

Complications of Lateral Lumbar Interbody Fusion (XLIF). Narrative Literature Review

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ABSTRACT

Introduction: The lateral approach for lumbar interbody fusion has been described for the treatment of diverse pathologies. Although it is a safe procedure, its popularity has led to an increase in reports of complications associated with it. The objective of this work is to conduct a narrative review of the literature on the most frequently reported complications associated with this surgical approach. **Materials and Methods:** We performed a narrative review of the literature based on the publications obtained from the following databases: PubMed.gov, Web of Science, Scopus and Lilacs to identify published articles that detail complications related to the lateral approach to the lumbar spine. **Results:** After analyzing the results of the bibliographic search, 18 articles were selected to carry out this review. **Conclusions:** The most frequent complications directly related to this approach are thigh pain and motor deficit for hip flexion and/or leg extension, which are mostly temporary and reversible. Severe or fatal vascular injuries have rarely been reported.

Keywords: Lateral lumbar arthrodesis; spine surgery; complications; XLIF; LLIF; lateral approach to the lumbar spine.

Level of Evidence: III

Complicaciones asociadas a la artrodesis intersomática lumbar por vía lateral. Revisión narrativa de la bibliografía

RESUMEN

Introducción: El abordaje lateral de la columna lumbar en la artrodesis intersomática está descrito para tratar varias enfermedades. Si bien es un procedimiento seguro, a medida que la técnica ha ganado popularidad, se han publicado diversas complicaciones asociadas. El objetivo de este artículo es presentar una revisión narrativa de la bibliografía para proveer al lector de un resumen organizado de las complicaciones comunicadas más frecuentes relacionadas con esta técnica. **Materiales y Métodos:** Se llevó a cabo una revisión narrativa de la bibliografía obtenida en las bases de datos PubMed, Web of Science, Scopus y Lilacs para identificar artículos que detallen complicaciones relacionadas con el abordaje lateral de la columna lumbar. **Resultados:** Luego del análisis de los resultados de la búsqueda bibliográfica, se seleccionaron 18 artículos para esta revisión. **Conclusiones:** Las complicaciones más frecuentes directamente relacionadas con este abordaje son la cruralgia y el déficit motor para la flexión de la cadera o la extensión de la pierna que, en su gran mayoría, son transitorias y reversibles. Hay escasos reportes de lesiones vasculares severas o fatales.

Palabras clave: Artrodesis lateral; cirugía de columna; complicaciones; XLIF; LLIF; abordaje lateral de columna lumbar.

Nivel de Evidencia: III

INTRODUCTION

The lateral approach to the lumbar spine for interbody fusion, commonly referred to as XLIF (extreme lateral interbody fusion) or LLIF (lateral lumbar interbody fusion), is a technique that emerged about 15 years ago and, according to most published series, the results are promising. It has been used to treat a variety of conditions, including degenerative, traumatic, oncological, and infectious.¹ It is a safe technique that provides adequate struc-

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How to cite this article: Pereira Duarte M. Complications of Lateral Lumbar Interbody Fusion (XLIF). Narrative Literature Review. *Rev Asoc Argent Ortop Traumatol* 2024;89(1):76-82. <https://doi.org/10.15417/issn.1852-7434.2024.89.1.1861>

tural support between the vertebral endplates, providing a larger contact surface for solid fusion, and allows the correction of deformities in the coronal and sagittal planes, as well as the indirect decompression of the spinal canal and foramina while sparing the posterior elements.²

Both the conventional lateral approach and minimally invasive approaches are promoted as techniques that have been successful in reducing vascular and visceral injury rates when compared to ALIF (anterior lumbar interbody fusion) while avoiding the trauma to the musculature, innervation, and paraspinal vasculature caused by posterior interbody fusion techniques such as TLIF (transforaminal lumbar interbody fusion) and PLIF (posterior lumbar interbody fusion). Potential benefits include smaller incisions, less blood loss, shorter surgical times, restoration of disc space height, reduced infection rates, shorter hospital stays, increased fusion rates, decreased subsidence rates, less postoperative pain, and lower reoperation rates.²

However, as this method and its variations have grown in popularity, associated complications have begun to be reported worldwide.

The objective of this article is to present a narrative review of the literature to provide the reader with an organized summary of the most frequently reported complications and to provide tools to avoid them.

MATERIALS AND METHODS

A narrative review of the literature obtained from the analysis of the following databases was carried out: PubMed, Web of Science, Scopus and Lilacs, to identify articles detailing complications related to the lateral approach to the lumbar spine.

The following combined search terms were used: “(lateral lumbar interbody fusion OR extreme lateral lumbar interbody fusion OR XLIF OR LLIF) AND (complic* OR complication OR adverse event)”.

