Minimally Invasive Lateral Transpsoas Approach to the Lumbar Spine

Pitfalls and Complication Avoidance

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KEYWORDS

• Lateral transpsoas approach • Direct lateral interbody fusion • Extreme lateral interbody fusion • Lumbar spine • Lumbosacral plexus • Surgical complications • Surgical technique

KEY POINTS

- The lateral transpsoas approach to the lumbar spine employs a true lateral position to laterally approach the midposition of the treatment disc through the psoas major muscle using fluoroscopy and tube dilators.
- The advantages to this approach include smaller incisions, less tissue dissection and blood loss, shorter operative time and hospital stay, and reduced postoperative pain.
- The main disadvantage is the fact that common fusion levels, particularly L4-5 and L5-S1, are often inaccessible.
- This approach carries a unique set of complications. The most significant of these can be divided into approach-related (eg, lumbar plexus injury, genitofemoral nerve trauma, psoas weakness, retroperitoneal hematoma, posterior abdominal wall hernias) and instrumentation-related (eg, graft subsidence, vertebral body fracture, pseudoarthrosis).

INTRODUCTION: NATURE OF THE PROBLEM

The minimally invasive lateral transpsoas approach to the lumbar spine, also known as extreme lateral interbody fusion (XLIF) or direct lateral interbody fusion (DLIF), has become an increasingly popular approach for achieving interbody fusion over the past decade.[1] This approach differs from other interbody fusion techniques in many ways. Instead of the prone or supine position, the lateral transpsoas technique employs a lateral decubitus position. The approach then utilizes a retroperitoneal dissection followed by splitting of the psoas muscle to gain access to the lateral aspect of the spine.

Reported advantages of this technique include a smaller incision and less blood loss compared with open procedures, leading to decreased operative times and shorter hospital stays as well as less postoperative pain.[2] Because the procedure utilizes a lateral (rather than anterior) retroperitoneal corridor, it also offers less risk of injury to peritoneal contents and the hypogastric sympathetic plexus when compared with more anterior minimally invasive approaches. Furthermore, the XLIF/DLIF technique has been shown to

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significantly improve regional, segmental, and global coronal balance in patients with degenerative lumbar disease and has been proven to be a feasible technique for achieving fusion in adult degenerative scoliosis.[3,4] In an in vitro setting, the direct lateral approach has been proven to be biomechanically equivalent to the anterior approach.[4]

Despite these advantages, the DLIF/XLIF technique carries a unique set of complications with the potential for significant neurologic morbidity. Because the technique differs from the others, mainly in its lateral transpsoas approach to the spine, the most significant complications of the technique are approach-related.[2,5] Hardware- and instrumentation-related complications are also possible (as with any interbody fusion technique), and these will also be discussed in this article.

THERAPEUTIC OPTIONS AND SURGICAL TECHNIQUE

The lateral transpsoas procedure differs from anterior lumbar interbody fusion (ALIF), posterior lumbar interbody fusion (PLIF), and transforaminal lumbar interbody fusion (TLIF) in several important aspects (**Table 1**).[3,6–14]

While ALIF utilizes supine positioning with an anterior abdominal approach and PLIF, and TLIF uses prone positioning with posterior approaches, DLIF/XLIF is unique in that lateral decubitus positioning is used for a true lateral retroperitoneal approach to the spine. Neurologic monitoring, especially electromyography (EMG), is then employed via placement of electrodes that correspond to the L2-L5 myotomes with stimulation to confirm adequate twitch strength. This allows for accurate reproducible EMG recordings, which are mandatory throughout the DLIF/XLIF procedure, because the psoas muscle-splitting approach exposes the lumbar plexus to potential injury.[15–17]

After positioning and initiation of neurologic monitoring, a lateral radiograph is obtained to confirm a truly lateral position and to center the planned incision over the treatment level. An incision is made on the lateral aspect of the abdomen directly over the spine, and blunt dissection is used to identify a retroperitoneal corridor to the

Table 1
Comparison of surgical approaches for lumbar interbody fusion

	ALIF	PLIF	TLIF	DLIF/XLIF
Access	Open or laparoscopic	Open or minimally invasive	Open or minimally invasive	Minimally invasive
Approach	Anterior abdominal (retroperitoneal or transperitoneal)	Midline posterior incision with laminectomy/ laminotomy and nerve root retraction	Offset posterior incision with access through intervertebral foramen	Lateral retroperitoneal approach to anterior spine with specialized retractors
Advantages	• Avoids paraspinal muscle trauma • Less risk of dural tears and nerve root traction • Direct disc space visualization may allow more complete discectomy and better fusion	• Decompression allows treatment of canal pathology as well as stabilization	• Good visualization of neural elements without significant dural retraction • Provides access to posterior elements as well as disc space	• Anterior psoas dissection may reduce nerve root injury • Less blood loss and postoperative pain by avoiding paraspinal muscle trauma
Drawbacks	• Potential retraction injury to great vessels and/or peritoneal contents • Potential hypogastric plexus injury	• Significant nerve root retraction with risk of injury and dural tears • Significant paraspinal muscle dissection	• Only a partial laminectomy with less canal decompression	• Psoas dissection puts lumbar plexus at risk for injury • Decreased ability to address posterior element pathology