Video Contents

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Section 5: Special Considerations

• **Fig. 1.3** **A–C**. Adjacent level disease: Patient with midlumbar backache (prior L3-4 direct lateral fusion with plate, backed with pedicle screws) and new preoperative computed tomography (CT) scan showing a retropulsed and migrated prior L2-3 interbody cage. **D–F**. Postoperative CT scan showing replacement of a larger graft at L2-3 level via direct lateral approach, with pedicle screws with dramatic relief of symptoms. (Courtesy Jonathan Pace, MD, Department of Neurosurgery, Case Western Reserve University, Cleveland, Ohio, and David J. Hart, MD, Department of Neurosurgery, Wake Forest University Baptist Medical Center, Winston-Salem, North Carolina.)

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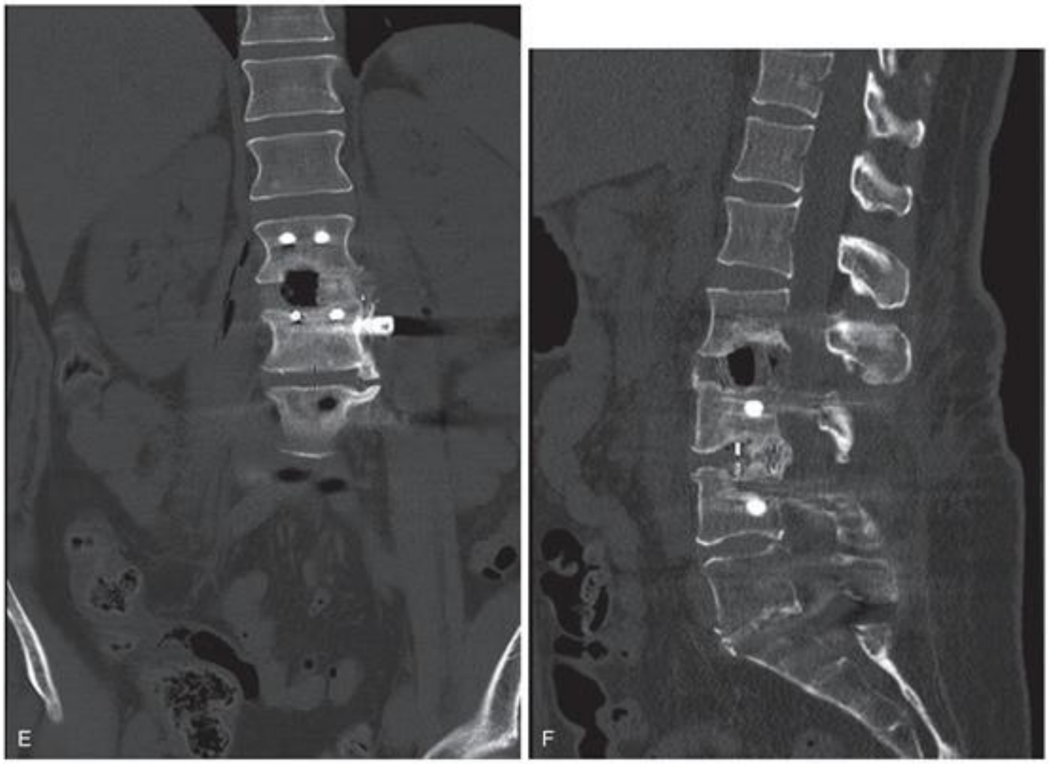