The titles of the studies found in the databases were compared. Duplicate records were removed and the remaining articles were screened for inclusion according to title and abstract. In addition, the references of the included articles were reviewed to ensure that no relevant citations were missed. The author of this article conducted the eligibility assessments independently and in a standardized manner.

The selection criteria were as follows:

- Articles published in English or Spanish
- Articles published in a peer-reviewed scientific journal
- Prospective or retrospective, randomized or non-clinical trials
- Case-control or cohort studies (prospective or retrospective)
- Articles published in the last 20 years
- Articles that included a description and detail of the complications directly related to the lateral approach to the lumbar spine.

The exclusion criteria were:

- Other reviews, case reports, letters to the editor, animal studies, book chapters and commentaries
- Articles reporting no complications in the results
- Articles including approaches other than the lateral approach to the lumbar spine
- Articles in languages other than English and Spanish

RESULTS

A total of 1044 articles were identified in the four databases. After initial screening, application of inclusion and exclusion criteria, and elimination of duplicates, 18 studies were included and comprehensively evaluated.³⁻²⁰

DISCUSSION

In their first publication on this procedure in 2006, Ozgur et al.¹ reported no complications in the first 13 patients treated. However, they began to appear as the procedure gained popularity.

The most frequent complications after a lateral approach to the lumbar spine are anterior thigh pain or dysesthesia. Its etiopathogenesis involves irritation of the psoas muscle or neuropraxia of the genitofemoral nerve (branch of the lumbar plexus) during blunt dissection of this muscle, either due to retractor pressure, indirect ischemia or postoperative hematoma.^{1,3-5,21-25} The rate of this complication ranges from 23%⁶ to 39%⁷. However, Rodgers et al.³ described a much wider range, from 0.7% to 62.7%. Most of the injuries occur when the psoas is split with the dilators or the retractor²⁶ and it has been shown that the time spent in the open position has a direct relationship with the rate of postoperative neurological injury.^{3,8-10,27} The L4-L5 level is the most likely to suffer this injury, since, in approximately 44% of cases, nerve structures cross at the level of the theoretically ideal surgical field (Figure 1).²³ Pumberger et al.⁸ evaluated 181 patients, and 38% of them presented with anterior thigh pain six weeks after surgery. However, this percentage gradually decreased to 11% at 12 weeks and 1% at 26 weeks. Other authors reported spontaneous recovery from this complication in 50% of the cases after three months and 90% after one year.²⁸

