

Non-neurological major complications of extreme lateral and related lumbar interbody fusion techniques

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Abstract

Background: Complications exclusive of new neurological deficits/injuries that follow extreme lateral interbody fusion (XLIF) and related lateral lumbar interbody techniques should be better recognized to determine the safety of these procedures. Unfortunately, a review of the XLIF literature did not accurately reflect the frequency of these “other complications” as few US surgeons publish such adverse events that may lead to medicolegal suits.

Methods: Major complications occurring with XLIF included sympathectomy, major vascular injuries, bowel perforations, sterile seromas, and instrumentation failures.

Results: The frequency of sympathectomy was 4% for XLIF vs. 15% for anterior lumbar interbody fusion (ALIF). There were three major vascular injuries for XLIF; one fatal intraoperative event, one life-threatening retroperitoneal hematoma, and one iatrogenic lumbar artery pseudoaneurysm that was successfully embolized. Two bowel perforations were reported, whereas a third was a “direct communication.” One patient developed a sterile recurrent seroma due to vancomycin powder utilized for an XLIF. One study cited malpositioning of an XLIF cage resulting in a lateral L3–L4 extrusion, whereas the second series looked at the 45% risk of cage-overhang when XLIF devices were placed in the anterior one-third of the vertebral body.

Conclusion: Excluding new neurological deficits, XLIF techniques resulted in multiple other major complications. However, these small numbers likely reflect just the tip of the iceberg (e.g., 10%) and the remaining 90% may never be known as many US-based spine surgeons fail to publish such adverse events as they are “discoverable” in a court of law and may lead to medicolegal suits.

Key Words: Bowel perforation, extreme lateral interbody fusion, lateral cage extrusion, major vessel injury, non-neurological complications, persistent seroma, retroperitoneal hematoma, sympathectomy

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INTRODUCTION

Excluding new neurological deficits, other major complications following extreme lateral interbody fusions (XLIF) and related lateral lumbar interbody techniques should be better recognized to determine the safety of these procedures. The initial list of complications included sympathectomy, major vascular injuries, bowel perforations, seromas, and instrumentation failures. Unfortunately, this

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list does not likely accurately reflect the real frequency of these “other complications” as few US-based surgeons publish their personal/series-based adverse events due to medicolegal exposure (e.g., “discoverable” in a court of law and potentially leading to a suit). Therefore, the list of major XLIF complications likely constitutes just the tip of the iceberg (e.g., 10%), while the remaining 90% is yet to be published, leaving us wonder just how “safe” XLIF are.

EXCLUDING NEW NEUROLOGICAL DEFICITS, COMPLICATIONS OF MINIMALLY INVASIVE EXTREME LATERAL INTERBODY FUSION AND RELATED TECHNIQUES

Risk of sympathectomy with anterior lumbar interbody fusion vs. extreme lateral interbody fusion

Hrabalek *et al.* in 2015 retrospectively analyzed the risk of sympathectomy (utilizing thermography) performing anterior lumbar interbody fusion (ALIF) vs. XLIF procedures between the T12–L5 levels [Table 1].^[4] They found that ALIF correlated with a 15% rate of sympathectomy versus the 4% encountered with XLIF.

Three major vascular injuries attributed to extreme lateral interbody fusion

Three authors cited major vascular injuries attributed to XLIF. Santillan *et al.* in 2010 observed an iatrogenic lumbar artery pseudoaneurysm that followed a L4–L5 XLIF; it was successfully endovascularly embolized.^[8] In 2014, Assina *et al.* noted the advantages of minimally invasive surgery (MIS) XLIF that included “wide access to the lumbar disc space” without using a separate access surgeon, and minimal tissue disruption [Table 1].^[1] However, they reported a 50-year-old female who underwent an L4–L5 XLIF and sustained a fatal major intraoperative vascular injury. Subsequently, Peiro-Garcia *et al.* in 2015 cited the potential pros of a stand-alone XLIF approach to the lumbar spine (e.g., reduced intraoperative/postoperative bleeding/less tissue injury) along with its potential cons (e.g., trauma to segmental arteries and great vessels leading to retroperitoneal haematomas).^[5] Their patient developed hemorrhagic shock (e.g., tachycardia, hypotension, and anemia) due to a retroperitoneal hematoma directly resulting from a major vessel injury occurring during an XLIF.

