Neuroimaging of the Postoperative Spine

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KEYWORDS

• Magnetic resonance imaging • Postoperative spine • Spinal implants • Spinal surgery
• Spinal mini-invasive procedures

KEY POINTS

- Imaging of the postoperative spine is a challenging task for the radiologist and requires a general knowledge of the surgical and the new minimally invasive procedures, and of the evolving spinal instrumentation.
- Thanks to its capabilities, MR imaging is crucial for the evaluation of patients with recurrent or new symptoms after surgery or minimally invasive techniques, including both early and late complications.
- Technical aspects have to be considered to reduce artifacts from metallic devices.
- For the correct interpretation of the postoperative spinal imaging, the radiologist must have detailed understanding of the initial pathologic condition, the surgical procedure performed, the clinical presentation of the patient, the time interval from the procedure to the imaging study, and the evolution of the expected postoperative changes.

DISCUSSION OF PROBLEM/CLINICAL PRESENTATION

Neuroimaging following operative treatments of the spine, either by surgery or by minimally invasive procedures, depends on many factors, including cause of intervention, used technique, current symptoms, and time elapsed since procedure.[1–3] Generally, postoperative neuroimaging is performed in patients with clinical symptoms (mostly pain with or without neurologic deficit), in which minor and major complications are to be excluded.

Postoperative complications may occur after both surgery and minimally invasive procedures.[4] To understand the postoperative spinal neuroimaging, radiologists must know the operative and instrumentation options to explore the postprocedural complications.

SPINAL TREATMENT PROCEDURES IN PILLS AND NEW TRENDS

Classically, spinal treatments can be categorized as follows:

a. Decompressive, performed to remove herniated disc material or to relieve a segment of spinal stenosis.
b. Spinal stabilization/fusion procedures, in cases of spinal instability from degenerative disc disease, spondylolisthesis, trauma, tumors, infections, and iatrogenic causes, such as prior surgery.
c. A combination of both.

The authors have nothing to disclose.

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Surgery

Spine surgery is used to treat diseases and injuries affecting the spinal column, including degenerative disorders, trauma, instability, deformities, infections, and tumors.

Surgical decompressive procedures include discectomy, laminotomy, laminectomy, and facetectomy. The term laminotomy refers to removal of only the inferior margin of the lamina and is often used in cases of microdiscectomy. In unilateral laminectomy, the entire lamina on one side of the spinous process is removed. Total or bilateral laminectomy involves removal of the lamina on both sides, plus the spinous process.

Surgical fusion procedures are often categorized based on the direction from which the spine is approached (anterior, posterior, lateral, caudal) as well as on their degree of invasiveness.[5–7] Surgical approaches are presented in **Table 1**.

Endoscopic Surgery

Endoscopic operations are now considered standard for intraforaminal/extraforaminal disc herniations.[8] The most common full endoscopic technique for patients with lumbar disc afflictions is the posterolateral *transforaminal* approach, but also full endoscopic *interlaminar* access was developed. Laser and bipolar radiofrequency current can be used. Basically, the transforaminal procedure has more limitations than the interlaminar, but it is less traumatic for the tissue.

Table 1
Surgical spine approaches

Type	Features
Cervical spine approaches	
Anterior cervical approaches	
Transoral-transpharyngeal approach	Access to anterior clivus, C1 and C2
Anteromedial approach	Complications can be spinal cord and, rarely, vascular injury
Posterior cervical approaches	
Laminotomy, laminectomy, laminoplasty	Degenerative spondylosis, disc herniations Complications are vertebral artery injury, post-laminectomy kyphosis, and new cervical radiculopathy
Posterior fusion hardware	Posterior cervical fusion typically involves lateral mass screws from C3 to C6, with traditional pedicle screws being reserved for the larger C2 and C7 levels
Thoracic approaches	Relatively high incidence of neurologic injury
Posterior and posterolateral approach	Transpedicular, transfacet, and transforaminal
Costotransversectomy	—
Lateral extracavitary approach	—
Lumbar approaches	
Anterior lumbar approach	Performed when posterior decompression is not required; vascular complications are reported less than 5%
Posterior lumbar approach	
Standard open discectomy	Laminotomy or hemilaminectomy, resection of the ligamentum flavum and retraction of neural elements
Posterior lumbar interbody fusion (PLIF)	Involves bilateral laminectomies and partial facetectomy
Transforaminal lumbar interbody fusion	Variation of PLIF through the foramen
Posterolateral fusion	Alternative or supplement to PLIF: bone graft is placed laterally between the transverse processes
Total disc replacement	Alternative to spinal fusion. Used for discogenic pain without significant spondylolisthesis