Orthopedic Assessment
For the Nurse Practitioner
Annette R. Kornasiewicz, PT, MDT

Objectives
Describe the basic components of the full spectrum of adult orthopedic patient care.

Describe the components of a musculoskeletal history and physical exam for the major anatomic areas: neck, shoulder, elbow, wrist, low back, hip, knee and ankle.

Recognize the appropriate initial management of common musculoskeletal injuries and complaints.

Identify and differentiate between typical presentations of common musculoskeletal conditions and differential diagnosis.

Presenter Bio
Bachelor of Arts in English, Magna Cum Laude in 1994, and Bachelor of Science in Physical Therapy, Cum Laude in 1998 from the University of Toledo and the Medical College of Ohio in Consortium with UT respectively.

Out-Patient Orthopedic PT at St. Luke’s Hospital for 18 years caring for a myriad of musculoskeletal conditions.

Certified in the McKenzie Mechanical Diagnosis and Therapy, 2008

Pelvic Floor therapist for 10 years serving men and women with a wide array of conditions.

Guest Faculty lecturer since 2010 at the University of Toledo Doctor of Physical Therapy program for the topics of Pelvic Floor Rehabilitation and Differential Diagnoses for the Vascul Floor

Honduras Medical Mission in 2011 with the University of Toledo Medical College, providing physical therapy interventions in the field for one week.

PT and Clinic Volunteer for Migrant Worker Mobile Health Clinics yearly since 2011

One of the pioneering PTs who developed and implemented the process by which physical therapy students and clinicians became involved in the UT Community Care Free Medical Clinic and continue to volunteer as one of about 10 PTs in the area.

Retired Master Sergeant, 20 years in the Ohio Air National Guard as a Security Police Specialist and Public Affairs representative.
Skin ailments, joint disorders, and back pain—not life-threatening conditions—are the most common reasons for visits to U.S. health care providers, according to a new Mayo Clinic Proceedings study. Rochester Family Medicine Clinic between January 2005 and December 2009. They found that the 10 most common diagnoses were:

- Skin disorders
- Osteoarthritis and joint disorders
- Back problems
- Cholesterol problems
- Upper respiratory conditions, excluding asthma
- Anxiety, depression, and bipolar disorder
- Chronic neurologic disorders
- High blood pressure
- Headaches and migraines
- Diabetes

Nearly half the study population suffered from a skin disorder—such as acne, cysts, or dermatitis—in the five-year period (Perry, Minneapolis Post, 1/17; Mayo Clinic release, 1/16).

All pain is assumed visceral or pathophysiological until proven orthopedic or mechanical

All upper extremity orthopedic or mechanical pain is assumed from the Neck until proven otherwise

All lower extremity orthopedic or mechanical pain is assumed from the Back until proven otherwise

History/Subjective – special considerations for each joint

Physical Examination
Observation – walking in and sitting
Inspection
Neuromuscular Tests – Active then passive
Palpation
Provocation Tests
Special Tests
Examination of Related Areas
What is NOT Musculoskeletal

- Angina with nausea, vomiting, profuse sweating, SOB, fever, pallor, fatigue, weight loss, fainting or drop attacks, diarrhea
- Gradual, progressive or cyclical presentation of symptoms
- Generalized Malaise
- Inability to alter or provoke/reproduce the symptoms
- Night pain
- Symptoms are constant and intense
- Presence of bilateral symptoms such as numbness/tingling, skin rash, edema or nail bed changes
- Pathological changes in bowel or bladder
- Lack of significant objective neuromusculoskeletal signs and symptoms

Orthopedic Assessment

When to perform a Neurological Assessment

In an orthopedic setting, the subjective history will trigger a full neurological assessment when assessing a patient who:

- has suffered a brain injury or stroke
- reports numbness, tingling and or pain down one or both extremities
- presents with new balance disturbances
- complains of progressive weakness

The complete neurological exam consists of history-taking and the assessment of:

- mental status
- cranial nerve function
- motor function
- sensory function
- cerebellum and gait
- reflexes
The Neurological Assessment

Mental Status

A & O x 4
Mini-Mental State Examination (MMSE), also known as the Folstein Mini Mental State Exam

FEAR AVOIDANCE BELIEFS QUESTIONNAIRE (FABQ).
There is research regarding the prognosis of a patient who has fear-based beliefs connected to their back pain, and this test is administered in conjunction with evidence based practice treatment approaches.

Cranial Nerve Function

Motor Function: Motor Assessment

- **Strength:** Arm Drift. Instruct the patient to extend his or her arms straight out, with palms up and eyes closed. Significant proximal weakness will cause the affected arm to drift into pronation. Other sensitive tests for extremity weakness include hand grasp, plantar flexion of the foot and dorsiflexion of the foot (heel walking/toe walking). Formal testing of the affected muscle groups may be needed.

- **Atrophy:** Observe large muscle groups (i.e., calf muscles, biceps) for symmetry and determine if their size is appropriate for the patient's age.