• **Fig. 1.3, cont'd**

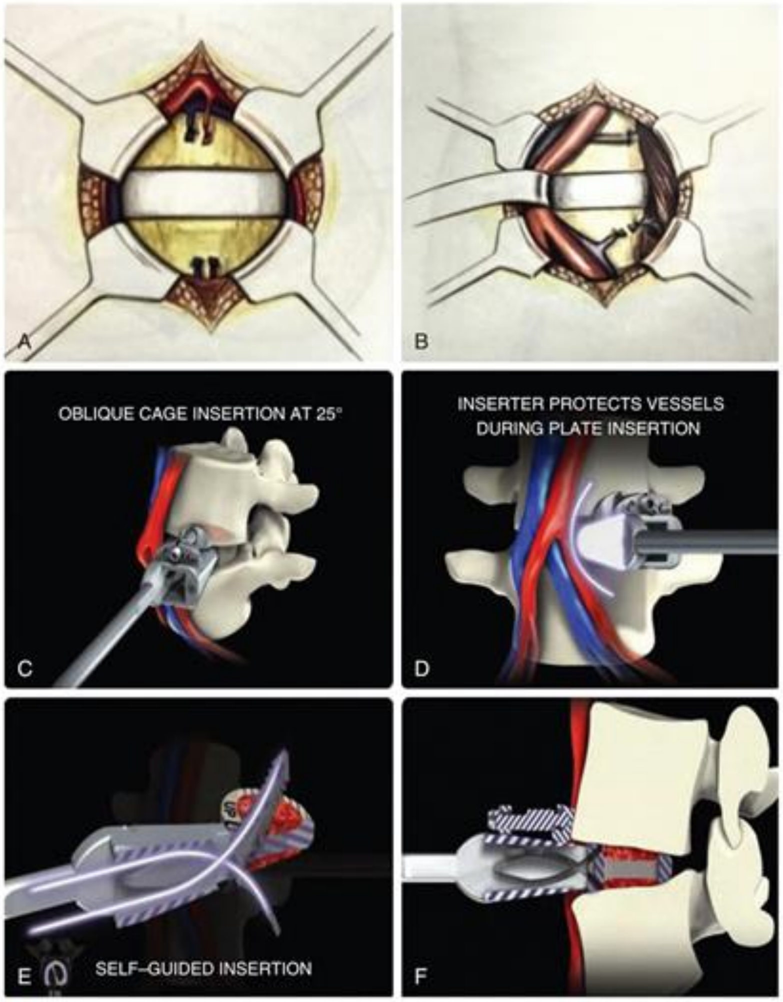
Complications Following Lumbar Interbody Fusion Surgery

Acute and delayed complications of any spinal surgery may be associated with LIFs as well. The most devastating complication, of course, is death, and mortality rates following spine surgery have been reported to be between 0.15% and 0.29%.[38,39] Surgical site infections may be superficial or deep, and may necessitate prolonged antibiotic therapy or even the removal of implants.[40] Discitis following surgery is a debilitating, but fortunately rare, complication.[41] Incidental dural tears during surgery may result in postoperative cerebrospinal fluid leak and meningitis and may result in symptomatic adhesive arachnoiditis. A rare, but often irreversible complication is loss of vision owing to compression of the orbits while the patient is positioned prone for lumbar spine surgery.[42]

Neurologic injury may range from injury to the nerve roots to a complete cauda equina syndrome (0.38%).[43] This syndrome could result owing to an injury from a misplaced screw (out of the pedicle), neuropraxia from excessive manipulation during reduction of the spondylolisthesis, or even from direct injury to the neural structures. Postoperative epidural hematoma compressing on the cauda equina or conus medullaris also needs to be ruled out, especially when the neurologic deficit is rapidly worsening in the acute postoperative period. In most cases, a finding of postoperative deficits would mandate an emergent computed tomography scan to rule out hardware failure, malposition, fracture, or migration—treatable causes.[44] Computed tomography or magnetic resonance imaging could be used to assess surgical site hematoma, cerebrospinal fluid leak, and pressure on neural structures. The complications specific to each LIF technique are extensively described in Chapter 2.

Deep vein thrombosis has been reported to occur in as many as 15% to 17% of patients undergoing spine surgery, although the incidence of symptomatic deep venous thromboembolism is much lower. The use of chemoprophylaxis is still controversial owing to the incidence of postoperative epidural hematoma which may cause neurologic deficits. Judicious use of mechanical prophylaxis and early mobilization of patients at high risk may help to mitigate the incidence of symptomatic deep venous thromboembolism. Low-molecular-weight heparin has also been used for the first week in some studies.[45,46]

Ekman et al.[47] followed 111 patients who were randomized to exercise, surgery without fusion, or surgery with spinal instrumentation for a mean of 12.6 years.[47] They found that adjacent segment disk disease was higher in patients with spinal instrumentation, and that it was highest in patients who had laminectomy and spinal stabilization. Semirigid or dynamic stabilization has been attempted to reduce the incidence of this complication, but the results are not yet convincing.[48]

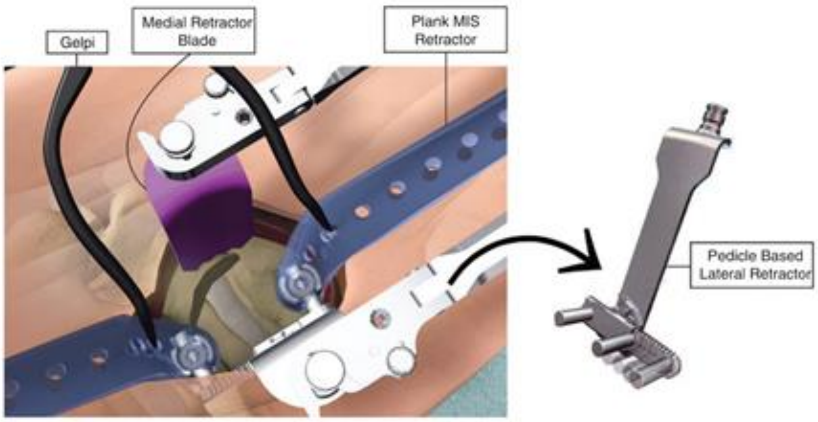


• **Fig. 1.4** **A and B**. Vessel retraction during anterior retroperitoneal exposure at L5-S1 and L4-5 levels, respectively. **C**. An oblique cage insertion at 25 degrees obviating vessel retraction and ligation-sectioning of its branches. **D**. Use of inserter protecting the large vessels. **E and F**. Anchoring blades with directional serrations to prevent graft back-outs, compared to conventional straight screws. (Figures C–F Courtesy Zimmer Biomet, Warsaw, Indiana, USA.)

