ROLE OF RADIOLOGY IN INTERVERTEBRAL DISC PROLAPSE

BY DR. SWATHI REDDY
RADIOLOGICAL INVESTIGATIONS

- Radiograph
- Magnetic resonance imaging
- Computed tomography
- Bone scan
- Sometimes, more advanced imaging techniques are used in anticipation for surgery and that includes CT myelography and PET scans.
X-RAY LUMBAR SPINE

- The most commonly ordered spinal imaging test is X-ray because of its ready availability and low cost.
- Radiographs are helpful mainly for evaluation of fracture, bony deformity including degenerative changes, sacroiliitis, disc and vertebral body height and assessment of bony density and architecture.
- In most cases, the following views are obtained namely
  - AP view
  - Lateral view
Standard projections

- PA/AP view
  - the entire lumbar spine should be visible, with a demonstration of T11/T12 superiorly and the sacrum inferiorly
  - often performed erect unless otherwise indicated

- lateral view
  - visualisation of lumbar vertebral bodies, pedicles, and facet joints
  - ideal projection when examining for suspected fractures
  - can be performed erect to assess stable fracture (under a specialist’s guidance)

Modified trauma projections

- horizontal beam lateral
  - visualisation of lumbar vertebral bodies, pedicles, and facet joints taken supine
  - used in the context of trauma

Additional projections

- oblique view
  - used to visualise the articular facets and pars interarticularis of the lumbar spine

- flexion-extension view
  - functional view used to assess spinal stability
In the radiographs we have to check for the following:
- Alignment
- Curvature
- Vertebrae
- Disc spaces
- Facet joints
- Pre-vertebral and paravertebral soft tissues
X-RAY LUMBAR SPINE- AP AND LATERAL VIEWS
Drawbacks of lumbar radiography

- Exposure of gonads to ionizing radiation.
- Plain radiographs cannot visualize the discs and are not sensitive for herniated discs and are not helpful in diagnosing nerve root impingement.
- Despite these limitations they are commonly recommended prior to proceeding with more advanced imaging like CT/MRI
MRI and CT

- MRI and CT is indicated in patients with severe or progressive neurological deficits or with suspicion of serious underlying conditions such as vertebral infection, cord compression and cauda equina syndrome etc.

- Both MRI and CT are advanced and excellent imaging modalities because of their multiplanar imaging capability.
ADVANTAGES OF CT OVER MRI

- CT has superior depiction of cortical bone than MRI. Thus when bony anatomy is critical, CT is preferable.
- In patients with acute trauma, CT is better in visualizing fractures.
- CT is more reliable than MRI in detecting facet joint degenerative changes.
- But if the patient complains of neurological symptoms an MRI is indicated.
- Plain CT has a limited role in identifying and characterizing the disc pathology. However, CT myelography can be done in patients who are contraindicated to MRI scanning, Otherwise the procedure is not commonly indicated.
CT MYELOGRAPHY

- It involves lumbar or cervical spine puncture with radiographic contrast material injected into the spinal canal, followed by CT.

- In CT myelography, the contrast acts as same way as it does when administered IV in that it is high in attenuation and therefore bright on CT. This allows for detailed imaging of spinal cord.

- The CT myelogram gives similar information as the bright T2 CSF on MRI. And hence this procedure has been replaced by MRI.
## CT Myelography

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<th>Indications</th>
<th>Advantages</th>
<th>Disadvantages</th>
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<td>Spinal stenosis, nerve root compression</td>
<td>Defines extent of subarachnoid space, identifies spinal block</td>
<td>Invasive, complications (CSF leak, headache, contrast reaction, etc.)</td>
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<td>CSF leak</td>
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<td>Ionizing radiation and iodinated contrast</td>
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<td>MRI inadequate or contraindicated</td>
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PLAIN CT VS CT MYELOGRAM
Bone scans are used mainly to detect occult fractures, stress fractures, infections and bony metastasis and to differentiate them from degenerative changes. They have a very limited role in diagnosing low back pain due to disc pathology.
MRI - IMAGING MODALITY OF CHOICE FOR DISC PATHOLOGY

- MRI is the best imaging modality of choice in evaluating disc pathology.
- MRI does not require radiation exposure and provides better visualization of soft tissue and spinal canal and is thus preferred over CT.
- MRI also helps in characterizing the disc pathology into disc herniation i.e., protrusion, extrusion, and sequesteration.
- It also helps in assessing the complications of disc herniation such as spinal canal stenosis which is again characterized into central canal, lateral recess, and neural foraminal stenosis.
Standard MRI lumbar spine sequences

- T1W axial and sagittal
- T2W axial and sagittal
- STIR/ T2 fat sat coronal
T2W sequences are ideal for identification of intervertebral disc pathology.

A normal intervertebral disc on MRI appears hyperintense on T2 because of high water content in it.

Loss of high T2 signal is due to disc dessication and these discs appear hypointense on T2.

MRI can identify various types of disc herniation and assess the sequelae of disc herniation.
Normal MRI
This is an example of a normal MRI (except for the small disc bulge at L1-2. Note the appearance of the normal disc. A normal disc is well hydrated and has a whitish appearance on the MRI. The outer portion of the disc is the tough annulus which appears black. The spinal canal is wide and cylindrical.

Nucleus of Discs with normal whitish appearance

Annulus of disc with normal solid black appearance. There are no cracks or herniations posteriorly.

Smooth cylindrical shape of spinal cord without any disc bulges on the cord.

No Posterior Bone Spurs are present.
DISC HERNIATION

- Disc Herniation: It is defined as localized displacement of disc material beyond the limits of intervertebral disc space.
- Herniated discs may take the form of
  - Protrusion
  - Extrusion
  - Sequestration
Normal LUMBAR MRI

LUMBAR MRI showing herniated disc
Disc protrusion: If the greatest distance between the edges of displaced part of the disc is less than the distance between the edges of the base, then it is termed as disc protrusion.
Disc protrusion at L4-L5 level
Disc extrusion at L5-S1 level

- Disc extrusion: If the distance between the edges of the disc material beyond the disc space is greater than the distance between the edges of the base.
Disc sequesteration at L5-S1 level.

- Disc sequesteration: If the displaced disc material has no continuity with the parent disc.
T2W sagittal- disc bulge at L4-L5 and left paracentral disc extrusion at L5-S1
T2W Axial: Disc extrusion at L5-S1 with compression of left traversing nerve roots
MRI plays a pivotal role in precise localization of intervertebral disc changes. Because of its multi-planar image acquisition capability, excellent soft tissue contrast and lack of radiation exposure it turned out to be a standard imaging modality for localizing and characterizing disc pathology.
THANK YOU