Spine and Femoral Head Instrumentation for the Radiologist

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Spine and Hip Instrumentation for the Radiologist

✧ Radiologists, Neurosurgeons, Orthopedic Surgeons = Team!

✧ Spine Instrumentation
  • Cervical spine surgical approaches and devices
  • Lumbar spine surgical approaches and devices
  • Scoliosis surgical approaches and devices
  • Role of radiologist in evaluating the instrumentation

✧ Hip Instrumentation
  • Femoral Neck Fractures and stabilization devices
  • Inter-Trochanteric Fractures and stabilization devices
Unique role for Radiologist

- Neurosurgery/Orthopedics strengths
  - patient history and physical exam, intra-op surgical findings, post-op exam

- Radiology strengths
  - exam indications and physics behind them
  - infection, arthritis, neoplasms
Pathology requiring spine instrumentation/intervention

- **Congenital**
  - scoliosis

- **Trauma, Infection, Tumor**
  - degenerative changes
  - compression fracture
  - slipped disc
  - antero- or retro-listhesis

Long-term success depends on formation of osseous fusion complex

*Young et al, Radiographics 2007*
53 yrs M with bilateral upper extremity parasthesias s/p fall at work

C-spine: No fracture, severe degenerative disc disease with cord compression
53 yrs M with bilateral upper extremity parasthesias s/p fall at work
46 yr M w/ hx of neck and right arm pain after work related injury (heavy lifting)

MRI:
- Broad-based disc protrusion at C6-C7 level
- C6-C7 bilateral foraminal narrowing
- Disc degeneration with spondylosis at C3-C6

PACS, BIDMC
Anterior Cervical Discectomy and Fusion (ACDF)

- Radiculopathy, Disc herniation, Fracture, Instability
- Anterior column reconstruction with plates
- Allograft or autograft bone blocks for reconstruction after discectomy

http://commons.wikimedia.org/wiki/File:ACDF_surgery_english.png
54 yr F with longstanding hx of C6 distribution pain and numbness

Refractory to multimodal course of conservative care:
- bracing
- physical therapy
- series of epidural steroid injections
- nerve root blocks
- facet injections
- chiropractic manipulation
- medications.
48 year old woman with back pain and L4-5 spondylolisthesis/spondylolysis
Anterior and Posterior Lumbar Spinal Fusion

- 66 yr F with severe back pain and degenerative disk disease L5-S1

- Mild anterolisthesis of L4 on L5 and retrolisthesis of L5 on S1.
Anterior and Posterior Lumbar Spinal Fusion

[Images of X-rays and medical equipment]
42 yr M s/p fall and anterior and posterior spinal fusion at L4-S1
Evaluation of Fusion

1. Less than 3 degrees of intersegmental position change on lateral flexion and extension views.
2. No lucent area around the implant.
3. Minimal loss of disk height.
4. No fracture of the device, graft, or vertebra.
5. No sclerotic changes in the graft or adjacent vertebra.
6. Visible bone formation in or about the graft material.

Young et al, Radiographics 2007
Ray, Spine 1997
Complications

- Injury to nerves and vessels
  - Thecal sac, central cord, inter-vertebral foramina, cauda equina
  - Abdominal vessels, muscles, posterior mediastinum, pre-vertebral soft tissues
- Vertebral bodies and inter-vertebral spaces above and below instrumentation (instability, osteophytes, disc herniation)
- Infection (subcutaneous soft tissue vs deep tissue with osteomyelitis)

Young et al, Radiographics 2007
Femoral Head Instrumentation

- **Congenital**
  - SCFE

- **Trauma, Infection, Tumor**
  - degenerative changes
  - fracture s/p fall or trauma
    - Femoral neck
    - Inter-Trochanteric

- **Types of instrumentation**
  - screws and pins
  - dynamic hip screw
  - intramedullary rod and gamma nail
  - arthroplasty (total vs hemi)
  - Evaluate for loosening, migration, osteomyelitis
43 yr M firefighter s/p impact with car while directing traffic
Femoral Neck Fractures

- common in elderly with osteoporosis and s/p falls
- complete union:
  - 100% in Garden I and II
  - 93% in Garden III
  - 57% in Garden IV
- osteonecrosis:
  - 8% in Garden I and II
  - 30% in Garden III and IV

Garden I  Garden II
Garden III  Garden IV

45 yr M firefighter s/p fall

87 yr F s/p fall and right inter-trochanteric fracture

Intra-op intramedullary rod and gamma nail placement and fixation with distal interlocking screw
Femoral Head Cut-Out = Complication of Intra-medullary rod and gamma nail fixation

Gamma nail has migrated superolaterally within the femoral head with surrounding adjacent lucency consistent with hardware loosening.
88 yr F s/p fall and left inter-trochanteric fracture and hx of right hemiarthroplasty
Hip Arthroplasty

Total Arthroplasty

Hemi - Arthroplasty

Unipolar

Bipolar

http://www.med.wayne.edu/diagradiology/RSNA2003/hips-unipolar_cemented.htm

http://www.corin.co.uk/s_products/surfacing.html

PACS, BIDMC

PACS, BIDMC

PACS, BIDMC

PACS, BIDMC
83 yr F s/p fall and right femoral neck fracture

Unipolar Arthroplasty
91 yr F with back and bilateral thigh pain. No hx of fall.

Right Total Arthroplasty and Left Bipolar Arthroplasty
Femoral Head/Acetabular Hardware Interpretation for the Radiologist

- **Type of hardware (no need for brand names)**
  - cannulated screw, derotational screw
  - dynamic hip screw (DHA)
  - intramedullary rod and gamma nail
  - total or hemi-arthroplasty

- **Type of fracture**
  - intracapsular (femoral head or neck): capital, subcapital, transcervical, or basicervical
  - extracapsular (trochanters)
    - intertrochanteric or subtrochanteric

- **Hardware complications**
  - pin location
  - migration of acetabulum
  - loosening, fracture of femoral rod
  - additional bone fractures
  - osteomyelitis
  - heterotopic ossification
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