- **Tone:** Observe and test muscles for flaccidity, spasticity or rigidity.
  - Flaccidity - No tone.
  - Rigidity presents as stiffness regardless of the rate of passive movement. When an extremity is rigid, it "catches" during passive movement.
  - Spasticity, on the other hand, is dependent on rate. When the spastic extremity is moved slowly, the tone appears normal. If the extremity is moved quickly, it "catches" and loses all resistance.
The Neurological Assessment

Patterns of weakness can help localize a lesion to a particular cortical or white matter region, spinal cord level, nerve root, peripheral nerve, or muscle. Muscle strength is often rated on a scale of 0/5 to 5/5 as follows:

- 0/5: no contraction
- 1/5: muscle flicker, but no movement
- 2/5: movement possible, but not against gravity (test the joint in its horizontal plane)
- 3/5: movement possible against gravity, but not against resistance by the examiner
- 4/5: movement possible against some resistance by the examiner (sometimes this category is subdivided further into 4–/5, 4–/5, and 4+/5)
- 5/5: normal strength

Myotomes of the upper extremity

<table>
<thead>
<tr>
<th>ACTION</th>
<th>MUSCLE</th>
<th>NERVE</th>
<th>ROOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoulder Abduction</td>
<td>Intrinsic Anterior</td>
<td>C5</td>
<td></td>
</tr>
<tr>
<td>Elbow Flexion</td>
<td>Biceps, Brachialis</td>
<td>C5,6</td>
<td></td>
</tr>
<tr>
<td>Elbow Extension</td>
<td>Triceps, Brachialis</td>
<td>C7,8</td>
<td></td>
</tr>
<tr>
<td>Wrist Extension</td>
<td>Extensors, Median</td>
<td>C7,8</td>
<td></td>
</tr>
<tr>
<td>Wrist Flexion</td>
<td>Flexors</td>
<td>C6,7</td>
<td></td>
</tr>
<tr>
<td>Finger Flexion</td>
<td>Flexors</td>
<td>C6,7</td>
<td></td>
</tr>
<tr>
<td>Finger Extension</td>
<td>Extensors, Median</td>
<td>C7,8</td>
<td></td>
</tr>
<tr>
<td>Finger Abduction</td>
<td>Dorsal Interossei</td>
<td>Ulnar T1</td>
<td></td>
</tr>
<tr>
<td>Finger Abduction</td>
<td>Palmar Interossei</td>
<td>Ulnar T1</td>
<td></td>
</tr>
<tr>
<td>Thumb Abduction</td>
<td>Adductor Pollicis</td>
<td>Median T1</td>
<td></td>
</tr>
<tr>
<td>Thumb Abduction</td>
<td>Adductor Pollicis</td>
<td>Median T1</td>
<td></td>
</tr>
</tbody>
</table>

The Neurological Assessment

Myotomes of the upper extremity

![Myotomes of the upper extremity](https://www.neuroexam.com/neuroexam/content.php?p=29)


![Myotomes of the upper extremity](http://cambridgequestions.co.uk/questiondiagrams/Myotome%20Table%20(Upper%20Limb).png)

![Myotomes of the upper extremity](https://www.google.com/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&ved=0ahUKEwjZqLTbpNDPAhXDHT4KHRkbCS0QjRwIBw&url=http%3A%2F%2Fwww.glowm.com%2Fsection_view%2Fheading%2FNeurophysiologic%2520Testing%2520of%2520the%2520Pelvic%2520Floor%2Fitem%2F57&psig=AFQjCNF8h8CMY4oNGGbtvslLqOAx2Z_qzw&ust=1476190581172811)
The Neurological Assessment

Sensory Examination

- Test pain, light touch down the affected and adjacent dermatomes. The location of tingling, burning or numbness will identify the affected dermatome.

- Proprioception - Ask patient to close their eyes while practitioner will move the toe up or down. The patient is asked to sense the direction.

- Stereognosis is dependent on touch and position sense, as well as the cerebral cortex function of recognition. Ask the patient to close his or her eyes and identify a familiar object, such as a key or pencil, which you have placed in the patient's hand.

- Vibration - Test vibration by placing a vibrating tuning fork over the distal interphalangeal joint of a finger and the great toe. Ask the patient to tell you when the vibration disappears.

The Neurological Assessment

Upper extremity dermatomes

![Upper Extremity Dermatomes Image]

The Neurological Assessment

Lower Extremity Dermatomes

![Lower Extremity Dermatomes Image]
The Neurological Assessment

Cerebellum and Gait

The cerebellum organizes and coordinates movements but does not control individual muscles. Therefore, smooth, coordinated movements depend on normal functioning of the cerebellum. Ataxia describes disorganized, unsteady or inaccurate movements.

- Finger to nose test
- Rapid alternating palm up down motions
- Heel-knee-shin test
- Walk heel to toe

The Neurological Assessment

Reflexes

The major deep-tendon reflexes are the
- Achilles (S1, S2),
- patellar (L3, L4),
- biceps (C5, C6) and
- triceps reflexes (C7, C8).

- Grade the response on a scale from 0 to 4+.
  - Zero reflects no contraction (absent reflex)
  - 1+ is diminished but present
  - 2+ is normal
  - 3+ is hyperactive
  - 4+ is hyperactive with clonus. Asymmetric reflexes indicate neurologic (or muscular) dysfunction.

Great Musculoskeletal Questions

- When? (Acute, Sub Acute or Chronic)
- Traumatic onset or insidious onset
- What makes your pain better?
- What makes your pain worse?
- Night pain? Are you able to return to sleep?
- Is there anything else you want to tell me about your condition?
Clinical Assessment
Special Considerations for:
- Neck
- Shoulder
- Elbow
- Hand/Wrist
- Low Back
- Hip
- Knee
- Calf
- Ankle

Clinical Testing/Neck and Back Pain

2015 study looking for pain–free individuals have positive cervical or lumbar findings on MRI/CT (5). Thirty–three articles reporting imaging findings for 3110 asymptomatic individuals met our study inclusion criteria.

- The prevalence of disk degeneration in asymptomatic individuals increased from 37% of 20–year–old individuals to 96% of 80–year–old individuals.
- Disk bulge prevalence increased from 30% of those 20 years of age to 84% of those 80 years of age.
- Disk protrusion prevalence increased from 29% of those 20 years of age to 43% of those 80 years of age.
- The prevalence of annular fissure increased from 19% of those 20 years of age to 29% of those 80 years of age.

EBP and The Patient Response–Based Model

Evidence Based Assessment – Clinical Practice guidelines for Low Back Pain and Hip Arthritis have been established through the Journal of Orthopaedic and Sports Physical Therapy (3,4)

The Patient Response–Based Model – involves a positive or negative within–session or between–session findings to adjust treatment dosage, intensity and application for optimal results

McKenzie Approach for centralization and decentralization of radiculopathy
Robin McKenzie – The McKenzie Approach for Spine Pain and Radiculopathy


Udermann B, Tillotson J, Donelson R, Mayer J, Graves J. Can an educational booklet change behaviour and pain in chronic low back pain patients? ISSLS, Adelaide, April 2000. Nine months after reading Treat Your Own Back 81% of 62 recruits with chronic back pain of average 10 years duration were available. About 90% were still using posture and exercise advice from the book, 60% were free of pain, and another 22% had had less pain. Pain severity and number of episodes had significantly improved. Most attributed improvements to what they had learned in the book.

McKenzie Method of Mechanical Diagnosis and Therapy

The Neck

What is normal? Stand and let’s take a look

Flexion, Extension, Lateral or side bending, Rotation

Neck Anatomy

https://www.brentlam.com/litteratur.doc
Vertebral Artery Testing should be performed on any neck patient presenting with a history of dizziness, migraine symptoms, nausea, syncope, dysarthria, dysphagia, and disturbances of the hearing or vision, paresis or paralysis of an extremity.

https://www.youtube.com/watch?v=74l7mdVHv5s

(However, this testing has been questionable regarding its sensitivity and validity (6))

Postural syndrome

Cervical Disc Herniation – with radiculopathy
Postural Syndrome – Neck Pain

Like a bent finger

- History/Subjective – INTERMITTANT. Pain arising from prolonged stretching – patients complain of pain at work, on computer, in the car. No radiation or radiculopathy. Pain began for no apparent reason.
- Observation – Poor posture
- Inspection – Normal
- Neuromuscular screen – Normal
- Palpation – Some upper trap tenderness
- Provocation Tests – Static positioning
- Special Tests – Normal

Neck Pain? Why ask Why?

- “Text Neck”
  - Neck muscles are designed to support the weight of your head, about 10 to 12 pounds
  - For every inch you drop your head forward, you double the load on these muscles, placing tension on the vertebral bodies, nerves and joint spaces

TREATMENT

Good Posture – Line up your ear with your shoulder with your hip. Slouch Otherwise or change position often

- Look at your phone at eye level

https://health.clevelandclinic.org/2015/03/text-neck-is-smartphone-use-causing-your-neck-pain/

Cervical Disc Herniation – Neck pain with radiculopathy

McKenzie classifies this as a Derangement – “Cut Knuckle”

History/Subjective – Most often seen in people between 30-50 years of age. Insidious onset. Began as stiff neck, progressed into pain in the upper trap, lateral arm, can progress into the hand. Better with walking and light activity, worse with sitting, in car or at work.
- Observation – sitting in department in no acute distress, may have wry neck. Poor posture.
- Inspection – Decreased cervical lordosis, atrophy in involved myotome.
- Neurological Assessment – Involved dermatome, myotome may have positive findings and the patient may have decreased reflexes in the upper extremity.
Range of Motion and Neuromuscular Findings – Cervical active and passive range of motion may be limited in extension, rotation and side bend of the ipsilateral side due to herniation. Muscle weakness may be present along the involved myotome. GENERALLY NO RANGE OF MOTION LOSS PERIPHERALLY.

Palpation – Palpate cervical levels C2–C7 to establish symptom reproduction, ie pain at that site or radicular pain/numbness/tingling.

Special Testing – VAT, ligamentous, positional centralization.

Treatment:
Active motion that consists of postural exercises and cervical retraction in sitting has been shown to reduce cervical pain and decompress cervical neural elements (8).

Overall there is strong evidence that a treatment approach that consists of some element of orthopedic manual therapy is associated with a positive outcome. (9, 10)

Stronger outcomes are indicated when combined with exercise or postural correct, centralization (11).
Cervical Disc Herniation - Neck pain with radiculopathy

- Generalized continued activity in the pain-free zone
- Change posture often – every hour
- Cervical retraction in sitting or supine if centralization occurs ≤ 10 every hour
- Consider course of PP
- Medication use – i.e. NSAIDS – 2009 Systematic review
  “There is little evidence to suggest that drug treatments are effective in treating herniated disc,” and
  antibiotics don’t seem to improve symptoms of radiculopathy caused by disc herniation. We found no evidence
  examining the effectiveness of antibiotics in people with herniated disc.
  We found no evidence of sufficient quality to judge the effectiveness of epidural injections of corticosteroids.
  (12)


The Shoulder

- What is normal? Stand and let’s take a look
  Ball and Socket Joint
  - Abduction, ADDuction
  - Horizontal flexion/ext
  - Flexion
  - Extension
  - IR/ER 90 degrees?