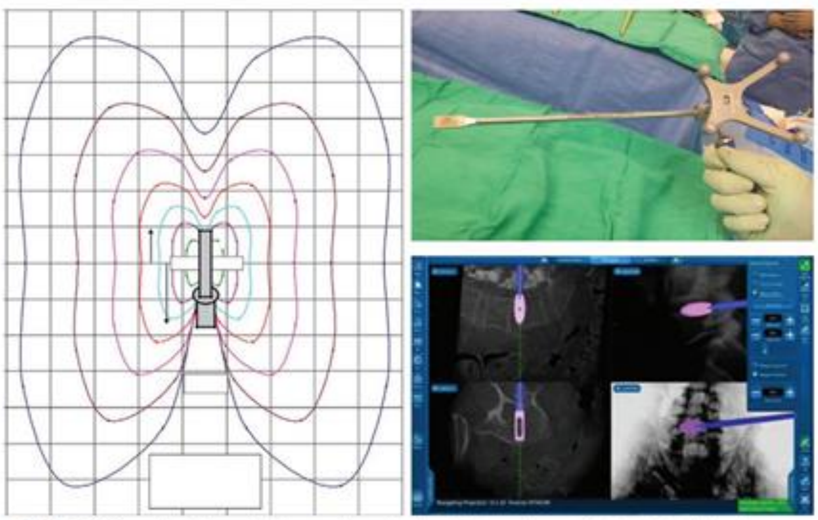
Techniques and Technologies in Lumbar Interbody Fusion Surgery

This textbook provides an overview of the novel technologies and techniques involved in modern LIF surgeries. Fig. 1.4 clearly represents the vessel-mobilization strategies at various disk levels during an anterior lumbar interbody exposure and the new oblique-modification technique synergized with appropriate nuances in technology. This is a perfect example of synergistic improvisation in both anatomy-based technique and technology, which also accommodates the straight transpedicular screws easily. Likewise, Fig. 1.5 describes the mini-open modification of TLIF using a "pedicle-based" lateral retractor system, providing an extended lateral view of the disk space, causing lesser muscular and vascular interruption, and also preventing muscle creep from intraoperative shifting of retractor assembly. This technique provides a better visualization of Kambin's triangle during TLIF, providing wider lateral working space and hence safe and easy placement of interbody graft.

Neuronavigation and robotics have emerged as the latest additions to the armamentarium. Fig. 1.6 illustrates intraoperative navigation using interbody graft registration with intraoperative images using O-arm images transferred to a Stealth system. Both two-dimensional and three-dimensional image acquisitions are



• **Fig. 1.5** Lateral retractor-distractor blade based on pedicle to expose the Kambin's triangle. This lateral retractor, along with a Gelpi self-retaining ratcheted finger-ring retractor, can facilitate extreme lateral dissection by providing a fixed "extreme lateral" point preventing vascular disruption and muscle shifting caused by migration of the retractor assembly. (Courtesy K2M, Inc., Leesburg, Virginia.)



• **Fig. 1.6** O-arm technology for intraoperative spinal navigation and use in lumbar interbody fusion surgery. Note the radiation dose curves around the surgical table. (Images Provided by Medtronic Inc. Incorporates technology developed by Gary K. Michelson, MD.)

possible with surgical personnel situated at least 15 feet away from the patient during image acquisition, minimizing the radiation load for the surgeon and the operating room team. Similarly, there have been many recent FDA–approved devices in spinal robotics marketed for transpedicular access, including MedTech's ROSA and Mazor X, a third-generation robotic system following the original Spine Assist in 2004 and Renaissance system in 2011. However, there is paucity of literature elucidating the efficacy and superiority of using robotic technology in lumbar interbody graft insertion.

Conclusions

Although a century has passed since the first attempt at fusion of the lumbar spine, the relative and absolute indications and contraindications are still a matter of debate. Whereas there is a broad consensus that patients with unstable spondylolisthesis and symptomatic disease need surgical fixation, other scenarios are not so clear-cut as in the presence of associated synovial cysts at that level suggesting mobility. Most surgeons would agree that the following patients would merit surgery for spinal stabilization: