The Aging Spine

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The Aging Spine

- **Goals and Objectives**
  - Spine pathology is described based on anatomical locations groups and best practice should address the continuum of spine pathology according to age.
- **Educational needs:**
  - Understanding normal aging of the spine.
  - Creating an algorithm for differential diagnosis according to age.
- **Knowledge and Competence**
  - Clear understanding of the patho-anatomy of the spine is needed.
  - Patho-physiology of aging in women will be required.
  - Guidelines and algorithms will be provided to triage and navigate general complaints in the aging woman with spine issues.
  - Red flags will be highlighted for specific disease processes.

Spine patho-anatomy

- Spine consists of:
  - vertebral bodies
  - intervertebral discs
  - encases the spinal cord
  - myelinated nerves
  - positioned in the middle of the upright body
  - curvatures maintain an upright spinal balance.
7 ages of the Spine

1. New born
   - Spina bifida
     - Various forms
     - Folate deficiency
   - Infections
     - Staph aureus
     - Homophiles influenza
     - Kingella Kincae

2. Children
   - Infections
     - Discitis
   - Tumors
     - Eosinophilic granuloma
   - Juvenile onset scoliosis
   - JRA
   - Dysplastic spondylolisthesis
7 ages of the spine

3. Adolescent
- Infections
- Tumors
  - Osteoid osteoma
  - Osteoblastoma
- Scheuermann’s kyphosis (boys)
- Spondylolysis/Spondylolisthesis
- Idiopathic Scoliosis (90% girls)

7 ages of the spine

4. Young adults
- Disc herniation
- Spondylolisthesis
- Fractures
7 ages of the spine

5. Middle age
- Disc degeneration
- Disc herniation
- Progression of disease

6. Older adults
- Disc degeneration
- Spondylosis
- Stenosis
7 ages of the spine

7. Geriatric spine
- Compression fractures
- Metastatic tumors
- Myeloma

Bone health in the spine

- The aging spine has both
  - Osteoporosis
  - Osteoarthritis
    - Degeneration of cartilage
    - Degradation of the disc
- Osteoporosis
  - Age-related decrease in bone mass secondary to uncoupling of osteoclast-osteoblast activity
  - Disrupted microarchitecture
- Osteoarthritis has increases in
  - Chondrocytes size, protein content
  - Stiffness, ratio of proteoglycan keratin sulfate to chondroitin sulfate
  - Hypocellular
  - Water content
- Disc degradation
  - Loss of water content and conversion to fibrocartilage.
The picture of aging

Evaluation:

- **History** is the most important element of evaluating the spine.
- Clinical examination of the spine is geared to finding signs of neural compression and evaluate the *posture* and motion.
- Radiology:
  - Basic x rays are mandatory
  - MRI
    - neurological evaluation
    - Occult fractures
    - Tumors
Special tests

- **Dexa scanning:**
  - Rotational deformities and OA of the facets create a false high bone density.
- **Biological markers for bone turnover not routinely reliable**
- **MRI:**
  - Test of choice for soft tissues, disc degeneration, nerve compression and ideal for early compression fractures.
- **CT scan:**
  - Ideal for bone pathology including destructing lesions arthritis and joint destructions as well as nerve root compression

Natural history of the aging spine

1. **Height loss Disc degeneration (25% of spinal column height)**
- **annulus fibrosus**
  - outer structure that encases the nucleus pulposus
  - composed of type I collagen that is obliquely oriented, water, and proteoglycans
  - characterized by high tensile strength and its ability to prevent intervertebral distraction
  - remains flexible enough to allow for motion
  - high collagen / low proteoglycan ratio (low % dry weight of proteoglycans)
  - fibroblast-like cells
  - responsible for producing type I collagen and proteoglycans
DISC DEGENERATION

- nucleus pulposus
  - central portion of the intervertebral disc
  - composed of type II collagen, water, (88%) and proteoglycans
  - hydrated gel due to high polysaccharide
  - proteoglycans interact with water and resist compression
  - viscoelastic matrix distributes the forces smoothly to the annulus and the end plates
  - low collagen / high proteoglycan ratio (high % dry weight of proteoglycans)
  - chondrocyte-like cells
  - responsible for producing type II collagen and proteoglycans

Disc herniation is not aging

Disc Herniation
- herniated disks are associated with a spontaneous increase in the production of:
  - osteoprotegrin (OPG)
  - interleukin-1 beta
  - receptor activator of nuclear factor-kB ligand (RANKL)
  - parathyroid hormone (PTH)

Disc Aging
- overall loss of water content and conversion to fibrocartilage, decrease in:
  - nutritional transport
  - absolute number of viable cells
  - proteoglycans
  - pH
- increase in:
  - keratin sulfate to chondroitin sulfate ratio
  - lactate
  - degradative enzyme activity
- no change in
  - absolute quantity of collagen
Natural history of the aging spine

2. Vertebral compression fractures:
   - vertebral compression fractures (VCF) are the most common fragility fracture
   - 700,000 VCF per year in US
   - 70,000 hospitalizations annually
   - 15 billion in annual costs
   - demographics
     - affects up to
       - 25% people over 70 years
       - 50% people over 80 years
   - risk factors
     - history of 2 VCFs
       - is the strongest predictor of future vertebral fractures in postmenopausal women

Osteoporosis

- bone is normal quality but decreased in quantity
- cortices are thinned
- cancellous bone has decreased trabecular continuity
- (BMD) peaks at between 33 to 40 yrs in women
- WHO defines osteoporosis as T score below -2.5
- Associated conditions
  - compromised pulmonary function
  - increased kyphosis can affect pulmonary function
  - each VCF leads up to 9% reduction in FV
- mortality
  - 1-year mortality ~ 15% (less than hip fx)
  - 2-year mortality ~20% (equivalent to hip fx)
Natural history of the aging spine

3. Spinal stenosis

- Reduction in dimensions of central or lateral lumbar spinal canal caused by
  - bony structures
  - facet osteophytes
  - uncinate spur (posterior vertebral body osteophyte)
  - spondylolisthesis
- soft tissue structures
  - herniated or bulging discs
  - hypertrophy or buckling of the ligamentum flavum
  - synovial facet cysts

End result:

Loss of sagittal balance with multiplane deformity and failure of the motion segment
Red Flags:

- Constant pain not related to position
- Night pain
- Pain not alleviated with NSAIDS
- Weight loss
- Fever
- Systemic illness

- Comprehensive metabolic panel
  - Hypercalcemia
  - Liver disease
- CBC
  - Neutrophil
  - Anemia
- ESR
  - Infection and malignancy
- CRP
  - Infection and malignancy
Prevention

- Protein rich diet
- Impedance exercise
- Agile
- Stretching, Yoga
- Core strengthening
- Weight training

Hard Core | Three exercises for strengthening the body's pillar

- **Gate Bridge**
  - Lie face-up on the ground with your arms to the side. Knees bent and heels on the ground. Lift hips until knees, hips and shoulders are in a straight line. Hold for two or three seconds. Repeat several times.

- **Lateral Piller Bridge**
  - Lie on your side with your forearms on the ground under your shoulder. Push your hip off the ground. Create a straight line from ankle to shoulder. Hold this position for 15 to 30 seconds. Repeat several times.

- **Plank with Arm Lift**
  - Start in a push-up position with your feet and shoulders apart. Without moving your torso, lift left arm and slightly to the left. Hold for one or two seconds. Then switch to the right arm. Repeat several times.

Thank you
References


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