Shoulder – Rotator Cuff

The Shoulder

The shoulder is one of the largest and most complex joints in the body. The shoulder joint is formed where the humerus (upper arm bone) fits into the scapula (shoulder blade), like a ball and socket. Other important bones in the shoulder include:

- The acromion is a bony projection off the scapula.
- The clavicle (collarbone) meets the acromion in the acromioclavicular joint.
- The coracoid process is a hook-like bony projection from the scapula.
- The rotator cuff is a collection of muscles and tendons that surround the shoulder, giving it support and allowing a wide range of motion.
- The bursa is a small sac of fluid that cushions and protects the tendons of the rotator cuff.
- A cuff of cartilage called the labrum forms a cup for the ball-like head of the humerus to fit into.
- The humerus fits relatively loosely into the shoulder joint. This gives the shoulder a wide range of motion, but also makes it vulnerable to injury.

Extrinsic Causes of Shoulder Pain

- Cervical radiculopathy
- Muscular dystrophy
- Cardiac Ischemia
- Thoracic Outlet Syndrome
- Aortic Diseases
- Upper Lobe Pneumonia
- Pancoast Tumor
- Metastatic Tumor
- Biliary Disease
- Hepatic Disease
- Pancreatitis
- Splenic injury
- Perforated viscus

Shoulder Conditions

- **Rotator cuff tear**: A tear in one of the muscles or tendons surrounding the top of the humerus. A rotator cuff tear may be a sudden injury, or may result from steady overuse.

- **Shoulder impingement/tendinopathy/tendonitis**: The acromion (edge of the scapula) presses on the rotator cuff as the arm is lifted. If inflammation or an injury in the rotator cuff is present, this impingement causes pain.

- **Frozen shoulder/Adhesive Capsulitis**: Inflammation develops in the shoulder that causes pain and stiffness. As a frozen shoulder progresses, movement can be severely limited.
The Shoulder – Rotator Cuff
Chronic TEAR and PAIN

237 asymptomatic individuals

17.3% prevalence of RC tear in at least one shoulder.
20% in 60–69 years old and
40.7% in subjects 70 years of age or older


The Shoulder – Rotator Cuff
Impingement vs Chronic TEAR

History/Subjective – Overhead activity, repetitive work environment. Pain with reaching behind, in scaption. Pain may be referred to the lateral upper arm. Dull ache or no pain at rest, sharp with certain movements. It is usually difficult for the patient to sleep on the affected side.

Observation – Asymmetry of shoulder heights possible, chronic rounded shoulders can foster anterior translation of the humeral head.

Range of motion/MMT– Active is tested bilaterally, typically there is a painful arc in impingement syndrome between 60–120 degrees of scaption, abduction. Depending on the status of a tear active scaption and abduction is limited to around 45–60 degrees. Passive range is full and painless until the end ranges of IR/ER. Weakness in ER/scaption is present differing in severity.

Palpation – Tender at the insertion of the supraspinatus tendon bilaterally, acromial rim anteriorly

The Shoulder – Rotator Cuff
Impingement vs Chronic TEAR

Special Tests

Hawkin’s

Neer

Jobe’s Test (Empty Can Test)¹³

Drop Arm Test¹⁴
The Shoulder – Rotator Cuff Impingement vs Chronic TEAR

TREATMENT

- Avoid overhead activity in the early stages (under 90 degrees)
- Postural correct and scapular retraction
- Thoracic/Cervical mobilizations
- Sleep with affected arm under pillow
- Repeated neck retraction
- Course of PT
- NSAIDS/ice

Frozen Shoulder/Adhesive Capsulitis

In frozen shoulder, the shoulder capsule thickens and becomes tight. Stiff bands of tissue — called adhesions — develop. In many cases, there is less synovial fluid in the joint.

The causes of frozen shoulder are not fully understood. There is no clear connection to arm dominance or occupation. A few factors may put you more at risk for developing frozen shoulder:

- **Diabetes.** Frozen shoulder occurs much more often in people with diabetes, affecting 10% to 20% of these individuals. The reason for this is not known.
- **Other diseases.** Some additional medical problems associated with frozen shoulder include hypothyroidism, hyperthyroidism, Parkinson’s disease, and cardiac disease.
- **Immobilization.** Frozen shoulder can develop after a shoulder has been immobilized for a period of time due to surgery, a fracture, or other injury. Having patients move their shoulders soon after injury or surgery is one measure prescribed to prevent frozen shoulder.

History/Subjective

Pain from frozen shoulder is usually dull or aching. It is typically worse early in the course of the disease. The pain is usually located over the outer shoulder area and sometimes the upper arm. Patients will complain of the inability to perform certain tasks due to loss of range, like reaching back in the car, unfastening bra, reaching overhead or getting coat on.

Neuromuscular Testing

The hallmark sign of this condition is LOSS OF PASSIVE RANGE OF MOTION of the affected shoulder, with a stiff end feel of the joint capsule

Loss of motion in a capsular pattern, proposed by Cyriax: External rotation followed by abduction, followed by IR

MMT - strong in mid ranges with some weakness in abduction, both rotations and to a lesser extent flexion of the shoulder joint

Passive - Negative

Special Tests - Joint play mat be tight and painful suggestive of non-contractile process

Treatment: Stretching/Manipulation
Lateral epicondylitis can result from repetitive and forceful forearm supination and pronation, and/or extension of the forearm and wrist. Such motions involve the extensor carpi radialis brevis and longus muscles of the forearm, which originate from the lateral epicondyle of the elbow.

