAID analgesic
- CATAPRES** (clonidine): antihypertensive agent
- CATAPRES ITS** (transdermal clonidine): antihypertensive
- CECLOR, CECLOR CD** (cefactor): antibiotic
- CEDAX** (cefbutenil): antibiotic
- Ceenu** (lornetidine): anticancer agent, Rx: brain CA, Hodgkin's disease
- Cefactor** (CECLOR): antibiotic
- Cefadroxil** (DURICEF): antibiotic
- Cefazolin** (ANCEP): antibiotic
- Cefixime** (SUPRAX): broad spectrum antibiotic
- Cefotetan** (CEFOTAN): antibiotic
- Cefprozil** (CEFZIL): antibiotic
- Ceftibuten** (CEDAX): antibiotic
- CEFTIN** (cefuroxime): antibiotic
- CEFZIL** (cefprozil): antibiotic
- CELESTONE** (betamethasone): steroid anti-inflammatory
- CellCept** (mycophenolate): immunosuppressant, Rx: organ transplants
- CELONTIN** (methsuximide): anticonvulsant, Rx: absence Sz
- Cephalexin** (KEFLEX): antibiotic
- CEREZYME** (imiglucerase): enzyme, Rx: Gauchers disease
- Cetirizine** (ZYRTEC): antihistamine, Rx: allergic rhinitis, urticaria
- CHEMET**: lead chelator, Rx: lead poisoning
- Chloral Hydrate**: sedative
- Chlordiazepoxide**: benzodiazepine hypnotic
- Chlorothiazide** (DIURIL): antihypertensive/diuretic
- Chlorpheniramine**: antihistamine
- Chlorpromazine** (THORAZINE): major tranquilizer
- Chlorpropamide** (DIABINESE): oral hypoglycemic, Rx: diabetes
- Chlorthalidone** (HYGROTON): antihypertensive / diuretic
- Chlorzoxazone** (PARAFON FORTE): sedative / muscle relaxant
- CHROMAGEN** (iron, vitamin C, folic acid): Rx: anemias
- Cimetidine** (TAGAMET): histamine-2 blocker which inhibits gastric acid secretion, Rx: ulcers
- CIPRO** (ciprofloxacin): antimicrobial agent
- CLAFORAN** (cefotaxime): antibiotic
- CLARITIN** (loratadine): non-sedating antihistamine, Rx: allergies
- CLARITIN-D** (loratadine, pseudoephedrine): antihistamine / decongestant, Rx: allergic rhinitis
- Clarithromycin** (BIAIXIN): antibiotic
- Clemastine** (TAVIST): antihistamine, Rx: allergy
- CLEOCIN** (clindamycin): antibiotic
- CUMARA** (estradiol) hormone, Rx: menopause
- Clindamycin** (CLEOCIN): antibiotic
- CLINORIL** (sulindac): NSAID analgesic, Rx: arthritis
- Clobetasol** (TEMOVATE): steroid anti-inflammatory, Rx: dermatoses
- Clofibrate** (ATROMID-S): reduces serum lipids
- CLOMID** (clomiphene): ovulatory stimulant, fertility drug
- Clomiphene** (CLOMID): ovulatory stimulant, fertility drug
- Clomipramine** (ANAFRANIL): tricyclic antidepressant
- Clonazepam** (KLONOPIN): anticonvulsant, Rx: seizures, panic disorders
- Clonidine** (CATAPRES): antihypertensive agent
- Clorazepate** (TRANXENE): anti-anxiety / anticonvulsant
- Clotrimazole** (MYCELEX): antifungal, Rx: Candida
- Clozapine** (CLOZARIL): antipsychotic, Rx: schizophrenia
- CLOZARIL** (clozapine): psychotropic, Rx: schizophrenia
- COCAINE** (cocaine HCl): mucous membrane anesthetic
- Codeine**: narcotic analgesic / antitussive
- CODICLEAR OM** (hydrocodone, guaifenesin): narcotic antitussive / expectorant, Rx: coughs
- CODIMAL DH** (hydrocodone, phenylephrine, pyrilamine): narcotic antitussive / decongestant, Rx: colds, allergies
- CODIMAL DM** (dextromethorphan, phenylephrine, pyrilamine): non-narcotic antitussive / decongestant, Rx: colds, allergies
- CODIMAL PH** (codeine, phenylephrine, pyrilamine): narcotic antitussive / decongestant compound, Rx: colds, allergies
- COGENTIN** (benztropine): antiparkinsonian, Rx: EPS
- COGNEX** (tacrine): cholinomimetic/ACh-ase inhibitor, Rx: Alzheimer's Disease
- COLACE** (docusate): stool softener
- ColBENEMID** (probenecid, colchicine): uricosuric, Rx: gout
- Colchicine** (ColBENEMID): reduces incidence of gout attacks
- COLESTID** (cholestipol): reduces serum cholesterol
- Colectipol** (COLESTID): reduces serum cholesterol
- Colistin** (CORTISPORIN-TC): antibiotic, Rx: ear infections
- COMBIPATCH** (estradiol, norethindrone): estrogens, Rx: menopause symptoms
- COMBIPRES** (donidone, chlorthalidone): antihypertensive/diuretic
- COMBIVENT** (albuterol, ipratropium): bronchodilators, Rx: asthma
- COMBIVIR** (lamivudine, zidovudine): antivirals, Rx: HIV, AIDS
- COMPazine** (prochlorperazine): phenothiazine antiemetic
- COMPRO** (prochlorperazine): phenothiazine antiemetic
- CONCERTA** (methylphenidate): stimulant, Rx: attention deficit hyperactivity disorder in children, narcolepsy
- CONDYLOX** (podofilox): antimitotic, Rx: anogenital warts
- Conjugated Estrogens** (PREMARIN): Rx: menopause
- COPAXONE** (glatiramer): neurologic agent, Rx: Multiple Sclerosis
- CORDARONE** (amiodarone): antiarrhythmic, Rx: ventricular tachycardia/fibrillation
- CORDRAN** (flurandrenolide): steroid anti-inflammatory
- COREG** (carvedilol): α & β -blocker, Rx: HTN, CHF, angina
- CORMAX** (dobelasol): steroid anti-inflammatory, Rx: dermatoses
- CORTENEMA** (hydrocortisone): steroid anti-inflammatory, Rx: colitis
- COPTIC Ear Drops** (chloroxylenol, pramoxine, hydrocortisone): antiseptic, antifungal, steroid anti-inflammatory
- CORTIFOAM** (hydrocortisone): steroid anti-inflammatory, Rx: proctitis
- CORTISOL** (hydrocortisone): steroid anti-inflammatory
- Cortisone** (CORTONE): steroid anti-inflammatory
- CORTISPORIN** (neomycin, polymyxin, hydrocortisone): antibiotic / steroid anti-inflammatory
- CORTONE** (cortisone): steroid anti-inflammatory
- CORZIDE** (bendroflumethiazide, nadolol): β -blocker, diuretic, Rx: HTN
- COSOPT** (timolol, dorzolamide): β -blocker, decreases intraocular pressure, Rx: glaucoma
- COTAZYM, COTAZYM-S** (pancrelipase): digestive enzyme, Rx: pancreatitis, cystic fibrosis
- COUMADIN** (warfarin): anticoagulant, Rx: thrombosis prophylaxis
- COVERA HS** (verapamil): calcium blocker, Rx: HTN, angina
- COZAAR** (losartan): antihypertensive
- CREON** (pancrelipase): pancreatic enzyme replacement
- CRIVIXAN** (indinavir): protease inhibitor antiviral, Rx: AIDS
- Cromolyn** (INTAL): anti-allergenic, Rx: asthma prophylaxis
- CUPRIMINE** (penicillamine): chelating agent, anti-inflammatory, Rx: Wilson's disease, arthritis, heavy metal toxicity
- CUTIVATE** (fluticasone): topical steroid anti-inflammatory, Rx: dermatoses

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Cyanocobalamin (vitamin B-12): Rx: anemia
Cyclobenzaprine (FLEXERIL): skeletal muscle relaxant
Cyclosporine (SANDIMMUNE): immunosuppressant agent, Rx: prophylaxis of rejection of transplanted organs
Cyclophosphamide (CYTOXAN): anticancer agent, Rx: Hodgkin's disease, lymphomas
CYCRIN (medroxyprogesterone): hormone, Rx: uterine bleeding
CYLERT (pemoline): stimulant, Rx: Attention Deficit Disorder in children
Cyproheptadine (PERIACTIN): antihistamine
CYSTOSPASZ, CYSTOSPASZ-M (hyoscyamine): urinary tract antispasmodic
CYTOMEL (liothyronine): thyroid hormone, Rx: hypothyroidism
CYTOTE (misoprostol): prevents gastric ulcers caused by NSAIDs
CYTUVENE (ganciclovir): antiviral, Rx: cytomegalovirus, ARC, AIDS
CYTOXAN (cyclophosphamide): anticancer agent, Rx: Hodgkin's disease, lymphomas antihistamine / decongestant, Rx: allergies

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Danazol (DANOCRINE): gonadotropin inhibitor, Rx: endometriosis, fibrocystic breast disease
DANOCRINE (danazol): gonadotropin inhibitor, Rx: endometriosis, fibrocystic breast disease
DANTRIUM (dantrolene): skeletal muscle antispasmodic, Rx: multiple sclerosis, cerebral palsy
Dapsone: antibacterial drug, Rx: leprosy, dermatitis herpetiformis
DARANIDE (dichlorphenamide): carbonic anhydrase inhibitor - lowers intraocular pressure, Rx: glaucoma
DARAPRIM (pyrimethamine): antiparasitic, Rx: malaria, toxoplasmosis
DARVOCE-T-N (propoxyphene, APAP): narcotic analgesic
DARVON (propoxyphene): narcotic analgesic
DARVON Compound (propoxyphene, ASA, caffeine) narcotic analgesic compound
DAYPRO (oxaprozin): NSAID, Rx: arthritis
DDAVP (desmopressin): antidiuretic hormone, Rx: nocturia, diabetes insipidus
ddc (HIVID, zalcitabine): antiviral, Rx: AIDS
DECADRON (dexamethasone): steroid anti-inflammatory
DECADRON L.A. (dexamethasone): steroid anti-inflammatory
DECLOMYCIN (demeclocycline): antibiotic
DECONSAL II (pseudoephedrine, guaifenesin): decongestant / expectorant, Rx: colds
DEFEN-LA (pseudoephedrine, guaifenesin): decongestant, expectorant, Rx: the common cold
Deferoxamine (DEFERAL): iron-chelator, Rx: iron toxicity
Dehydroepiandrosterone (VITAMIST): vitamins, minerals
Delavirdine (RESCRIPTOR): antiviral, Rx: HIV
DEMADEX (torsemide): diuretic, Rx: HTN, edema, CHF, kidney disease, liver disease
DEMEROL (meperidine): narcotic analgesic
DEMERSER (metyrosine): antihypertensive, Rx: pheochromocytoma
DEMULEN: oral contraceptive
DEPAKENE (valproic acid): antiepileptic, Rx: epilepsy
DEPAKOTE (divalproex): antiepileptic, Rx: absence seizures
DEPAON (divalproex): antiepileptic, Rx: absence seizures
DEPEN (penicillamine): DMARD, Rx: arthritis, pain
DEPONIT (nitroglycerin): transdermal nitrate Rx: angina
EPO-MEDROL (methylprednisolone): steroid anti-inflammatory
EPO-PROVERA (medroxyprogesterone): contraceptive / anticancer agent, Rx: endometrial or renal CA
EPRENLYL (selegiline): MAO inhibitor, Rx: Parkinson's disease

DERIFIL (chlorophyllin copper): internal deodorant, Rx: colostomy, incontinence
DEFERAL (deferoxamine): iron-chelator, Rx: iron toxicity
Desflurane (SUPRANE): inhaled general anesthetic agent
Desipramine (NORPRAMIN): tricyclic antidepressant
Desmopressin (DDAVP): antidiuretic, Rx: bed-wetting, diabetes insipidus
DESOGEN (desogestrel, estradiol): oral contraceptive
Desonide (DESOWEN): steroid anti-inflammatory
DESOWEN (desonide): steroid anti-inflammatory
DESOSYN (methamphetamine): stimulant
DETROL (tolterodine): cholinergic, Rx: urinary urgency
Dexamethasone (DECADRON): steroid anti-inflammatory agent
DEXEDRINE (dextroamphetamine): stimulant
Dextroamphetamine (DEXEDRINE): stimulant, Rx: attention deficit hyperactivity disorder, narcolepsy
DEXTROSTAT (dextroamphetamine): stimulant, Rx: attention deficit hyperactivity disorder, narcolepsy
Dextromethorphan (OELSVM): cough suppressant
d4T stavudine (ZERIT): antiviral, Rx: HIV
DIABETA (glyburide): oral hypoglycemic, Rx: diabetes
DIABE-TUSS DM (dextromethorphan): antitussive, Rx: cough
DIABINESE (chlorpropamide): oral hypoglycemic agent, Rx: diabetes
DIAMOX (acetazolamide): diuretic / anticonvulsant, Rx: glaucoma, CHF, epilepsy, mountain sickness
DIASAT (diazepam): anxiolytic, Rx: anxiety, seizure, panic disorder
Diazepam (VALIUM): anxiolytic, Rx: anxiety, seizure, panic disorder
Diazoxide (HYPERSTAT): antihypertensive / antihypoglycemic
DIBENZYLONE (phenoxylbenzamine): alpha blocker, Rx: HTN, sweating
Diclofenac (VOLTAREN): NSAID, analgesic, Rx: arthritis
Dicyclomine (BENTYL): anticholinergic, Rx: colitis
Didanosine (VIDEX): antiviral, Rx: AIDS, HIV
DIDRONEL (etidronate): bone metabolism regulator, Rx: Paget's disease, total hip replacement
DIFFERIN (adapalene): topical retinoid, Rx: acne
DIFLUCAN (fluconazole): antifungal agent
Diflunisal (DOLOBID): NSAID analgesic
Digoxin (LANOXIN): cardiac glycoside, Rx: CHF, supraventricular dysrhythmias
Dihydrocodeine (SYNALGOS-DC): narcotic analgesic
DILACOR XR (diltiazem): calcium blocker, Rx: HTN, angina
DILANTIN (phenytoin): anticonvulsant
DILATRATE SR (isosorbide): long-acting nitrate, Rx: angina
DILAUDID, DILAUDID HP (hydromorphone): narcotic analgesic
DILOR, DILOR-200, DILOR-400, DILOR ELIXIR (diphylline): xanthine bronchodilator, Rx: asthma, COPD
DILOR-G (diphylline, guaifenesin): bronchodilator/expectorant
Diltiazem, Diltiazem CD (CARDIZEM): calcium blocker, Rx: angina, HTN, PSVT
Dimenhydrinate (DRAMAMINE): antihistamine, Rx: allergies
DIMETANE-DX (brompheniramine, pseudoephedrine, dextromethorphan): antihistamine / decongestant / antitussive
Diocetyl (docusate): stool softener, Rx: constipation
DIOVAN (valsartan): angiotensin II inhibitor, Rx: HTN
DIPENTUM (olsalazine): anti-inflammatory agent, Rx: ulcerative colitis
Diphenhydramine (BENADRYL): antihistamine
Diphenoxylate (LOMOTIL): narcotic, Rx: diarrhea
Diphenoxylate & Atropine (LOMOTIL): narcotic, antispasmodic, Rx: diarrhea

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- DIPRIVAN** (propofol): general anesthetic agent
- Dipyridamole** (PERSANTINE): vasodilator, Rx: angina
- Dirthromycin** (DYNABAC): antibiotic
- DISALCID** (salsalate): NSAID, Rx: arthritis
- Disopyramide** (NORPACE): antiarrhythmic, Rx: PVCs
- Disulfiram** (ANTABUSE): inhibits metabolism of alcohol, Rx: alcohol addiction
- DITROPAN, DITROPAN XL** (oxybutynin): anticholinergic/antispasmodic, Rx: urinary frequency, incontinence, dysuria
- DIUCARDIN** (hydroflumethiazide): antihypertensive / diuretic
- DIURIL** (chlorothiazide): antihypertensive / diuretic
- DIUTENSEN-R** (methylothiazide, reserpine): an antihypertensive / diuretic compound
- Docusate** (DIALOSE): stool softener
- DOLOBID** (diflunisal): NSAID analgesic
- DOLOPHINE** (methadone): narcotic analgesic
- Donepezil** (ARICEPT): cholinergic, Rx: Alzheimer's disease
- DONNAGEL** (kaolin, pectin, belladonna alkaloids): antispasmodic / stool binder, Rx: diarrhea
- DONNATAL** (phenobarbital, belladonna alkaloids): barbiturate sedative, antispasmodic, Rx: ulcers
- DONNAZYME** (pancreatic enzymes): Rx: pancreatic insufficiency
- DOPRAM** (doxapram): respiratory stimulant, Rx: COPD, surgery
- DORYX** (doxycycline): an antibiotic
- Dorzolamide** (TRUSOPT): Rx: glaucoma, reduces IOP
- DOSTINEX** (cabergoline): dopaminergic, Rx: hyperprolactinemia
- DONOVEX** (calcipotriene): topical agent, Rx: psoriasis
- Doxapram** (DOPRAM): respiratory stimulant, Rx: COPD, surgery
- Doxazosin** (CARDURA): alpha blocker, Rx: HTN, prostatic hypertrophy
- Doxepin** (SINEQUAN): tricyclic antidepressant
- DOXIL** (doxorubicin): antineoplastic, Rx: AIDS-related tumors
- Doxorubetin** (DOXIL): antineoplastic, Rx: AIDS-related tumors
- Doxycycline** (VIBRAMYCIN): antibiotic
- DRAMAMINE** (dimenhydrinate): antinauseant
- DULCOLAX** (bisacodyl): laxative
- DURAMORPH** (morphine): narcotic analgesic
- DURATUSS** (hydrocodone, pseudoephedrine, guaifenesin) antitussive / decongestant / expectorant, Rx: colds, allergies
- DURATUSS DM** (dextromethorphan, guaifenesin) antitussive, expectorant, Rx: colds, allergies
- DURATUSS G** (guaifenesin) expectorant, Rx: colds, allergies
- DURA-VENT** (phenylpropranolamine, guaifenesin): decongestant / expectorant
- DURICEF** (cefadroxil): antibiotic
- DYAZIDE** (HCTZ, triamterene): antihypertensive / diuretic, Rx: HTN
- DYLIX** (diphyllin): xanthine bronchodilator, Rx: asthma
- DYNABAC** (dirthromycin): antibiotic
- DYNACIN** (minocycline): antibiotic
- DYNACIRC CR** (isradipine): calcium blocker, Rx: HTN, angina
- Dyphylline** (LUFYLLUN): bronchodilator, Rx: COPD, asthma
- DYRENIUM** (triamterene): potassium-sparing diuretic, Rx: CHF
- DYTUSS** (diphenhydramine, alcohol): antihistamine
- E E E E E E E E E E**
- E-MYCIN** (erythromycin): antibiotic
- EASPRIN** (ASA): NSAID analgesic, Rx: arthritis
- ECOTRIN**: enteric-coated aspirin, NSAID analgesic
- EDECIN** (ethacrynic acid): diuretic, Rx: CHF
- EES** (erythromycin): antibiotic
- EFFEXOR, EFFEXOR XR** (venlafaxine): antidepressant
- ELAVIL** (amitriptyline): tricyclic antidepressant
- ELDEPRYL** (selegiline): MAO inhibitor, Rx: Parkinson's disease
- ELIMITE** (permethrin): topical scabicide agent, Rx: scabies, lice
- ELMIRON** (pentosan): urinary tract analgesic, Rx: cystitis
- ELOCON** (mometasone): topical steroid anti-inflammatory
- ELSPAR** (asparginase): antineoplastic, Rx: leukemia, sarcoma
- EMCYT** (estramustine): anticancer agent, Rx: prostate CA
- EMLA** (lidocaine, prilocaine): topical anesthetic
- Enalapril** (VASOTEC): ACE inhibitor, Rx: HTN, CHF
- Enalaprilat** (VASOTEC): IV ACE inhibitor, Rx: HTN
- ENDAL-HD** (hydrocodone, phenylephrine, chlorpheniramine): narcotic antitussive / decongestant / antihistamine
- ENDURON** (methylclothiazide): antihypertensive / diuretic
- Enflurane** (ETHRANE): general anesthetic, Rx: surgery
- ENTEX Capsules, Liquid** (phenylephrine, phenylpropan-olamine, guaifenesin): decongestant / expectorant
- ENTEX LA** (phenylpropranolamine, guaifenesin): decongestant / expectorant compound
- ENTEX PSE** (pseudoephedrine, guaifenesin): decongestant / expectorant
- Ephedrine** (MUDRANE): bronchodilator, Rx: asthma, COPD
- EPI-PEN** (epinephrine): bronchodilator / vasoconstrictor, Rx: allergic reaction
- Epinephrine** (PRIMATENE MIST): bronchodilator, Rx: asthma
- EPVIR 3TC** (lamivudine): antiviral, Rx: HIV
- Epoetin Alfa** (EPOGEN): increases RBC production, Rx: anemia
- EPOGEN** (epoetin alfa): increases RBC production, Rx: anemia
- Epoprostenol** (FLOLAN): antihypertensive, Rx: pulmonary HTN
- EQUAGESIC** (meprobamate, ASA): tranquilizer/analgesic
- EQUANIL** (meprobamate): tranquilizer
- ERCAF** (ergotamine, caffeine): vasoconstrictors, Rx: migraine headache
- ERGAMISOL** (levamisole): immunomodulator, Rx: colon CA
- ERGOMAR** (ergotamine): antimigraine, Rx: vascular H/A
- ERYC** (erythromycin): antibiotic
- ERYPED** (erythromycin): antibiotic
- ERY-TAB** (erythromycin): antibiotic
- ERYTHROCIN** (erythromycin): antibiotic
- Erythromycin** (EES): antibiotic
- Erythromycin with sulfisoxazole**: antibiotics, Rx: UTI
- Erythropoietin** (EPOGEN): increases RBC production, Rx: anemia
- ESGIC** (APAP, caffeine, butalbital): analgesic / muscle relaxant / anti-anxiety compound, Rx: headache
- ESGIC-PLUS** (butalbital, APAP, caffeine): sedative / analgesic
- ESKALITH** (lithium): tranquilizer, Rx: mania, depression
- Esmotol** (BREVIBLOC): β -blocker, Rx: SVT
- Estazolam** (PROSOM): sedative / hypnotic, Rx: insomnia
- ESTRACE** (estradiol): estrogen, Rx: menopause
- ESTRADERM** (estradiol): topical estrogen, Rx: menopause
- Estradiol** (CLIMARA): estrogen, Rx: menopause
- ESTRATEST** (estrogens, methyltestosterone): Rx: menopause
- ESTROSTEP** (norethindrone, estradiol): oral contraceptive
- Estropipate** (OGEN): estrogens, Rx: menopause
- Ethinyl Estradiol** (ORTHO-NOVUM): oral contraceptive
- ETHMOZINE** (moricizine): Rx: severe ventricular dysrhythmias
- Etodolac** (LODINE): NSAID, analgesic, Rx: HA, arthritis, gout
- ETRAFON** (perphenazine, amitriptyline): major tranquilizer, tricyclic antidepressant, Rx: anxiety with depression
- EULEXIN** (flutamide): anticancer agent, Rx: prostate CA
- EVISTA** (raloxifene): Rx: osteoporosis prevention
- EXGEST LA** (phenylpropranolamine, guaifenesin): decongestant / expectorant
- EXTENDRYL** (phenylephrine, methscopolamine, chlorpheniramine): antihistamine, decongestant, Rx: allergies