Rare bowel perforations attributed to extreme lateral interbody fusion

Two studies documented bowel perforations resulting from XLIF procedures, whereas a third case was a personal communication to the author.^[2,9] Tormenti *et al.*, in 2010, examined the complications of 8 XLIF/pedicles screw fusions utilized to treat adult scoliosis, and contrasted these results with 4 other patients

undergoing posterior-only procedures/fusions.^[9] Complications exclusive of new neurological deficits for the 8 patients included one bowel perforation requiring laparotomy/colon resection (later followed by a posterior procedure only), whereas 1 of the 4 patients undergoing posterior surgery required revision of instrumentation. In 2015, Balsano *et al.* wrote that XLIF procedures were developed to avoid/limit the morbidity of ALIF (e.g. especially major vessel/visceral injuries) [Table 1].^[2] However, they presented a 70-year-old male who, following an L3–L4 and L4–L5 transposas XLIF fusion, sustained a bowel injury.

Through a personal communication, the author was also told of a patient who within 12 hours of XLIF surgery was draining feces.

Case of sterile seroma after multilevel extreme lateral interbody fusion due to vancomycin powder

Youssef *et al.* in 2014 cited a 59-year-old female who developed a recurrent sterile postoperative seroma following the application of 2 g of vancomycin powder to the XLIF wound; 1 g/bone graft/fusion and 1 g placed in the soft tissues [Table 1].^[10] Six weeks later, due to a fall, the patient had a magnetic resonance (MRI) study that showed a surgical sacral fracture and a large epidural L3–L5 fluid collection; the fracture had to be repaired, and the seroma drained. Nevertheless, the fluid collection later required multiple additional aspirations. Notably, there was no clear explanation as to the etiology of this untoward event although one major differential diagnosis was an allergic response to the vancomycin.

Malpositioning of extreme lateral interbody fusion cages: Migration and overhang

Malpositioning and overhang are two technical surgical complications that must be considered when performing XLIF interbody cage procedures.^[3,6] Daffner and Wang in 2010 presented a 49-year-old female who underwent a L3–L4 XLIF cage placement to address a pseudarthrosis resulting from a fusion attempted caudad to an old scoliosis arthrodesis.^[3] When the cage extruded laterally 1 month postoperatively, it was removed/replaced though a mini-open lateral approach and supplemented with a lateral plate (e.g., to additionally address the “significant coronal deformity/lateral listhesis” due to the scoliosis). Furthermore, in 2010, Regev *et al.* noted that MIS XLIF or MIS direct lateral interbody fusion (DLIF) cage overhang (beyond the disc space) could occur if the cage length was solely estimated/based on anteroposterior fluoroscopy.^[6] Using both MR and CT studies, they determined that 45% of cages were placed centrally (vertebral width was widest at 50 ± 4 mm), 34% were placed in the anterior one-third of the disc (vertebral body width was narrowest 41.7 ± 6 mm),

Table 1: Non-neurological complications (COMP) following minimally invasive surgery (MIS) extremelateral lumbar interbody fusion (XLIF)

