MR imaging the post operative spine - What to expect!

Poster No.: C-2334
Congress: ECR 2012
Type: Educational Exhibit
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Keywords: Musculoskeletal spine, MR, Education
DOI: 10.1594/ecr2012/C-2334

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Learning objectives

1) Briefly review the normal MR anatomy of the spine and discuss the commonly employed surgical interventions.

2) To understand the imaging findings of the normal, uncomplicated post operative changes.

3) To illustrate the appearance of commonly encountered pathology.

Background

As there have been an ever increasing number of spinal interventions, Radiologists are asked to image more and more post procedure or post operative spines to look for any complications.

It is thus pivotal for the reporting Radiologist to be aware of the normal post operative appearances, so as not to confuse these with the pathological findings which would need treatment.

Few practical tips:

- The presence of metal hardware in an anatomic area of interest has proved a difficult and annoying problem for radiologists. Metal produces both a large area of signal void and extensive distortion around the implant. In patients with metal hardware it is beneficial to scan them on lower strength magnetic field MR scanners as the high strength magnets can cause significant artefact (Fig 1 to Fig 4).
- Using MARS (metal artifact reduction sequence) helps to reduce the metal artefacts from the metal hardware.
- Contrast enhanced MR using Gadolinium improves sensitivity and can help differentiate normal post operative appearances from pathology.
- T2 fat suppressed sequences (STIR) are helpful in differentiating fatty marrow from oedema.
- It is also important to establish the time period from surgery to imaging in order to differentiate normal post operative findings form pathology.
Imaging findings OR Procedure details

It is important to review the Sagittal T1, Sagittal T2 (STIR), Gd enhanced Sagittal T1, Axial T1 Gd enhanced images.

Various spinal interventions include:

• Relatively simple procedures - such as lumbar puncture, facet joint injection.
• Laminectomy - resection of a part of the Lamina.
• Discectomy - Removal of the part of the disc.
• Spinal fixation - These devices provide stability and restore anatomic alignment in the treatment of fractures, degenerative disease, infection, and tumors and correct congenital deformities such as those seen in scoliosis.

Normal post operative findings:

• Vertebral marrow - appearances are usually unchanged since before surgery, with no enhancement (unless Modic type 1 changes are present)
• Nerve Roots - may enhance for 6 months.
• Disks - posterior annulus enhancement and increased T2 signal may persist for years (Fig 5 to 8).
• Epidural tissue
  a) Scarring/fibrosis
  b) Contrast enhancement from fibrosis for years.
  c) Fibrosis shows diffuse enhancement whereas a disc shows peripheral enhancement.

Pathological findings:

1) Recurrent disc herniation.

Gadolinium-enhanced MR helps in differentiating postoperative scarring from recurrent disk herniation. Accuracy of contrast-enhanced MRI has been reported to be as high as 96%. Scar tissue consistently enhances postoperatively and continues to enhance (Fig 4 to 8).

Although anterior epidural scar invariably shows this pattern of consistent enhancement, posterior epidural scar may not (Fig 9).
Gadolinium is particularly useful when a mixture of scar and recurrent disk herniation is found; the enhancing scar can be separated from the nonenhancing, low-signal recurrent disk herniation (Fig 10, 11).

There can however be an enhancing inflammatory reaction around a herniated disk even in the absence of prior surgery.

2) **Bony stenosis:** This may account for up to 60% of failed back surgery cases. The MR appearances may vary depending on the degree of marrow content. If in doubt CT with intrathecal contrast is helpful in evaluating canal narrowing from postoperative bone overgrowth.

3) **Post operative infection:** This can be due to disc space infection or epidural abscess. Although relatively uncommon these complications do occur. MRI using STIR (Fat suppressed T2 images) are very helpful and show disc and bone oedema which may be difficult to visualize on T1 weighted and T2 weighted images.

Epidural abscess is hypointense on T1 and hyperintense on T2 and show mass effect on the thecal sac with post gadolinium enhancement (Fig 12, 13).

4) **Post operative CSF leak or Pseudomeningocele:** This represents a localized collection of fluid communicating with the thecal sac. This results from an iatrogenic dural tear during surgery. A diagnosis of pseudomeningocele can be confidently made when a communication between the thecal sac and the collection is seen on MR or on CT myelogram the contrast enters the fluid collection (Fig 14 to 16).

5) **Post procedural epidural haematoma:** The blood in the epidural space may have varied appearance on T1 and T2 weighted sequences depending on stage of hemorrhage. It is valuable to remember the signal characteristics on T1 and T2 weighted sequences (Fig 17 to 20).

Images for this section:
Fig. 1: Sag image on 0.35T MR scanner. Note that the metal hardware is not seen to cause significant artefact.
Fig. 2: Sag image on 0.35T MR scanner. Note that the metal hardware is not seen to cause significant artefact.
**Fig. 3:** Sag image on 3T MR scanner. Note that the metal hardware is seen to cause significant artefact.
**Fig. 4:** Sag image on 3T MR scanner. Note that the metal hardware is seen to cause significant artefact.
Fig. 5: Preoperative disc (arrow) on Sag T2 images.
Fig. 6: Pre op axial T2 image. Disc (arrow).
Fig. 7: Post op T2 axial image. Normal post operative appearance.
Fig. 8: T1 axial Gd enhanced image. Normal post operative appearance.
Fig. 10: Pre op T2 weighted images. Axial images shows disc (arrow)
Fig. 14: T2 weighted axial image shows CSF leak. The hyperintense CSF was seen to communicate with the dural sac.
**Fig. 15:** T2 weighted axial image shows CSF leak. The hyperintense CSF was seen to communicate with the dural sac.
**Fig. 16:** T2 weighted Sag. image shows CSF leak. The hyperintense CSF was seen to communicate with the dural sac.
**Fig. 17:** Axial T2 image. The intrdural haematoma in the spinal canal appears hypointense to CSF.
**Fig. 18:** Sag T2 image. The intradural haematoma in the spinal canal appears hypointense to CSF.
Fig. 19: Sag T1 image. The intradural haematoma in the spinal canal appears hyperintense to CSF.
**Fig. 13:** T1 Gd enhanced axial image. Post operative collection. Patient had a fluid collection adjacent to the metal hardware, which turned out to be an abscess.
**Fig. 12:** Post operative collection. Patient had a fluid collection adjacent to the metal hardware, which turned out to be an abscess.
Fig. 11: Gd enhanced T1 image shows peripheral enhancing recurrent disc.
Fig. 9: Post operative fibrotic change. See the homogenously enhancing (arrow) fibrotic change.
**Fig. 20:** Sag T2 image with intra and extradural haematoma post release of cord tethering.
Conclusion

To achieve accurate image interpretation, the radiologist must be familiar with the appearances of normal post operative findings and typical appearance of pathology on the MR examination of a post operative spine.

Personal Information

References


