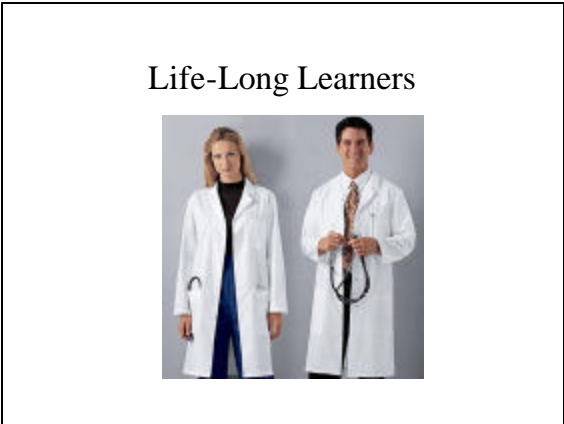


**Orthopedics and Neurology**  
 Clinical Assessment Protocol

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**DIAGNOSIS 612**  
**Orthopedics and Neurology**

- This lecture and laboratory course introduces students to the procedures necessary to examine the neuromusculoskeletal system. Normal and abnormal findings are presented and discussed. An emphasis is placed on a student's understanding of clinical anatomy and interpretation of positive tests and signs.  
*2 lecture hours, 4 laboratory hours, 4 semester hours*



**Orthopedics and Neurology**  
 Clinical assessment protocol

- Patient history
- Inspection/observation
- Palpation
- Range of motion
- Orthopaedic and neurologic testing
- Diagnostic imaging
- Functional testing

**Orthopedics and Neurology**  
 Clinical assessment protocol

• <b>Subjective</b>	Patient history
• <b>Objective</b>	Objective findings
• <b>Assessment</b>	Diagnoses
• <b>Plan</b>	Further testing or treatment

**Orthopedics and Neurology**  
 Clinical assessment protocol

<b>Closed-Ended History</b>	<b>Open-Ended History</b>
Patient completes an intake form with direct and pointed questions.	An open dialogue to discuss the patient's condition

### Closed-Ended History

Completion of an intake form by patient



### Open-Ended History

Doctor records medical history



### Orthopedics and Neurology

OPQRST Mnemonic

- Onset of complaint
- Provoking or palliative concerns
- Quality of pain
- Radiating to a particular area or referred
- Site and severity of complaint
- Time frame of complaint

### Orthopedics and Neurology

Observation

- General appearance
- Functional status
- Body type
- Postural deviations

### General Appearance

Obese, middle-aged, Caucasian female



### Functional Status

Athletically active adults



### Body Type and General Appearance

Young, healthy appearing, mesomorphic, male Caucasian



### Body Type

Mesomorph



### Body Type

Endomorph



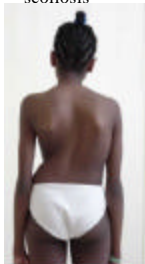
### Body Type

Ectomorph



### Postural Deviations

Young, healthy appearing, mesomorphic, black female with scoliosis



### Orthopedics and Neurology

Observation

- Postural deviations
  - Gait
  - Muscle guarding
  - Compensatory or substitutive movements
  - Assistive devices for functional status

## Posture Deviations

Antalgic posture with limping gait



## Orthopedics and Neurology

Inspection

- Skin
- Subcutaneous soft tissue
- Bony structure

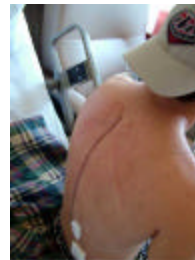
## Orthopedics and Neurology

Skin Inspection

- Contusions or cicatrix formations
- Evidence of trauma or surgical intervention
- Changes in color or texture
- Open wounds

## Skin Inspection

Post-surgical thoracic spine cicatrix formations



## Skin Inspection

Contusions from "Kinetic Impact Munitions"



## Orthopedics and Neurology

Subcutaneous Inspection

- Inflammation and swelling or atrophy
  - Compare for bilateral symmetry
  - Circumferential mensuration of extremities