Typical activities that involve such motions include a backhand return in racket sports (e.g., tennis) and using a screwdriver. Pain along the common extensor tendon when the long finger is extended against resistance and the elbow is held straight is diagnostic.

Treat initially with rest, ice, NSAIDs, and stretching of the extensor muscles, followed by exercises to strengthen wrist extensors and flexors. POSTURE and MOUSE position?

Sometimes corticosteroid injections and rarely surgery may help.
The Hand/Wrist

- What is normal?
- Stand and let’s take a look
- Wrist Supination, Pronation, Extension, Flexion, Radial and Ulnar Deviation, and Fingers

Hand Anatomy

- Carpal Tunnel Syndrome
- https://www.moveforwardpt.com/image.axd?id=ee55b495-e5bb-4f5d-bf15-1e8414ec3f65&t=634796061214070000

Carpal Tunnel Syndrome

- Carpal tunnel syndrome occurs when thickening from irritated tendons or other swelling narrows the tunnel and causes the median nerve to be compressed
- The median nerve controls sensations to the palm side of the thumb and 1st 2nd and 3rd digits, as well as impulses to some small muscles in the hand that allow the fingers and thumb to move.
- Pain, weakness, or numbness in the hand and wrist may be present, radiating up the arm.
Carpal Tunnel Syndrome

- **History/Objective**
  Symptoms usually start gradually, with frequent burning, tingling, or itching numbness in the palm of the hand and the fingers, especially the thumb and the index and middle fingers. The symptoms often first appear in the dominant hand first and then both hands. Tingling and numbness along the median nerve distribution usually appear first during the night. Patients may describe mechanical problems and work stress.

- **Inspection/observation** - In severe and chronic cases there may be atrophy of the muscles in the median nerve distribution.
  Neuromuscular testing – range of motion may be normal actively, however passively pain may be produced in extreme wrist flexion and radial deviation. Grip strength may be weak due to pain or chronicity/reflex inhibition.

- **Special tests**
  Tinel – tap or press on the median nerve in the patient’s wrist. The test is positive when tingling in the fingers or a resultant shock-like sensation occurs.
  Phalen, or wrist-flexion, test involves having the patient hold his or her forearms upright by pointing the fingers down and pressing the backs of the hands together. Test for one minute. This test is positive if it reproduces tingling or numbness in a median nerve distribution.

- **Differential diagnosis**
  Overactivity of the pituitary gland; hypothyroidism; rheumatoid arthritis; diabetes

Carpal Tunnel Syndrome continued

- **Special tests**
  Tinel – tap or press on the median nerve in the patient’s wrist. The test is positive when tingling in the fingers or a resultant shock-like sensation occurs.

- **Differential diagnosis**
  Overactivity of the pituitary gland; hypothyroidism; rheumatoid arthritis; diabetes

**BREAK**
What is normal?
Stand and let’s take a look
Lumbar flexion, extension, lateral bending and rotation

What is normal?

What is normal?

The low back - anatomy

Rule out cancer in Low Back Pain

70% of spine tumors occur in the thoracic region
20% in the lumbar (lower back) region
10% in the cervical (neck) region (17)

Predominant signs and symptoms of spinal tumors are:

- Average age 65
- Night pain average 6.8/10
- Unexplained weight loss
- Spontaneous onset
- Standing and walking INCREASE symptoms
- Unresponsive to conservative treatment

0.7% of back pain patients in primary care have metastatic cancer
Rule out cancer in Low Back Pain

- Age 50 or older
- History of cancer
- Unexplained weight loss > 10 pounds in 6 months
- Failure of conservative therapy medical care in the past month without improvement (18)

100% SENSITIVITY

The Low Back Abby-Normal

The Low Back – Pain sensitive structures

“Any innervated structure in the lumbar spine can cause symptoms of low back and referred pain into the extremity or extremities.” (16)

Muscles
Ligaments
Dura mater and nerve roots
Zygapophyseal joints
Annulus fibrosis
Thoracolumbar Fascia
Vertebrae
The Low Back

**RISK FACTORS:**
Current literature does not support a definitive cause, as risk factors are multifactorial and weakly associated with the development of low back pain. Hypertension and lifestyle (smoking, obesity) risk factors are associated more strongly with sciatica.

**TESTING:**
MRI, myelography and CAT are not strongly related to low back symptoms. Evidence of herniated disc material in these studies are positive in 20–76% of subjects with no sciatica. Savage et al (12) reported that 32% of their asymptomatic subjects had evidence of DDD, disc bulging or protrusion, facet hypertrophy or nerve root compression, and only 47% of their subjects who had low back pain at the time had an abnormality identified.

**PSYCHOSOCIAL FACTORS:**
Appear to play a larger prognostic role than physical factors in low back pain (11).

---

Postural Syndrome – Back Pain

**Like a bent finger**
- History/Subjective – INTERRMITTANT. Pain arising from prolonged stretching – patients complain of pain at work, on computer, in the car. No radiation or radiculopathy. Pain began for no apparent reason.
- Observation – Poor posture
- Inspection – Normal
- Neuromuscular screen – Normal
- Palpation – Some diffuse low back tenderness
- Provocation Tests – Static positioning
- Special Tests – Normal

---

Musculoskeletal Pain Creator

**BAD POSTURE**
- Remember your head weighs about 10–12 lbs when held in a perfect axial compression load

---

http://www.mychhs.colostate.edu/david.greene/Functional_Mechanical_Anto/my/OT450_PowerPoints/VertColPelvisPositioning/xray_side-by-side.jpg
Lumbar Disc Herniation – Back pain with radiculopathy

McKenzie classifies this as a Derangement – “Cut Knuckle”

History/Subjective – Most often seen in people between 30-50 years of age, insidious onset. Begin as stiff back, pain may radiate to lower extremity. Better with walking and light activity, worse with sitting, in car or at work. Question normal bladder function (cauda equina).

Observation – sitting in department with difficulty finding a position of comfort, leaning away from involved side.

Inspection – Decreased lumbar lordosis, atrophy in involved myotome.

NEUROLOGICAL ASSESSMENT – Involved dermatome, myotome may have positive findings and the patient may have decreased reflexes in the lower extremity

Range of Motion and Neuromuscular Findings – Lumbar active and passive range of motion may be limited in extension and side bend of the ipsilateral side due to herniation. Painful flexion, difficulty with sit to stand. Muscle weakness may be present along the involved myotome. GENERALLY NO RANGE OF MOTION LOSS PERIPHERALLY

Palpation – Palpate cervical levels C2-C7 to establish symptom reproduction, ie pain at that site or radicular pain/numbness/tingling

Special Testing – SLR, Slump positive, positional centralization

McKenzie Approach to Low Back Pain
Clinicians should consider utilizing repeated movements to promote centralization to reduce symptoms in patients with acute low back pain with related lower extremity pain, and to reduce symptoms in patients with acute, sub-acute or chronic low back pain with mobility deficits (4).

Clinical Practice Guidelines for Low Back Pain

Clinical Practice Guidelines for ACUTE Low Back Pain
Clinical Predictors for 50% or greater decreased pain and Decreased Oswestry Disability Index Score in two visits in which patients received a general lumbopelvic thrust manipulation:

- Duration of symptoms of less than 16 days
- No symptoms distal to knee
- Lumbar hypomobility
- At least one hip > 35 degrees of IR
- FABQ-W score of less than 19

4 or more predictors increased the probability of success with thrust manipulation from 45% to 95% (4)

Clinical Practice Guidelines for Low Back Pain (4)
Relative to Acute/Sub Acute/Chronic Stages and relative to the patient response–based model

- Remain Active – low intensity prolonged aerobic exercise
- Avoid Bed Rest
- Manual therapy thrust (if acute)
- Manual therapy procedures and active exercise to improve range of motion
- Education to adopt positions of centralization
- Patient education and counseling to address specific fear–avoidance behaviors
Ball and socket joint – Flexion, Extension, ADDuction, Abduction, IR, ER

What is normal?
Stand and let’s take a look

HISTORY:
Atraumatic, slow progressive.
Patient is generally over 50, chronic.
Pain in groin, moderate or anterior hip pain with WB
Painful to roll on it at night.
Morning stiffness in hip less than 1 hour

OBSERVATION:
- Trendelenburg Gait – compensated vs uncompensated

INSPECTION:
- Typically no obvious bruising or swelling

NM TESTING:
Limited hip IR and hip flexion by more than 15 degrees
Hip Osteoarthritis (continued)

- **PALPATION:**
  - Tenderness to palpation is common over the anterior aspect of the hip joint

- **PROVOCATIVE TESTS:**
  - FABER (Patrick’s) Test
  - Scour Test
  - Standing single-leg rotation with hip stabilization then without

- **DIFFERENTIAL DIAGNOSIS:**
  - Is this a fracture?
  - Is the prosthesis sound? (CLUNK—yikes)

---

Hip Osteoarthritis Treatment

- **TREATMENT:** *A meta-analysis has shown education in combination with NSAIDs to be 20–30% more effective in controlling pain than NSAIDs alone for hip OA and RA* (10)
  - Cane on non-affected side/Holding loads on ipsilateral side
  - Pillow between knees with sleep
  - Clinical practice guidelines recommend increasing range of motion, strengthening the hip and aerobic conditioning/endurance. Exercise working up to 20 minutes per day at 60–80% (stationary bike, walking/treadmill holding on) (10)
  - Weight loss
  - PT

---

Hip Osteoarthritis Treatment

- **Sitting hip FLEXION**
  - [Image](http://www.bodiempowerment.com/wp-content/uploads/2014/08/Piriformis-stretch-seated.jpg)
- **Sitting hip ER**
  - [Image](http://www.cafeoflifewc.com/wp-content/uploads/2016/04/hipflexorstretch.jpg)
- **Standing hip EXTENSION**
  - [Image](http://www.active.com/Assets/Running/580/Seated-Hip-Flexion.jpg)

---

5 times per day / 10 reps then 10 second hold - only if pain decreases and range increases
Hip Osteoarthritis Treatment

- **Strengthening**
  
  Hip Abductors in standing
  
  Sit to stand (always hold on)
  
  Mini squats – symmetrical

---

Hip Fracture? X Ray!

- The affected leg is externally rotated and may be shortened
- Assess peripheral pulses and checking Doppler pressures to assure vascular patency is very important.
- The patient with a stress fracture may present more subtly, reporting pain in the anterior groin or thigh. This pain increases with activity and can persist for hours afterward.
- The pain can progress to a point of consistency, even without activity. This pain generally expresses itself in the groin, however, it can also be referred to the knee.
- An antalgic gait pattern is often present. Signs and symptoms usually involve a diffuse or localized aching pain in the anterior groin or thigh region during weight-bearing activities that is relieved with rest. Night pain is also common.

---

The Knee

- What is normal?
  Stand and let’s take a look

- Hinge Joint, Flexion and Extension, Hyperextension, IR
Ligament Injuries
Meniscal Tears
Osteoarthritis
Total Knee Replacement
Ligament and Meniscal Injury

ACL/PCL injury and other ligament injuries can be caused by:

- Twisting your knee with the foot planted
- Getting hit on the knee (lateral to medial force for ACL)
- Extending the knee too far – hyperextension
- Jumping and landing on a flexed knee, deep squat
- Stopping suddenly when running
- Suddenly shifting weight from one leg to the other
- Falling on tibial shaft (PCL)

ACL injuries – common presentation

- Patient will commonly hear a “pop”
- Unable or able to return to sports
- Feeling of instability or giving way as swelling resolves
- Positive anterior drawer or Lachman’s test
- Positive Ballotable Patella Test

Meniscal Tear

- History: Can be traumatic or progressive, patient will complain of “clicking” sound in their knee as they walk. The knee will “lock” and be painful at end ranges.
- Observation: Antalgic acutely, tentative pivot
- Physical exam and special tests: Loss of terminal knee extension
  3-5 of the following signs there is an 85-90% positive meniscal tear (JMMT 2002)
  - McMurtry test positive
  - Apley compression test positive
  - Pain at end range flexion
  - Pain at end range extension
  - Joint line pain
Meniscal Tear

Meniscal tears are highly prevalent, with imaging evidence of a meniscal tear observed in 35% of persons older than 50 years of age; two thirds of these tears are asymtomatic.(4)

LITERATURE REVIEW (2013)

There was only one randomized, controlled trial, which was a single-center study involving 90 patients.

This study did not show a significant difference in pain relief or functional status between arthroscopic partial meniscectomy plus a physical-therapy regimen and physical therapy alone.(23)

KNEE OSTEOARTHRITIS

About 13% of women and 12% of men aged 60 years and older have symptomatic knee OA. The proportion of people affected with symptomatic knee OA is likely to increase accompanying the aging of the population and the rate of obesity or overweight in the general population.(21).

During a one year period, 13% of people over 55 years may demonstrate persistent episode of knee pain, in whom about one in six have to consult their general practitioners about it in the same time period.

History: Pain can be sudden or slow, progressive that worsens over time. Stiff in the morning or after times of static positioning, then better in mid-day. Patient may complain of pain with sit to stand, stair negotiation and as the condition progresses, walking.

Observation/Gait: Antalgic, perhaps genu valgus or varus deformity.

Neuromuscular testing – weak quads and hip abductors/ERs, Loss terminal knee extension.

Palpation: Joint-line pain, painful patellar mobilizations, crepitus.

Provocative testing: Painful compression/possible positive ballotable patella.

American Journal of Preventative Medicine, August 2008


The objective of this study was to determine if differences in the progression of knee OA in middle- to older-aged runners exist when compared with healthy nonrunners over nearly 2 decades of serial radiographic observation.

METHODS:

Forty-five long-distance runners (300 minutes per week) and 53 controls with a mean age of 58 (range 50-72) years in 1984 were studied through 2002 with serial knee radiographs.

RESULTS:

Most subjects showed little initial radiographic OA (6.7% of runners and 8 controls); however, by the end of the study runners did not have more prevalent OA (20 vs 32%, p =0.25) nor more cases of severe OA (2.2% vs 4.4%, p=0.21) than did controls.

CONCLUSIONS:

Long-distance running among healthy older individuals was not associated with accelerated radiographic OA.
KNEE OSTEOARTHRITIS

Osteoarthritis, OA, is the most common type of arthritis, affecting approximately 27 million Americans.

July, 2005 Arthritis and Rheumatology

Weight loss reduces knee-joint loads in overweight and obese older adults with knee osteoarthritis. (18 month study)

Data were obtained from 142 sedentary, overweight, and obese older adults with self-reported disability and radiographic evidence of knee OA who underwent 3-dimensional gait analysis.

A weight reduction of 9.8 N (1 kg) was associated with reductions of 40.6 N and 38.7 N in compressive and resultant forces, respectively, indicate that each pound of weight lost will result in a 4-fold reduction in the load exerted on the knee per step during daily activities.

KNEE OSTEOARTHRITIS

Treatment Options

Physical activity and strengthening

Bracing

Supplements: CS+GH has comparable efficacy to celecoxib in reducing pain, stiffness, functional limitation and joint swelling/effusion after 6 months in patients with painful knee osteoarthritis, with a good safety profile. (22)

Injections

Differentiated Mesenchymal Stem Cells for Treatment of Osteoarthritis (?)

The TOTAL Knee

https://www.youtube.com/watch?v=EV6a995pyYk
The Total Knee

Down the road, signs and symptoms of trouble...

Signs and symptoms of DVT
Wear and tear – 95% last for 15–20 years
A fall then change in status
Persistent pain, swelling 6 months post op
Complaints of instability
Recent infection (ie tooth sensitivity) then erythema at TKA knee

Stiffness that restricts function

The Calf/DVT

Estimates suggest that 60,000–100,000 Americans die of DVT/PE (19)

- 10 to 30% of people will die within one month of diagnosis
- Sudden death is the first symptom in about one-quarter (25%) of people who have a PE.
- Among people who have had a DVT, one-half will have long-term complications (post-thrombotic syndrome) such as swelling, pain, discoloration, and scaling in the affected limb.
- One-third (about 33%) of people with DVT/PE will have a recurrence within 10 years.
- Approximately 5 to 8% of the U.S. population has one of several genetic risk factors, also known as inherited thrombophilias in which a genetic defect can be identified that increases the risk for thrombosis.

Currently, there is no national monitoring system for VTE, making it difficult to understand the true burden of VTE in the United States—venous thromboembolism (VTE).

Wells’ Clinical Decision Rule for DVT

<table>
<thead>
<tr>
<th>Wells Prediction Rule for DVT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
</tr>
<tr>
<td>Acute onset of pain, swelling, or warmth in leg</td>
</tr>
<tr>
<td>Protein, positive, on immobilization or travel syndrome</td>
</tr>
<tr>
<td>Calf tenderness or calf swelling, or calf edema</td>
</tr>
<tr>
<td>History of cancer</td>
</tr>
<tr>
<td>DVT or PE diagnosis</td>
</tr>
<tr>
<td>Recent deep vein injury</td>
</tr>
<tr>
<td>Inability to compression</td>
</tr>
<tr>
<td>History of cancer</td>
</tr>
<tr>
<td>Endovascular surgery</td>
</tr>
<tr>
<td><strong>Score</strong></td>
</tr>
<tr>
<td>≥ 3</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>≤ 1</td>
</tr>
</tbody>
</table>

Wells’ Clinical Decision Rule for PE

Ankle/Plantar Flexion, Dorsiflexion, Inversion (35), Eversion (25) or Supination and Pronation

Ankle/Foot

Ankle/Foot – Anatomic review
Ankle Injuries

- Half of all ankle sprains occur during an athletic activity.
- Every day in the U.S., 25,000 people sprain their ankle vs 55,000 ankle fractures per year. (175,000 per week vs 1000 per week)

Source: https://www.researchgate.net/publication/262016114_Epidemiology_of_Foot_and_Ankle_Fractures_in_the_United_States_An_Analysis_of_the_National_Trauma_Data_Bank_2007_to_2011
- More than 1 million people visit emergency rooms each year because of ankle injuries.
- The most common ankle injuries are sprains and fractures, however you can also tear or strain a tendon.


Ankle Injuries

- History - traumatic inversion injury
- Observation - gait is antalgic, weight bearing?
- Inspection - swelling, bruising
- Neuromuscular Tests - loss of eversion strength, diffuse loss of PF/DF strength
- Palpation - point tender?
- Differential diagnosis - Ottawa Ankle Rules

Ottawa Ankle Rules - is this a fracture or a sprain?

<table>
<thead>
<tr>
<th>Ankle Rules</th>
<th>Mid-Foot Rules</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tender over either posterior aspect of either malleoli?</td>
<td>Tender over either navicular or base of 5th metatarsal</td>
</tr>
<tr>
<td>Able to bear weight both immediately post-injury and in the ER?</td>
<td>Able to bear weight both immediately post-injury and in the ER?</td>
</tr>
</tbody>
</table>
Clinical Usefulness of the Ottawa Ankle Rules for Detecting Fractures of the Ankle and Midfoot (21)

An Analysis of 32 articles regarding the Ottawa Ankle Rules

Conclusions:
Evidence supports the use of the Ottawa Ankle Rules as an aid in ruling out fractures of the ankle and midfoot. The rules have a high sensitivity (almost 100%) and modest specificity. Use of the Ottawa Ankle Rules holds promise for saving time and reducing both costs and radiographic exposure without sacrificing diagnostic accuracy in ankle and midfoot fractures.

Inversion Injuries
- Inversion injuries
  - SPRAINS
    - RICE
    - Gentle ROM
    - Gradual return to FWB
  - Ankle Alphabet
    - Heel pumps
    - Towel calf stretches
    - Single leg stance
    - Normalize gait with assistive device (single crutch) or Air Cast

Ottawa Ankle Rules
- Clinical Usefulness of the Ottawa Ankle Rules for Detecting Fractures of the Ankle and Midfoot (21)
  - An Analysis of 32 articles regarding the Ottawa Ankle Rules
  - Conclusions:
    - Evidence supports the use of the Ottawa Ankle Rules as an aid in ruling out fractures of the ankle and midfoot. The rules have a high sensitivity (almost 100%) and modest specificity. Use of the Ottawa Ankle Rules holds promise for saving time and reducing both costs and radiographic exposure without sacrificing diagnostic accuracy in ankle and midfoot fractures.

Negative X-Rays
Plantar Fasciitis

Signs and Symptoms

Plantar fasciitis is caused by straining the ligament that supports your arch. Repeated strain can cause tiny tears in the ligament. These can lead to pain and swelling. Pain typically is worse in the morning when the feet hit the ground. Pain is in the arch or at the calcaneus.

- Excessive pronation
- High arches or flat feet.
- Walking, standing or running for long periods of time, especially on hard surfaces
- Paresthesia or incoordination
- Shoes that don't fit well or are worn out.
- Tight Achilles tendons or calf muscles.

http://www.webmd.com/a-to-z-guides/tc/plantar-fasciitis-topic-overview#1

Treatment options

- Frequent end-range activity: Lunge squats with sore foot behind x 10 every hour/two
- Stretch the Achilles tendon and plantar fascia – sitting using force to stretch foot and arch, standing against wall with knee straight and bent (3 minutes 4 x per day)
- Strengthen forefoot with balance activity
- Ice bottle massage - 15 min 3 x per day/NSAIDS
- Resting splint or casting
- Good shoes with good arch support to decrease pronation moment