Degenerative Disc Disease

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Big Problem

- Great majority of adults suffer from at least one episode of acute low back pain during lifetime.
- Disc degeneration as an autopsy finding 90% by age 50.
- Disc herniation is seen 20%-30% of asymptomatic persons.
- $$$$ spent for diagnosis, management and lost productivity.
Normal Disc
DEGENERATION AND AGING
Imaging Findings

- Disc space narrowing
- Decreased T2 signal in the disc space
- Fissures, fluid, vacuum changes and calcification
- Ligamentous signal changes
- Marrow signal changes
- Osteophytosis
- Disk herniation
- Malalignment
- Stenosis.
Purpose of Imaging

- Objective documentation
- Accurate description
- Correlation with symptoms
- Influence treatment
- Monitor treatment
- Provide prognostic information
Nomenclature and Classification of Lumbar Disc Pathology

Recommendations of the Combined Task Forces of the North American Spine Society, American Society of Spine Radiology, and American Society of Neuroradiology

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Ground Rules

- Definitions based on morphologic and pathologic findings
  - Do not imply any particular etiology,
  - Do not suggest any particular treatment
  - Do not make a distinction between symptomatic and asymptomatic “disease”
Q1

• Description of which of the following MRI findings demonstrates the greatest interreader variability in radiology reporting?

A. Disc herniation
B. Disc desiccation
C. Annular tear
D. Facet hypertrophy
Q1

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General Classification of Disc Lesions

- Normal (excluding aging changes)
- Congenital/Developmental variant
- Degenerative/traumatic lesion
  - Anular tear
  - Herniation
    - Protrusion/Extrusion
    - Intravertebral
  - Degeneration
    - Spondylosis deformans
    - Intervertebral osteochondrosis
- Inflammation/Infection
- Neoplasia
- Morphologic variant of unknown significance
Normal Disc
Q2

- Which of the following pathologic findings must accompany disc herniation?

A. Disc desiccation
B. Vertebral osteochondrosis
C. Spondylosis deformans
D. Annular tear
E. Complete rupture of the annulus fibrosis
Q2

• Which of the following pathologic findings must accompany disc herniation?

A. Disc desiccation
B. Vertebral osteochondrosis
C. Spondylosis deformans
D. Annular tear
E. Complete rupture of the annulus fibrosis
Q2

• Which of the following pathologic findings must accompany disc herniation?

A. Disc desiccation
B. Vertebral osteochondrosis
C. Spondylosis deformans
D. Annular tear fissure
E. Complete rupture of the annulus fibrosis
Annular Fissure

C: CONCENTRIC FISSURE
R: RADIAL FISSURE
T: TRANSVERSE FISSURE
Annular Fissure
"Symmetrical Bulging Disc"
Bulging Disc:
A finding not diagnosis

- Disc degeneration
- Normal variant (usually at L5/S1)
- Due to vertebral remodeling secondary to osteoporosis, trauma or other deformity
- Ligamentous laxity due to loading
- Partial volume averaging
- Illusion caused by disc herniation
“Pseudobulging” Disc: Parti
The L5-S1 Problem
“Overcall”
The L5-S1 Problem: “Undercall”
The L5-S1 Problem: "Undercall"
"Asymmetrical Bulging Disc"
Disc Herniation

• Localized displacement of disc material (nucleus, cartilage, fragmented apophyseal bone, or fragmented annular tissue) beyond the intervertebral disc space.

• Displacement can only occur in association with disruption of the normal annulus.
Intravertebral Herniations

Intervertebral disc space
Intervertebral disc space

Herniation
By convention, a "focal herniation" involves less than 25% (90°) of the disc circumference.
By convention, a "broad-based" herniation involves between 25% and 50% (90°-180°) of the disc circumference.
• Differentiation of extrusion from protrusion is primarily based on which of the following features?

A. Size
B. Shape
C. Location
D. Continuity
E. Containment
Q3

- Differentiation of extrusion from protrusion is primarily based on which of the following features?

A. Size
B. Shape
C. Location
D. Continuity
E. Containment
Herniated discs may take the form of protrusion or extrusion, based on the shape (not size) of the displaced material.
Protrusion
Protrusion vs. Extrusion

Extrusion:
• Herniated disc > base

Protrusion:
• Herniated disc < base

• IN ANY PLANE
Extrusion
Extrusion
Protrusion  Migrated  Sequestrated
Midline vs. Paramidline
Migrated

Sequestered
Description of a Disc Herniation

• Morphology
  ➢ Protrusion
  ➢ Extrusion
  ➢ Intravertebral

• Location
• Consistency
• Size
• Continuity
• Containment
Q5

• Which of the following features of a disc herniation is most difficult to evaluate on MRI

A. Size
B. Location
C. Consistency
D. Contiguity
E. Containment
Q5

- Which of the following features of a disc herniation is most difficult to evaluate on MRI

A. Size
B. Location
C. Consistency
D. Contiguity
E. Containment
Spine Nomenclature

Version 1.0
• Bulge > 180°
• Herniation < 180°
• Annular tear/fissure
• ----

Version 2.0
• Bulge > 90°
• Herniation < 90°
• Annular fissure
• Acute vs. chronic
  – Bright signal of the disc material on T2-weighted images suggests relative acuteness. Such changes may persist for months, however. Without clinical correlation and/or serial studies, it is not possible to date….
Acute Disc Herniation
SPINAL STENOSIS

- Central Canal
- Lateral Recess
- Neural Foramen
Central Canal Stenosis
LATERAL RECESS

Vertebra

Pedicle

Thecal Sac

Superior Facet

Pars Interarticularis
NEURAL FORAMEN

- Cranial Pedicle
- Vertebra / Disc
- Lateral Facet Joint
- Caudad Pedicle
Congenital Spinal Canal Stenosis
Degenerative Marrow Changes

• Modic Type I
• Modic Type II
• Modic Type III
Modic type I
Modic type II
Modic type III
Q4

• With regards to Modic marrow signal changes which of the following is INCORRECT?

A. Type I can convert to type II
B. Type II can convert to type III
C. Type II can convert to type I
D. There is no clinical significance of Modic changes
Q4

• With regards to Modic marrow signal changes which of the following is INCORRECT?

A. Type I can convert to type II
B. Type II can convert to type III
C. Type II can convert to type I
D. There is no clinical significance of Modic changes
Marrow Signal Changes

• Type I changes are more common in symptomatic patients than asymptomatic
• Post surgery resolution of type I signal changes is associated with better outcome
• Evolution of Modic signal changes is usually from type I to type II and then to type III
• Reversal of type II to type I documented
Facet Changes
Spondylolisthesis; Pars Defect vs. Degenerative
Spondylolisthesis; Degenerative
Degenerative Lumbar Spine Disease

- Intrareader reliability
- Describe disc herniations by their location, size, shape and continuity using standard terminology
- Don’t think too much about effects on treatment etc.