Objectives:

1.0 Without the aid of references, the student will identify the bones, bony projections, and articulations of the spinal column on a human skeleton, diagram, or radiograph with 80 percent accuracy.

1.1 Identify the five areas of the spinal column by name.

1.2 Describe the normal kyphotic and lordotic curvatures of the spine.

1.3 Describe the typical cervical, thoracic, and lumbar vertebra, naming the bony projections and articular surfaces.

1.4 Identify and describe the sacrum and coccyx.

1.5 Locate the atlas and axis.

1.6 List two functions of the spinal column.

1.7 Describe and explain the function of the intervertebral discs.

2.0 Without the aid of references, the student will demonstrate a cognitive knowledge of the routine and special radiographic positions and techniques used to demonstrate the vertebrae and spinal column on a written test, with a minimum of 80 percent.

2.1 Describe the routine positions for cervical spine radiography.

2.2 Name and describe routine positions for thoracic spine radiography.

2.3 Describe special breathing and technique considerations in radiography of the thoracic spine.

2.4 Name and describe routine and special views of the lumbar spine and lumbosacral joint.

2.5 Name and describe routine positions and tube alignment for radiography of the sacrum and coccyx.

2.6 Describe the radiographic positions and alignment for scoliosis and postural deformities.

3.0 In simulated circumstances, the student will demonstrate the position of the patient, angle, and alignment of the tube, selection of exposure factors, and instructions to the patient for routine spine radiography. All items on a lab competency must be rated satisfactory.

3.1 Position the subject for routine cervical spine radiographs in the erect or recumbent position.
3.2 Provide the patient with necessary instructions and positioning aids for erect or recumbent studies of the cervical spine.

3.3 Adapt radiographic procedure for cervical spine radiographs as used for trauma cases.

3.4 Position the subject for routine radiographs of the thoracic spine and cervicothoracic junction.

3.5 Demonstrate how the anode heel effect and breathing techniques are used in thoracic spine radiography.

3.6 Position the subject for routine and special views of the lumbar spine.

3.7 Position the subject and align the x-ray tube for routine views of the sacrum, coccyx, and sacroiliac joints.

3.8 Measure the subject and set up the control panel for spine radiographs.

3.9 Demonstrate positions and techniques used for scoliosis and posture deformity studies.

5.0 Without the aid of references, the student will evaluate radiographs of the spine for part position, alignment of the patient/tube/film, density, contrast, and detail with 80 percent accuracy.

5.1 Identify bones, bony processes, and articulations on spine radiographic images.

5.2 Assess the degree of adequate density and contrast on spine radiographs.

5.3 Explain what potential exposure factor changes might be made to enhance radiographic images.

5.4 Identify soft tissue structures demonstrated on spine radiographs.

5.5 Assess the position and alignment of part/tube/image receptor on spine radiographs.

5.6 Explain how positioning and alignment might be improved.

5.7 Identify obvious pathology on spine radiographs.

Topical Outline:

I. Anatomy
   A. Function
   B. Description
   C. Diagrams
II. Positions
   A. Cervical spine
      1. Anterior-posterior
      2. Lateral
      3. Obliques
      4. Pillars
      5. Odontoid "Open Mouth"
      6. Flexion and extension
   B. Thoracic spine
      1. Anterior-posterior
2. Lateral
C. Cervicothoracic spine
D. Lumbar spine
   1. Anterior-posterior
   2. Lateral
   3. Obliques
   4. Lumbosacral junction
E. Sacrum
   1. AP
   2. Lateral
F. Coccyx
   1. AP
   2. Lateral
G. S. I. Joints
   1. AP bilateral
   2. PA
H. Scoliosis series

III. Pathology
A. Trauma
B. Congenital
C. Metabolic

Learning Activities:

1. PowerPoints, classroom demonstrations, return demonstrations, skeletal anatomy study, radiographic images, workbooks, flashcards, worksheets and Blackboard website including review games.

2. Quizzes, discussions, worksheets and Blackboard games

3. Positioning demonstrations

4. Referencing terminology

5. Required reading:


6. Competency Testing:
   - C-Spine - AP, Odontoid, Lat, 2 obliques
   - T-Spine - AP, Lat, Swimmers
   - L-Spine - AP, Lat, L5/S1, 2 obliques
   - Sacrum/Coccyx – 2 AP’s, Lat

7. Complete Pocket notebook for review – must have bony thorax/chest/spine routines complete.
Terminology:

Ankylosing Spondylitis – Rheumatoid arthritis variant involving the SI joints and spine.

Arthritis - inflammation of joints due to infectious, metabolic, or constitutional causes

Arthrosis- 1 : an articulation between bones 2 : a degenerative disease of a joint

Atlas – C1 – no body on this vertebra

Axis- C2 has dens or odontoid process

Cauda equina –The bundle of spinal nerves below L2 which resembles a horse’s tail.

Dens – odontoid – protuberance from C2

Fractures –
  Clays/Shoveler’s  Avulsion fracture of the spinous process in the lower cervical and upper thoracic region
  Compression – Fracture that causes compaction of bone and a decrease in length or width.
  Hangman’s – Fracture of the anterior arch of C2 due to hyperextension
  Jefferson – Comminuted fracture of the ring of C1

Hemivertebra – the absence of the right or left half of a vertebra, or it may fuse with the one above or below it, leaving the other half as a separate bone.

Kyphosis – Abnormally increased convexity in the thoracic curve.

Lordosis- Abnormally increased concavity of the cervical and lumbar spine.

Metastasis-Transfer of cancerous lesion from one area to another.

Nucleus pulposus – The pulpy center of a disc

Osteochondritis - a loose piece of bone and cartilage separates from the end of the bone because of a loss of blood supply. The loose piece may stay in place or fall into the joint space, making the joint unstable. This causes pain and feelings that the joint "sticks" or is "giving way." These loose pieces are sometimes called "joint mice." Osteochondritis dissecans usually affects the knees and elbows.

Osteoporosis – Loss of bone density

Prolapsed intervertebral disc

Scoliosis – Lateral deviation of the spine with possible vertebral rotation.

Spina bifida – Failure of the posterior encasement of the spinal cord to close.

Spondylolysis- Breaking down of the vertebra

Spondylolisthesis- Forward displacement of a vertebra over a lower vertebra, usually L5-S1.

Subluxation – Incomplete or partial dislocation.

Tumor – (Multiple Myeloma) Malignant neoplasm of plasma cells involving the bone marrow and causing destruction of the bone
Content Description:

I. Anatomy

A. Function
   1. Central axis of skeleton
   2. Support
   3. Protects spinal cord

B. Description

1. Composed of 24 true vertebra at the superior section
   a. Cervical (lordotic curve)
      (1) Seven vertebra
      (2) Atlas
      (3) Axis (epistropheus)
      (4) Vertebra prominens
   b. Thoracic (kyphotic curve)
      (1) Twelve vertebra
      (2) Articulate with ribs
      (3) Larger than cervical vertebra
   c. Lumbar (lordotic curve)
      (1) Five vertebra
      (2) Largest vertebra

2. Nine false vertebra
   a. Sacrum
      Five fused segments
   b. Coccyx
      Four segments (sometimes fused)

3. Intervertebral discs
   a. Fibrocartilage
   b. Function as cushions
   c. Nucleus pulposus

4. Parts of the vertebra (see diagrams following this section)
Thoracic Vertebra

A

Superior articular process and facet
Costal facet (for tubercle of rib)
Lamina
Superior articular process
Transverse process
Pedicle
Superior costal facet
Body
Intervertebral foramina
Facets and demifacet on vertebra bodies
Zygapophyseal joints

B

Floor of intervertebral foramen
Superior articular process
Facet for costal tubercle
Pedicle
Superior costal facet (demifacet)
Transverse process
Lamina
Spinous process
Superior articular process
Body
Inferior costal facet (demifacet)
Inferior articular process
Inferior articular process
First thoracic vertebra
First rib
Spinozus process
Costotransverse joint
Costovertebral joint
Zygapophyseal joint
Twelfth rib
Twelfth thoracic vertebra
Lumbar Vertebra
II. Positions (See detailed positioning sheets)

A. Cervical vertebrae
   1. A.P.
   2. Lateral
   3. Obliques
   4. Odontoid "Open Mouth"
   5. Flexion and extension
   6. Optional - Pillars

B. Thoracic vertebrae
   1. A.P.
   2. Lateral

C. Cervicothoracic vertebrae "swimmers"

D. Lumbar vertebrae
1. A.P.
2. Lateral
3. Obliques
4. L-S joint

E. Sacrum
1. AP
2. Lateral

F. Coccyx
1. AP
2. Lateral

G. Scoliosis series

III. Pathology
A. Trauma
1. Fractures
   a. Transverse process
   b. Body
   c. Neural arch -- spondylolysis – breaking down of the vertebra
   e. Odontoid process
   f. Compression Fractures – Fracture that causes compaction of bone and a decrease in length or width.
   g. Hangman’s Fracture of the anterior arch of C2 due to hyperextension.
   h. Jefferson – Comminuted fracture of the ring of C1.

2. Dislocations
   a. Forward displacement--spondylolisthesis
   b. Side displacement--scoliosis
   c. Rotation displacement
   d. Downward displacement--spondylizema
   e. Posterior displacement--hourglass intervertebral foramen

3. Prolapsed intervertebral disc
4. Herniated intervertebral disc

B. Congenital anomalies
1. Growth is completed in the area of the vertebral column by the 14th year; however, the ossification period is completed in 7 years

2. Developmental defects
   a. Restrosomatic hiatus
   b. Epiphysis of T-process (not closed)
   c. Pars interarticularis defects
   d. Spinal bifida (occulata-nerve protruding into trench L-5 and L-4) due to the laminae filing to unite posteriorly. Usually lower lumbar and upper sacral regions.
   e. Os odontoideum--unfused odontoid

3. Postural abnormalities
   a. Scoliosis
   b. Kyphosis
c. Lordosis

C. Metabolic
1. Schuermann's disease (osteochondrosis) necrosis of the epiphysis of the vertebrae (osteochondrosis of the V.)
2. Hodgkin's disease (lymph nodes--pseudoleukemia) ivory type v. (osteitis)
3. Paget's disease--ten steitis deformans--deformation of flat bones and bowing of long bones
4. Osteoporosis--lack of osteoblasts to lay down bone matrix
5. Spondylolysis--vertebral arch fracture
6. Spondylolisthesis--forward displacement of one v. over another (usually L-4 or L-5)
7. Tuberculosis--will collapse v. causing (hump)
8. Sickle cell anemia--centrum becomes indented
9. Turner's syndrome (squared v.)
10. Osteolysis--loss of calcium from bone
11. Osteosclerosis--abnormal hardening of bone
12. Spondylitis--inflammation of vertebrae
13. Bechterew's disease--calcification of ligaments around vertebra