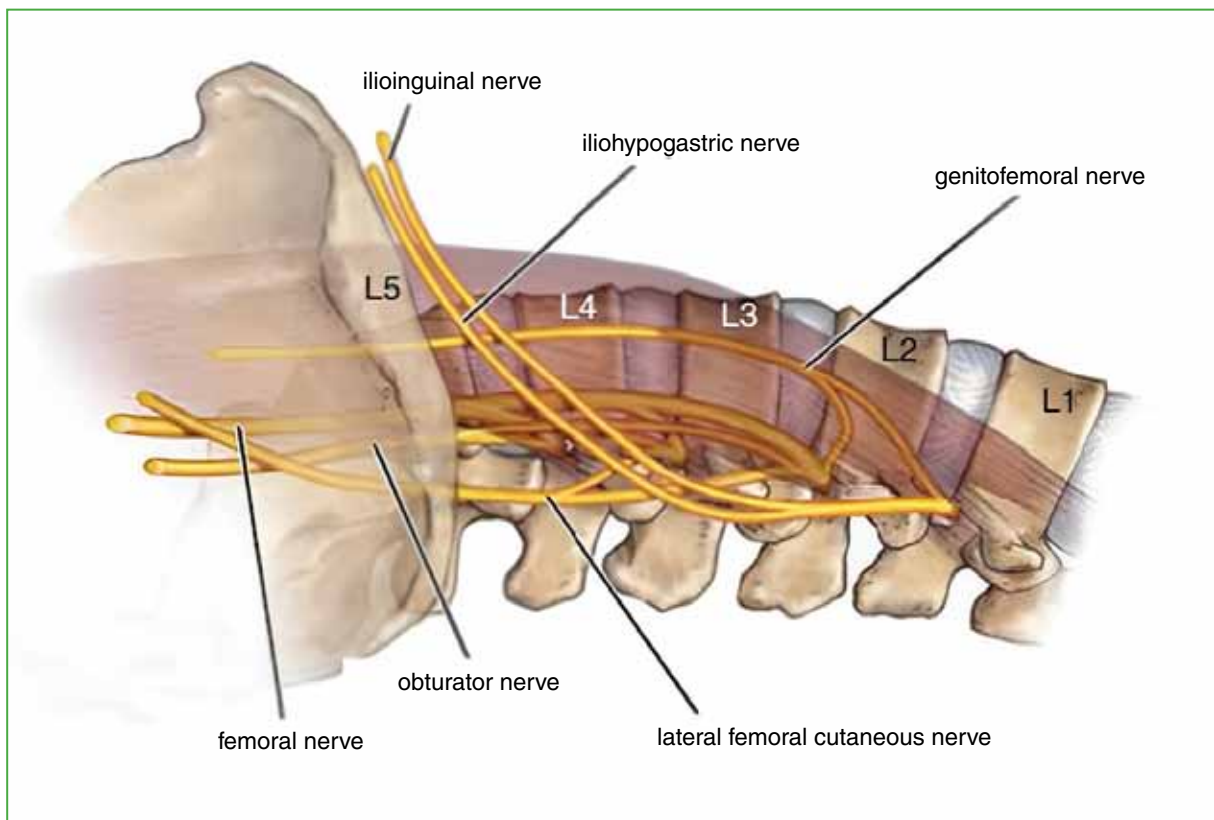


Figure 1. Diagram showing the usual location of the roots that constitute the lumbar plexus and their relationship with the spine and the psoas muscle.

The second most frequent complication is the deficit in muscle strength for hip flexion, the rate of which varies from 1% to 36%.^{6,9,24,29,30} In these cases, Pawar et al.³¹ referred to a mechanical deficit due to direct injury to the psoas muscle and a neurological deficit due to irritation or injury to the intramuscular nerve plexus. According to these authors, the rate of mechanical deficit in hip flexion was 13.1% (n = 32) at 6 weeks, and decreased to 3.7% (n = 9) at 12 weeks; 2.9% at 6 months; and 1.6% at 12 months. Meanwhile, the motor deficit related to the lumbar plexus was lower, 4.9% (n = 12), 4.9% (n = 12), 2.9% (n = 7), and 2.9% (n = 7), respectively. Female sex and dura-

tion of surgery were independent risk factors for mechanical flexor deficit, while duration of surgery was the only independent risk factor for motor deficit related to lumbar plexus involvement. This variable is directly related to the time the gap remains open and the dilation as described above.

Sympathetic deafferentation is a neurological complication as well, with a frequency of 4% to 12%,¹⁹ and is due to an injury to the lateral sympathetic trunk. Typically, patients report a slight increase in size and temperature in a limb that is ipsilateral to the injury, with more perspiration than in the contralateral limb. Nonetheless, the authors' clinical experience demonstrates that the coldness of the contralateral limb in comparison to the affected limb is what strikes the patient or evaluator the most.

The most feared complications during this procedure are major vascular injuries, which are extremely rare (0.4%)¹⁹ or very rarely reported, but the consequences can be devastating, such as death.¹⁷ There is a risk of injury to the venous component during right approaches,¹⁸ while arterial injury is more likely in left approaches. Small vessel injuries are also included within vascular injuries. In a series of 181 patients, Pumberger et al.⁸ reported one injury to the segmental lumbar artery (0.5%) and two (1%) injuries to the ascending iliolumbar vein.

Implant subsidence is the migration of the implant from its original location in any direction. This complication has a rate of 10-14%^{19,21} and may or may not be associated with vertebral endplate fracture (Figure 2).^{12-14,25} According to Essig et al.,¹⁵ advanced age, osteoporosis and a sagittal orientation of the facets are risk factors for implant subsidence when this technique is used in isolation or *stand alone*. These authors suggest complementary posterior support when these conditions exist. Anterior implant subsidence is related to an unnoticed tear of the anterior longitudinal ligament during a very anterior discectomy or due to untimely dilatation of the disc space, as well as in ACR (anterior column realignment) procedures³² with the use of hyperlordotic cages without self-retaining devices.