## Orthopedics and Neurology

### Subcutaneous Inspection

- Increase in size
  - Edema
  - Articular effusion
  - Muscle hypertrophy or other
  - Note nodules, lymph nodes, or cysts

## Subcutaneous Inspection

### Pitting Edema



## Subcutaneous Inspection

### Articular effusion



## Orthopedics and Neurology

### Bony Structure Inspection

- Evaluate
  - Functional abnormality
    - Gait deviance
    - Altered range of motion

## Orthopedics and Neurology

### Bony Structure Inspection

#### Evaluate

1. Spine
  - Scoliosis
  - Pelvic tilt or obliquity
  - Shoulder height

## Bony Structure Inspection

### Scoliosis examination



## Orthopedics and Neurology

### Bony Structure Inspection

- Note and possibly measure extremity malformations
  - Traumatic
    - Healed Colles' fracture with residual angulation
  - Congenital
    - Genu varus or Genu valgus

## Colles Fracture

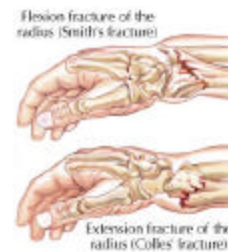


## Bony Structure Inspection

### Colles Fracture



## Wrist Fractures



## Orthopedics and Neurology

### Bony Structure Inspection

- *All bony structures should be visually assessed for abnormalities and documented*

## Orthopedics and Neurology

### Skin palpation

- Palpation with light touch
1. Temperature
    1. Elevated with inflammation
    2. Lowered with vascular deficiency
  2. Mobility
    1. Post-traumatic or post-surgical adhesions

## Orthopedics and Neurology

Subcutaneous soft tissue palpation

### Palpation with increased pressure

1. Consists of fat, fascia, tendons, muscles, ligaments, joint capsules, nerves, and blood vessels
2. Note tenderness
3. Determine tenderness and grade it

## Orthopedics and Neurology

Tenderness Grading Scale

- Grade I
- Grade II
- Grade III
- Grade IV
- Pain
- Pain and winces
- Winces and withdraws
- Does not allow palpation

## Orthopedics and Neurology

Differentiate types of edema

- |                   |   |
|-------------------|---|
| 1. Blood          | 1. Immediate post-traumatic warm and hard     |
| 2. Synovial fluid | 2. 8-24 hours post-traumatic, boggy or spongy |

## Orthopedics and Neurology

Differentiate types of edema

- |                     |                                |
|---------------------|--------------------------------|
| 3. Callus           | 3. Tough and dry swelling      |
| 4. Chronic swelling | 4. Thickened or leathery       |
| 5. Acute            | 5. Soft and fluctuating edema  |
| 6. Bone             | 6. Hard                        |
| 7. Pitting edema    | 7. Thick and slow moving edema |

## Orthopedics and Neurology

Pulse palpation

- Thoracic outlet syndrome
- Arterial insufficiency
- Vertebrobasilar compromise

## Orthopedics and Neurology

Palpation of bony structures

- Alignment problems
  - Dislocations
  - Luxations
  - Subluxations
  - Fractures

## Orthopedics and Neurology

Palpation of bony structures

- Tenderness is a major finding
  - Identify tendons and ligaments
  - Sprain, strain, or fracture

## Orthopedics and Neurology

Palpation of bony structures

- Bony enlargements
  - Healing of fractures
  - Degenerative joint disease

## Orthopedics and Neurology

Range of Motion

1. Passive
2. Active
3. Resisted

## Orthopedics and Neurology

Passive Range of Motion

Examiner moves the body part

1. Note normal, increased, or decreased ROM and in which planes
2. Note pain
  - Ipsilateral pain = capsular or ligamentous lesion
  - Contralateral pain = Muscular lesion

## Passive Range of Motion



## Orthopedics and Neurology

Active Range of Motion

- Patient moves body part
- Tests muscle integrity and nerve supply
- Compare ROM
- Correlate pain with movement
- Note crepitus (crackling)

## Active Range of Motion



## Orthopedics and Neurology

Active Range of Motion

- Crepitus is crackling sound
- Indicates
  - Roughening of joint
  - Increased friction between tendon and sheath caused by edema or roughening

## Orthopedics and Neurology

Active Range of Motion

- You will not be required to utilize goniometer or inclinometer in this course
- Medical conditions involving impairment ratings or disability determinations require specific mensuration

## Orthopedics and Neurology

Resisted Range of Motion

- Examiner resists patient movement
- Assesses musculotendinous and neurologic structures
- Primarily used to test neurologic function

## Resisted Range of Motion



## Orthopedics and Neurology

Resisted Range of Motion

- Musculotendinous injuries are more painful than weak
- Neurologic lesions are more weak than painful

## Orthopedics and Neurology

### Six Ranges of Motion and Pain Variations

1. Normal mobility with no pain
2. Normal mobility with pain elicited
3. Hypomobility with no pain
4. Hypomobility with pain elicited
5. Hypermobility with no pain
6. Hypermobility with pain elicited

## Orthopedics and Neurology

### Hard End Feel Evaluation

- Normal Physiological
- Abrupt hard to stop movement when bone contacts bone
- Passive elbow extension
- Olecranon process contracts the olecranon fossa
- Abnormal Pathologic
- Abrupt stopping movement before normal expected passive movements
- Cervical flexion hard end feel due to severe DJD

## Orthopedics and Neurology

### Soft End Feel Evaluation

- Normal
- When 2 body surfaces come together, a soft compression of tissue is felt
- Passive elbow flexion
- Anterior aspect of the forearm approximates the biceps muscle
- Abnormal
- A soft boggy sensation resulting from synovitis or soft tissue edema
- Ligamentous sprain

## Orthopedics and Neurology

### Firm End Feel Evaluation

- Normal
- A firm or spongy sensation that has some give when a muscle, ligament, or tendon is stretched
- Passive wrist flexion, passive external shoulder rotation
- Abnormal
- A firm springy sensation to movement with a slight amount of give in capsular joints
- Frozen shoulder or adhesive capsulitis

## Orthopedics and Neurology

### Springy, Block End Feel Evaluation

- Abnormal Pathologic End Feels
- Rebound effect with limited motion; usually in joints with a meniscus.
- Torn meniscus

## Orthopedics and Neurology

### Empty End Feel Evaluation

- Abnormal Pathologic End Feels
- An empty feel in a joint with severe pain when passively moved. The movement cannot be performed because of the pain.
- Fracture, subacromial bursitis, neoplasm, joint inflammation.

## Orthopedics and Neurology

Special physical, orthopaedic, and neurologic testing

- Provocative maneuvers
- Place functional stress on isolated tissue structures
- Reveal pathologies and biomechanical lesions
- Multiple tests are necessary to confirm a diagnosis

## Orthopedics and Neurology

Special physical, orthopaedic, and neurologic testing

- *“Primum non nocere”*
- *First do no harm*
- Prior to performing provocative maneuvers it is essential that you rule out contraindications to such procedures.

## Hippocrates

Epidemics, Book 1, Section XI

- *“Declare the past, diagnose the present, foretell the future; practice these acts. As to diseases, make a habit of two things— to help, or at least to do no harm.”*

## Hippocrates

Father of Chiropractic Medicine



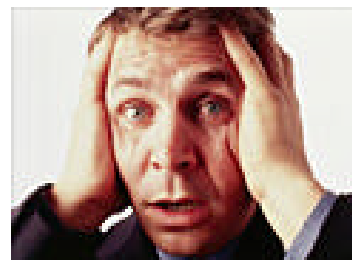
## Orthopedics and Neurology

Special physical, orthopaedic, and neurologic testing

- Rust’s sign
- Post-traumatic holding of head with both hands in order to support the weight of the head on the cervical spine.
- Supine patient will grasp back of head while attempting to rise into a seated position