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Famciclovir (FAMVIR): antiviral, Rx: herpes
Famotidine (PEPCID): H-2 blocker, inhibits gastric acid, Rx: ulcers
FAMVR (famciclovir): antiviral, Rx: herpes zoster, genital herpes
FASTIN (phenfermine): stimulant, Rx: appetite suppression
FE-50 (iron): iron supplement
Felbamate (FELBATOL): antiepileptic, Rx: seizures
FELBATOL (felbamate): antiepileptic, Rx: seizures
FELDENNE (piroxicam): NSAID analgesic
Fetidipine (PLENDIL): calcium blocker, Rx: HTN, angina
FEMARA (letrozole): estrogen inhibitor, Rx: breast cancer
FENESIN (guaifenesin): expectorant, Rx: colds
FENESIN DM (dextromethorphan, guaifenesin): antitussive / expectorant, Rx: colds
Fenopropfen (NALFON): NSAID analgesic
Fentanyl (DURAGESIC): narcotic analgesic
FEOSOL: iron supplement
FERO-FOLIC-500 (iron, folic acid, vitamin C): vitamins
FERO-GRAD-500 (iron, vitamin C): vitamin / mineral
Ferrous Gluconate: iron supplement
Ferrous SuKate: iron supplement
FETRIN (iron, vitamin C, cyanocobalamin): vitamins
Fexotenedine (ALLEGRA): antihistamine, Rx: allergies
FIORICET (butalbital, APAP, caffeine): analgesic, Rx: H/A
FIORICET with Codeine (butalbital, APAP, caffeine, codeine): sedative / narcotic analgesic
FIORINAL (butalbital, ASA, caffeine): non-narcotic analgesic
FIORINAL w/ Codeine (butalbital, ASA, caffeine, codeine): narcotic analgesic compound
FLAGYL (metronidazole): antimicrobial agent
Flavoxate (RISPASS): urinary tract antispasmodic, Rx: urinary incontinence
FLEXERIL (cyclobenzaprine): skeletal muscle relaxant
FLONASE (fluticasone): steroid, Rx: allergic rhinitis
FLORICAL (fluoride, calcium): mineral supplement
FLOMAX (tamsulosin): alpha-1 blocker, Rx: enlarged prostate
FLOVENT (fluticasone): steroid anti-inflammatory, Rx: asthma
FLOXIN (ofloxacin): antibiotic
Floxuridine (FUDR): antineoplastic, Rx: liver, GI cancer
Fluconazole (DIFLUCAN): antifungal agent
FLUMADINE (rimantadine): antiviral, Rx: influenza A
Fluoxetine (PROZAC): heterocyclic antidepressant
Fluphenazine: antipsychotic, Rx: schizophrenia, delusions, hallucinations
Flurazepam (DALMANE): sedative-hypnotic, Rx: insomnia
Flurbiprofen: NSAID analgesic, Rx: arthritis
Fluvastatin (LESCOL): cholesterol reducer
Fluvoxamine (LUVOX): antidepressant, Rx: depression
Folic Acid B9 (CEFOL): vitamin coenzyme, Rx: anemia
FORTAZ (ceftazidime): antibiotic
FOSAMAX (alendronate): reduces bone loss, Rx: osteoporosis, Paget's disease
Fosinopril (MONOPRIL): ACE inhibitor, Rx: HTN
FULVICIN (griseofulvin): antifungal agent
FUMATINIC (iron, vitamins): vitamin / mineral supplement
FURADANTIN (nitrofurantoin): antibacterial agent, Rx: UTI
Furosemide (LASIX): diuretic, Rx: CHF, hypertension
FUROXONE (fuzolidone): antimicrobial, Rx: diarrhea

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GASTROCROM (cromolyn): antiasthmatic, antiallergic, Rx: diarrhea, H/A, urticaria, nausea

GAVICON (magnesium, aluminum): antacid, laxative
Gemfibrozil (LOPID): lowers serum lipids
GEMZAR (geroncitabine): antineoplastic, Rx: lung, pancreatic CA
Gentamicin (GARAMYCIN): antibiotic
GENOTROPIN (somatotropin): growth stimulant, Rx: AIDS, wasting syndrome, growth disorders
GEOCILLIN (carbenicillin): antibiotic
Glimepiride (AMARYL): oral hypoglycemic, Rx: diabetes
Glipizide (GLUCOTROL): oral hypoglycemic, Rx: diabetes
Glucagon: hormone, mobilizes glucose, Rx: hypoglycemia
GLUCOPHAGE (metformin): oral hypoglycemic, Rx: diabetes
Glucosamine (COSAMIN-DS): cartilage growth stimulant
GLUCOTROL (glipizide): oral hypoglycemic, Rx: diabetes
GLUCOVANCE (glyburide, metformin): oral hypoglycemic
GLUTOFAC-MX (vitamins, minerals): Rx: dietary supplement
Glyburide (DIABETA): oral hypoglycemic, Rx: diabetes
Glycopyrrolate (ROBINUL): anticholinergic, Rx: peptic ulcers
GLYNASE (glyburide): oral hypoglycemic, Rx: diabetes
GLYTEL (miglitol): oral hypoglycemic, Rx: diabetes
GOLYTEL (polyethylene glycol, electrolytes): bowel evacuant
Goserelin (ZOLADEX): antineoplastic, Rx: prostate CA, endometriosis
Granisetron (KYTRIL): antiemetic, Rx: chemotherapy, nausea
GRIFULVIN V (griseofulvin): antifungal, Rx: ringworm
Grepafloxacin (RAXAR): antibiotic, Rx: bronchitis, gonorrhea
GRISACTIN (griseofulvin): antifungal agent
Griseofulvin (FULVICIN): antifungal, Rx: ringworm
Gria-PEG (griseofulvin): antifungal, Rx: ringworm
GUAIFED, GUAIFED-PD (guaifenesin, pseudoephedrine): expectorant / decongestant
Guaifenesin (ROBITUSSIN): expectorant, Rx: colds, bronchitis
Guaifenesin w/ Codeine (ROBITUSSIN): expectorant / narcotic antitussive
GUAL-VENT (pseudoephedrine, guaifenesin): decongestant / expectorant, Rx: colds, bronchitis
Guanabenz (WYTENSIN): antihypertensive, Rx: HTN
Guanfacine (TENEX): antihypertensive, Rx: HTN
GYNAZOLE-I (butconazole): antifungal, Rx: yeast infections

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HABITROL (nicotine): Rx: relief of nicotine withdrawal symptoms
HALCION (triazolam): benzodiazepine hypnotic, Rx: insomnia
HALDOL (haloperidol): major tranquilizer
HALFPRIN (aspirin): Rx: acute MI prophylaxis
Haloperidol (HALDOL): antipsychotic, Rx: psychotic disorders, hyperactivity
HCTZ (hydrochlorothiazide): antihypertensive / diuretic, Rx: HTN
HEALTHY HEART (vitamins): vitamin supplement
HEMOCYTE (iron): iron supplement
HEMOCYTE PLUS (iron, vitamins, minerals): vitamin / mineral supplement
HEMOCYTE F Elixir (iron, vitamins, alcohol): vitamin / mineral supplement
HEMOCYTE F Tablets (iron, folic acid): iron supplement, Rx: hepatic dysfunction
HEP-FORTE (protein, vitamins, mineral): nutritional supplement
HEXALEN (altretamine): anticancer agent, Rx: ovarian cancer
HISTUSSIN D (hydrocodone, pseudoephedrine): narcotic antitussive / decongestant
HISTUSSIN HC (hydrocodone, phenylephrine, chlorpheniramine): narcotic antitussive / decongestant / antihistamine
HIVID (zalcitabine) antiviral, Rx: AIDS
Homosalate (SOLBAR): sunscreen, Rx: UVA, UVB protection

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- HUMALOG** (insulin): hypoglycemic, Rx: diabetes mellitus
HUMATE-P (antihemophilic factor IV): Rx: hemophilia
HUMATROPE (somatropin): human growth hormone
HUMEGON (menotropins): gonadotropin hormone, Rx: infertility
HUMBID LA (guaifenesin): expectorant, Rx: colds
HUMORSOL (demecarium): topical miotic, Rx: glaucoma
HUMULIN N, HUMULIN R (insulin): hypoglycemic, Rx: diabetes
HYALGAN (sodium hyaluronate): intra-articular polymer injection, Rx: osteoarthritis
Hyaluranton (HYALGAN): intra-articular polymer injection, Rx: osteoarthritis
HYCANTIN (topotecan): antineoplastic, Rx: ovarian, hepatic CA
HYCODAN (hydrocodone, homatropine): narcotic antitussive
HYCOMINE COMPOUND (hydrocodone, chlorpheniramine, APAP, caffeine, phenylephrine): narcotic antitussive / antihistamine / decongestant, Rx: colds, URI
HYCOMINE SYRUP (hydrocodone, phenylpropranolamine): narcotic antitussive / decongestant, Rx: cough, nasal congestion
HYCOTUSS (hydrocodone, guaifenesin): narcotic antitussive / expectorant
Hydralazine (APRESOLONE): antihypertensive agent
HYDRA-ZIDE (hydralazine, HCTZ): antihypertensive / diuretic
HYDREA (hydroxyurea): anticancer agent, Rx: melanoma, leukemia, ovarian CA
HYDROCET (hydrocodone, APAP): narcotic analgesic comp.
Hydrochlorothiazide (HCTZ): antihypertensive / diuretic
Hydrocodone: narcotic analgesic / antitussive
Hydrocodone with APAP (T-GESIC): narcotic analgesic
Hydrocortisone (CORTEF): steroid anti-inflammatory agent
HYDROCORTONE (hydrocortisone): steroid anti-inflammatory
HYDRODIURIL (HCTZ): antihypertensive / diuretic
Hydroflumethiazide (SALUTENSIN): antihypertensive / diuretic
Hydromorphone (DILAUDID): narcotic analgesic / antitussive
Hydroquinone (MELANEX): Rx: pigmentation disorders
Hydroxypropyl (LACRISERT): ophthalmic lubricant, Rx: dry eyes
Hydroxyurea (HYDREA): anticancer agent, Rx: melanoma, leukemia, ovarian CA
Hydroxyzine (ATARAX): sedative / tranquilizer / antihistamine
HYGROTON (chlorhalidone): antihypertensive / diuretic
HYLOREL (guanadrel): sympatholytic antihypertensive
Hyoscyamine (CYSTOSPAS): antispasmodic, Rx: lower urinary tract and GI tract spasm
Hypericum (St John's wort): mood elevator, dietary supplement
HYPERSTAT (diazoxide): antihypertensive, Rx: HTN
HYTONE (hydrocortisone): steroid anti-inflammatory
HYTRIN (terazosin): antihypertensive agent
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- IBERET** (iron, vitamins, mineral): vitamin / mineral supplement
IBU (ibuprofen): NSAID, analgesic
ibuprofen (ADVIL): NSAID, analgesic
Ibutilide (CORVERT): antiarrhythmic, Rx: A Fib
ILETIN (insulin preparations): Rx: diabetes mellitus
IMDUR (isosorbide mononitrate): long-acting nitrate, Rx: angina
Imipramine (TOFRANIL): tricyclic antidepressant
IMITREX (sumatriptan): Rx: migraine headache
IMODIUM (loperamide): slows peristalsis, Rx: diarrhea
IMODIUM A-D (loperamide): anti-diarrheal agent
IMURAN (azathioprine): immunosuppressant, Rx: organ transplants, ulcerative colitis, lupus, severe arthritis
Indapamide (LOZOL): antihypertensive / diuretic
INDERAL, INDERAL LA (propranolol): β -blocker, Rx: HTN, angina, cardiac dysrhythmias, MI, and migraine headache
- INDERIDE** (propranolol, HCTZ): β blocker, antihypertensive / diuretic compound, Rx: hypertension
INDOCIN, INDOCIN SR (indomethacin): NSAID, Rx: arthritis
Indomethacin (INDOCIN): NSAID analgesic, Rx: arthritis
INFERGEN (interferon alfacon-1): antiviral, Rx: hepatitis C
INH (isoniazid): antibiotic, Rx: tuberculosis
Insulin (HUMULIN): hypoglycemic, Rx: diabetes mellitus
INTAL (cromolyn): antiallergic, Rx: asthma prophylaxis
Interferon alfa-2a (ROFERON-A): antitumor/antiviral, Rx: hepatitis C, leukemia, AIDS-related Kaposi's sarcoma
Interferon alfa-2b (INTRON-A): antitumor/antiviral, Rx: leukemia, melanoma, lymphoma, genital warts
Interferon Alfacon-1 (INFERGEN): antiviral, Rx: hepatitis C
Interferon beta 1a (AVONEX): immunologic, Rx: MS
Interferon beta 1b (BETASERON): immunologic, Rx: MS
Interferon gamma 1b (ACTIMMUNE): immunologic, Rx: Chronic Granulomatous Disease
INVERSINE (mecamylamine): antihypertensive agent
INVRASE (saquinavir): protease inhibitor antiviral, Rx: HIV
IONAMIN (phentermine): stimulant, Rx: appetite suppression
Ipratropium (ATROVENT): bronchodilator
ISMO (isosorbide mononitrate): vasodilator, Rx: angina
Isoetharine (BRONKOMETER): β -bronchodilator, Rx: COPD, asthma
Isoniazid (INH): antibiotic, Rx: tuberculosis
Isoproterenol: β -bronchodilator, Rx: asthma, COPD
ISOPTIN SR (verapamil): calcium blocker, Rx: angina, HTN, headache
ISORDIL (isosorbide dinitrate): long-acting nitrate, Rx: angina
Isosorbide dinitrate (ISORDIL): long-acting nitrate, Rx: angina

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- K-LOR** (KCl): potassium supplement
K-PHOS (potassium phosphate): potassium ion
K-TAB (KCl): potassium supplement
KADIAN (morphine): narcotic analgesic
Kaolin-Pectin (KAOPECTATE): stool binder, Rx: diarrhea
KAOPECTATE (kaolin, pectin): stool binder, Rx: diarrhea
KAYEXALATE (sodium polystyrene): ion exchange resin, Rx: hyperkalemia
KEFLEX (cephalexin): antibiotic
KEFTAB (cephalexin): antibiotic
KEFUROX (cefuroxime): antibiotic
KEFZOL (cefazolin): antibiotic
KERLONE (betaxolol): β -1 blocker, Rx: HTN
Ketoconazole (NIZORAL): antifungal agent
Ketoprofen (ORUDIS): NSAID, Rx: arthritis
Ketorolac (TORADOL): NSAID analgesic
KIE Syrup (potassium iodide, ephedrine): expectorant / bronchodilator, Rx: asthma
KIONEX (sodium polystyrene): ion exchange resin, Rx: hyperkalemia
KLARON (sulfacetamide): antibacterial
KLONOPIN (clonazepam): benzodiazepine hypnotic, Rx: seizures
KLOR-CON (KCl): potassium supplement
KOGENATE (antihemophilic Factor VIII), Rx: hemophilia
KRISTALOSE (lactulose): stool softener, Rx: constipation
KRONOFED-A (pseudoephedrine, chlorpheniramine): decongestant, antihistamine, Rx: colds, allergies
KUTRASE (digestive enzymes, hyoscyamine, phenyltoloxamine): antispasmodic/sedative, Rx: indigestion
KU-ZYME (digestive enzymes): Rx: indigestion
KWELL (lindane): parasiticide, Rx: lice, scabies

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KYTRIL (granisetron): antiemetic / antinauseant

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Labetalol (NORMODYNE): β blocker, Rx: HTN, angina

LACTOCAL-F: multivitamin / mineral supplement

Lactulose (DUPHALAC): laxative, Rx: constipation

LAMICTAL (lamotrigine): anticonvulsant, Rx: seizures

LAMISIL (terbinafine): antifungal, Rx: fungal infections

Lamivudine (EPIVIR): antiviral, Rx: HIV

Lamotrigine (LAMICTAL): anticonvulsant, Rx: seizures

LANOXICAPS (digoxin): cardiac glycoside, Rx: CHF, supraventricular dysrhythmias

LANOXIN (digoxin): cardiac glycoside, Rx: CHF, dysrhythmias

Lansoprazole (PREVACID): suppresses gastric acid, Rx: ulcers

LANTUS (insulin): hypoglycemic agent, Rx: diabetes

LARIAM (mefloquine): antimalarial agent

LESCOL (fluvastatin): cholesterol reducer

LEUKERAN (chlorambucil): anticancer agent, Rx: leukemia, lymphoma, Hodgkin's disease

LEUKINE (sargamostim): white blood cell mobilizer, Rx: chemotherapy, bone marrow transplant

Leuprolide (LUPRON): hormone, Rx: endometriosis

Levalbuterol (XOPENEX): β -2 bronchodilator, Rx: COPD, asthma

Levamisole (ERGAMISOLE): immunostimulant, Rx: colon CA

LEVAQUIN (levofloxacin): antibacterial, Rx: pneumonia

Levetiracetam (KEPPRA): antiepileptic, Rx: seizures

LEVATOL (penbutolol): β blocker, Rx: hypertension

LEVBID (hyoscamine): antispasmodic, Rx: ulcers

LEVLEN 21,28 (levonorgestrel, estradiol): oral contraceptive

Levodopa (ATAMET): dopamine precursor, Rx: Parkinson's disease

LEVO-DROMORAN (levorphanol): narcotic analgesic

levofloxacin (LEVAQUIN): antibacterial, Rx: pneumonia

Levonorgestrel (NORPLANT): implanted contraceptive

LEVORA (levonorgestrel, estradiol): oral contraceptive

Levorphanol (LEVO-DROMORAN): narcotic analgesic

LEVOTHROID (levothyroxine): thyroid hormone

Levothyroxine (SYNTHROID): thyroid hormone

LEVOXYL (levothyroxine): thyroid hormone

LEVSIN, LEVSINEX (hyoscamine): antispasmodic, Rx: ulcers

LEXEL (enalapril, felodipine): ACE inhibitor, calcium blocker, Rx: HTN

LIBRIUM (chloridiazepoxide): benzodiazepine hypnotic

LIDEX, LIDEX E (flucinolone): steroid anti-inflammatory agent

LIMBITROL, LIMBITROL DS (chloridiazepoxide, amitriptyline): benzodiazepine hypnotic / tricyclic antidepressant, Rx: depression with anxiety

Lindane (KWELL): parasiticide, Rx: scabies

Liothyronine (CYTOMEL): thyroid hormone

Liotrix (THYROLAR): thyroid hormone

LIPITOR (atorvastatin): antihyperlipidemic, Rx: high cholesterol

Lisinopril (ZESTRIL): ACE inhibitor, Rx: HTN, CHF, MI

Lisipril, HCTZ (ZESTORETIC): ACE inhibitor, Rx: HTN, CHF, MI

Lithium (LITHOBID): antimanic, Rx: depression, mania

LITHOBID (lithium): antimanic agent, Rx: depression, mania

LOCOID (hydrocortisone): steroid anti-inflammatory

LODINE, LODINE XL (etodolac): NSAID, analgesic

LODRANE Allergy Capsules (brompheniramine): antihistamine

LODRANE LD Capsules (brompheniramine, pseudoephedrine): antihistamine / decongestant

LODRANE Liquid (brompheniramine, pseudoephedrine):

antihistamine / decongestant

LOESTRIN 21, FE (norethindrone, estradiol): oral contraceptive

LOMOTIL (diphenoxylate, atropine): narcotic antidiarrheal / antispasmodic compound

LOXON (diphenoxylate, atropine): narcotic antidiarrheal / antispasmodic compound

LO/OVRAL, LO/OVRAL 28: oral contraceptive

Loperamide (IMODIUM): antidiarrheal agent

LOPID (gemfibrozil): lowers serum lipids

LOPRESSOR (metoprolol): β -1 blocker, Rx: hypertension

LOPRESSOR HCT (metoprolol, hydrochlorothiazide): β -1 blocker, diuretic, Rx: hypertension

LOPROX (ciclopirox): antifungal, Rx: ringworm, Candida

LORABID (loracarbef): antibiotic, Rx: sinusitis

Loratadine (CLARITIN): non-sedating antihistamine, Rx: allergies

Lorazepam (ATIVAN): benzodiazepine hypnotic

LORCET 10/650, LORCET HD, LORCET PLUS (hydrocodone, APAP): narcotic analgesic compound

LORTAB (hydrocodone, APAP): narcotic analgesic

Losartan (COZAAR): antihypertensive, Rx: HTN

LOTENSIN (amodepril): ACE inhibitor, Rx: HTN, CHF

LOTREL (amiodipine, benazepril): calcium blocker / ACE inhibitor, Rx: HTN

LOTRIMIN (clotrimazole): antifungal agent

LOTRISONE (clotrimazole, betametasone): topical antifungal / steroid anti-inflammatory compound

LOTROXEX (alosetron): antidiarrheal, Rx: irritable bowel syndrome

Lovastatin (MEVACOR): lowers serum cholesterol

Loxapine (LOXITANE): antipsychotic, Rx: schizophrenia

LOXITANE (loxapine): tranquilizer

LOZOL (indapamide): antihypertensive / diuretic

LUFYLLIN (diphylline): bronchodilator, Rx: COPD, asthma

LUPRON DEPOT (leuprolide): hormone, Rx: endometriosis

LUVOX (fluvoxamine): antidepressant, Rx: Obsessive Compulsive Disorder

LYSDREN (mitolane): chemotherapy agent, Rx: adrenal

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MACROBID (nitrofurantoin): antibacterial, Rx: UTI

MACRODANTIN (nitrofurantoin): antibacterial, Rx: UTI

MAG-CARB (magnesium carbonate): nutritional supplement

MAGONATE (magnesium gluconate): electrolyte sedative, Rx: alcoholism, HTN, asthma

MAG-OX (magnesium): mineral dietary supplement

MAGSAL (magnesium, phenyltoloxamine): sedative compound

MAGTAB SR (magnesium): nutritional supplement

MALARONE (atovaquone, proguanil): antimalarial agents

Malathion (OVIDE): organophosphate insecticide, Rx: head lice

Maprotiline (LUDIOMIL): cyclic antidepressant

MARAX (ephedrine, theophylline, hydroxyzine): bronchodilator compound, Rx: asthma

MARINOL (dronabinol): appetite stimulant, Rx: weight loss in AIDS, chemotherapy

MATERNA: vitamin supplement

MATULANE (procarbazine): anticancer drug, Rx: Hodgkin's disease

MAVIK (trandolapril): ACE inhibitor, Rx: HTN

MAXAIR (pirbuterol): β -2 stimulant, Rx: asthma, COPD

MAXAQUIN (lomefloxacin): antibiotic

MAX2DE (triamterene, HCTZ): antihypertensive/diuretic, Rx: HTN

MEBARAL (mephobarbital): barbiturate sedative / anticonvulsant

Meclizine (ANTIVERT): antinauseant, Rx: vertigo

Meclotenamate: NSAID, Rx: arthritis, pain, dysmenorrhea, heavy menstrual blood loss

- MEDIGESIC** (butalbital, APAP, caffeine): analgesic compound, Rx: headache
- MEDIPELEX**: vitamin / mineral complex
- Medroxyprogesterone**: hormone, Rx: endometriosis, amenorrhea, uterine bleeding, contraception-
- MEFOXIN** (cefexitin): antibiotic
- MEGACE** (megestrol): appetite stimulant, Rx: anorexia with AIDS; also an antineoplastic, Rx: breast, endometrial CA
- Megestrol** (ME ACE): antineoplastic, Rx: breast, endometrial CA
- MEGADOSE**: vitamin / mineral complex
- Melatonin**: hormone, Rx: jet lag, depression
- MENEST** (estrogens): hormones, Rx: menopause, breast CA, prostatic CA
- MENTAX** (butenafine): antifungal, Rx: ringworm, athlete's foot
- MEPERGAN** (meperidine, promethazine): narcotic analgesic, phenothiazine sedative / antiemetic
- Meperidine** (DEMEROL): narcotic analgesic
- Mephobarbital** (MEBARAL): barbiturate sedative, anticonvulsant
- MEPHYTON** (vitamin K-1): Rx: coagulation disorders
- Meprobamate** (MILTOWN): tranquilizer
- MEPRON** (atovaquone) antibiotic, Rx: pneumocystis carinii - pneumonia in AIDS
- MESTINON** (pyridostigmine): anticholinesterase, Rx: myasthenia gravis
- Metaproterenol** (ALUPENT): β -2 bronchodilator, Rx: COPD, asthma
- Metformin** (GLUCOPHAGE): oral hypoglycemic, Rx: diabetes
- Methadone** (DOLOPHINE): narcotic analgesic
- Methamphetamine** (DESOXYN): stimulant appetite suppressant, Rx: ADD, obesity
- Methazolamide**: reduces intraocular pressure, Rx: glaucoma
- Methenamine** (URISED): antiseptic, Rx: UTI, cystitis
- METHERGINE** (methylergonovine): uterotonic, Rx: postpartum hemorrhage
- Methimazole** (TAPAZOLE): Rx: antithyroid, Rx: hyperthyroidism
- Methocarbamol** (ROBAXIN): skeletal muscle antispasmodic
- Mettiotrexate**: anticancer agent, Rx: psoriasis, arthritis
- Methsuximide** (CELONTIN): anticonvulsant, Rx: absence seizures
- Methylclothiazide** (AQUATENSEN): antihypertensive / diuretic
- Methyldopa** (ALDOMET): antihypertensive
- Methylphenidate** (RITALIN): stimulant, Rx: attention deficit disorder, narcolepsy
- Methylprednisolone** (MEDROL): steroid anti-inflammatory
- Metoclopramide** (REGLAN): improves gastric emptying, Rx: heartburn, ulcers
- Metolazone** (ZAROXOLYN): antihypertensive / diuretic
- Metoprolol** (LOPRESSOR): cardioselective β -blocker, Rx: HTN, angina, arrhythmias
- Metronidazole** (FLAGYL): antimicrobial agent
- MEVACOR** (lovastatin): lowers serum cholesterol
- Mexiletine** (MEXITIL): antiarrhythmic
- MEXITIL** (mexiletine): antiarrhythmic
- MEZLIN** (meziocillin): broad spectrum antibiotic
- MICARDIS** (telmisartan): ACE inhibitor, Rx: HTN
- Miconazole** (MONISTAT): antifungal, Rx: candidiasis
- MICONASE** (glyburide): oral hypoglycemic, Rx: diabetes
- MICRONOR** (norethindrone): oral contraceptive
- MICROZIDE** (HCTZ): thiazide antihypertensive / diuretic
- MIDAMOR** (amiloride): potassium-sparing diuretic
- Midazolam** (VERSED Syrup): sedative / anxiolytic
- MIDRIN** (isometheptene, dichloralphenazone, APAP): vasoconstrictor/sedative/analgesic, Rx: headache
- Miglitol** (GLYCET): oral hypoglycemic, Rx: diabetes
- MILTOWN** (meprobamate): tranquilizer
- MINIPRESS** (prazosin): alpha-1 blocker, Rx: hypertension
- MINITRAN** (transdermal nitroglycerin): nitrate, Rx: angina
- MINIZIDE** (prazosin, polythiazide): antihypertensive
- MINOCIN** (minocycline): antibiotic
- Minocyclim** (MINOCIN): antibiotic
- Minoxidil**: vasodilator / antihypertensive / topical hair growing agent, Rx: HTN, baldness
- MIRALAX** (polyethylene glycol): laxative
- Mirtazapine** (REMERON): antidepressant, Rx: depression
- MOBAN** (molindone): tranquilizer
- MOBIC** (meloxicam): NSAID analgesic
- MODERIL** (rescinnamine): antihypertensive
- MODICON 21, 28**: an oral contraceptive
- MODURETIC** (amiloride, HCTZ): antihypertensive / diuretic
- Moexipril** (UNIVASC): ACE inhibitor, Rx: HTN
- Mometasone** (ELOCON): topical steroid anti-inflammatory
- MONISTAT, MONISTAT DUAL-PAK, MONISTAT 3** (miconazole): an antifungal agent, Rx: candidiasis
- MONOCAL** (fluoride, calcium): mineral supplement
- MONOCLATE-P** (Factor VIII): antihemophilic factor
- MONODOX** (doxycycline): antibiotic
- MONOKET** (isosorfaide mononitrate): nitrate, Rx: angina
- MONOPRIL** (fosinopril): ACE inhibitor, Rx: HTN
- MONUROL** (fosfomycin): antibiotic, Rx: UTI
- Morphine sulfate**: narcotic analgesic
- MOTOFEN** (difenoxy, atropine): narcotic antiarrhythmic agent
- Moxifloxacin** (AVELOX): antibiotic, Rx: bronchitis, pneumonia
- MS CONTIN** (morphine): narcotic analgesic
- MSIR Capsules, Solution, Concentrate** (morphine): a narcotic analgesic
- MUCO-FEN DM** (dextromethorphan, guaifenesin): antitussive / expectorant, Rx: colds
- MUCO-FEN LA** (guaifenesin): expectorant, Rx: colds
- Mupirocin** (BACTROBAN): topical antibacterial, Rx: skin infections
- MYAMBUTOL** (ethambutol): chemotherapeutic, Rx: tuberculosis
- MYCELEX, MYCELEX G** (clotrimazole): antifungal, Rx: candidiasis
- MYCOSTATIN** (rifabutin): antibiotic, Rx: AIDS
- MYCOSTATIN** (nystatin): antifungal, Rx: candidiasis
- Mycophenolate** (CELLCEPT): immunosuppressant, Rx: organ transplants
- MYKROX** (metolazone): an antihypertensive / diuretic
- MYLERAN** (busulfan): anticancer agent, Rx: leukemia
- MYLICON** (simethicone): antifatulent
- MYLSOLINE** (primidone): anticonvulsant, Rx: epilepsy

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- Nabumetone** (RELAFEN): NSAID, Rx: arthritis
- Nadolol** (CORCARD): β -blocker, Rx: HTN, angina, arrhythmias
- NAFT1N** (nafitine): topical antifungal agent
- NALEX-A** (chlorpheniramine, phenylephrine, phenylephrine): antihistamine / sedative / decongestant, Rx: colds
- NALEX DH** (hydrocodone, phenylephrine, alcohol): narcotic antitussive / decongestant, Rx: colds
- NALFON** (fenoprofen): NSAID analgesic
- Naimefene** (REVEX): narcotic antidote, Rx: narcotic overdose
- Nartrexone** (REVIA): opioid antagonist; alcohol deterrent
- Naphazoline** (NAPHCON): steroid anti-inflammatory, Rx: itching eyes, ocular congestion
- NAPHCON** (naphazoline): steroid anti-inflammatory, Rx: itching eyes, ocular congestion
- NAPRELAN** (naproxen): NSAID analgesic

lower case = generic name, UPPER CASE = Brand name, Rx = prescribed for, APAP = acetaminophen, CA = Cancer, CHF = Congestive Heart Failure, COPD = Chronic Obstructive Pulmonary Disease, EPS = Extrapyrimalid Symptoms (dystonia), HTN = hypertension

APROSYN (naproxen): NSAID analgesic
Aproxen (ANAPROX): NSAID analgesic
Varatriptan (AMERGE): Rx: migraine headache
VAROIL (phenelzine): MAO inhibitor, Rx: depression, bulimia
VASACORT, NASACORT AQ (triamcinolone): steroid anti-inflammatory, Rx: allergies
VASALIOE (flunisolide): steroid anti-inflammatory agent
VASAREL (flunisolide): steroid anti-inflammatory, Rx: rhinitis
VASOBAL (cyanocobalamin): vitamin B-12, Rx: anemia
VAVANE (thiothixene): major tranquilizer
VELBINE (vinorelbine): antineoplastic, Rx: breast and ovarian CA, Hodgkin's disease
Vedocromil (TILADE): anti-inflammatory, Rx: asthma
Vefazodone (SERZONE): antidepressant, Rx: depression
VegGram (naldixic acid): antibacterial, Rx: UTI
Velinavir (VIRACEPT): protease inhibitor antiviral, Rx: HIV
NEMBUTAL (pentobarbital): barbiturate sedative / hypnotic
NEOEOCAORON (neomycin, dexamethasone): antibiotic / steroid anti-inflammatory
Neomycin (NEOSPORIN): antibiotic
NEORAL (cyclosporine): immunosuppressant, Rx: organ transplant
NEOSPORIN OINTMENT (polymyxin, bacitracin, neomycin): antibiotic compound
NEO-SYNEPHRINE (phenylephrine): vasoconstrictor, decongestant
NESACAIN (chlorprocaine): local anesthetic
NEPTAZINE (methazolamide): reduces aqueous humor production, Rx: glaucoma
NESTABSCBF (multivitamins): vitamin supplement
Netilmicin (NETROMYCIN): antibiotic
NETROMYCIN (netilmicin): antibiotic
NEUPOGEN (filgrastim): nutrient, Rx: chemotherapy
NEURONTIN (gabapentin): antiepileptic
NEUTREXIN (trimeprexate): antineoplastic, Rx: CA and pneumocystis pneumonia in AIDS
Nevirapine (VIRAMUNE): antiviral, Rx: HIV, AIDS
NEXIUM (esomeprazole): suppresses gastric acid pump, Rx: ulcers, esophagitis
Niacin (vitamin B-3): reduces serum cholesterol
NIACOR (niacin): vitamin B-3, Rx: lowers serum cholesterol
Nicardipine (CARDENE): calcium blocker, Rx: angina, HTN
NICORETTE (nicotine chewing gum): Rx: cigarette withdrawal
Nicotine (NICOTROL NS): Rx: relief of nicotine withdrawal symptoms
NICOTROL NS, NICOTROL TRANSOERMAL (nicotine): Rx: relief of nicotine withdrawal symptoms
Nitadipine, Nitedipin CC, Nhedipine XL (PROCARDIA): calcium blocker, Rx: angina, HTN
NIFEREX, NIFEREX-150 (iron): mineral, Rx: anemia
NIFEREX-150 FORTE (iron, vitamins): iron / vitamin supplement
NIFEREX-PN, NIFEREX-PN FORTE (iron, multivitamins): iron / vitamin supplement
NILANORON (nilutamide): antiandrogen, Rx: prostate CA
NIMOTOP (nimodipine): calcium channel blocker, improves neurological deficits after subarachnoid hemorrhage
Nisoldipine (SULAR): calcium channel blocker, Rx: HTN
NITRO-OUR (nitroglycerin): long-acting nitrate, Rx: angina prophylaxis
Nitrofurantoin (FURADANTIN): antibacterial agent, Rx: UTI
Nitroglycerin (NITROSTAT): vasodilator, Rx: angina
NITROL (nitroglycerin): nitrate ointment, Rx: angina
NITROLINGUAL SPRAY (nitroglycerin): nitrate, Rx: angina
NITROSTAT (nitroglycerin): vasodilator, Rx: angina

NIX (permethrin): parasiticide, Rx: head lice
Nizatidine (AXID): histamine-2 antagonist, Rx: ulcers
NIZORAL (ketoconazole): antifungal agent, Rx: yeast infections
NOLAHIST (phenindamine): antihistamine, Rx: allergies
NOLAMINE (phenindamine, chlorpheniramine, phenylpropranolamine): antihistamine / decongestant
NOLVAOEX (tamoxifen): anticancer agent, Rx: breast CA
NORCO cm (hydrocodone, APAP): narcotic analgesic compound
NOROETTE: oral contraceptive
NOREL (guaifenesin, phenylpropranolamine, phenylephrine): expectorant / decongestant, Rx: colds
NOREL PLUS (APAP, phenyltoloxamine, chlorpheniramine): analgesic / decongestant / antihistamine, Rx: colds
Norelthindrone (ORTHO-NOVUM): oral contraceptive
NORFLEX (orphenadrine): non-narcotic analgesic
NORGESIC (orphenadrine): non-narcotic analgesic
NORINYL: oral contraceptive
NORMOQYNE (labetalol): β blocker, Rx: HTN, angina
NOROXIN (norfloxacin): urinary tract antibiotic
NORPACE (norpac CR (disopyramide): antiarrhythmic
NORPLANT (levonorgestrel): contraceptive
NORPRAMIN (desipramine): tricyclic antidepressant
NOR-QO (norethindrone): oral contraceptive
Nortriptyline (PAMELOR): tricyclic antidepressant
NORVASC (amlodipine): calcium blocker, Rx: HTN, angina
NORVIR (nortavir): protease inhibitor antiviral, Rx: HIV
NOVOLIN (insulin): Rx: diabetes mellitus
NUBAIN (nalbuphine): narcotic analgesic
NUCOFEO (codeine, pseudoephedrine): narcotic antitussive / decongestant compound
NUCOFEO EXPECTORANT (codeine, pseudoephedrine, guaifenesin): narcotic antitussive / decongestant / expectorant
NU-IRON (iron): Rx: anemia
NU-IRON PLUS (iron, vitamins): iron/vitamin supplement
NU-IRON V (iron, vitamins): iron/vitamin supplement
NUMORPHAN (oxymorphone): narcotic analgesic
NUPRIN (ibuprofen): NSAID analgesic
Nystatin (MYCOSTATIN): antifungal agent
NYSTOP (nystatin): antifungal, Rx: Candida

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OBEGYN: vitamins and minerals
OCUFLOX (ofloxacin): ophthalmic anti-infective, Rx: conjunctivitis, corneal ulcers
Ofloxacin (FLOXIN): antibiotic
OGEN (estropipate): estrogen, Rx: menopause
Olanzapine (ZYPREXA): antipsychotic, Rx: psychosis
Olisalazine (DIPENTUM): salicylate, Rx: ulcerative colitis
Omeprazole (PRILOSEC): suppresses gastric acid secretion, Rx: ulcers, esophagitis, GERD
OMNICEF (cetridinir): antibiotic, Rx: pneumonia, bronchitis
OMNIHIST LA (chlorpheniramine, phenylephrine, methscopolamine): antihistamine / decongestant
Opium Alkaloids: narcotic analgesic / antidiarrheal
ORAMORPH (morphine sulfate): narcotic analgesic
ORAP (pimozide): antipsychotic, Rx: motor & phonic tics
ORGANIOIN NR (guaifenesin): expectorant, Rx: bronchitis
ORLAAM (levomephadryl): opiate agonist, Rx: narcotic addiction
Orlistat (ZENICOL): lipase inhibitor, Rx: obesity
ORNAOE (chlorpheniramine, phenylpropranolamine): antihistamine / decongestant compound
Orphenadrine (NORFLEX): non-narcotic analgesic

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ORTHO-CEPT 21, 28: oral contraceptive
 ORTHO-CYCLEN-21, 28: oral contraceptive
 ORTHO-EST (estropipate): estrogen, Rx: menopause, osteoporosis
 ORTHO-NOVUM: oral contraceptive
 ORTHO TRI-CYCLEN-21, 28: oral contraceptive
 ORUDIS (ketoprofen): NSAID, Rx: arthritis
 ORUVAIL (ketoprofen): NSAID analgesic
 OS-CAL: Calcium and Vitamin D supplement
 OVCON: oral contraceptive
 OVRAL: oral contraceptive
 OVRETTE (norgestrel): oral contraceptive
 OXANDRIN (oxandrolone): anabolic steroid, Rx: osteoporosis, weightloss
 Oxaprozin (DAYPRO): NSAID, Rx: arthritis
 Oxazepam (SERAX): benzodiazepine hypnotic
 OXISTAT (oxiconazole): topical antifungal agent
 Oxycodone (PERCODAN): narcotic analgesic
 Oxycodone w/ APAP (TYLOX): narcotic analgesic compound
 OXYCONTIN (oxycodone): narcotic analgesic

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PACAPS (butalbital, caffeine, APAP): sedative / analgesic, Rx: headache
 PAMELOR (nortriptyline): tricyclic antidepressant
 PANCREASE, PANCREASE MT (pancreatic enzymes): Rx: cystic fibrosis, pancreatitis
 Pantoprazole (PROTONIX): suppresses gastric acid, Rx: ulcers
 PARAFON FORTE (chlorzoxazone, acetaminophen): muscle relaxant / analgesic compound
 PARAPLATIN (carboplatin): anti-cancer agent, Rx: ovarian CA
 Paricalcitol (ZEMPLAR): vitamin-D, Rx: hyperparathyroidism
 PARLODEL (bromocriptine): Rx: Parkinson's disease, hypogonadism, infertility, amenorrhea
 PARNATE (tranylcypromine): MAO inhibitor, Rx: depression
 Paroxetine (PAXIL): antidepressant
 PASER (aminosalicylic acid): bacteriostatic, Rx: TB
 PATANOL (olopatadine): Rx: allergic conjunctivitis
 PAVULON (pancuronium): paralytic, Rx: surgery, endotracheal intubation
 PAXIL (paroxetine): antidepressant
 PCE (erythromycin): antibiotic
 PEDIACOF (codeine, phenylephrine, chlorpheniramine, potassium iodide): narcotic antitussive / decongestant / antihistamine
 PEDIAFLO (fluoride): mineral, Rx: osteoporosis, dental canes
 PEDIAPRED (prednisolone): steroid, Rx: allergies, arthritis, MS
 PEDIAZOLE: antibiotic compound
 PEDIOTIC (neomycin, polymyxin, hydrocortisone): antibiotic / steroid, Rx: ear infections
 Pemoline (CYLERT): stimulant, Rx: ADHD, narcolepsy
 Penbutolol (LEVATOL): β blocker, Rx: HTN, angina
 Penciclovir (DENAVID): antiviral, Rx: herpes
 PENECORT (hydrocortisone): steroid anti-inflammatory
 PENETREX (enoacin): antibacterial, Rx: STDs, UTI
 Penicillamine (CUPRIMINE): chelator, anti-rheumatic, Rx: heavy metal poisoning, Wilson's disease, arthritis, cystinuria
 Penicillin: antibiotic
 PENTASA (mesalamine): Rx: ulcerative colitis
 Pentazocine (TALWIN): narcotic analgesic
 Pentazocine & Naloxone (TALWIN NX): narcotic analgesic
 Pentobarbital (NEMBUTAL): sedative / hypnotic, Rx: insomnia
 Pentosan (ELMIRON): urinary tract analgesic, Rx: bladder pain
 Pentostatin (NIPENT): oncologic, antibiotic, Rx: leukemia

Pentoxifylline (TRENAL): reduces blood viscosity, improves circulation in peripheral vascular disease
 PENTOXIL (pentoxifylline): reduces blood viscosity, improves circulation in peripheral vascular disease
 PENTRITOL (pentaerythritol tetranitrate): long-acting nitrate, Rx: angina prophylaxis
 PEPCID (famotidine): Histamine-2 blocker which inhibits gastric acid production, Rx: ulcers
 PERCOCET (oxycodone, APAP): narcotic analgesic
 PERCODAN (oxycodone, aspirin): narcotic analgesic
 PERCODAN-DEMI (oxycodone, aspirin): narcotic analgesic
 PERCOLONE (oxycodone): narcotic analgesic
 PERDIEM (psyllium): bulk-forming laxative
 PERIDIN C (vitamins, antioxidants): dietary supplement
 PERIGARD (chlorhexidine): oral rinse
 Pergolide (PERMAX): dopamine receptor stimulator, Rx: Parkinson's disease
 PERGONAL (menotropins): gonadotropin hormone, Rx: stimulates ovulation, spermatogenesis
 PERIACTIN (ciproheptadine): antihistamine
 PERI-COLACE (casanthranol, docusate): laxative / stool softener
 PERIOSTAT (doxycycline): antibiotic
 Perindopril (ACEON): ACE inhibitor, Rx: HTN
 PERMAX (pergolide): dopamine receptor stimulator, Rx: Parkinson's disease
 Permethrin Lotion (NIX): parasiticide, Rx: head lice
 Perphenazine (TRILAFON): phenothiazine major tranquilizer
 PERSANTINE (dipyridamole): cerebral & coronary vasodilator, Rx: CVA, angina
 PFIZERPEN (penicillin): antibiotic
 PHENAPHEN with codeine (APAP, codeine): narcotic analgesic
 Phenelzine (NARDIL): MAO inhibitor, Rx: depression, bulimia
 Phenazopyridine (PYRIDIUM): urinary tract analgesic
 PHENERGAN (promethazine): phenothiazine sedative / antemetic
 Pheniramine (POLY-HISTINE): antihistamine, Rx: allergies
 Phenobarbital: barbiturate sedative / anticonvulsant
 Phentemine (ADIPEX-P): amphetamine, Rx: obesity
 Phenylephrine (NEO-SYNEPHRINE): decongestant, Rx: colds
 Phenylpropranolamine (ENTEX): decongestant, Rx: colds
 Phenylpropranolamine w/ guaifenesin (ENTEX LA): decongestant / expectorant compound
 Phenytoin (DILANTIN): anticonvulsant, Rx: epilepsy
 PhosLo (calcium): phosphate reducer, Rx: renal failure
 Phosphatidylcholine (PHOSCHOL): lecithin, Rx: nutritional supplement, synthesizes acetylcholine
 PHOTOFRIN (porfirin): antineoplastic, Rx: esophageal CA, lung CA
 PHRENILIN (butalbital, APAP): analgesic compound
 Phytonadione (AQUAMEPHYTON): Vitamin K1, Rx: coagulation disorders
 Pilocarpine (SALAGEN): cholinergic, Rx: dry mouth, Sjogren's syndrome
 PIMA (potassium iodide): expectorant, Rx: asthma, bronchitis
 Pimozide (ORAP): antipsychotic, Rx: Tourette's syndrome
 Pindolol (VISKEN): β -blocker, Rx: HTN, angina
 Pioglitazone (ACTOS): oral hypoglycemic, Rx: diabetes
 Piperacillin (PIPRACL): antibiotic
 PIPRACIL (piperacillin): antibiotic
 Pirbuterol (MAXAIR): beta bronchodilator, Rx: asthma, COPD
 Piroxicam (FELDENE): NSAID analgesic, Rx: arthritis
 PLACIDYL (ethchlorvynol): hypnotic, Rx: insomnia
 PLAQUENIL (hydroxychloroquine): antimalarial agent
 PLENDIL (felodipine): calcium blocker, Rx: HTN, angina
 PNEUMOMIST (guaifenesin): expectorant, Rx: asthma, bronchitis

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PNEUMOTUSSIN HC (guaifenesin, hydrocodone): expectorant / narcotic antitussive

PODOCON-25 (podophyllin): cytotoxic, Rx: venereal warts

Polymyxin (NEOSPORIN): antibiotic

Polythiazide (RENESE): antihypertensive/ diuretic, Rx: CHF, HTN

POLYTPIM (trimethoprim, polymyxin): antibacterial, Rx: eye infections

PONSTEL (metenamic acid): NSAID analgesic

POTABA (aminobenzoate): Rx: fibrosis, scleroderma

Potassium Chloride (K-TAB): potassium supplement

PRANDIN (repaglinide): Increases insulin release, Rx: diabetes

PRAMOSONE (hydrocortisone, pramoxine): steroid anti-inflammatory / anesthetic, Rx: dermatoses

PRAVACHOL (pravastatin): cholesterol reducer

Pravastatin (PRAVACHOL): cholesterol reducer

Praiosin (MINIPRESS): alpha-1 blocker, vasodilator, Rx: HTN

PRECOSE (acarbose): delays carbohydrate digestion, Rx: diabetes mellitus

Prednisolone (PRELONE): steroid anti-inflammatory agent

Prednisone: steroid anti-inflammatory agent

PREMPRO (estrogens): hormone, Rx: menopause

PRELONE SYRUP (prednisolone): steroid anti-inflammatory

PRELU-2 (phendimetrazine): amphetamine appetite suppressant, Rx: obesity

PREMARIN: estrogens, Rx: menopause

PREMPHASE (estrogens, medroxyprogesterone): hormones, Rx: menopause, osteoporosis

PREVACID (lansoprazole): gastric acid pump inhibitor, Rx: ulcers, esophagitis

PREVALITE (cholestyramine): cholesterol reducer

PRILOSEC (omeprazole): gastric acid pump inhibitor, Rx: ulcers, esophagitis

PRIMATENE MIST (epinephrine): bronchodilator, Rx: asthma

PRIMATENE Tablets (theophylline, ephedrine, phenobarbital) xanthine bronchodilator, Rx: asthma

Primidone (MYSOLINE): anticonvulsant, Rx: epilepsy

PRINIVIL (lisinopril): ACE inhibitor, Rx: HTN, CHF

PRINZIDE (lisinopril, HCTZ): antihypertensive compound

Probenecid (BENEMID): increases uric acid secretion in gout; also slows the elimination of penicillin from the body

Procainamide (PROCANBID): antiarrhythmic

PROCANBID (procainamide): antiarrhythmic

PROCARDIA, PROCARDIA XL (nifedipine): calcium channel blocker, Rx: angina, hypertension

Prochlorperazine (COMPAZINE): phenothiazine antiemetic

PRODIUM (phenazopyridine): urinary tract analgesic, Rx: UTI

PROFEN-LA, PROFEN II (phenylpropanolamine, guaifenesin): decongestant / expectorant

PROGLYCEM (diazoxide): increases blood glucose, Rx: hypoglycemia

Promethazine (PHENERGAN): sedative / antiemetic

PROPAGEST (phenylpropanolamine): nasal decongestant

PROPECIA (finasteride): Rx: hair loss prevention

Propranolol (PRO-BANTHINE): anticholinergic, inhibits gastric acid secretion, Rx: peptic ulcers

Propoxyphene (DARVON): narcotic analgesic

Propranolol (INDERAL): β blocker, Rx: HTN, prophylaxis of angina, cardiac dysrhythmias, AMI, and migraine HA

PROPULSID (cisapride): increases gastric emptying

Propylthiouracil: antithyroid agent, Rx: hyperthyroidism

PROSCAR (finasteride): Rx: prostatic hypertrophy

PROSOM (estazolam): hypnotic, Rx: insomnia

PROSTIGMIN (neostigmine): anticholinesterase, Rx: myasthenia gravis

PROTID (APAP, chlorpheniramine, phenylephrine): analgesic / antihistamine / decongestant, Rx: colds

PROTONIX (pantoprazole): proton pump inhibitor, Rx: ulcers

PROTROPIN (somatrem): human growth hormone

PROVENTIL HFA (albuterol): β -2 bronchodilator, Rx: asthma

PROVERA (medroxyprogesterone): hormone, Rx: amenorrhea

PROZAC (fluoxetine): heterocyclic antidepressant

Pseudoephedrine (SUDAFED): decongestant, Rx: colds

PULMICORTurbuhaler (budesonide): steroid anti-inflammatory, Rx: asthma

PULMOTYZE (dornase alfa or DNase): lytic enzyme which dissolves infected lung secretions, Rx: cystic fibrosis

PURINETHOL (mercaptopurine): anti-leukemia agent

Pyrazinamide (RIFATER): antibacterial, Rx: TB

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Q-BID (coenzyme Q-10): helps maintain healthy muscle, increases ATP production

Quetiapine (SEROQUEL): antipsychotic, Rx: psychosis

QUINAGLUTE (quinidine): antiarrhythmic, Rx: supraventricular and ventricular dysrhythmias

Quinapril (ACUPRIL): ACE inhibitor, Rx: HTN, CHF

QUINIDEX (quinidine): antiarrhythmic, Rx: supraventricular and ventricular dysrhythmias

Quinidine gluconate (quinidine): antiarrhythmic, Rx: supraventricular and ventricular dysrhythmias

Quinidine sulfate (quinidine): antiarrhythmic, Rx: supraventricular and ventricular dysrhythmias

Quinine: antimalarial, Rx: malaria

Quinupristin/Dalfopristin (SYNERCID): antimicrobials

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Raloxifene (EVISTA): Rx: osteoporosis prevention

Ramipril (ALTACE): ACE inhibitor, Rx: HTN

Ranitidine (ZANTAC): histamine-2 blocker, Rx: ulcers

REBETRON (interferon alfa, ribavirin): antivirals, Rx: Hepatitis C

RECOMBINATE (Factor VIII): clotting agent, Rx: hemophilia

RECOMBIVAX HB (hepatitis B vaccine): vaccine, Rx: hepatitis B

REGLAN (metoclopramide): improves gastric emptying, Rx: heartburn, ulcers

REGONOL (pyridostigmine): anticholinesterase, Rx: Myasthenia Gravis

REGRANEX (becaplermin): cellular growth agent, Rx: ulcers, diabetes

RELAFEN (nabumetone): NSAID, Rx: arthritis

REMERON (mirtazapine): antidepressant, Rx: depression

RemHentanil (ULTIVA): narcotic analgesic

RENESE (polythiazide): antihypertensive/diuretic, Rx: CHF, HTN

RENOVA (tretinoin): anti-acne, anti-wrinkle agent

Repaglinide (PRANDIN): stimulates insulin release, Rx: diabetes

REPRONEX (menotropins): fertility drug. Induces ovulation

REQUIP (ropinirole): dopaminergic, Rx: Parkinson's disease

Rescinnamine (MODERIL): antihypertensive

RESCRIPTOR (descaripridine): antiviral, Rx: HIV

RESCULA (unoprostone): lowers intraocular pressure, Rx: glaucoma

Resepine (SALUTENSIN): antihypertensive / tranquilizer

RESPA-1st (pseudoephedrine, guaifenesin): decongestant/ expectorant

RESPA-DM (dextromethorphan, guaifenesin): antitussive / expectorant

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RESPA-GF (guaifenesin): expectorant
 RESPAHIST (brompheniramine, pseudoephedrine): antihistamine / decongestant
 RESPAIRE-SR (pseudoephedrine, guaifenesin): decongestant / expectorant
 RESTORIL (temazepam): benzodiazepine hypnotic
 RETIN-A (tretinoin): anti-acne, anti-wrinkle agent
 RETROVIR (zidovudine): antiviral agent, Rx: HIV (AIDS) virus
 REVIA (naltrexone): opioid antagonist, alcohol deterrent
 REZUUN (troglitazone): oral hypoglycemic, Rx: diabetes
 RHINOCORT (budesonide): corticosteroid, Rx: allergic rhinitis
 Riboflavin (vitamin B-2): vitamin supplement
 RIFADIN (rifampin): antibiotic, Rx: tuberculosis, meningitis
 RIFAMATE (rifampin, isoniazid): antibiotics, Rx: tuberculosis
 RIFATEB (isoniazid, rifampin, pyrazinamide): antibiotic, Rx: TB
 RILUTEK (riluzole): Rx: amyotrophic lateral sclerosis (ALS)
 RIMACTANE (rifampin): antibiotic, Rx: TB, meningitis
 RISPERDAL (risperidone): antipsychotic, Rx: schizophrenia
 RITALIN, RITALIN-SR (methylphenidate): stimulant, Rx: attention deficit disorder in children, narcolepsy
 RHonavir (NORVIR): antiviral, Rx: HIV
 RMS (morphine sulfate): narcotic analgesic suppositories
 ROBAXIN (methocarbamol): sedative, Rx: painful musculoskeletal conditions
 ROBAXIN 750 (methocarbamol): sedative, Rx: painful musculoskeletal conditions
 ROBAXISAL (methocarbamol, aspirin): sedative / analgesic, Rx: painful musculoskeletal conditions
 ROBINUL, ROBINUL FORTE (glycopyrrolate): anticholinergic, Rx: peptic ulcers
 ROBITUSSIN (guaifenesin): expectorant
 ROBITUSSIN A-C (guaifenesin, codeine, alcohol): expectorant, cough suppressant, Rx: colds
 ROBITUSSIN43AC (guaifenesin, codeine, alcohol, pseudoephedrine): expectorant, cough suppressant, decongestant, Rx: colds
 ROCALTRON (calcitriol): vitamin D analog, Rx: hypocalcemia, bone disease
 ROCEPHIN (ceftriaxone): antibiotic
 ROFERON-A (interferon): immunoadjuvant, Rx: hairy cell leukemia, AIDS-related Kaposi's sarcoma
 ROGAINE (minoxidil): topical hair growing agent, Rx: baldness, HTN
 RONDEC Chewable Tablet (brompheniramine, pseudoephedrine): antihistamine / decongestant
 RONDEC Oral Drops, RONDEC Syrup, RONDEC Tablet, RONDEC TR Tablet (carbinoxamine, pseudoephedrine): antihistamine / decongestant
 RONDEC DM (carbinoxamine, pseudoephedrine, dextromethorphan): antihistamine / decongestant / antitussive
 Ropinrole (REQUIP): dopaminergic, Rx: Parkinson's disease
 Rosiglitazone (AVANDIA): oral hypoglycemic, Rx: diabetes
 ROWASA (mesalamine): anti-inflammatory, Rx: colitis, proctitis
 ROXANOL 100 (morphine): narcotic analgesic
 ROXICODONE (oxycodone): narcotic analgesic
 ROXIOX (oxycodone, APAP): narcotic analgesic compound
 ROXIPRIN (oxycodone, ASA): narcotic analgesic compound
 RUM-K (potassium): potassium supplement
 RYNATAN (phenylephrine, chlorpheniramine, pyrilamine): antihistamine / decongestant compound
 RYNATUSS: antitussive / decongestant / antihistamine

RYTHMOL (propafenone): antiarrhythmic, Rx: severe ventricular dysrhythmias

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SAFE TUSSIN 30 (guaifenesin, dextromethorphan): expectorant / antitussive

SAIZEN (somatropin): growth hormone
 SAL-ACID (salicylic acid): Rx: removes warts
 SALACTIC Film (salicylic acid): Rx: removes warts
 SALAGEN (pilocarpine): parasympathomimetic, Rx: glaucoma
 SALBUTAMOL (albuterol): β -2 bronchodilator, Rx: asthma, COPD
 SALFLEX (salsalate): NSAID analgesic, Rx: arthritis
 Salicylic acid (SAL-ACID): Rx: removes warts
 Salmeterol (SEREVENT): β -2 bronchodilator, Rx: asthma, COPD
 SALP ANT Gel (salicylic acid): for removal of common warts
 Salsalate (SALFLEX): NSAID analgesic, Rx: arthritis
 SANDIMMUNE (cyclosporine): immunosuppressant agent, Rx: prophylaxis of rejection of transplanted organs
 SANDOSTATIN (octreotide): antidiarrheal, growth inhibitor, Rx: carcinoid tumor, acromegaly, intestinal tumors, diarrhea
 SANGCYA (cyclosporine): immunosuppressant agent, Rx: prophylaxis of rejection of transplanted organs
 Saquinavir (INVIRASE): antiviral, Rx: HIV
 SARAPIN (Pitcher Plant extract): analgesic, Rx: nerve block for sciatic pain, neuritis, neuralgia
 Sargamostim (LEUKINE): bone marrow stimulant, Rx: bone marrow transplant, leukemia
 Scopolamine: antispasmodic / sedative
 SECTRAL (acebutolol): β -blocker, Rx: KTN, cardiac dysrhythmias
 SEDAPAP (butalbital, APAP): sedative/analgesic, Rx: tension H/A
 Selenium (SELSUN BLUE): trace mineral, Rx: seborrhea, dandruff
 SEMPRED-D (acrivastine, pseudoephedrine): antihistamine / decongestant
 Senna Extract (SENOKOT): laxative, Rx: constipation
 SENOKOT (senna fruit extract): a laxative
 SENOKOT XTRA (senna extract): laxative, Rx: constipation
 SENOKOT-S (senna, docusate): laxative / stool softener, Rx: constipation
 SENSORCAINE, SENSORCAINE-MPF (bupivacaine): local anesthetic
 SENSORCAINE with Epi (bupivacaine, epinephrine): local anesthetic with vasoconstrictor
 SEPTRA, SEPTRA DS (trimethoprim, sulfamethoxazole): antibacterial compound, Rx: UTI, ear infection, bronchitis
 SERENTIL (mesoridazine): major tranquilizer
 SEREVENT (salmeterol) β -2 bronchodilator, Rx: asthma, COPD
 Sermorelin (GEREF): growth hormone
 SEROMYCIN (cytosine): antibiotic, Rx: TB, UTI
 SEROPHENE (clomiphene): induces ovulation
 SEROQUEL (quetiapine): antipsychotic, Rx: schizophrenia
 SEROSTIM (somatropin): hormone, Rx: AIDS wasting
 Sertraline (ZOLOFT): antidepressant, Rx: depression, panic disorder, obsessive-compulsive disorder
 SERZONE (nefazodone): antidepressant, Rx: depression
 SILVADENE (silver sulfadiazine): topical antimicrobial agent, Rx: infection prophylaxis for burns of the skin
 SINEMET, SINEMET CR (carbidopa, levodopa): dopamine precursors, Rx: Parkinson's Disease
 SINEQUAN (doxepin): tricyclic antidepressant
 SINGULAIR (montelukast): Rx: asthma
 SINULIN (APAP, phenylpropanolamine, chlorpheniramine): analgesic / decongestant / antihistamine, Rx: colds, allergies

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SINUTAB (phenylephrine, guaifenesin): decongestant / expectorant
SINUTAB SINUS (APAP, pseudoephedrine): analgesic / decongestant

SINUTAB SINUS ALLERGY (APAP, pseudoephedrine, chlorpheniramine): analgesic / decongestant / antihistamine

SINUVENT (phenylpropranolamine, guaifenesin): decongestant / expectorant

SKELAXIN (metaxalone): sedative / analgesic

SLO-BID (theophylline): bronchodilator, Rx: COPD, asthma

SLO-NIACIN (niacin): reduces serum cholesterol

SLO-PHYLUN (theophylline): bronchodilator, Rx: COPD, asthma

SOMA (carisoprodol): sedative / antispasmodic

SOMA Compound (carisoprodol, aspirin): sedative / antispasmodic / analgesic, Rx: muscle spasm

SORBITRATE (isorbide dinitrate): nitrate, Rx: angina

SORIATANE (acitretin): retinoid, Rx: psoriasis

Sotalol (BETAPACE): β blocker, Rx: HTN, angina, arrhythmias

SPECTAZOLE (econazole): antifungal agent

SPECTROBID (bacampicillin): antibiotic

Spironolactone (ALDACTONE): potassium-sparing diuretic

Spironolactone, Triamterene, HCTZ: diuretics, Rx: HTN

SPORANOX (itraconazole): antifungal

SSKI (potassium iodide): expectorant

STADOL NS (butorphanol): narcotic analgesic

Stevudine d4T (ZERIT): antiviral, Rx: HIV

STELAZINE (trifluoperazine): major tranquilizer

STERAPRED, STERAPRED DS (prednisone): steroid anti-inflammatory

STIMATE (desmopressin): pituitary hormone, Rx: hemophilia

STROMECTOL (ivermectin): anti-parasite, Rx: intestinal nematodes

Sucralfate (CARAFATE): anti-ulcer agent, Rx: duodenal ulcers

SUDAFED (pseudoephedrine): nasal decongestant

SUDAFED COLD & ALLERGY (pseudoephedrine, chlorpheniramine): decongestant / antihistamine

SUFENTA (sufentanil): narcotic analgesic / anesthetic

SULAR (nifedipine): calcium channel blocker, Rx: HTN

Suhamethoxazole (GANTANOL): bacteriostatic, Rx: UTI

SuKaniamide (AVC): anti-infective, Rx: Candida

Sulfisoxazole (GANTRISIN): bacteriostatic agent, Rx: UTI

Sulindac (CLINORIL): NSAID analgesic, Rx: arthritis

Sunatriptan (MILTREX): Rx: migraine headache

SUPRAX (cefixime): broad spectrum antibiotic

SURMONTIL (trimipramine): tricyclic antidepressant

SUSTIVA (efavirenz): antiviral, Rx: HIV, AIDS

SYMMETREL (amantadine): antiparkinsonian / antiviral

SYNALAR (fluciclonolone): topical steroid anti-inflammatory

SYNALGOS-DC (dihydrocodeine, aspirin, caffeine): narcotic analgesic compound

SYNEMOL (fluciclonolone): topical steroid anti-inflammatory

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TAGAMET (cimetidine): histamine-2 blocker which inhibits gastric acid secretion, Rx: ulcers

TALACEN (pentazocine + APAP): narcotic analgesic

TALWIN Compound (pentazocine, ASA): narcotic analgesic

TALWIN NX (pentazocine, naloxone): narcotic analgesic

TAMBOCOR (flecainide): ventricular antiarrhythmic

Tamoxifen (NOLVADEX): anticancer agent, Rx: breast CA

TAO (troleandomycin): antibiotic, Rx: pneumonia, URI

TAPAZOLE (methimazole): antithyroid, Rx: hyperthyroidism

TARKA (trandolapril, verapamil): ACE inhibitor/calcium blocker, Rx: HTN

TAVIST (clemastine): antihistamine, Rx: allergies

TAVIST-D (clemastine, phenylpropranolamine): antihistamine / decongestant, Rx: allergies

TAZICEF (ceftazidime): antibiotic

TAZIDIME (ceftazidime): antibiotic

TEDRAL (theophylline, ephedrine, phenobarbital): bronchodilator compound, Rx: asthma, bronchitis

TEGRETOL, TEGRETOL XR (carbamazepine): Rx: convulsant, Rx: epilepsy

Temazepam (RESTORIL): benzodiazepine hypnotic

Temisartan (MICARDIS): ACE inhibitor, Rx: HTN

TEMOVATE (clobetasol): steroid anti-inflammatory

TENEX (guanfacine): antihypertensive agent

Teniposide (VUMON): antineoplastic, Rx: leukemia

TENORETIC (atenolol, chlorthalidone): β -1 blocker/diuretic, Rx: HTN

TENORMIN (atenolol): β -1 blocker, Rx: dysrhythmias, HTN, angina, MI prophylaxis

TENSILON (edrophonium): cholinergic, Rx: Myasthenia Gravis

TERAZOL (terconazole): antimicrobial, Rx: candidiasis

Terazosin (HYTRIN): alpha-1 blocker antihypertensive

Terbinafine (LAMISIL): antifungal, Rx: nail fungus, ringworm

Terbutaline (BRETHINE): β bronchodilator, Rx: COPD, asthma

Tereonazole (TERAZOL): antimicrobial, Rx: candidiasis

TERRA-CORTRIL (hydrocortisone, oxytetracycline): steroid anti-inflammatory, antibiotic, Rx: ocular infections

TERRAMYCIN (oxytetracycline): antibiotic

TERRAMYCIN With Polymyxin B (oxytetracycline): antibiotics

TESLAC (testolactone): antineoplastic, Rx: breast cancer

TESSALON (benzonatate): non-narcotic cough suppressant

TESTRED (methyltestosterone): androgenizing hormone

TESTODERM (testosterone): androgen, Rx: hypogonadism

Testosterone (ANDRODERM): androgenizing hormone

Tetracaine (CETACAINE): topical anesthetic

Tetracycline (ACHROMYCIN): antibiotic

TETRAMUNE (diphtheria & tetanus toxoids): vaccine

Thalidomide (THALOMID): immunosuppressant, Rx: HIV, leprosy

THALITONE (chlorthalidone): antihypertensive / diuretic, Rx: HTN, CHF

THALOMID (thalidomide): immunosuppressant, Rx: HIV, leprosy

THEO-24 (theophylline): bronchodilator, Rx: asthma, COPD

THEO-DUR (theophylline): bronchodilator, Rx: asthma, COPD

THEOLAIR (theophylline): bronchodilator, Rx: asthma, COPD

THEOPHYLLINE (THEO-DUR): bronchodilator, Rx: asthma, COPD

THEO-X (theophylline): bronchodilator, Rx: asthma, COPD

THERA-GESIC (salicylate): topical NSAID analgesic, Rx: arthritis

THERAMYCIN Z (erythromycin): antibiotic

Thiabendazole (MINTEZOL): antiparasitic, Rx: pinworm, roundworm, trichinosis

Thiamine (vitamin B-1): vitamin supplement

THIOLA (tiopronin): cysteine-depleting agent, Rx: kidney stone prevention

Thioguanine (TABLOID): anticancer agent, Rx: leukemia

THIOPENTAL (pentothal): general anesthetic

THIOPLEX (thiotepa): antineoplastic, Rx: breast, ovarian, and urinary cancer

Thioridazine: major tranquilizer

Thiotepa (THIOPLEX): antineoplastic, Rx: breast, ovarian, and urinary cancer

Thiothixene (NAVANE): major tranquilizer

THORAZINE (chlorpromazine): major tranquilizer

THYREL TRH (protirelin): increases release of thyroid stimulating hormone

THYROID Tablets: thyroid hormone

lower case = generic name, UPPER CASE = Brand name, Rx = prescribed for, APAP = acetaminophen, CA = Cancer, CHF = Congestive Heart Failure, COPD = Chronic Obstructive Pulmonary Disease, EPS = Extraparalymidal Symptoms (dystonia), HTN = hypertension

- THYROLAR** (liotrix): thyroid hormone
- Tiagabine** (GABITRIL): antiepileptic, Rx: partial seizures
- TIAZAC** (diltiazem): calcium blocker, Rx: HTN, angina
- TICAR** (ticarcillin): antibiotic
- TICLID** (ticlopidine): platelet inhibitor, Rx: stroke prophylaxis
- TIGAN** (trimethobenzamide): antiemetic
- TILADE** (nedocromil): anti-inflammatory, Rx: asthma
- TIMENTIN** (ticarcillin / clavulanate): antibiotic compound
- TIMOLIDE** (timolol, HCTZ): β -blocker/antihypertensive/diuretic
- Timotol** (BLOCADREN) β -blocker, Rx: HTN, angina, arrhythmias
- TIMOPTIC** (timotol): β -blocker, Rx: glaucoma
- Tizanidine** (ZANAFLEX): alpha blocker, Rx: spasticity
- TOBRADEX** (tobramycin, dexamethasone): antibiotic / steroid, Rx: eye infection / inflammation
- TOFRANIL** (imipramine): tricyclic antidepressant
- Tolazamide**: oral hypoglycemic, Rx: diabetes
- Tolbutamide**: oral hypoglycemic, Rx: diabetes
- TOLECTIN** (tolmetin): NSAID analgesic
- Tolmetin** (TOLECTIN): NSAID analgesic
- TONOCARD** (tocainide): ventricular antiarrhythmic
- TOPAMAX** (topiramate): anticonvulsant, Rx: seizures
- TOPROL-XL** (metoprolol): cardioselective beta blocker, Rx: HTN, angina, arrhythmias
- TORADOL** (ketorolac): NSAID analgesic
- TORNALATE** (bitolterol): β bronchodilator, Rx: asthma
- Tramadol** (ULTRAM): analgesic
- TRANDATE** (labetalol): β blocker, Rx: hypertension
- TRANSDERM NITRO** (nitroglycerin): nitrate vasodilator, Rx: angina prophylaxis
- TRANSDERM-SCOP** (scopolamine): anticholinergic antiemetic, Rx: motion sickness prophylaxis
- TRANXENE T-TAB, TRANXENE-SD** (clorazepate): benzodiazepine hypnotic, Rx: anxiety, seizures
- TRAUMEEL**: anti-inflammatory, Rx: arthritis
- Trazodone** (DESYREL): antidepressant
- TRECATOR-SC** (ethionamide): bacteriostatic, Rx: tuberculosis
- TRENTAL** (pentoxifylline): reduces blood viscosity, improves circulation in peripheral vascular disease
- Tretinoin** (RETIN-A): anti-acne, anti-wrinkle agent
- Triamcinolone** (AZMACORT): steroid anti-inflammatory
- Triamterene c HCTZ** (DYAZIDE): antihypertensive / diuretic
- TRIAVIL** (amitriptyline, perphenazine): tricyclic antidepressant / major tranquilizer combination
- Triazolam** (HALCION): benzodiazepine hypnotic, Rx: insomnia
- Trifluoperazine** (STELAZINE): major tranquilizer
- Trihexyphenidyl** (ARTANE): antispasmodic, Rx: Parkinson's Disease
- TRILAFON** (perphenazine): major tranquilizer
- TRI-LEVELN**: oral contraceptive
- TRILISATE** (salicylate): anti-inflammatory/analgesic
- Trinethoprim** (BACTRIM): antibiotic
- Trimethoprim-sulfamethoxazole** (BACTRIM): antibacterials, Rx: UTI, ear infection, bronchitis
- TRINALIN** (azatadine, pseudoephedrine): antihistamine / decongestant compound
- TRI-NORINYL 21, 28**: oral contraceptive
- TRINSICON** (vitamins): anti-anemia compound
- TRIPHASIL**: oral contraceptive
- Triprolidine** (ACTIDIL): antihistamine, Rx: allergies
- TRITEC** (ranitidine): histamine-2 blocker, Rx: ulcers
- Troglitazone** (REZULIN): oral hypoglycemic, Rx: diabetes
- TRUSOPT** (dorzolamide): Rx: glaucoma, reduction of intraocular pressure
- TUSS-DA RX** (dextromethorphan, pseudoephedrine): antitussive / decongestant
- TUSSAFED HC** (hydrocodone, phenylephrine, guaifenesin): narcotic antitussive / decongestant / expectorant
- TUSSEND Expectorant** (hydrocodone, pseudoephedrine, guaifenesin): narcotic antitussive / decongestant / expectorant
- TUSSEND Syrup, TUSSEND Tablets** (hydrocodone, pseudoephedrine, chlorpheniramine): narcotic antitussive / decongestant / antihistamine
- TUSSIONEX** (hydrocodone, chlorpheniramine): narcotic antitussive / antihistamine, Rx: coughs, allergies, the cold
- TUSSI-ORGANIDIN** (glycerol, codeine): a narcotic antitussive / expectorant compound
- TUSSI-ORGANIDIN DM** (dextromethorphan, iodinated glycerol): antitussive / mucolytic, expectorant, Rx: COPD, asthma, colds
- TYLENOL w/ Codeine** (APAP, codeine): narcotic analgesic
- TYLOX** (oxycodone, acetaminophen): narcotic analgesic
- U U U U U U U U U U**
- UBI-QGEL** (coenzyme Q-10): helps maintain healthy muscle, increases ATP production, Rx: mitochondrial cytopathy
- ULTRABROM, ULTRABROM PO** (brompheniramine, pseudoephedrine): antihistamine / decongestant
- ULTRAM** (tramadol): analgesic, Rx: pain relief
- ULTRASE, ULTRASE MT** (pancreatic enzymes): Rx: cystic fibrosis, pancreatitis
- UNI-DUR** (theophylline): bronchodilator, Rx: asthma, COPD
- UNIPHYL** (theophylline): bronchodilator, Rx: asthma, COPD
- UNIRETIC** (moexipril, HCTZ): ACE inhibitor/diuretic, Rx: HTN
- UNISOM** (doxylamine): antihistamine sedative, Rx: insomnia
- UNIVASC** (moexipril): ACE inhibitor, Rx: HTN
- Urea** (ACCUZYME): debriding ointment, Rx: pressure ulcers
- URECHOLINE** (bethanechol): increase bladder tone, Rx: urinary retention
- UREX** (methenamine): antiseptic, Rx: UTI
- URISED** (methenamine, methylene blue, salicylate, atropine, hyoscylamine): antiseptic/analgesic/antispasmodic, Rx: UTI
- URISPAS** (flavoxate): urinary tract antispasmodic, Rx: urinary incontinence
- UBOBIOTIC** (oxytetracycline, sulfamethizole, phenazopyridine): antibiotic / analgesic, Rx: UTI
- UROKIT-K** (potassium citrate): urinary alkalinizer, Rx: kidney stones
- URO-MAG** (magnesium): magnesium supplement
- URO-QID ACID No. 2** (methenamine): bactericide, Rx: UTI
- V V V V V V V V V V**
- Valacyclovir** (VALTREX): antiviral, Rx: herpes, shingles
- VALIUM** (diazepam): benzodiazepine hypnotic
- Valproex** (DEPAICON): anticonvulsant, Rx: seizures
- Valproic acid** (DEPAKENE): anticonvulsant, Rx: seizures
- Valrubricin** (VALSTAR): anticancer agent, Rx: bladder cancer
- Valsartan** (DIOVAN): angiotensin II inhibitor, Rx: HTN
- VALTREX** (valacyclovir): antiviral, Rx: herpes, shingles
- VANCENASE, VANCENASE AQ** (beclomethasone): steroid anti-inflammatory agent, Rx: allergic rhinitis, nasal polyps
- VANCERIL Inhaler** (beclomethasone): steroid, Rx: asthma
- VANCOICIN** (vancomycin): antibiotic
- Vancomycin** (VANCOICIN): antibiotic, Rx: colitis
- VANOXIDE HC** (benzoyl peroxide, hydrocortisone): skin cleanser, steroid anti-inflammatory, Rx: acne
- VANTIN** (cetpedoxime): antibiotic

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VAQTA (hepatitis A vaccine): inactivated virus vaccine
VASCOR (bepridil): calcium blocker, Rx: angina prophylaxis
VASERETIC (enalapril, HCTZ): antihypertensive / diuretic
VASOTEC (enalaprilat): ACE inhibitor, Rx: HTN, CHF
VASOXYL (methoxamine): vasoconstrictor, Rx: increases BP
VECTRIN (minocycline): antibiotic
VELBAN (vinblastine): antineoplastic, Rx: Hodgkin's disease, lymphoma, Kaposi's sarcoma
VELOSULIN (insulin): hypoglycemic, Rx: diabetes mellitus
Venlafaxine (EFFEXOR): antidepressant
VENTOLIN (albuterol): β -2 bronchodilator, Rx: asthma, COPD
VePesid (etoposide): anticancer agent, Rx: lung, testicular CA
Verapamil (CALAN): calcium blocker, Rx: angina, PSVT, HTN, H/A
VERELAN, VERELAN PM (verapamil): calcium blocker, Rx: angina, hypertension, headache
VERMOX (mebendazole): anthelmintic, Rx: intestinal worms
VERSED (midazolam): benzodiazepine hypnotic
VERSANOID (tretinoin): anticancer agent, Rx: leukemia
VIAGRA (sildenafil): Rx: penis erectile dysfunction
VIBRAMYCIN (doxycycline): antibiotic
VIBRA-TABS (doxycycline): antibiotic
VICODIN HP, VICODIN ES (hydrocodone, APAP): narcotic analgesic / antitussive compound
VICODIN TUSS (hydrocodone, guaifenesin): narcotic analgesic / antitussive expectorant compound
VICON FORTE: vitamins
VICOPROFEN (hydrocodone, ibuprofen): narcotic analgesic compound
VIDEX (didanosine): antiviral, Rx: AIDS
VIOKASE (pancreatic enzymes): Rx: cystic fibrosis, pancreatitis
VIOMAX (rofecoxib): NSAID analgesic
VIRACEPT (nelfinavir): protease inhibitor antiviral, Rx: HIV
VIRAMUNE (nevirapine): antiviral, Rx: HIV
VIRAZOLE (ribavirin): antiviral, Rx: chronic Hepatitis C
VIRILON (methyltestosterone): androgen / masculinizing hormone
VISTARIL (hydroxyzine): antiemetic/antihistamine/sedative
VITAFOL, VITAFOL SYRUP, VITAFOL-PN: multivitamins and minerals
VIVACTIL (protriptyline): tricyclic antidepressant
VIVELLE (estradiol), Rx: osteoporosis, menopausal symptoms
VOLMAX (albuterol): β -2 bronchodilator, Rx: asthma, COPD
VOLTAREN (diclofenac): NSAID analgesic, Rx: arthritis

W W W W W W W W

Warfarin (COUMADIN): anticoagulant, Rx: A-Fib, MI, venous thrombosis
WELLBUTRIN (bupropion): antidepressant
WIGRAINE (ergotamine, caffeine): alpha blocker/cranial vasoconstrictor, Rx: migraine headache
WINRHO SO (immune globulin): immunizing agent, Rx: prevents isoimmunization in pregnant Rh- women given Rh+ blood
WINSTROL (stanozolol): anabolic steroid / androgen, Rx: hereditary angioedema
WYCILUN (penicillin): antibiotic
WYGESIC (propoxyphene, APAP): narcotic analgesic

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XANAX (alprazolam): benzodiazepine hypnotic
XELODA (capecitabine): oral anticancer agent, Rx: breast CA
XENICAL (orlistat): lipase inhibitor, Rx: obesity

Y Y Y Y Y Y Y Y Y Y

Yellow Fever Vaccine (YF-VAX): vaccine

YF-VAX (yellow fever vaccine): vaccine
YODOXIN (iodoquinol): amebicide, Rx: intestinal amebiasis
Yohimbine (APHRODYNE): alpha blocker, Rx: impotence

Z Z Z Z Z Z Z Z Z Z

ZAGAM (sparfloxacin): antibiotic, Rx: pneumonia, bronchitis
Zaicitabine (HIVID): antiviral, Rx: HIV, AIDS
Zailepor (SONATA): anxiolytic, hypnotic, Rx: insomnia
ZANAFLEX (tizanidine): muscle relaxant, Rx: muscle spasticity
ZANOSAR (streptozocin): antineoplastic, Rx: pancreatic cancer
ZANTAC (ranitidine): Histamine-2 blocker, inhibits gastric acid secretion, Rx: ulcers
ZARONTIN (ethosuximide): anticonvulsant, Rx: absence seizures
ZAROXOLYN (metolazone): antihypertensive / diuretic
ZEBETA (bisoprolol) B-blocker antihypertensive
ZEPHREX, ZEPHREX LA (pseudoephedrine, guaifenesin): decongestant / expectorant
ZERIT (stavudine d4T): antiviral, Rx: HIV
ZESTORATE (lisinopril, HCTZ): ACE inhibitor/diuretic, Rx: HTN
ZESTRIL (lisinopril): ACE inhibitor, Rx: HTN, CHF
ZIAC (bisoprolol, HCTZ): antihypertensive / diuretic, Rx: HTN
Zidovudine (AZT): antiviral agent, Rx: HIV (AIDS) virus
ZITHROMAX (azithromycin): antibiotic
ZOCOR (simvastatin): cholesterol reducer
ZOFRAN (ondansetron): anti-nauseant, Rx: chemotherapy
ZOLADEX (goserelin) gonadotropin-releasing hormone agonist, Rx: endometriosis
ZOLOFT (sertraline): antidepressant
Zolpidem (AMBIEN): hypnotic, Rx: insomnia
ZOMIG (zolmitriptan): Rx: migraine headache
ZOVIRAX (acyclovir): antiviral agent, Rx: herpes, shingles
ZYDONE (APAP, hydrocodone): narcotic analgesic
ZYFLO (zileuton): bronchospasm inhibitor, Rx: asthma
ZYLOPRIM (allopurinol): reduces serum uric acid, Rx: gout
ZYMASE (pancreatic enzymes): Rx: cystic fibrosis, pancreatitis
ZYRTEC, ZYRTEC Syrup (cetirizine): antihistamine, Rx: allergy, hives, asthma

Here is some medication humor to fill this space:

How many pharmacists does it take to replace a light bulb?
Two. One to count the pills, and one to label the bottle.

Patient asks a pharmacist: "Why does my prescription medication have 30 side effects?"

Pharmacist replies: "because that's all we've documented so far."

A SHORT HISTORY OF MEDICINE: "Doctor, I have an ear ache."
2000 B.C. - "Here, eat this root."
1000 B.C. - "That root is heathen, say this prayer."
1850 A.D. - "That prayer is superstition, drink this potion."
1940 A.D. - "That potion is snake oil, swallow this pill."
1985 A.D. - "That pill is ineffective, take this antibiotic."
2002 A.D. - "That antibiotic is artificial. Here, eat this root!"

A miracle drug is one that has now the same price as last year.

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Instructions

For all **traditional NSAIDs**: Do not take with other prescription or OTC NSAIDs. Take in morning or evening at the same time every day. Take with food, a glass of milk or an antacid.

For **OTC NSAIDs**: Do not take for more than 10 days for pain or more than 3 days for fever unless directed by a doctor.

Possible Side Effects

Abdominal or stomach cramps, pain or discomfort; diarrhea; dizziness; drowsiness or lightheadedness; headache; peptic ulcer, heartburn or indigestion; nausea or vomiting

Drug	Brand Name(s)	Dose
Diclofenac potassium	<i>Cataflam</i>	OA: 100-150 mg/day in 2 or 3 doses. RA: 100-200 mg/day in 3 or 4 doses.
Diflunisal	<i>Dolobid</i>	RA & OA: 500-1,500 mg/day in 2 doses
Etodolac	<i>Lodine</i>	800-1,200 mg/day in 2 to 4 doses.
Ibuprofen	<i>Motrin</i>	1,200-3,200 mg/day in 3 or 4 doses
	<i>Advil, Motrin IB, Nuprin</i>	200-400 mg every 4 to 6 hours as needed, no more than 1,200 mg/day
Ketoprofen	<i>Actron, Orudis KT</i>	12.5 mg every 4 to 6 hours as needed
Naproxen	<i>Naprosyn</i>	500-1,500 mg per day in 2 doses
Naproxen sodium	<i>Aleve</i>	220 mg every 8 to 12 hours as needed
Piroxicam	<i>Feldene</i>	20 mg/day in 1 or 2 doses

COX-2 Inhibitors: Do not take with prescription or OTC NSAIDs.

Celecoxib	<i>Celebrex</i>	OA: 200 mg/day in 1 or 2 doses RA: 200-400 mg/day in 2 doses.
Rofecoxib	<i>Vioxx</i>	OA: 12.5 mg-25 mg/day in single dose.

Salicylates: Take with food. Do not chew tablets; do not crush enteric-coated or time-release forms and mix with water. Do not combine with other NSAIDs.

Aspirin	<i>Anacin, Ascriptin, Bayer, Bufferin, Ecotrin, Excedrin</i>	3,600-5,400 mg/day in several doses
Magnesium salicylate	<i>Arthritab, Bayer Select, Doan's Pills</i>	2,600 to 4,800 mg per day in 3 to 6 doses

Potential Side effects for salicylates (acetylated): Ulcers or internal bleeding can occur without warning, regular checkups are important. Confusion, deafness, dizziness, or ringing in the ears may indicate too high a dose. Use precautions if patient drinks alcohol, uses blood thinners or has any of the following: sensitivity or allergy to aspirin or similar drugs, kidney disease, liver disease, heart disease, high blood pressure, asthma or peptic ulcers.

lower case = generic name, UPPER CASE = Brand name, Rx = prescribed for, APAP = acetaminophen, CA = Cancer, CHF = Congestive Heart Failure, COPD = Chronic Obstructive Pulmonary Disease, EPS = Extrapyramidal Symptoms (dystonia), HTN = hypertension

Appendix

Visceral Pain Referral Patterns.....	312
Genetics.....	313-314
Dermatologic Terms	315-17
Blood Draw	318
Complete Blood Count.....	319
Clinical Enzymology	320
Selected Condition Labs.....	321
Hormone Review	322-323
Minor Surgery Review	324-325
Urinalysis	326-327
Research Summary	328
Sensitivity & Specificity.....	329

Common Outpatient ICD-9 Codes

Common Chiropractic ICD-9.....	330-332
Neoplasms, Endocrine, Mental.....	333
Nervous & cCirculatory ICD-9.....	334
Respiratory, Digestive, GU	335
Skin & Musculoskeletal ICD-9	336
Abbreviations	337-338

References for Appendix

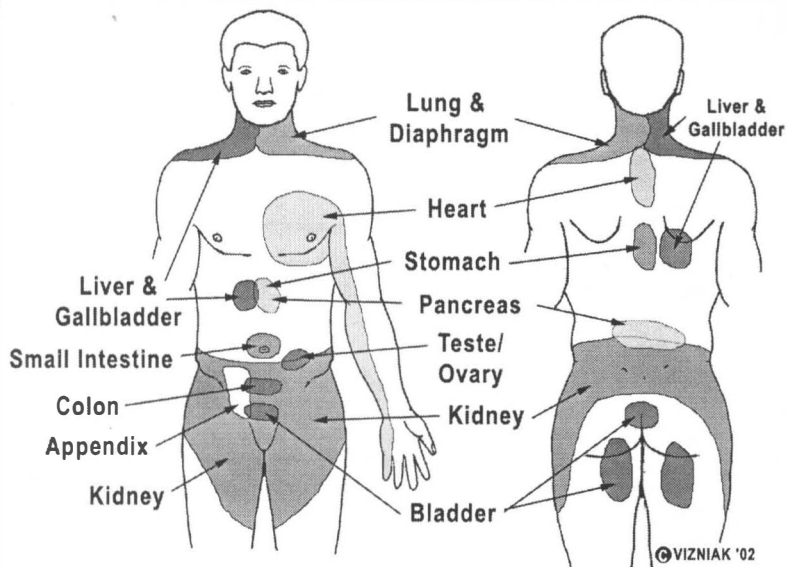
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Additional Recommended Information Resource:

Refer to the Western States Chiropractic College Clinics - Conservative Care Pathways
Clinical Standards, Protocols, and Education (CSPE)

Order through - <http://www.wschiro.edu/>

VISCERAL PAIN REFERRAL PATTERNS



Visera

Heart
Appendix
Liver/Gallbladder/Diaphragm
Lung
Pancreas
Pericardium
Esophagus
Pleura
Stomach
Aortic Arch

Pain Referral

L or R shoulder/chest
Lower right Quadrant
R shoulder and abdomen
L or R shoulder/chest
T6-T9 low back pain
L chest or shoulder
Midline upper back
R/L shoulder/chest
Epigastric L or R shoulder
Upper back, base of neck

Visceral Reflexes

- Carotid Sinus (Sensory IX) (Motor X) – pressure on carotid sinus decreases BP
- Cilio-spinal (cervical sympathetic) – squeeze neck and eyes dilate
- Corneal (Sensory V) (Motor VII) – touch cornea and eye blinks
- Oculocardiac (Sensory V) (Motor X) – pressure on eye and decrease BP

Genetic Counseling

Questions to ask when faced with a genetic condition:

1. What is the exact diagnosis?
2. What are the known facts & results of an examination of a family history?

What is the chance of having another affected child?

- For an autosomal recessive genetic trait → 25%
- For an autosomal dominant genetic trait (w/ high penetrance) → 50%
- For rare sex-linked recessive traits → 25% (0% females, 50% males)
- For trisomies of autosomes (or sex chromosomes) → slight increase over the population of the same age
- For multifactorial inheritance → usually less than 10% but often requires the use of empirical risk tables

Multifactorial Inheritance

- Multiple genes determining a trait (polygenic inheritance)
- Genetic & environmental factors
- The greater the number of genes involved in a polygenic system the more continuous the variation

Heritability: the fraction of the phenotypic variability in the population which is determined entirely by genotype

Heritability = 1 → population phenotypic variation entirely due to genotype

Heritability = 0 → population phenotypic variation due entirely to environment

Patterns of Disease

1. Family risk is considerably higher than the general population
2. Family risk drops sharply with increased distance to the index case - for first degree relatives risk is relatively high
3. Recurrent risk is higher when more than one family member is affected
4. Risk is often related to severity
5. May exhibit a "threshold" of expression (termed "threshold traits")
6. Prior history of the disease ("empirical risk tables") is a useful way to determine recurrent risk in the absence of empirical risk tables, one can sometimes estimate the recurrent risk by taking the square root of the population prevalence

Empirical risk tables require knowing three things (either about the disease or the family):

1. Heritability of the disease
2. Population frequency of the disease
3. Information about the number of normals and abnormal in the family

GENETICS OF SELECTED CONDITIONS

Autosomal Dominant Inheritance

Marfan's Syndrome - autosomal dominant disorder of connective tissue (fibrillin), characteristics: tall person with disproportionately long limbs, subluxations of the lens, cardiovascular defects, arachnodactyly

Osteogenesis Imperfecta - autosomal dominant disorder of connective tissue collagen, characteristics: very fragile bones, short stature, malformed bones, blue sclera

Achondroplasia (achondroplastic dwarfism) - autosomal dominant disorder of skeletal system, 90% of cases represent new mutations

Autosomal Recessive Inheritance

Albinism - autosomal recessive disorder of altered melanin production, characteristics: hypopigmentation, (hair, skin, iris) & photophobia

Cystic Fibrosis - autosomal recessive mutation for protein "cystic fibrosis transmembrane regulator", characteristics: abnormal chloride transport leads to abnormal activity of the sweat glands (unusually salty), pancreatic insufficiency (leading to malabsorption & malnutrition), abnormal respiratory system (thick mucous secretions) → pulmonary obstruction & promotes pulmonary bacterial infections

Phenylketonuria (PKU) - autosomal recessive disorder of amino acid metabolism, characteristics: inability to convert phenylalanine to tyrosine, animal odor & mental retardation (if untreated)

Autosomal Co-Dominant Inheritance

Familial Hypercholesterolemia - disorder of high serum cholesterol due to gene defect coding for an abnormal LDL receptor, Frequency: 1/500 persons

Sickle Cell Anemia - hemoglobin disorder, heterozygotes are said to have the "sickle cell trait", Frequency: 1/12 in African Americans

Multifactorial Inheritance

Adolescent Idiopathic Scoliosis - physical abnormality of young persons often defined as a spinal curvature $>10^\circ$, incidence = 0.5%, it is much more common in females than males, & heritability is estimated to be approximately 80%

Spondylolysis & Spondylolisthesis - Spondylolysis has an incidence of ~5% & spondylolisthesis is about 2.5%. It is loosely marked as autosomal dominant, with a penetrance of ~40%, spondylolisthesis can be thought of as multifactorial because; it demonstrates reduced penetrance, & it can develop further due to environmental causes. An autosomal dominant mode of inheritance with ~40% penetrance allows us to generate approximate risk despite potential predictive inaccuracy

X-Linked Recessive Inheritance

Hemophilia A - coagulation disorder → prolonged bleeding time, easy bruising & hemorrhage into joints & muscles.

Duchene-Type Muscular Dystrophy - disease of progressive muscular weakness (onset in childhood) especially of the legs & pelvis, death by 3rd decade.

Common Color Blindness - "confusion" of certain red & green colors

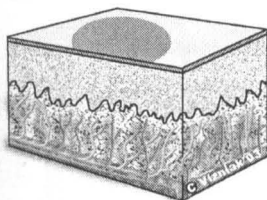
Sex-Related Inheritance

Sex influenced inheritance - variable expression of autosomal gene depending on sex of individual

Hemochromatosis - high serum levels of iron, Frequency: 1/300 (Caucasians of European descent), progressive storage of iron (as hemosiderin) in the liver, heart, skin, & joints, Symptoms: cirrhosis of the liver, bronze skin pigment, & cardiomyopathy, complain of joint pain

Male Pattern Baldness (androgenic alopecia) - condition of hair loss, expression is a function of androgenic hormone

Macule

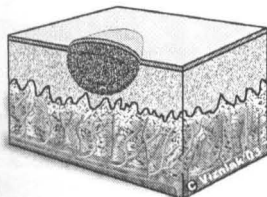


- Flat, circumscribed discoloration (solely color change)
- Less than 1 cm diameter (greater than 1 cm = patch)
- May be brown, blue, red or hypopigmented

Potential Causes

- Brown – freckles, café-au-lait spot, lentigo, flat nevi
- Blue – tattoo, Mongolian spot, ochronosis
- Red – Still's disease (juvenile RA), rheumatic fever
- Hypopigmentation – post inflammatory psoriasis, vitiligo, tinea versicolor, tuberous sclerosis

Papule

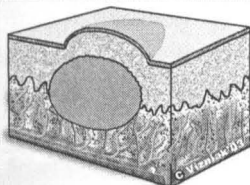


- Solid, elevated, circumscribed, superficial thickening of dermis
- Less than 1 cm diameter (greater than 1 cm = patch)
- May become continuous (plaque), color varies

Potential Causes

- Brown – dermatofibroma, melanoma, nevi, seborrheic keratosis, warts (verruca), urticaria pigmentosa
- Red – acne, atopic dermatitis, cherry angioma, molluscum contagiosum, lichen planus

Nodule (large nodule is referred to as a Tumor)

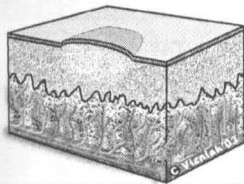


- Solid, elevated, circumscribed lesion
- Less than 1 cm diameter (greater than 1 cm = tumor)
- May extend deeper into dermis

Potential Causes

- Xanthoma, fibroma, interdermal nevi, basal cell carcinoma, hemangioma, lymphoma, squamous cell carcinoma, warts

Wheal (urticaria - hive)



- Superficial, transient edematous (not free fluid) lesion

Potential Causes

- Mosquito bite, allergic reaction, dermatographism, angioedema, hives, urticaria pigmentosa

Benign Skin Tumors

Corns - local callosities due to pressure of abrasion; smooth, glassy appearance, painless

Skin Tags & Polyps - benign tumor, common in older adults

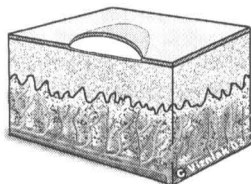
Epidermal Cyst (cutaneous nodule) - Keratin cyst within dermis, round, firm, slightly elevated; contains white, foul smelling keratin; invaginated epidermal cells, epidermal nevus

Nevus Sebaceous - most common on scalp, sebaceous gland hyperplasia, may enlarge during puberty, yellow to brown papules, 20% malignancy, metastasis is rare

Seborrheic Keratosis - Benign neoplasm of epidermal cells, may be mistaken for malignant melanoma & vice-versa, Lesions - rough (verruccose), smooth (horn cells), Dermatitis papulosa nigra

DERMATOLOGIC TERMS

Vesicle

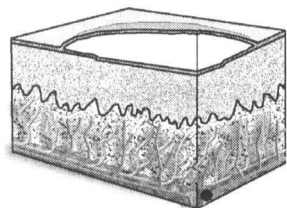


- Elevated, circumscribed, fluid-filled cavity
- Less than 1 cm diameter

Potential Causes

- Pemphigus, early chicken-pox (varicella), herpes simplex, herpes zoster (shingles), contact dermatitis, scabies

Bulla

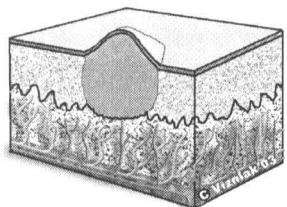


- Large elevated, circumscribed, fluid-filled cavity
- Greater than 1 cm diameter

Potential Causes

- Friction blister, burns, contact dermatitis, pemphigus, lupus erythematosus

Pustule



- Elevated, turbid fluid (pus) filled, circumscribed lesion
- Vary in size

Potential Causes

- Acne, candidiasis, chicken pox, folliculitis, herpes simplex, impetigo, scabies, herpes zoster

Dermatologic Terms

Alopecia - pattern baldness (genetic), destruction of hair follicles (trauma)

Comedone (black-head) - plug of sebaceous & keratinous material lodged in opening of hair follicle, white-head (milia), Sebaceous cyst

Cyst - circumscribed encapsulated lesion containing fluid or solid matter, example: sebaceous cyst

Echymosis - purplish patch caused by extravasation of blood into skin

Petechiae - superficial circumscribed hemorrhage < 0.5 cm diameter

Purpura - superficial circumscribed deposits of blood, > 0.5 cm diameter

Excoriation (scratch) - may be self inflicted

Folliculitis - inflammation of hair follicles, often associated w/ infection

Furuncle (boils) & Carbuncles - focal accumulation of pus

Maceration - skin damage following prolonged wetting, associated w/ abrasion and/or infection

Milia - small superficial keratin cyst with no visible opening

Telangiectasia ("spider veins") - dilated superficial blood vessels, associated w/ sun, x-ray, lu, scleroderma, cirrhosis, CREST syndrome, basal cell carcinoma, pregnancy

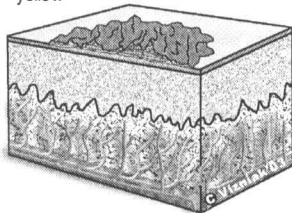
Vegetating - resembles plant or fungal growth

Verrucose - rough and wart-like

Wen (only on scalp) - cyst containing keratinous material

Crust (scab)

- Collection of serum & dried cellular debris
- Vary in color from red-brown, honey to yellow

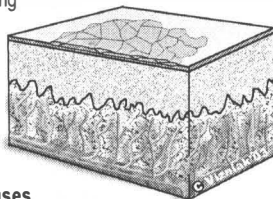


Potential Causes

- Impetigo, eczematous inflammation, pemphigus foliaceus, scab following abrasion

Scales

- Excess dried abnormal dried epidermal cells produced by abnormal keratinization and shedding

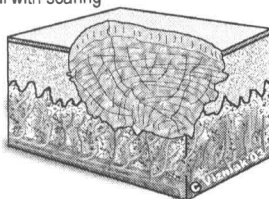


Potential Causes

- Fine to stratified – psoriasis, ichthyosis, lupus, pityriasis, scarlet fever, tinea versicolor, xerosis
- Scaling in sheets – Kawasaki syndrome, toxic shock syndrome, Staph. scalded skin syndrome, eczema

Ulcer

- Deep, scooped out lesion, involves dermis & epidermis
- Heal with scarring

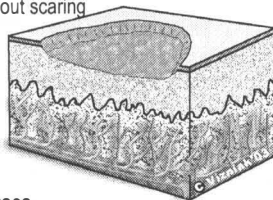


Potential Causes

- Stasis ulcer, chancre (syphilis), pressure sore, neoplasm, chancroid, ischemic

Erosion

- Shallow, scooped out lesion, restricted to epidermis
- Heal with out scarring

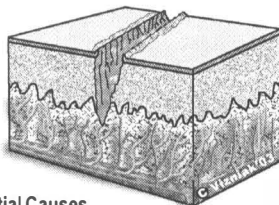


Potential Causes

- Candidiasis, dermatophyte infection, eczema, herpes simplex, interigo, excoriations (self induced abrasion), insect bites, dermatitis

Fissure

- Linear crack with abrupt edges into dermis

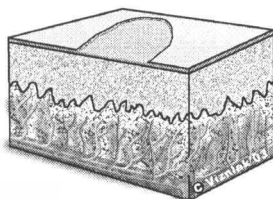


Potential Causes

- Chapping
- Interigo
- Cheilosis (vitamin B2 deficiency)
- Eczema, Perleche

Atrophy

- Depression in skin due to thinning of epidermis



Potential Causes

- Aging (elderly patients have thinner skin)
- Striae, Dermatomyositis
- Lichen sclerosis et atrophicus
- Morphea, Topical & intralesional steroids

BLOOD DRAW

Laboratory Safety

1. Exercise "Universal Precautions"
2. Use latex gloves when performing venipuncture or handling ANY body fluid
3. Lab coats, goggles, glasses etc
4. Use proper SHARPS and BIOHAZARD containers
5. Know your blood borne pathogens plan

Venipuncture

- 21 gauge needle most common - larger number = smaller hole (bore)
 - If tourniquet is on for >1 min, it must be left off for 3min before next attempt
 - Tubes with **no additives** are filled **first** – Red top – do not invert
 - Tubes with **additives** are filled **second** – Purple top
 - Caution: keep the needle well anchored while engaging/disengaging tubes
1. Patient sits or lies supine with elbow anchored/supported; doctor STANDS (never reach across table); organize equipment within easy reach.
 2. Cleanse puncture site; wipe dry or allow to air dry while gloving up
 3. Apply tourniquet; patient clenches fist; palpate veins
 4. Uncap needle; hold needle *bevel up*; anchor vein; puncture vein
 5. Engage evacuated tube; release tourniquet; patient unclenches fist
 6. Disengage tube once filled & insert next tube or if finished – withdraw needle
 7. Have patient apply mild pressure with gauze for 5 min over puncture site
 8. Dispose of needle in sharps container as soon as possible
 9. **Label tubes ASAP**, apply bandage

RED TOP TUBE: Contains no anticoagulant or preservative. Used for serum samples in which contact with serum separator gel may affect results.

SERUM SEPARATOR TUBE (SST): Contains a gel which when centrifuged forms a barrier to separate the blood cells (clot) and the serum. Used to collect serum for most routine medical surveillance testing.

LAVENDER TOP TUBE: Contains EDTA as anticoagulant. Used for various hematology procedures (CBC, hematocrit, etc.), cholinesterase and blood solvent determinations.

ROYAL BLUE TOP TUBE: Contains EDTA and used for whole blood analysis of trace metals.

GRAY TOP TUBE: Contains sodium fluoride as preservative and potassium oxalate as anticoagulant; used for both whole blood and plasma analyses: glucose, acetone, & alcohols.

Finger Stick

1. Patient washes hands in warm water
2. Arrange equipment on a paper towel; lancet, alcohol wipes, gauze, capillary tubes, sealing clay, bandage
3. Choose appropriate finger (3rd or 4th most common); cleanse with alcohol and dry
4. Expose lancet and puncture
5. Wipe away first drop of blood with gauze
6. Rhythmically & GENTLY squeeze fingertip from proximal to distal; fill capillary tube being careful to avoid air gaps
7. After tube(s) are filled, apply gauze to finger tip & have patient hold with gentle pressure
8. Seal tube with clay

COMPLETE BLOOD COUNT

Anemia yes or no	RBC count	Absolute # of circulating RBCs per unit volume of blood Indirect measure of the amount of the circulating hemoglobin (i.e.: oxygen carrying capacity of the blood) ↑ → polycythemia vera; ↓ → anemia
	Hemoglobin Concentration	Direct measure of weight of hemoglobin/unit volume of blood 1. Most sensitive measurement for existence of anemia 2. Used medically to judge need for transfusion ↑ → dehydration, polycythemia vera; ↓ → anemia, pregnancy
	HCT (Hematocrit)	PCV (Packed Cell Volume), ratio of the volume of the RBCs (after centrifugation) to that of whole blood ↑ → polycythemia vera, Addison's disease, acute pancreatitis ↓ → anemia, cystic fibrosis, CHF, pregnancy
Categorize type of anemia	MCV (Mean Corpuscular Volume)	Calculated measure of the size of the average circulating RBC MCV = HCT/RBC x 10 1. Microcytic: < 80 μm ³ (fL); → iron deficiency anemia, leukocytosis 2. Normocytic: 80 – 100 μm ³ 3. Macrocytic: >100 μm ³ ; → chronic alcoholism, methanol poisoning
	MCH (Mean Corpuscular Hemoglobin)	Calculated weight of hemoglobin in the average circulating RBC MCH = HGB/RBC x 10 1. Hypochromic: <27 pg, normochromic: 27-32 pg, Hyperchromic: >32 pg
	MCHC (Mean Corpuscular Hb Concentration)	Average concentration of Hb in a given volume of packed cells MCHC = HGB/HCT x 100 1. Hypochromic: <330 g/L → aplastic anemia, acquired hemolytic anemia 2. Normochromic: 330-370 g/L 3. Hyperchromic: >370 g/L → polycythemia vera, malignancy, leukemia, rheumatoid arthritis
RDW (Red cell Distribution Width)		• Index of RBC size differences; Anisocytosis - ↑ RDW
RBC morphology		Microscope determinations from Wright's stained peripheral blood smear 1. Microcytosis: small MCV, Macrocytosis: large MCV 2. Poikilocytosis: different shapes
WBC count (Leukocyte count)		Absolute quantification of total circulating WBC/unit volume blood 1. Leukocytosis: ↑ total WBC count → infection, inflammation, leukemia, bacterial infection 2. Leukopenia: ↓ total WBC count → aplastic anemia, pernicious anemia, severe infections, viral infections
WBC differential count -cytosis/-philia = ↑ -penia = ↓		Neutrophilia → Hodgkin's disease, infection; Neutropenia = ↓ Lymphocytosis → pertussis, mono, mumps, German measles, TB Lymphocytopenia = ↓ Monocytosis → chronic infections, leukemia, TB, protozoan infection Monocytopenia = ↓ Eosinophilia → allergies, parasitic infections, scarlet fever Basophilia → polycythemia vera, leukemia, chicken pox, small pox
Platelet count		Absolute quantification of number of circulating thrombocytes/volume 1. Thrombocytosis: ↑ platelet count 2. Thrombocytopenia: ↓ platelet count

→ may indicate/suggests/seen in, ↑ = increase, ↓ = decrease, TB = tuberculosis

CLINICAL ENZYMOLOGY

Enzyme	Source	Significance
ALP <i>alkaline phosphatase</i>	Bone Liver Placenta Intestine Malignant tissue	↑ ALP Primary biliary tract disorders Bone disorders (osteoblastic) Healing fractures (Paget's)
ALT <i>alanine aminotransferase</i> SGPT (<i>serum glutamate-pyruvate transaminase</i>)	Liver (99%) Heart Muscle Kidney	↑ ALT Liver disease Myocardial Infarction (MI) Skeletal muscle disease
AST <i>aspartate aminotransferase</i> SGOT (<i>serum glutamic-oxaloacetic transaminase</i>)	Liver Heart Skeletal Muscle Kidney, brain, pancreas, spleen, lungs	↑ AST Hepatobiliary inflammation Myocardial pathology Cirrhosis Neoplasm Skeletal muscle condition
GGT <i>gamma glutamyl transferase</i> GGTP (<i>gamma glutamyl transpeptidase</i>)	Liver Kidney	↑ GGT Liver disorders: all forms hepatotoxic drugs – ETOH, (alcoholics), Acetaminophen Diabetes mellitus, Renal disease, Neurological disorders
LDH/LD <i>lactate dehydrogenase</i>	LD ₁ (LDH ₁) Heart, RBCs LD ₂ (LDH ₂) Heart, RBCs LD ₃ (LDH ₃) Lungs LD ₄ (LDH ₄) Liver, Sk. Muscle LD ₅ (LDH ₅) Liver, Sk. Muscle	↑ LDH Hematologic conditions Liver inflammation Disseminated cancer Cardiopulmonary conditions Liver inflammation Muscular pathology Liver disorders
CK <i>creatine kinase</i> CPK (<i>creatine phosphokinase</i>)	CK1 (CKBB) Brain, smooth muscle, GI, genitourinary CK2 (CKMB) Cardiac muscle CK3 (CKMM) Cardiac & Sk. muscle	↑ CK Myocardial Infarction Skeletal muscle abnormalities Trauma 'Severe' exercise Brain trauma (CKBB)

Sk. = skeletal, GI = gastrointestinal

Allergic Reactions

- Eosinophilia, increased total IgG
- RAST testing

Atherosclerosis

- Cholesterol (HDL, LDL, VLDL)
- Triglycerides, glucose
- Uric acid, thyroxine

Bacterial Infections

- Neutrophilia
- High total WBC

Bone Cancer

- Anemia is usually N/N anemia
- Elevated serum ALP

Hepatitis

- AST, ALT, ALP
- Leukopenia, bilirubinuria
- Specific serological viral markers for individual types
- Anti-HAV (IgM), HbsAg (surface antigen), Anti-HCV, Anti-HBc (core antigen)

Kidney Function

- BUN, albumin, globulins, uric acid, creatinine

Lymphoma

- Normally do not have peripheral blood involvement until late in the disease
- Eosinophilia, leukocytosis, thrombocytosis
- Increased ESR (due to increased calcium, uric acid, and ALP)
- N/N anemia, Decreased SI, TIBC
- Hodgkin's disease – Reed-Stenberg cells
- Non-Hodgkin's lymphoma – less predictable and more serious

Metastatic Cancer

- Check to see which levels of enzymes are highest
- Increased WBC, ALP, pancytopenia
- Consider bone scan

Musculoskeletal Panel

- Calcium, phosphorus, uric acid, ALP

Mononucleosis

- Leukocytosis, lymphocytes comprise > 50%
- (+) HA monospot
- Anti-VCA IgM, IgG

Multiple Myeloma

- ↑ IgG (monoclonal antibody), Rouleaux formation, Bence-Jones proteins (urine)
- Increased total protein, increased globulins, decreased A/G ratio
- N/N anemia, pancytopenia
- Bone marrow aspiration is definitive

Myocardial Infarction

- SGOT, LDH, CPK

Obstructive Liver Disease

- Bilirubin (best) – total, indirect, or direct
- ALP (best)
- ALT (mild increase), AST (mild increase)
- GGT/GGTP (increase), LDH if severe

Pancreas Function

- Lipase & amylase

Prostate Cancer

- Digital Rectal Exam
- PSA – may also be increased in benign prostatic hypertrophy (BPH)
- May be falsely elevated post-prostatic massage/exam

Rheumatoid Arthritis

- Rheumatoid factor – IgM type
- N/N anemia
- ESR, CRP, and other acute phase reactant proteins may be increased
- Involves PIP joints and MCP joints

SLE (Lupus)

- ANA or FANA (Anti-Nuclear Antibodies)
- Anti-DNA (only do this if ANA/FANA is positive)
- CBC - N/N anemia, Leukocytopenia, lymphocytopenia
- Possible thrombocytopenia
- UA – hematuria, proteinuria, casts
- LE prep – too expensive, not used often

Thyroid Disease

- Free T4, T3
- TSH – best test for a general screen
- THBR (thyroid hormone binding ratio)
- Serum calcium, PTH

Viral Infections

- Lymphocytosis (normal 20-40%)
- Possible decreased WBC count or neutrophils (neutropenia)

HORMONE REVIEW

Source	Hormone	Action
Adenohypophysis (anterior pituitary) (pars distalis)		
somatotrophs	Growth hormone (GH) (somatotrophin)	Metabolic effects Adipose (\uparrow lipolysis, \downarrow TAG synthesis), Muscle (\downarrow glycolysis, \downarrow Glucose uptake), Liver (release somatomedins (IGF)) Growth effects – works synergistically with insulin & somatomedins (\uparrow cell proliferation, \uparrow skeletal growth, \uparrow protein synthesis)
mammotrophs	Prolactin (PL)	Initiate & sustain lactation. (\uparrow synthesis: protein, FA, lactose)
thyrotrophs	Thyroid stimulating hormone (TSH)	Stimulate: secretion of T_3 & T_4 , thyroid maintenance, body metabolic rate
gonadotrophs	Follicle-stimulating hormone (FSH)	Acts synergistically with LH (ICSH) to promote follicular growth
	Luteinizing hormone (LH) or Interstitial Cell-stimulating hormone (ICSH)	Promote follicular growth, ovulation, corpus luteum formation, steroid synthesis
corticotrophs	Adrenocorticotropin (ACTH)	Stimulate adrenal gland to release cortisol in response to stress, adrenal cortex maintenance
Neurohypophysis (posterior pituitary) (pars nervosa)		
Neurons from paraventricular & supraoptic nuclei of hypothalamus	Antidiuretic hormone (ADH) (vasopressin)	\uparrow water resorption in kidneys (diabetes insipidus = \downarrow ADH)
	Oxytocin (OXY)	Contraction of myoepithelial cells (milk delivery), Parturition: \uparrow frequency & strength of uterine smooth muscle contraction.
Parathyroid Gland		
Chief cells	Parathormone (PTH)	Bone: Ca^{2+} mobilization Kidney: $\uparrow Ca^{2+}$ resorption, $\uparrow P_i$ excretion, \uparrow 1,25-DHCC production
Thyroid Gland		
Follicular Cells	Thyroxine (tetraiodothyronine) (T_4) Triiodothyronine (T_3)	T_3 active form. \uparrow BMR, CNS-development Bone: stimulate growth centers Cardiac: $\uparrow \beta$ r/c \rightarrow \uparrow C.O. & \uparrow pulse rate General: \uparrow protein syn., long-term temp. regulation
C-cells (parafollicular cells)	Calcitonin	Bone: \uparrow osteoblastic activity, \downarrow osteoclastic activity
Testis		
Interstitial cells (Leydig)	Testosterone	Androgenic & anabolic effects Male fetal development, growth at puberty, influences muscle growth, sex drive, aggressive behaviour, hematopoiesis
Ovary		
Theca interna, interstitial cells	Estradiol (E_2)	Initiation of puberty, establish & maintain ovulatory cycle, maintenance of bone mass
Corpus luteum,	Progesterone	Uterus (\downarrow contractility of myometrium), breast (\uparrow glandular tissue), thermogenic effects

Source	Hormone	Action
Adrenal gland		
Cortex zona glomerulosa	Aldosterone (mineral corticoid)	↑Na ⁺ resorption (Cl ⁻ , HCO ₃ ⁻ , H ₂ O follow Na ⁺) (DCT, collecting duct, sweat salivary glands, GI tract) ↑K ⁺ excretion, Addison's disease = ↓aldosterone
zona fasciculate zona reticularis	Cortisol (glucocorticoid) Androgens	Liver (↑gluconeogenesis) Adipose (↑FA mobilization) Extra-hepatic tissue (↓protein syn. & ↑catabolism)
Medulla chromaffin cells chromaffin cells	Norepinephrine Epinephrine	Receptors: β → (+) cAMP → lipolysis, gluconeogenesis, smooth muscle relaxation α2 → (-) camp, α1 → (+) Ca ²⁺
Kidney		
	Erythropoetin 1,25 DHCC	erythropoesis, ↑BP (long-term) ↑Ca ²⁺ GI absorption (↑Ca ²⁺ mobilization)
Pancreatic Islets		
B cells	Insulin	↓ [glucose]serum (↑G uptake in adipose, muscle & liver), glycogen synthesis, TG syn.; protein syn.
A cells D cells	Glucagon	↑ [glucose]serum (↑glycogenolysis, ↑ gluconeogenesis – Liver)
Stomach		
G-cells (enteroendocrine)	Gastrin	Secretion of: ↑HCl, ↑Pepsin. ↑motility (mixing). ↑blood flow.
Duodenum		
I-cells	Cholecystokinin (CCK)	(+) acinar cell enzymes, potentiates ductal cell enzyme secretions in pancreas, gall bladder contraction, (-) gastric emptying, stimulates SATIETY center (ventromedial nucleus- hypothalamus), potentiates CCK
S-cells	Secretin	↑ secretion: (Na ⁺ HCO ₃ ⁻), enzymes
Placenta		
syncytiotropho- blast	Human Chorionic Gonadotropin (HCG) Estradiol (E2) Estriol	Promotes maintenance of corpus luteum → continued secretion of E2 & progesterone
	Chorionic growth hormone Human Chorionic Somatomammotrophin (HCS)	↑alveolar development in maternal breast, influence nutrients available for fetal growth (↑[glucose]serum)

↓ = decrease, ↑ = increase, ant. pit. = anterior pituitary, post. pit. = posterior pituitary, IGF = Insulin-like Growth Factor, TAG = Triacylglycerol (TG), P_i = inorganic phosphate, MM = muscle, FA = Fatty Acid, BMR = Basal Metabolic Rate, r/c = receptor, C.O. = Cardiac Output, DCT = distal convoluted tubule, GI = gastrointestinal tract, BP = blood pressure, syn. = synthesis, ALP = Alkaline Phosphatase, (-) = inhibits/decreases, (+) = stimulates/promotes, Δ's = changes

MINOR SURGERY REVIEW

Summary of Local Anesthetics for Minor Wound Care

Agent	Concentration	Onset of action	Duration of Block	Maximum single dose
Lidocaine (Xylocaine)	1.0%	4-10 min	60-120 min	4.5 mg/kg of 1% (30cc per average adult)
Mepivacaine (Carbocaine)	1.0%	6-10 min	90-180 min	5 mg/kg of 1% (35cc per average adult)
Procaine (Novacaine)	1.0%	5-10 min	60-120 min	4 mg/kg of 1% (25cc per average adult)
Bupivacaine (Marcaine)	0.25%	8-12 min	240-280 min	3 mg/kg of 0.25% (80cc per average adult)
TAC	*	5-10 min	~20 min	5cc-10cc mixture

* TAC = combination mixture of 0.5% tetracaine, epinephrine 1:2000, & cocaine 11.8%, & is applied with a topical 2 x 2 inch sponge

Epinephrine as an additive mixture – concentration 1:100,000 or 1:200,000, added to local anesthetic as a vasoconstrictor., contraindicated in body parts such as fingers, nose, ears, penis & toes

Conduction Anesthesia

Direct Infiltration – introduce local anesthetic through wound directly, needle is introduced to exposed edges of wound

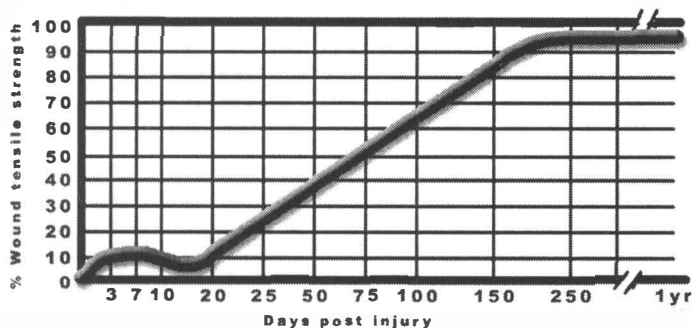
Field Block – probably most common, preferred alternative if wound is dirty or contaminated, object is to lay down a wall of anesthesia completely around surgical site. (see figure below)



Nerve Block – anesthesia where sensory nerves are anesthetized by injecting either directly into, or immediately around a particular nerve or plexus

Types of Wound Healing

1. **Primary Union** – Relatively clean wounds with little tissue loss (eg. laceration from knife), can be closed with sutures or skin tapes with in 6 hours
2. **Secondary union** – wound involve significant tissue loss (e.g., bums, ulcers), & are not sutured but left to heal by granulation & reepithelialization
3. **Tertiary union** – used for bites & large puncture wounds, wounds over 12 hours old, management includes cleansing, irrigation, & debridement, & antibiotic coverage



Suture Selection

1. **5-0 & 6-0 braided silk** – for fine suturing about face and fingers.
2. **3-0 & 4-0 braided silk** – for heavy work about scalp & limbs, especially high stress areas (over joints)
3. **3-0 & 4-0 nylon** – minor wounds and lacerations about the scalp, limbs and trunk
4. **5-0 & 6-0** – for fine suturing on face and hands
5. **5-0 plain catgut** – for fine vessel ties and fine interrupted subcutaneous sutures on face
6. **3-0 & 4-0 plain catgut** – larger vessel ties and interrupted subcutaneous sutures on trunk and limbs
7. **4-0 polyglycolic acid** – deep closes of the scalp, trunk and extremities
8. **5-0 polyglycolic acid** – deep closures of the hand and face
9. **4-0, 5-0, 6-0 polypropylene** – for subcuticular pull-out sutures
10. **4-0 chromic catgut** – repair of deeper structures where a longer period of time for security is desired

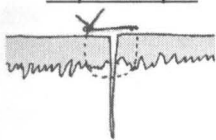
Suture Type	Knot Security	Tensile Strength	Wound Security	Tissue Reaction	Workability
Nylon (Ethilon, Dermalon)	xx	xxx	xxx	xx	xx
Polypropylene (Prolene)	x	xxxx	xxxx	x	x
Silk	xxxx	x	x	xxxx	xxxx
Multifilament Dacron	xxxx	xx	xxx	xxx	xxxx
Braided Nylon	xxx	xx	xx	xx	-
Chromic Gut	xx	xx	10-14 days	xxx	Absorbable Sutures
Polyglycolic acid	xxxx	xxxx	25 days	x	
Polyglycan-910	xxx	xxxx	30 days	x	

x = poor, xx = fair, xxx = good, xxxx = excellent

Suture Removal Intervals (days)

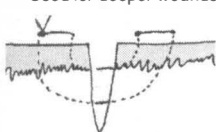
Face	3-5	Nose	3-5	Trunk	7-10
Eyelid	4	Scalp	7-10	Arm	8-10
Ear	4-5	Neck	5-7	Hand	8-12
Leg	12-14	Foot	10-12		

Simple Interrupted

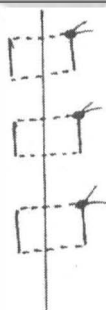


Vertical Mattress

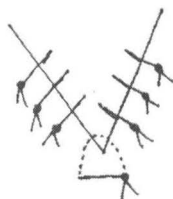
Used for deeper wounds



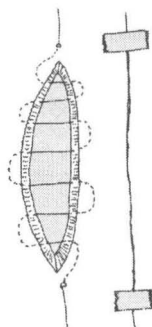
Horizontal Mattress



Apical Suture



Intradermal Subcuticular "Pull out"



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URINALYSIS

Visual Examination

Color (normal: colorless to amber)

- Yellow/green/brown: Bilirubinuria (FOAM test)
- Red: Hemoglobin, myoglobin, foods/dyes (e.g. beets)
- Brown/black: Homogentisic Acid
- Blue/green: Indicans (bad protein digestion)
Pseudomonas infection, chlorophyll

Appearance (normal: clear to slightly hazy)

- Hazy to cloudy: amorphous sediment, epithelial cells, WBCs (pyuria), RBCs, microorganisms, crystals, sperm
- Milky: WBC, WBC clumps, Fat

Chemical Examination (reagent strip, dipstick)

pH (normal: 4-8 usually slightly acidic)

- Acid urine: normal western diet, ketosis, systemic acidosis, acidification therapy
- Alkaline urine: vegetarian diet, postprandial specimen, stale specimen, UTI, alkalinization therapy

Specific Gravity (normal: 1.005-1.035)

- 'True' kidney function test, easily altered by fluid consumption -not very sensitive
- Dilute: ↑ fluid intake, random specimen, renal disease
- Concentrated: ↓ fluid intake, 1st morning specimen, ↑ levels of solutes: ↑ glucose, ↑ ketones, ↑ protein

Glucose (normal: none detected)

Glucosuria with hyperglycemia

- Following a heavy meal
- Diabetes mellitus
- "Hyper"-endocrinopathies (thyroid, Cushing's)
- Pancreatic disease
- Drug associated

Glucosuria without hyperglycemia

- Renal tubular disease
- Late (normal) pregnancy

Ketones (normal: none detected)

Ketones are the byproducts of fatty acid metabolism and impaired glucose metabolism.

Ketones (ketone bodies)

acetoacetic acid, acetone, β -hydroxybutyric acid

Ketonuria observed in:

- Inadequate carbohydrate diet
- Successful *weight loss diet*, *malnutrition*
- Defect in carbohydrate metabolism
Diabetes mellitus
- Defects in carbohydrate absorption
Malabsorption
- *Febrile illness (fever)*

Protein (normal: none detected)

Types of protein in urine: albumin, globulins, Hb, fibrinogen, nucleoproteins, Bence Jones proteins

Categories

- Pre-renal proteinuria
- Fever, hypertension, Bence Jones
Renal proteinuria
- Kidney disease
Post-renal proteinuria
- Vaginal secretions, infection in renal pelvis

Minimal (<0.5 g/24 hrs.)

- Vigorous exercise
- Orthostatic (postural) proteinuria
- Pregnancy
- Hypertension
- Kidney dysfunction
- Lower UTI

Moderate (0.5-3.0 g/24 hrs.)

- Chronic glomerulonephritis
- Pyelonephritis
- Diabetic neuropathy
- Multiple myeloma
- Pre-eclampsia

Marked (>3.0 g/24 hrs.)

- Acute & chronic glomerulonephritis
- Diabetic neuropathy
- Nephritic syndrome
- Nephrosis
- Lupus nephrosis
- Amyloidosis

Urobilinogen (normal: 0.1-1 EI unit/mL)

Catabolic product of conjugated bilirubin via bacterial actions in the intestines, up to 20% of urobilinogen formed in intestines is reabsorbed into enterohepatic system and some find its way into the urine

↑ Urinary urobilinogen:

- Hemolytic disease
- Hepatic disease

↓ Urinary urobilinogen:

- Biliary obstruction

Bilirubin (normal: none detected)

Only conjugated bilirubin can be excreted by the kidney, therefore bilirubinuria is only observed when there is conjugated hyperbilirubinemia

intrahepatic obstructive disorders:

- Hepatitis

extrahepatic obstructive disorders:

- Biliary tract obstruction

Leukocyte Esterase (normal: none)

cytoplasmic enzyme of neutrophils. Reagent strip turns positive in the presence of significant numbers of WBCs, either lysed or intact. Sensitive indicator of UTI

Potential False Positives:

- Vaginal contamination, heavy mucus discharge, *Trichomonas* infestation, ↑ ascorbic acid (vitamin C)

Pyuria (↑ WBC in urine)

- Inflammation within the urinary tract, UTI

Nitrite (normal: none detected)

Dietary urinary nitrate is reduced to nitrite by many urinary tract pathogens - requires adequate time for incubation

Specific indicator of UTI, not very sensitive

Ascorbic Acid

Presence of adequate amounts of ascorbic acid in the urine may effect the dipstick's biochemistry such that there may be reduced positives or false negatives for the following:

- Blood, Glucose, Nitrite, Bilirubin

Hemoglobin (normal: none detected)

Presence of hematuria always warrants investigation into the site of bleeding

Hematuria (without casts or proteinuria)

- Normal individuals
 - Menstrual contamination
 - Following vigorous exercise
- Trauma to any part of the urinary tract, lower UTI (especially cystitis), hypertension, bleeding disorders, kidney pathologies (stones, tumors)

Hematuria (with casts and proteinuria)

- Acute glomerulonephritis
- Chronic glomerulonephritis
- Rheumatoid diseases

Epithelial cells (normal: occasional/lpf)**Renal Epithelial cells****Transitional Epithelial cells****Squamous cells****Microorganisms****Bacteria** (normal occ/hpf)**Yeast** (normal: none detected)**Protozoa** - *Trichomonas vaginalis***Crystals****Calcium Oxalate Crystals****Uric Acid Crystals** (monosodium urate)**Cholesterol Crystals****Leucine, Tyrosine, Cysteine Crystals****Casts****Hyaline Casts** (protein casts)**RBC or Hemoglobin Casts**

(glomerulonephritis)

WBC Casts (pyelonephritis)**Epithelial Casts** (tubular damage)**Granular Casts****Waxy Casts** (renal failure)**Broad Casts** (chronic renal failure)

Koch's & Hills Postulates of Causality

1. **Temporal Order effect:** cause precedes effect
2. **Biological Gradient (Dose Response):** larger exposure to cause will lead to greater effects
3. **Consistency/ Repeatability effect (scientific replication):** repeatedly observed by different people, in different circumstances, and different times
4. **Interventional/ Manipulate (dechallenge/ rechallenge) effect:** association between cause and effect is reversible
5. **Biological Plausibility:** makes sense, according to biological knowledge of the time

Design Type – [strong or weak]...Survey? [weak] Retrospective? [weak] Prospective? [good]

External Validity: Q: Random sampling? Yes – generalizable No – not generalizable

Q: Defined Cohort [inclusion/exclusion criteria?] Control group? Attrition rate (less than 10%)?

Q: Has the term "Normal" been defined/applied sensibly as it applies to this test or measure?

Q: Was there a [blind] comparison with a *Reference ('gold') standard of diagnosis?*

Q: Are **sensitivity & specificity** defined in the study?

Q: Are **positive and negative predictive value** defined in the study?

Q: What is the **Prevalence** of the health-care condition?

Q: Is the condition common or rare? Natural history?

Q: Relevant clinical end-points/outcomes?

Q: **Valid** (accurate) & **Reliable** (consistent) Clinical Outcomes?

Q: Independent [Blinded] Outcome Assessors?

Q: Have tactics/ operations for the measurement or test been described in enough detail to permit their exact replication?

Q: What is the **Utility** of the test? Clinical applicability: Q: Are they like your patient(s)?

Q: Has the test resulted in increased knowledge that would lead to a change in case management?

Q: Will the results lead directly to selecting or avoiding therapy?

Q: Are the results useful for reassuring or counseling patients?

Q: Were the time related categories of acute, subacute, recurrent-persistent and/or chronic defined?

Inception Cohort = a well described or defined sample group (or cohort) of patients assembled at a common early point [at 'inception' or time zero] in the course of the disorder(s).

Patient "follow-ups" = repeatedly spaced clinical outcomes that assess the patient status over the entire length of the disorder – from the inception to its resolution.

DEFINITIONS What is a double-blind study? Two chiropractors reading an electrocardiogram

Retrospective: looking back in time

Prospective: looking forward in time

Reliability: reproducibility of test results, good reliability implies little random measurement error

Precision: magnitude of random measurement error, good precision implies small measurement error

Validity: ability of a procedure to yield a true value (are you measuring what you think you are)

Bias (general): unintentional, unwanted 'systematic error'

Experimental Bias: change attributed to the investigator's expectations regarding patient performance may influence the way clinical data/outcomes are gathered.

Intra-examiner reliability - agreeing with ones self (self consistency)

Inter-examiner reliability - agreement between two or more examiners

Nominal Data = Independent (mutually exclusive) categorical data

eg: fixated/not fixed, male/female **use:** Kappa concordance statistic

Ordinal Data = inherently rank-ordered but mutually exclusive categorical data

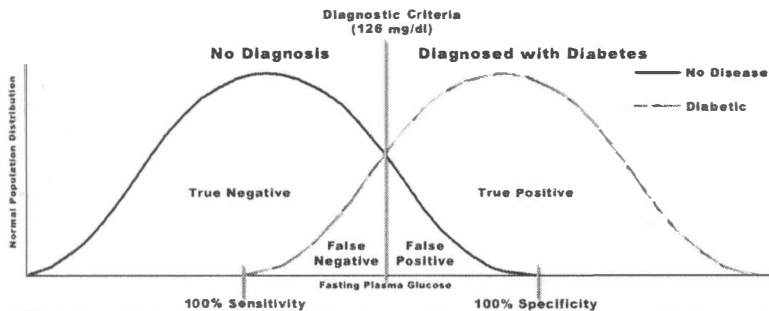
eg: totally disabled > severely disabled > moderately disabled > minimally disabled > etc.

use: Weighted Kappa statistic

Interval Data = rank ordered data with common scaling across all categories

eg: mm on a VAS scale, dL of a blood biochemical assay

use: Intraclass Correlation Coefficient - ICC



Sensitivity

Highly Sensitive Tests are Best used to Rule Out disease

- Help to identify patients **WITH** disease (true positives)
- Because positive results can be given to people who do not have the disease:

Specificity

Highly Specific Tests are Best used to Rule In disease

- Help to identify patients **WITHOUT** disease (true negatives)
- Because negative results can be given to people who do have the disease:

Negative Predictive Value (NPV)

- Percentage of patients who both test negative and do not have disease (true negatives)

Positive Predictive Value (PPV)

- Percentage of patients who both test positive and have the disease (true positives)

	Patients <i>WITH</i> condition	Patients <i>WITHOUT</i> condition
Patients who test POSITIVE (Positive Predictive Value)	True Positives	False Positive
Patients who test NEGATIVE (Negative Predictive Value)	False Negative	True Negative
	<i>Sensitivity</i>	<i>Specificity</i>

Pre-test probability of disease (prevalence) has the *greatest* impact on post-test probability.
 ∴ as prevalence increases so does the predictive value of a positive test (PPV).

Changing the diagnostic criteria (cut-off point) dramatically changes the characteristics of a given test.

COMMON CHIROPRACTIC ICD-9

Common Chiropractic

MEDICARE Subluxation

739.0	Occipital Subluxation
739.1	Cervical Subluxation
739.2	Thoracic Subluxation
739.3	Lumbar Subluxation
739.4	Sacroiliac Subluxation

Subluxation 839 series

839.08	Multiple Cervical Subluxation
722.0	Cervical Disc Syndrome w/o Myelopathy
353.2	Cervical Nerve Root Lesion
724.9	Foraminal Encroachment of Nerve Root - Cervical
847.0	Cervical Sprain/Strain
723.4	Brachial Neuritis
723.2	Cervicocranial Syndrome
723.3	Cervicobrachial Syndrome
353.0	Thoracic Outlet Syndrome
726.1	Rotator Cuff Syndrome
726.10	Supraspinatus Syndrome
354.0	Carpal Tunnel Syndrome
524.6	TMJ Dysfunction Syndrome
847.0	Acute post-traumatic torticollis

839.21	Subluxation of the Thoracic Vertebrae
722.11	Thoracic Disc Syndrome w/o Myelopathy
724.9	Foraminal Encroachment of Nerve Root, Thoracic
353.3	Thoracic Nerve Root Lesion
724.4	Thoracic Neuritis
847.1	Thoracic Sprain/Strain

839.20	Subluxation of the Lumbar Vertebrae
722.10	Lumbar Disc Syndrome w/o Myelopathy
724.9	Foraminal Encroachment of Nerve Root - Lumbar

724.4	Lumbar Neuritis
353.4	Lumbosacral Nerve Root Lesion
847.2	Lumbar Sprain/Strain
839.42	Subluxation of the Sacroiliac Joint

847.3	Sacroiliac (SI) Sprain/Strain
353.1	Lumbosacral Plexus Lesion
720.2	Sacroiliitis
839.41	Subluxation of the Coccyx
847.4	Coccyx Sprain/Strain
353.1	Lumbosacral Plexus Lesion
724.8	Facet Syndrome

Peripheral Joint Codes

831.01	Anterior Subluxation of Humerus
831.02	Posterior Subluxation of Humerus
832.02	Subluxation of Elbow
833.00	Subluxation of Carpal Bone
836.63	Medial Subluxation of Tibia

836.64	Lateral Subluxation of Tibia
838.01	Subluxation of Tarsal Bone

Sprain/Strain, Dislocation

840.0	Acromioclavicular (joint) (ligament)
840.1	Coracoclavicular (ligament)
840.2	Coracohumeral (ligament)
840.3	Infraspinatus (muscle) (tendon)
840.4	Rotator cuff (capsule)
840.5	Subscapularis (muscle)
840.6	Supraspinatus (muscle) (tendon)
840.8	Other specified sites of shoulder & upper arm (not good to use)
840.9	Unspecified site of shoulder and upper arm (not good to use)
839.8	Dislocation: other, closed, unspecified
831.00	Dislocation: shoulder, closed, unspecified
836.2	Knee meniscus injury, unspecified
845.00	Sprain/strain: ankle, unspecified
845.10	Sprain/strain: foot, unspecified
842.10	Sprain/strain: hand, unspecified
844.9	Sprain/strain: knee/leg, unspecified
847.0	Sprain/strain: neck, unspecified
848.9	Sprain/strain: other site, unspecified
840.9	Sprain/strain: shoulder/arm, unspecified
847.9	Sprain/strain: vertebral, unspecified
842.0	Sprain/strain: wrist, unspecified
839.8	Dislocation: other, closed, unspecified
831.00	Dislocation: shoulder, closed, unspecified
836.2	Knee meniscus injury, unspecified

Fractures

824.8	Fracture: ankle, closed, unspecified
814.00	Fracture: carpal, closed, unspecified
810.00	Fracture: clavicle, closed, unspecified
820.8	Fracture: femur/hip, closed, unspecified
821.01	Fracture: femur/shaft, closed
823.81	Fracture: fibula, closed, unspecified
825.20	Fracture: foot, closed, unspecified (not toes)
813.80	Fracture: forearm, closed, unspecified
812.20	Fracture: humerus, closed, unspecified
802.20	Fracture: mandible, closed, unspecified
815.00	Fracture: metacarpal, closed, unspecified
802.0	Fracture: nose, closed
829.0	Fracture: other sites, closed, unspecified
808.8	Fracture: pelvic, closed, unspecified
826.0	Fracture: phalanges, foot, closed
816.00	Fracture: phalanges, hand, closed, unspecified
807.00	Fracture: ribs, closed, unspecified
803.00	Fracture: skull, closed, unspecified
823.80	Fracture: tibia, closed, unspecified
823.82	Fracture: tibia/fibula, closed, unspecified
805.8	Fracture: vertebral, closed, unspecified

Other Trauma

- 919.0 Abrasion, unspecified
- 995.81 Adult physical abuse
- 924.9 Bruise contusion, unspecified
- 949.0 Burn, degree unspecified
- 995.50 Child abuse, unspecified
- 991.9 Cold injury, unspecified
- 850.9 Concussion, unspecified
- 929.9 Crushing injury, unspecified
- 994.1 Drowning/submersion
- 994.4 Exhaustion due to exposure
- 938 Foreign body, digestive system, unspecified
- 931 Foreign body, ear
- 932 Foreign body, nose
- 919.6 Foreign body, skin, superficial, unspecified
- E922.9 Gunshot wound, NOS
- 854.0 Head injury, NO
- 992.9 Heat injury, unspecified
- 919.4 Insect bite
- 908.9 Late effects of injury, unspecified
- 995.2 Medication, adverse effects, unspecified
- 879.8 Open wound, head/ neck/trunk, unspecified
- 894.0 Open wound, lower limb, unspecified
- 884.0 Open wound, upper limb, unspecified
- 959.9 Other trauma, unspecified
- 977.9 Poisoning, medicine overdose, unspecified
- 989.9 Poisoning, unspecified
- 999.9 Surgery/medical care complications, unspecified
- 733.1 Collapsed Vertebra
- 805.2 Compression Fracture
- 805.4 Compression Fracture Lumbar
- 736.81 Acquired Unequal Leg Length
- 755.30 Congenital Unequal Leg Length
- 781.2 Abnormality of Gait
- 719.7 Difficulty in Walking
- 781.3 Lack of Coordination
- 781.9 Abnormal Posture
- 737.1 Hyperkyphosis (Acquired)
- 737.2 Hyperlordosis (Acquired)
- 737.42 Hypolordosis of the Cervical/Lumbar Spine
- 732.1 Reversal of the Cervical Curve
- 734.43 Scoliosis
- 739.9 Curvature, Acquired
- 722.4 Degeneration of Cervical Disc(s)
- 722.51 Degeneration of Thoracic Disc(s)
- 722.52 Degeneration of Lumbar Disc(s)

- 715.9 Degenerative Joint Disease (Osteoarthritis)
- 715.95 Degenerative Joint Disease of the Hip
- 715.96 Degenerative Joint Disease of Knee
- 715.09 Osteoarthritis of Multiple Sites
- 716.9 Chronic Arthritis
- 734 Pes Planus, Acquired
- 754.61 Pes Planus, Congenital
- 736.41 Genu Valgus
- 733.0 Osteoporosis
- 733.01 Osteoporosis Senile
- 733.02 Osteoporosis Idiopathic

Symptoms

- 723.1 Cervicalgia
- 724.1 Thoracic Spine Pain
- 724.2 Lumbalgia
- 355.8 Nerve Inflammation/Compression (Lower Limb)
- 724.3 Sciatica Neuralgia
- 724.5 Vertebrogenic Pain Syndrome
- 726.90 Tendinitis/Capsulitis
- 727.00 Synovitis/Tenosynovitis
- 727.3 Bursitis
- 782.3 Edema of - whatever
- 729.1 Myofasciitis of Cervico-thoracic Musculature
- 729.1 Myofasciitis of Gluteal & Erector Spinae Musculature
- 728.9 Muscle Weakness
- 728.85 Muscle Spasm
- 780.4 Dizziness
- 780.5 Sleep Disturbance
- 780.7 Fatigue
- 787.2 Dysphagia
- 784.5 Dysphasia
- 784.9 Choking Sensation
- 784.49 Hoarseness of Speech
- 781.0 Nausea
- 354.1 Median Nerve Neuritis
- 354.2 Ulnar Nerve Lesion
- 354.3 Radial Nerve Lesion
- 355.0 Sciatic Nerve Lesion
- 782.0 Paresthesia/ Hypesthesia/ Numbness/ Tingling
- 354.8 Nerve Inflammation/Compression (Upper Limb)
- 443.0 Raynaud's Syndrome
- 354.4 Causalgia of Upper Limb
- 355.71 Causalgia of Lower Limb
- 355.9 Causalgia of (whatever)
- 780.2 Syncope
- 726.0 Adhesive Capsulitis of Shoulder
- 726.11 Calcific Tendinitis of Shoulder
- 726.12 Bicipital Tenosynovitis

Stiffness

- 719.51 Stiffness of Shoulder
- 719.52 Stiffness of Elbow
- 719.55 Stiffness of Sacroiliac Joint
- 719.57 Stiffness of Ankle/Foot
- 719.58.1 Stiffness of Cervical Spine/
Thoracic/Spine/Lumbar-Spine

Crepitus

- 719.68 Crepitus of Cervical Spine
- 719.61 Crepitus of Shoulder
- 719.63 Crepitus of Elbow
- 719.64 Crepitus of Hand/Wrist
- 719.66 Crepitus of Knee
- 719.67 Crepitus of Ankle/Foot
- 719.68 Crepitus of Cervical Spine/Thoracic
Spine/Lumbar-Spine

Headache

- 346.00 Classical Migraine
- 346.01 Migraine Headache with Aura,
Intractable
- 346.10 Common Migraine Headache
- 346.11 Common Migraine, Intractable
- 346.2 Allergic or Cluster Migraine Headache
- 346.9 Vasomotor Headache
- 784.0 Common Vascular Headache
- 307.81 Tension Headache

Miscellaneous

- 736.9 Acquired deformity, limb, unspecified
- 716.90 Arthropathy, unspecified
- 724.4 Back pain w/ radiation, unspecified
- 723.9 Cervical disorder, NOS
- 710.9 Connective tissue disease, unspecified
- 722.2 Disc syndrome, no myelopathy, NOS
- 727.43 Ganglion, unspecified
- 717.9 Internal derangement, knee, unspecified
- 737.9 Kyphosis/scoliosis, unspecified
- 724.2 Low back pain**
- 729.1 Myalgia/myositis, unspecified**
- 721.90 Osteoarthritis of spine, NOS
- 715.90 Osteoarthrosis, unspecified
- 730.0 Osteomyelitis, acute, unspecified
- 730.10 Osteomyelitis, chronic, unspecified
- 733.0 Osteoporosis, unspecified
- 724.5 Polymyalgia rheumatica
- 714.0 Rheumatoid arthritis (not juvenile
rheumatoid arthritis)
- 726.10 Shoulder syndrome, unspecified
- 727.0 Synovitis/tenosynovitis, unspecified
- 716.10 Traumatic arthropathy, unspecified

Infectious/Parasitic Diseases

- 052.9 Chickenpox, NOS
- 111.9 Dermatomycosis, unspecified
- 009.1 Gastroenteritis, infectious
- 007.1 Giardiasis
- 098.0 Gonorrhoea, acute, lower genitourinary
tract
- 054.9 Herpes simplex, any site
- 053.9 Herpes zoster, NOS
- 042 Human immunodeficiency virus disease
- V08 Human immunodeficiency virus positive,
asymptomatic
- 075 Infectious mononucleosis
- 136.9 Infectious/parasitic diseases,
unspecified
- 487.1 Influenza w/ upper respiratory symptoms
- 007.9 Intestinal protozoa, NOS
- 088.81 Lyme disease
- 055.9 Measles, NOS
- 112.0 Moniliasis, oral
- 112.3 Moniliasis, skin/nails
- 112.1 Moniliasis, vulva/vagina
- 072.9 Mumps, NOS
- 132.9 Pediculosis, unspecified
- 127.4 Pinworms
- 138 Polio, late effects
- 795.5 Positive PPD
- 082.0 Rocky mountain spotted fever
- 056.9 Rubella, NOS
- 003.0 Salmonella gastroenteritis
- 135 Sarcoidosis
- 133.0 Scabies
- 038.9 Septicemia, NOS
- 004.9 Shigellosis, unspecified
- 005.0 Staphylococcal food poisoning
- 034.0 Strep throat
- 097.9 Syphilis, unspecified
- 111.0 Tinea versicolor
- 131.9 Trichomoniasis, unspecified
- 011.90 Tuberculosis, pulmonary, NOS
- 099.9 Venereal disease, unspecified
- 077.99 Viral conjunctivitis
- 057.9 Viral exanthems, other, NOS
- 070.9 Viral hepatitis, NOS
- 079.99 Viral infection, unspecified
- 078.10 Warts, all sites
- 078.11 Warts, condyloma

Neoplasms

Malignant Neoplasms

188.9	Bladder, unspecified
174.9	Breast, female, unspecified
153.9	Colon, unspecified
184.9	Female genital, unspecified, CIS excluded
159.0	Gastrointestinal tract, unspecified
201.9	Hodgkin's, NOS
208.90	Leukemia, w/o remission, NOS
162.9	Lung, unspecified
187.9	Male genital, unspecified
185	Prostate
165.9	Respiratory tract, NOS
173.9	Skin, unspecified
199.1	Unspecified
189.9	Urinary, unspecified

Benign Neoplasms

211.3	Colon
214.9	Lipoma, any site
239.9	Neoplasm, unspecified
216.9	Skin, unspecified
239.2	Skin, soft tissue neoplasm, unspecified
229.9	Unspecified
218.9	Uterus (leiomyoma, unspecified)

Endocrine, Nutritional & Metabolic Disorders

266.2	B12 deficiency w/o anemia
276.5	Dehydration
250.91	Diabetes mellitus, I, complications
250.01	Diabetes mellitus, I, uncomplicated
250.90	Diabetes mellitus, II, complications
250.00	Diabetes mellitus, II, uncomplicated
250.13	Diabetic ketoacidosis
271.9	Glucose intolerance
240.9	Goiter, unspecified
274.9	Gout, unspecified
275.42	Hypercalcemia
276.7	Hyperkalemia
276.0	Hypnatremia
252.0	Hyperparathyroidism
242.9	Hyperthyroidism, NOS
275.41	Hypocalcemia
250.80	Hypoglycemia, diabetic, unspecified
251.2	Hypoglycemia, nondiabetic, unspecified
276.8	Hypokalemia
276.1	Hyponatremia
252.1	Hypoparathyroidism
244.9	Hypothyroidism, unspecified
272.9	Lipoid Disorder, unspecified
269.9	Nutritional deficiencies, unspecified
278.00	Obesity, NOS
790.6	Other abnormal blood chemistry
241.0	Thyroid nodule

Blood Diseases

288.9	Abnormal white blood cells, unspecified
285.1	Anemia, acute blood loss
280.9	Anemia, iron deficiency, unspecified
285.9	Anemia, other, unspecified
281.0	Anemia, pernicious
289.9	Blood disease, unspecified
287.9	Hemorrhagic conditions, unspecified
289.1	Lymphadenitis, chronic
238.4	Polycythemia vera
282.60	Sickle-cell anemia, unspecified
282.5	Sickle-cell trait

Mental Disorders

309.9	Adjustment reaction, unspecified
305.00	Alcohol abuse, unspecified
303.90	Alcoholism, unspecified
331.0	Alzheimers
307.1	Anorexia nervosa
300.00	Anxiety state, unspecified
314.01	Attention deficit, w/ hyperactivity
314.00	Attention deficit, w/o hyperactivity
307.51	Bulimia
312.90	Conduct disorder, unspecified
311	Depressive disorder, NOS
305.90	Drug abuse, unspecified
304.90	Drug dependence, unspecified
300.10	Hysteria, unspecified
307.40	Insomnia/nonorganic sleep disorder, unspecified
315.9	Learning disability/developmental delay, NOS
319	Mental retardation, unspecified
300.9	Neurosis, NOS
300.01	Panic disorder
301.9	Personality disorder, unspecified
298.9	Psychosis, unspecified
295.90	Schizophrenia, unspecified
290.0	Senile dementia, NOS
302.70	Sexual dysfunction, unspecified
308.3	Situational disturbance, acute
780.53	Sleep apnea w/ hypersomnia
307.81	Tension headache
305.1	Tobacco abuse

NERVOUS & CIRCULATORY ICD-9

Nervous System & Sense

Organ Disorders

Nervous System Diseases

351.0	Bell's palsy
354.0	Carpal tunnel
438.9	CVA, late effect, unspecified
345.90	Epilepsy, unspecified, w/o intractable epilepsy
322.9	Meningitis, unspecified
346.90	Migraine, unspecified, w/o intractable migraine
333.90	Movement disorder, unspecified
340	Multiple sclerosis
359.9	Myopathy, unspecified
349.9	Nervous system, NOS
357.9	Neuropathy, unspecified
332.0	Parkinsonism, primary
333.99	Restless legs
333.1	Tremor, essential/familial
781.0	Tremor/spasms, NOS
350.1	Trigeminal neuralgia

Eye Diseases

373.00	Blepharitis, unspecified
366.9	Cataract, unspecified
373.2	Chalazion
372.30	Conjunctivitis, unspecified
918.1	Corneal abrasion
370.00	Corneal ulcer, unspecified
940.9	Eye burn, unspecified
379.90	Eye disorder, unspecified
930.9	Eye foreign body, external, unspecified
378.9	Eye movement disorder, unspecified
365.9	Glaucoma, unspecified
373.11	Hordeolum (stye)
367.9	Refractive errors, unspecified
362.9	Retinal disorder, unspecified
368.10	Visual disturbance, unspecified
369.9	Visual loss, unspecified

Ear Diseases

388.9	Ear disorder, unspecified
381.50	Eustachian salpingitis, unspecified
389.9	Hearing loss, unspecified
380.10	Otitis externa, unspecified
382.00	Otitis media, acute
382.01	Otitis media, acute w/ rupture of ear drum
381.10	Otitis media, chronic serous
386.2	Vertigo, central
386.10	Vertigo, peripheral, unspecified
380.4	Wax in ear

Circulatory System

794.31	Abnormal electrocardiogram
410.10	Acute myocardial infarction, anterior, NOS (to 8 weeks)
410.40	Acute myocardial infarction, inferior, NOS (to 8 weeks)
410.70	Acute myocardial infarction, subendocardial (to 8 weeks)
410.60	Acute myocardial infarction, true posterior (to 8 weeks)
410.90	Acute myocardial infarction, unspecified (to 8 weeks)
428.1	Acute pulmonary edema
413.9	Angina pectoris, NOS
411.1	Angina, unstable
441.9	Aortic aneurysm, unspecified
447.9	Arterial disorder, other, unspecified
440.9	Atherosclerosis, NOS (excludes heart/brain)
427.31	Atrial fibrillation
861.01	Cardiac contusion
434.91	Cerebral artery occlusion, w/ infarction, unspecified
414.9	Chronic ischemic heart disease, unspecified
459.9	Circulatory disorder, unspecified
426.9	Conduction disorder, unspecified
428.0	Congestive heart failure
424.1	Disease of heart valve, aortic, NOS
394.9	Disease of heart valve, mitral, unspecified
424.3	Disease of heart valve, pulmonary
424.2	Disease of heart valve, tricuspid
796.2	Elevated BP w/o hypertension
429.9	Heart disease, other, unspecified
401.1	Hypertension, benign
401.0	Hypertension, malignant
403.91	Hypertension, renal disease, unspecified, w/ renal failure
402.91	Hypertensive cardiac w/ congestive heart failure
432.9	Intracranial hemorrhage, NOS
446.1	Kawasaki disease
412	Myocardial infarction, old
458.0	Orthostatic hypotension
427.0	Paroxysmal supraventricular tachycardia
420.91	Pericarditis, acute, nonspecific
443.9	Peripheral vascular disease, unspecified
427.60	Premature beats, unspecified
415.19	Pulmonary embolism, not iatrogenic
416.9	Pulmonary heart disease, chronic, unspecified
398.90	Rheumatic heart disease, unspecified
451.9	Thrombophlebitis, unspecified
435.9	Transient ischemic attack, unspecified
454.9	Varicose veins w/o ulcer/inflammation
459.81	Venous insufficiency, unspecified

Respiratory System

- 478.1 Abscess/ulcer of nose
- 493.90 Asthma, unspecified
- 466.11 Bronchiolitis, acute, due to RSV
- 466.0 Bronchitis, acute
- 491.9 Bronchitis, chronic, unspecified
- 496 Chronic obstructive pulmonary disease, NOS
- 464.4 Croup
- 492.8 Emphysema
- 464.30 Epiglottitis, acute
- 464.0 Laryngitis, acute
- 475 Peritonsillar abscess
- 462 Pharyngitis, acute
- 511.9 Pleural effusion, NOS
- 511.0 Pleurisy, NOS
- 486 Pneumonia, unspecified
- 512.8 Pneumothorax, spontaneous
- 860.0 Pneumothorax, traumatic, w/o open wound into thorax
- 861.21 Pulmonary contusion, w/o open wound into thorax
- 519.9 Respiratory disease, other, NOS
- 477.9 Rhinitis, allergic, cause unspecified
- 472.0 Rhinitis, chronic
- 461.9 Sinusitis, acute, NOS
- 473.9 Sinusitis, chronic, NOS
- 474.9 Tonsil/adenoid disease, chronic, unspecified
- 463 Tonsillitis, acute
- 465.9 Upper respiratory infection, acute, NOS

Digestive System

- 565.0 Anal fissure, nontraumatic
- 540.9 Appendicitis, unspecified
- 575.0 Cholecystitis, acute
- 574.20 Cholelithiasis, NOS
- 571.9 Chronic liver disease, unspecified
- 571.5 Cirrhosis, NOS
- 555.9 Crohn's disease, NOS
- 525.9 Dental, unspecified
- 562.11 Diverticulitis of colon, NOS
- 562.10 Diverticulosis of colon
- 536.8 Dyspepsia
- 530.9 Esophageal disease, unspecified
- 530.10 Esophagitis, unspecified
- 575.9 Gallbladder disease, unspecified
- 535.50 Gastritis, unspecified, w/o hemorrhage
- 558.9 Gastroenteritis, noninfectious, unspecified
- 530.81 Gastroesophageal reflux, no esophagitis
- 455.6 Hemorrhoids, NOS
- 553.3 Hernia, hiatal, noncongenital
- 550.90 Hernia, inguinal, NOS

- 553.9 Hernias, other, NOS
- 560.1 Ileus
- 560.9 Intestinal obstruction, unspecified
- 564.1 Irritable bowel syndrome
- 557.9 Ischemic bowel disease, unspecified
- 579.9 Malabsorption, NOS
- 528.9 Oral, soft tissue diseases, unspecified
- 529.9 Oral, tongue diseases, unspecified
- 577.0 Pancreatitis, acute
- 533.90 Peptic ulcer disease, unspecified, w/o obstruction
- 569.1 Rectal prolapse
- 524.60 Temporomandibular joint disorder, unspecified
- 556.9 Ulcerative colitis, unspecified

Genitourinary System

Urinary System Diseases

- 595.0 Cystitis, acute
- 595.1 Cystitis, interstitial, chronic
- 580.9 Glomerulonephritis, acute, unspecified
- 582.9 Glomerulonephritis, Chronic, unspecified
- 791.0 Proteinuria, nonpostural, nonobstetric
- 590.10 Pyelonephritis, acute, no necrosis
- 593.9 Renal disease, NOS
- 584.9 Renal failure, acute, unspecified
- 585 Renal failure, chronic
- 597.81 Urethral syndrome, nonvenereal disease, NOS
- 592.9 Urinary calculus, unspecified
- 599.6 Urinary obstruction, unspecified

Male Genital Organ Disease

- 607.1 Balanitis
- 603.9 Hydrocele, unspecified
- 302.72 Impotence, psychosexual dysfunction
- 607.84 Impotence, organic
- 608.9 Male genital disease, other, unspecified
- 604.90 Orchitis/epididymitis, unspecified
- 605 Phimosi
- 600 Prostatic hypertrophy, benign
- 601.9 Prostatitis, NOS
- 099.40 Urethritis, nongonococcal, unspecified
- 456.4 Varicocele

Breast Diseases

- 611.9 Breast disease, unspecified
- 611.72 Breast lump
- 610.2 Fibroadenosis
- 610.1 Fibrocystic disease
- 611.6 Galactorrhea
- 793.8 Mammogram, abnormal
- 675.9 Mastitis, lactating, unspecified
- 611.0 Mastitis, NOS

Genitourinary System continued

Female Genital Organ Diseases

- 616.2 Bartholin cyst
- 622.7 Cervical polyp, NOS
- 616.0 Cervicitis
- 618.9 Cystocele/rectocele/prolapse, unspecified
- 625.0 Dyspareunia
- 617.9 Endometriosis, unspecified
- 625.9 Female disease, other, unspecified
- 614.9 Pelvic inflammatory disease, unspecified
- 625.6 Stress incontinence, female
- 616.10 Vaginitis/vulvitis, unspecified

Disorders of Menstruation

- 626.0 Amenorrhea
- 626.2 Excessive/frequent menstruation
- 627.9 Menopausal disorders, unspecified
- 626.6 Metrorrhagia
- 625.3 Painful menstruation
- V07.4 Postmenopausal hormone replacement
- 625.4 Premenstrual tension syndrome

Fertility Problems

- 628.9 Infertility, female, unspecified
- 606.9 Infertility, male, unspecified

Skin, Subcutaneous Tissue

- 706.1 Acne, other
- 702.0 Actinic keratosis
- 704.00 Alopecia, unspecified
- 682.9 Cellulitis/abscess, unspecified
- 707.9 Chronic skin ulcer, unspecified
- 692.9 Contact dermatitis, NOS
- 700 Corn/callus
- 691.0 Diaper rash
- 691.8 Eczema, atopic dermatitis
- 704.9 Hair disease, unspecified
- 704.1 Hirsutism
- 684 Impetigo
- 703.0 Ingrown nail
- 683 Lymphadenitis, acute
- 703.9 Nail disease, unspecified
- 110.1 Onychomycosis
- 709.9 Other skin disease, unspecified
- 696.3 Pityriasis rosea
- 698.9 Pruritus, NOS
- 696.1 Psoriasis
- 695.3 Rosacea
- 706.2 Sebaceous cyst
- 690.10 Seborrheic dermatitis, NOS
- 702.19 Seborrheic keratosis, NOS
- 692.71 Sunburn
- 705.9 Sweat gland disease, unspecified
- 708.9 Urticaria, unspecified

Musculoskeletal & Connective

Tissue

- 736.9 Acquired deformity, limb, unspecified
- 716.90 Arthropathy, unspecified
- 724.4 Back pain w/ radiation, unspecified
- 723.9 Cervical disorder, NOS
- 710.9 Connective tissue disease, unspecified
- 722.2 Disc syndrome, no myelopathy, NOS
- 727.43 Ganglion, unspecified
- 717.9 Internal derangement, knee, unspecified
- 737.9 Kyphosis/scoliosis, unspecified
- 724.2 Low back pain
- 729.1 Myalgia/myositis, unspecified
- 721.90 Osteoarthritis of spine, NOS
- 715.90 Osteoarthritis, unspecified
- 730.00 Osteomyelitis, acute, unspecified
- 730.10 Osteomyelitis, chronic, unspecified
- 733.00 Osteoporosis, unspecified
- 725 Polymyalgia rheumatica
- 714.0 Rheumatoid arthritis (not juvenile rheumatoid arthritis)
- 726.10 Shoulder syndrome, unspecified
- 727.00 Synovitis/tenosynovitis, unspecified
- 716.10 Traumatic arthropathy, unspecified

Congenital Anomalies

- 743.65 Blocked tear duct
- 746.9 Congenital heart anomaly, NOS
- 755.9 Limb anomaly, unspecified
- 751.0 Meckel's diverticulum
- 759.9 Other congenital anomaly, unspecified
- 750.5 Pyloric stenosis
- 752.51 Undescended testis

APPENDIX

Selected Degrees

BSc	Bachelor of Science
CCSP	Certified Chiropractic Sports Physician
DC	Doctor of Chiropractic
DABCO	Diplomate of the Board of American Chiropractic orthopedists
DACBN	Diplomate of the American Chiropractic Board of Nutritionists
DACBR	Diplomate of the American Chiropractic Board of Radiologists
DACBSP	Diplomate of the American Chiropractic Board of Sports Physicians
DO	Doctor of Osteopathy
DPM	Doctor of Podiatric Medicine
EdD	Doctor of Education
JD	Juris Doctor
MD	Medical Doctor
MSc	Masters of Science
MST	Masters of Science in Teaching
RT	Radiographic Technologist

↓	decrease
↑	increase
→	may indicate/suggests
∴	therefore
(-)	negative
(+)	positive
[Ca ²⁺]	calcium concentration
<	less than
>	greater than
a	ante (before)
A→P	anterior to posterior
aa	amino acid
ac	before meals
AC	acromioclavicular
Ag	antigen
AROM	active range of motion
AS	ancillary studies
ASA	asalicylic acid (aspirin)
b/c	because
bid	2 times a day
BM	bowel movement
BMI	body mass index
BMR	basal metabolic rate
BP	blood pressure
bps	beats per second
c	with
C	cervical
c/o	complains of
CA	cancer

CAD	coronary artery disease
cc	chief complaint or cubic centimeters
CC	chief complaint or complex carbohydrate
CHF	congestive heart failure
CMT	chiropractic manipulative therapy
Cn	cranial nerve
CNS	central nervous system
COPD	chronic obstructive pulmonary disease
CT	computed tomography or connective tissue
CT	cervical thoracic
D&C	dilation & curettage (of uterus)
d/c	discontinue
d/t	due to
DDx	differential diagnosis
DIF	duration, intensity, frequency
DJD	degenerative joint disease
DOB	date of birth
DOE	dyspnea on exertion
DTR	deep tendon reflex
Dx	diagnosis
ECG	electrocardiogram
Edu	education
EENT	eye, ear, nose, throat
EMF	electromyography
EMS	electrical muscle stimulation
Et	etiology
exac	exacerbation
F	female
FUD	fever of unknown origin
Fx	fracture
GAG	glucoseaminoglycan
GERD	gastroesophageal reflux disease
GH	glenohumeral
GI	gastrointestinal
GPF	gross physical findings/
GTT	glucose tolerance test
GU	genitourinary
gyn	gynecology
h	hour
HA	headache
Hb	hemoglobin
HDL	high density lipoprotein
HIV	human immunodeficiency virus
HP	hot pack or type of sauce
hs	bedtime
HVG	high volt galvanic
Hx	history
Hz	cycles per second
i	insertion
I→S	inferior to superior
IBW	ideal body weight

ABBREVIATIONS

IF	intrinsic factor	q	every
IFC	interferential current	q4h	every 4 hours
ITB	iliotibial band	qid	4 times a day
L	left or lumbar	QL	quadratus lumborum
L→M	lateral to medial	R	right
LCL	lateral collateral ligament	r/c	receptor
LDL	low density lipoprotein	r/o	rule out
LMNL	lower motor neuron lesion	RA	rheumatoid arthritis
LMP	last menstrual period (first day)	RDA	recommended daily allowance
LNMP	last normal menstrual period	RDI	recommended daily intake
LOC	loss of consciousness	RM	repetition maximum
LS	lumbosacral	RMR	resting metabolic rate
LVG	low volt galvanic	ROM	range of motion
m	muscle or meter	RTC	return to clinic
M	male	s	without
M→L	medial to lateral	S→I	superior to inferior
mcg	microgram	SCFE	slipped capital femoral epiphysis
MCL	medial collateral ligament	SLAP	superior labrum anterior posterior
meds	medication	SLR	straight leg raise
METS	metastasis	SOB	shortness of breath/son of a ...
MI	myocardial infarction	SOL	space occupying lesion/shit out of luck
MRI	magnetic resonance imaging	SSx	signs & symptoms
msl	muscle	ST	soft tissue
m-stat	medically stationary	STI	sexually transmitted infection
MVA	motor vehicle accident	STM	soft tissue manipulative therapy
n	nerve	Sx	symptoms
N&V	nausea & vomiting	T	thoracic
NARE	no apparent residual effects	T&A	tonsillectomy & adenoidectomy
NCV	nerve conduction velocity	T&T	taut and tender
NPO	nothing orally	TAB	therapeutic abortion
NRE	no residual effects	TG	triglyceride
NSAID	non-steroidal anti-inflammatory drug	TL	thoracic-lumbar junction
NTT	normal to touch (temperature)	TPR	temperature pulse respiration
o	origin	Tx	treatment
OA	osteoarthritis	UA	urinalysis
ob	obstetrics	UMNL	upper motor neuron lesion
OCA	oral contraceptive agent	URI	upper respiratory infection
OD	osteocondritis dessicans	US	ultrasound
OTC	over the counter (meds)	UTI	urinary tract infection
P→A	posterior to anterior	UV	ultraviolet
PAR	procedure, alternative, risk or better than bogey	VLDL	very low density lipoprotein
pc	post prandial (after meals)	w/	with
PE	physical exam	w/in	within
PID	pelvic inflammatory disease	w/o	without
PMS	premenstrual syndrome	WBC	white blood cell
pp	patient presents	WC	workers' compensation
PRN	patient return as needed	WSLR	well straight leg raise
PROM	passive range of motion	WNL	within normal limits or 'we never looked'
PT	physical therapy	x	time
pt.	patient	XSLR	crossed straight leg raise

COMMON OUTPATIENT ICD-9 CODES

Medicare

- 739.0 Occipital Subluxation
- 739.1 Cervical Subluxation
- 739.2 Thoracic Subluxation
- 739.3 Lumbar Subluxation
- 739.4 Sacroiliac Subluxation
- 739.5 Rib Subluxation

Cervical

- 839.08 Multiple Cervical Subluxation
- 722.0 Cervical Disc Syndrome
- 353.2 Cervical Nerve Root Lesion
- 847.0 Cervical Sprain/Strain
- 723.4 Brachial Neuritis
- 723.3 Cervicobrachial Syndrome

Thoracic

- 839.21 Subluxation Thoracic
- 722.11 Thoracic Disc Syndrome
- 353.3 Thoracic Nerve Root Lesion
- 724.4 Thoracic Neuritis
- 847.1 Thoracic Sprain/Strain

Lumbar

- 839.20 Subluxation Lumbar
- 722.10 Lumbar Disc Syndrome
- 724.4 Lumbar Neuritis
- 353.4 Lumbosacral Nerve Root Lesion
- 847.2 Lumbar Sprain/Strain

Sacroiliac

- 839.42 Subluxation Sacroiliac Joint
- 847.3 Sacroiliac (SI) Sprain/Strain
- 353.1 Lumbosacral Plexus Lesion
- 720.2 Sacroilitis

Coccyx

- 839.41 Subluxation of the Coccyx
- 847.4 Coccyx Sprain/Strain
- 353.1 Lumbosacral Plexus Lesion

Common

- 724.8 Facet Syndrome
- 726.90 Tendinitis/Capsulitis
- 727.00 Synovitis/Tenosynovitis
- 727.3 Bursitis
- 728.85 Muscle Spasm
- 729.1 Myofascitis
- 728.9 Muscle Weakness

Miscellaneous

- 353.0 Thoracic Outlet Syndrome
- 726.1 Rotator Cuff Syndrome
- 726.10 Supraspinatus Syndrome
- 354.0 Carpal Tunnel Syndrome
- 524.6 TMJ Dysfunction Syndrome
- 724.2 Low back pain

Peripheral Joint Codes

- 831.01 Anterior Subluxation of Humerus
- 831.02 Posterior Subluxation of Humerus
- 832.02 Subluxation of Elbow
- 833.00 Subluxation of Carpal Bone
- 836.63 Medial Subluxation of Tibia
- 836.64 Lateral Subluxation of Tibia
- 838.01 Subluxation of Tarsal Bone

Sprain/Strain Upper Extremity

- 840.0 Acromioclavicular (joint)
- 840.1 Coracoclavicular (ligament)
- 840.2 Coracohumeral (ligament)
- 840.3 Infraspinatus (muscle) (tendon)
- 840.4 Rotator cuff (capsule)
- 840.5 Subscapularis (muscle)
- 840.6 Supraspinatus (muscle) (tendon)

Sprain/Strain Lower Extremity

- 836.2 Knee meniscus injury, unspecified
- 845.00 Ankle, unspecified
- 845.10 Foot, unspecified
- 844.9 Knee/leg, unspecified

Leg Length & Gait

- 736.81 Acquired Unequal Leg Length
- 755.30 Congenital Unequal Leg Length
- 781.2 Abnormality of Gait
- 719.7 Difficulty in Walking
- 781.9 Abnormal Posture

Spinal Curve

- 737.1 Hyperkyphosis (Acquired)
- 737.2 Hyperlordosis (Acquired)
- 737.42 Hypolordosis
- 732.1 Reversal of Cervical Curve
- 734.43 Scoliosis
- 739.9 Curvature, Acquired
- 722.4 Degeneration Cervical Disc(s)
- 722.51 Degeneration Thoracic Disc(s)
- 722.52 Degeneration Lumbar Disc(s)

Osteoarthritis / DJD

- 715.9 Degenerative Joint Disease (OA)
- 715.95 Degenerative Joint Disease Hip
- 715.96 Degenerative Joint Disease Knee
- 715.09 Osteoarthritis Multiple Sites
- 716.9 Chronic Arthritis

Headache

- 346.00 Classical Migraine
- 346.01 Migraine Headache with Aura
- 346.10 Common Migraine Headache
- 346.2 Cluster Migraine Headache
- 784.0 Common Vascular Headache
- 307.81 Tension Headache
- 784.0 Vertebrogenic Headache