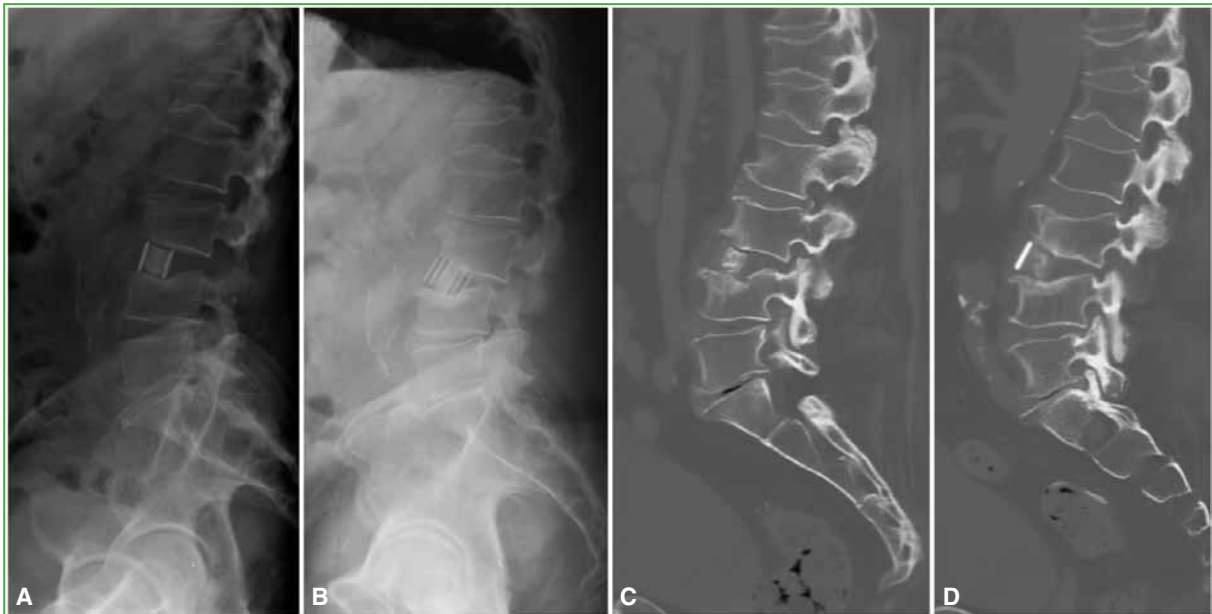


Figure 2. A. Immediate postoperative lumbosacral spine radiograph of a stand-alone L3-L4 interbody fusion by lateral approach. B. Radiographic control 15 days after surgery. Mobilization and rotation of the implant associated with subsidence of the superior vertebral endplate of L4 and inferior vertebral endplate of L3. C and D. Computed tomography of the lumbosacral spine, parasagittal slices, 15 days after surgery of the same patient. The above findings are observed. These studies show what is called implant subsidence.

Pseudarthrosis or consolidation failure is a late complication of the technique, but not so much of the approach. The rate varies between approximately 7.5%¹⁹ and 19%³⁰. This depends on the number of fused levels, the complementary posterior fixation, the thoroughness of the discectomy and the preparation of the endplates, as well as the patient's comorbidities (smoking, vascular disease, diabetes), among many other variables.

The surgical site infection rate is low compared to that of conventional posterior approaches to the lumbar spine (about 1-3%).^{3,20,33} In addition, the vast majority of reported cases have been superficial wound infections.³

Among the specific complications of this approach, abdominal wall hernias due to denervation have been described very infrequently. Dakwar et al.¹¹ reported an asymmetry in the abdominal wall due to protrusion of the contents, related to the denervation of the internal oblique and transversus abdominis muscles due to injuries to the ilioinguinal and iliohypogastric nerve branches. Likewise, the subcostal nerve that emerges from T12 innervates the rectus femoris and external oblique muscles, so it must be identified and protected.³⁴ According to the available evidence, if this complication arises, the patient's discomfort will be more aesthetic than functional due to the asymmetry.

Other published perioperative complications of this technique are: postoperative ileus, intestinal perforations, arrhythmias, respiratory failure, gastric ulcer, acute urinary retention, and seromas or delayed wound healing. All with a rate of less than 1%.^{19,21}

In 2019, Walker et al.³³ published a meta-analysis of complications of the lateral approach to the lumbar spine using prepsoas (1874 patients) and transpsoas (4607 patients) approaches. To the detriment of the prepsoas approach, they detected a higher incidence of sympathetic nerve lesions (5.4% prepsoas vs. 0% transpsoas) and more major neurovascular lesions (1.8% prepsoas vs. 0.4% transpsoas). Conversely, to the detriment of the transpsoas approach, they reported higher rates of temporary sensory deficits (21.7% vs. 8.7%), hip flexor weakness (19.7% vs. 5.7%) and infection (3.1% vs. 1.1%). Notably, the rates of urological, peritoneal and intestinal injuries, postoperative ileus, hematomas, subsidence (12.2% prepsoas vs. 13.8% transpsoas) and nonunion (9.9% prepsoas vs. 7.5% transpsoas) were similar in both groups.

It should be noted that, according to the available evidence, complication rates and severity have not been modified by obesity.¹⁶ Therefore, obesity does not predispose to a higher complication rate, unlike in conventional posterior approaches.

CONCLUSIONS

The most frequent complications directly related to the lateral approach to the lumbar spine are anterior thigh pain and motor deficits for hip flexion and leg extension, most of which are transient and reversible in the first six months. The prevalence of the rest of the complications varies according to the literature consulted, and reports of catastrophic vascular lesions are rare.

It should be noted that this approach requires careful and detailed imaging planning for each individual patient, along with knowledge of the anatomy and technique.

Conflict of interest: The author declares no conflicts of interest.

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