## Rust’s Sign

Do not perform orthopedic tests or spinal manipulation



## Orthopedics and Neurology

Special physical, orthopaedic, and neurologic testing

- Rust's sign indicates a probable upper cervical spine instability
- Severe upper cervical spine injury to muscle, ligament, disc, and osseous structures
- Rule out fracture, dislocation, severe strain or sprain

## Orthopedics and Neurology

Special physical, orthopaedic, and neurologic testing

- Rust's sign
- Patient is attempting to stabilize the head with slight traction and reduce pain
- Patient presents guarded movements
- Imaging studies must proceed any provocative testing

## Orthopedics and Neurology

Special physical, orthopaedic, and neurologic testing

- Sensitivity/Reliability Scale
- Based upon the biomechanics of the movement to isolate the affected structures

## Orthopedics and Neurology

Special physical, orthopaedic, and neurologic testing

- Sensitivity is the proportion of true positives that are correctly identified by the test.
- Specificity is the proportion of true negatives that are correctly identified by the test.

## Sensitivity and Specificity

Instability (Rust's sign)

	Abnormal	Normal	Total
• VFS (+)		(-)	
• Abnormal(+)	90	10	100
• Normal(-)	20	80	100
• Total	110	90	200

## Sensitivity and Specificity

- The proportions of these two groups that were correctly diagnosed by the sign were

$90/110=0.82$  (sensitivity) and

$80/90=0.89$  (specificity)

## Predictive Values

"Given a positive (or negative) test result, what is the new probability of instability?"

## Predictive Values

**Positive predictive value** = probability of instability among patients with a positive test

## Predictive Values

**Negative predictive value** = probability of no instability among patients with a negative test

## Predictive Values

<http://www.pocms.msu.edu/EBM/Diagnosis/PredictiveValues.htm>

	With instability	Without stability
Test is Positive	a(90)	b(10)
Test is Negative	c(20)	d(90)

## Predictive Values

We can now define positive and negative predictive value

- Positive predictive value =  $a / (a+b)$
- Negative predictive value =  $d / (c+d)$
- Post-test probability of instability given a positive test =  $a / (a+b)$
- Post-test probability of instability given a negative test =  $c / (c+d)$

## Predictive Values

We can now define positive and negative predictive value

- Positive predictive value =  $90 / (90+10) = 90\%$
- Negative predictive value =  $90 / (20+90) = 82\%$
- Post-test probability of instability given a positive test =  $90 / (90+10) = 90\%$
- Post-test probability of instability given a negative test =  $20 / (20+90) = 18\%$

## Diagnostic Imaging

### Plain film radiology

- *Bone is best-seen tissue on plain film radiography*

## Standard Plain Film Radiograph



## Diagnostic Imaging

### Computed Tomography

- *CT is best used for bone detail and demonstration of calcifications.*
- *Intervertebral disc defects may also be visualized on CT, but not as well as MRI*

## CT Scan

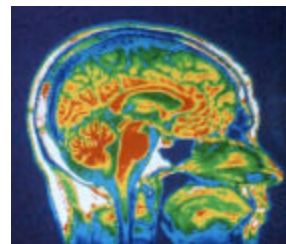


## Diagnostic Imaging

### Magnetic Resonance Imaging

- *MRI is invaluable in contrasting soft tissue structures in many planes without the use of ionizing radiation*
- *It poorly demonstrates bone density detail or calcifications; this is the advantage of CT.*

## MRI



## Diagnostic Imaging

### Myelography

- Water-soluble contrast medium is injected into the subarachnoid space
- Standard radiographic exposure is used to evaluate any defects of the spinal canal
- Spinal stenosis, spinal cord lesions, and dural tears



## Diagnostic Imaging

### Skeletal Scintigraphy or Bone Scans

- Intravenous radiopharmaceutical, technetium-99m
- Attracts osteoblastic activity, such as healing fractures
- Best suited for undetectable fractures and arthropathies (DJD, osteomyelitis, bony dysplasias, primary bone tumors, and METS)

