

Postoperative Spine Complications

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KEYWORDS

• Imaging • Postoperative spine • Complications • Surgery

KEY POINTS

- Imaging of the postoperative spine and associated complications is a common clinical scenario for the radiologist; however, despite advanced imaging techniques and better spatial resolution, this remains a challenging task.
- Evaluation of the postoperative spine requires a general knowledge of the surgical approach to each spinal region and the normal temporal evolution of expected postoperative changes.
- Knowledge of specific complications relating to each surgical approach and an understanding of general complications common among various surgical procedures, such as the appropriate evaluation of postoperative hardware, will assist the radiologist in interpretation of postoperative fusion and complications.

INTRODUCTION

Back pain is one of the most common clinical complaints in medicine. Low back pain affects up to 80% of the population during their lifetime and 1% to 2% of the United States population is disabled by low back pain.^{1,2} In 2002 the National Health Interview Study sampled 36,161 households, and found that back pain within the last 3 months was the most frequent type of pain reported with 26.4% of the respondents.³ The rate of spine surgery in the United States is the highest in the world, more than 1.2 million spinal surgeries being performed each year, although there is high geographic variation suggesting poor professional consensus on treatment approaches. For example, Medicare data for 2001 show a 6-fold variation in spine surgery rates among United States cities and a 10-fold variation in the rate of spinal fusion.^{4–6}

Postoperative complications may be immediately apparent after surgery or delayed by weeks, months, or years. The overall incidence of major

neurologic deficit immediately after spinal surgery is low, with an overall incidence of less than 1%, and slightly more common after thoracic spine surgery (0.49%), followed by the cervical (0.29%) and lumbar spine, respectively (0.08%).⁷ The etiology of major neurologic injury during spinal surgery can include direct surgical trauma to the cord or neural elements, compression and/or distraction of the vertebral column, vascular compromise (local infarct or systemic hypotension), epidural and subdural hematoma, and mechanical compression from infolding of the ligamentum flavum, posterior longitudinal ligament, disc, or adjacent bony structures. Over time an estimated 10% to 20% of patients will experience 1 or more complications relating to surgery, and imaging plays an important role in preoperative assessment and postoperative management.

Routine scheduled postoperative imaging may be performed in otherwise asymptomatic patients to evaluate the position and appearance of spinal

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instrumentation or to assess the progression of spinal fusion. Alternatively, imaging is often performed to assess immediate or delayed postoperative complications in the symptomatic patient and to further evaluate patients with little or no relief of symptoms following the initial surgical procedure; the so-called failed back surgery syndrome.

SURGICAL APPROACHES AND SPECIFIC RELATED COMPLICATIONS

Multiple surgical techniques are available to access the spinal osseous elements, spinal cord, nerve roots, and intervertebral disc. The individual techniques may vary by region and underlying abnormality. However, the basic goal of each technique is similar: to facilitate safe access to the pathologic area of interest and minimize potential risk. In general, spinal surgeries can be categorized as decompressive or spinal stabilization/fusion procedures, although many examples are a combination of both. Decompressive procedures include discectomy, laminotomy, laminectomy, and facetectomy to decompress a stenotic spinal canal or neural foramen. Spinal fusion allows stabilization of spinal segments for developmental, degenerative, and posttraumatic instability, or iatrogenic causes of instability such as prior surgery.

Cervical Spine Approaches

Anterior cervical approach

The transoral-transpharyngeal approach allows access to the anterior clivus, C1, and C2 for a variety of abnormalities including basilar invagination, odontoid fractures or nonunion, rheumatoid arthritis with cranial settling and/or pannus formation, developmental disorders such as os odontoidium and odontoid hypoplasia, and tumors.⁸ The alternative approach to the anterior spine is via a retropharyngeal technique. The anteromedial approach uses the space between the carotid sheath laterally and the sternocleidomastoid muscle and tracheoesophageal complex medially, whereas an anterolateral approach goes lateral to the carotid sheath.

Although rare, occurring in less than 0.2% of anterior cervical discectomy and fusion (ACDF) surgeries, one of the most feared complications related to the anterior cervical approach is direct spinal cord injury. Spinal cord impingement or direct spinal cord trauma may result from vertebral body screws that extend too far through the posterior cortex. However, the risk of spinal cord injury is higher when instruments are advanced into the spinal canal from the anterior approach to remove

posterior osteophytes.^{9,10} Plain radiographs and/or computed tomography (CT) will show misplacement of screws or other hardware that impinge or traverse the spinal cord. On magnetic resonance (MR) imaging spinal cord contusion or laceration is manifest, with focal areas of T2 hyperintensity within the spinal cord. If there is associated hemorrhage, gradient recalled echo sequences may show foci of susceptibility within the spinal cord.

The most common reported complications associated with anterior cervical approaches include postoperative dysphagia, postoperative hematoma, and recurrent laryngeal nerve palsy. Dural leak and esophageal perforation are additional less common, but clinically important complications related to the anterior cervical approach.⁹ Although postoperative dysphagia is common, imaging of the neck is often normal unless there is clear evidence of hardware failure or malpositioning that results in impingement on the esophagus and adjacent soft tissues (**Fig. 1**). A barium esophagram may show luminal narrowing during dynamic visualization of swallowing or delayed transit.¹¹

Injury to the vertebral artery, estimated to occur in 0.25% of anterior cervical discectomies, may occur following removal of bone too far laterally or lateral placement of hardware.^{12–14} The location of cervical hardware is best evaluated on CT. If vertebral artery injury is suspected intraoperatively or the patient presents with new neurologic deficits, initial evaluation with CT angiography will allow direct evaluation of hardware positioning and evaluation for potential vascular injury. There may be localized irregularity with or without narrowing, or demonstration of a dissection flap. Long tapered narrowing or occlusion is highly suggestive of dissection. Alternatively, vascular imaging may show focal pseudoaneurysm or active contrast extravasation.

Posterior cervical approach

A posterior approach to the cervical spine allows direct access to the posterior elements and the potential for wide exposure. A laminotomy, laminectomy, or laminoplasty can be performed to treat multilevel degenerative spondylosis, soft disc herniation, and ossification of the posterior longitudinal ligament.

The major complications associated with the posterior cervical approach include new transient or permanent cervical radiculopathy, vertebral artery injury, and progressive postlaminectomy kyphosis.

The placement of posterior fusion hardware in the cervical spine differs from that in the thoracic and lumbar spine. The pedicles in the cervical

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