Author Reference Date	Procedure	Findings	Complications	Complications	Complications
Daffner ^[3] 2010	1 XLIF case study	49-year-old Female L34XLIF	Pseudoarthrosis below prior scoliosis fusion	Major Complications Cage extruded laterally One month postoperatively Replaced cage	Major Complications Cage Extruded laterally; replaced with lateral plate
Regev ^[6] 2010	MIS XLIF and DLIF overhang	AP fluoroscopy insufficient	Required preoperative MR and CT to measure cage length to avoid overhand	MR/CT Vertebral Width: Anterior 1/3 41.7 mm Mid 50 mm Posterior 1/3 49 mm	Major Complications 45% of cages placed anterior 1/3 showed overhand Recommend: Use 15% shorter cage for anterior placement
Santillan ^[8] 2010	1 XLIF case study	Iatrogenic lumbar artery pseudo-aneurysm	Treatment: Successfully embolized	Major Complications 1 iatrogenic lumbar artery pseudoaneurysm	Major Complications Iatrogenic lumbar artery pseudoaneurysm successfully embolized
Tormenti ^[9] 2010	8 XLIF/Pedicle screws	4 Posterior Fusions Only	1 of 8 XLIF/pedicle screw COMP. 1 bowel perforation	1 or 4 Posterior fusions; 1 Revision of instrumentation	Major Complications 1 (12.5%) of 8 XLIF/Pedicle Screw Fusions Bowel Perforation
Rodgers ^[7] 2011	600 MIS XLIF most at 1-2 levels (741 total)	99.2% fused (83.2% with pedicle screws)	No wound infections No vascular injuries No Visceral injuries	Perioperative Complications In hospital 1.5% surgical 2.8% medical	Major Complications Postoperatively Out of hospital 1% surgery 0.8% medical
Youssef ^[10] 2014	1 XLIF Case study Sterile Seroma	Recurrent epidural fluid L3-L5 on MR	Multiple aspirations of sterile epidural fluid collection (Possible allergy)	Patient sustained fall requiring sacral fracture repair	Major Complications Recurrent Postoperative seromas due to powered Vancomycin
Assina ^[1] 2014	1 XLIF Case study	Major vascular injury	Advantages of MIS XLIF: Wide access to disc Minimal tissue disruption	Major Complication 50-year-old fatal intraoperative great vessel injury at L45 disc level	Major Complications 1 Major vascular injury with L4-L5 XLIF-Fatal
Balsano ^[2] 2015	XLIF Single case study	Bowel perforation	Complication of XLIF Fusion	Used XLIF to avoid ALIF vascular and visceral risk of injury	Major Complications Bowel perforation with XLIF
Peiro-Garcia ^[5] 2015	1 XLIF Case study	Pros MIS surgery: Less tissue injury Reduced LOS	Cons Injury to major vessels	Specific Case Study: Hemorrhagic Shock Tachycardia Hypotension Anemia	Major Complications Tachycardia, hypotension, anemia due to XLIF
Hrabalek ^[4] 2015	28 ALIF vs. XLIF Thoracic T12-L5 levels	Risks of sympathectomy 15% ALIF 4% XLIF	Higher 15% sympathectomy with ALIF T12-L5	Lower rate 4% sympathectomy with XLIF T12-L5	Major Complications Sympathectomy 15%ALIF vs. 4%XLIF

ALIF: Anterior Lumbar Interbody Fusion, CT: Computed Tomography, DLIF: Direct Lumbar Interbody Fusion, MIS: Minimally Invasive Surgery, MR: Magnetic Resonance Imaging, XLIF: Extreme Lateral Lumbar Interbody Fusion, COMP: Complications, LOS: Length of Stay

whereas 7% were placed in the posterior one-third of the disc space (width 49 ± 1 mm). For those placed in the anterior one-third of the disc space, 45% demonstrated overhang that could potentially compromise the

contralateral neural foramen in addition to other structures. They, therefore, recommended that surgeons consider shortening cages by 15% if they plan anterior placement.

Medical vs. surgical complications of extreme lateral interbody fusion

Rodgers *et al.* in 2011 evaluated intraoperative/postoperative complications of 600 predominantly 1–2 level MIS XLIF (741 levels) that included a 99.2% instrumentation rate (83.2% pedicle screws).^[7] Perioperative complications (up to 6 postoperative weeks) occurred in 6.2% of patients; in the hospital, these included 9 (1.5%) surgical and 17 (2.8%) medical events; out of the hospital 6 (1.0%) were surgery-related, whereas 5 (0.8%) consisted of medical events. They reported no wound infections, vascular injuries, or intraoperative visceral injuries, but 11 (1.8%) patients required additional surgery. Notably, this study demonstrated that MIS XLIF are not without their medical risks as 3.6% of patients had significant medical complications within 6 postoperative weeks. Furthermore, the surgical reported risks of just 2.3% within this short 6-week postoperative interval probably missed some of the 6-week postoperative complications (note: the series involved 600 cases and data analysis may not always be performed by experts), along with the even more critical 3, 6, and 12-month postoperative adverse events.

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Conflicts of interest

There are no conflicts of interest.

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