



Oblique Lumbar Interbody Fusion: Technical Aspects, Operative Outcomes, and Complications

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■ **OBJECTIVE:** Anterior lumbar interbody fusion (ALIF) and lateral lumbar interbody fusion (LLIF) are commonly used approaches for lumbar spine fusion surgery, each with their own unique advantages and disadvantages. ALIF requires mobilization of the great vessels and peritoneum, and dissection of the psoas muscle in the LLIF technique is associated with postoperative neurologic complications in the proximal lower limb. The anterior-to-psoas (ATP) or oblique lumbar interbody fusion (OLIF) technique is the proposed solution to accessing the L1-L5 levels without the issues encountered with ALIF and LLIF. In this review, the technical nuances, operative outcomes, and complications with the ATP/OLIF technique in the current literature are summarized.

■ **METHODS:** A systematic search of the literature was performed according to PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. Data collected included operative time, blood loss, postoperative hospital stay, and complications, which were then pooled together.

■ **RESULTS:** From the 16 studies selected, the mean blood loss was 109.9 mL, average operating time was 95.2 minutes, and mean postoperative hospital stay was 6.3 days. Fusion was achieved in 93% of levels operated. Incidence of intraoperative and postoperative complications was 1.5% and 9.9%, respectively. Transient thigh pain and/or numbness and hip flexion weakness occurred in 3.0% and 1.2% of patients, respectively.

■ **CONCLUSIONS:** Early results on the ATP/OLIF technique are promising and warrant further investigation with

well-designed prospective randomized studies to provide high-level evidence of the potential advantages over the ALIF and LLIF approaches.

INTRODUCTION

Lumbar interbody fusion (LIF) is an effective procedure for management of various spinal diseases including lumbar degenerative disease, spinal deformities, trauma, infections, and neoplasms.^{1,2} There are many approaches to performing LIF, each with their own unique profile of advantages and disadvantages. Anterior lumbar interbody fusion (ALIF) and lateral lumbar interbody fusion (LLIF/XLIF) are 2 commonly used approaches. ALIF provides excellent visualization and access to the disc space but is associated with comparatively higher rates of approach-related complications, including injury to the major retroperitoneal vessels, neurological structures, the peritoneum and its contents.²⁻⁵ The LLIF technique aims to circumvent these disadvantages but dissection of the psoas muscle introduces unique postoperative proximal lower limb neurologic deficits.⁶⁻⁸ The anterior-to-psoas (ATP) or oblique lumbar interbody fusion (OLIF) is the proposed solution to the approach-related disadvantages of ALIF and LLIF by using the anatomic space between the aorta/inferior vena cava (IVC) and psoas muscle to access the disc space.^{2,4,9,10}

The objective of this review is to summarize the technical experiences reported in the literature with the OLIF technique, to determine the operative outcomes achieved thus far and the complications profile in an attempt to elucidate the direction of future research.

Key words

- Anterior-to-psoas
- Lumbar interbody fusion
- Oblique lumbar interbody fusion

Abbreviations and Acronyms

- ALIF:** Anterior lumbar interbody fusion
- ATP:** Anterior-to-psoas
- IVC:** Inferior vena cava
- LIF:** Lumbar interbody fusion
- LLIF/XLIF:** Lateral lumbar interbody fusion
- OLIF:** Oblique lumbar interbody fusion

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METHODS

A systematic search of the literature was performed according to PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines.¹¹⁻¹³ Six electronic databases were accessed: Ovid Medline, PubMed, Cochrane Central Register of Controlled Trials, Cochrane Database of Systematic Reviews, ACP Journal Club, and Database of Abstracts of Review of Effectiveness. Search terms included MeSH terms and keywords such as “oblique lumbar interbody fusion,” “OLIF,” and “anterior to psoas,” combined with appropriate Boolean connectors. Bibliographies of retrieved articles were also searched for relevant references.

Clinical studies, case series, and reports detailing operating times, blood loss, hospital stay, fusion rates, and complications pertaining to the OLIF/ATP technique performed at lumbar disc levels between L1 and L5 were included. Excluded were studies in which OLIF/ATP was performed only at the L5/S1 disc level. The studies selected were appraised for their level of evidence according to the National Health and Medical Research Council guidelines.¹⁴

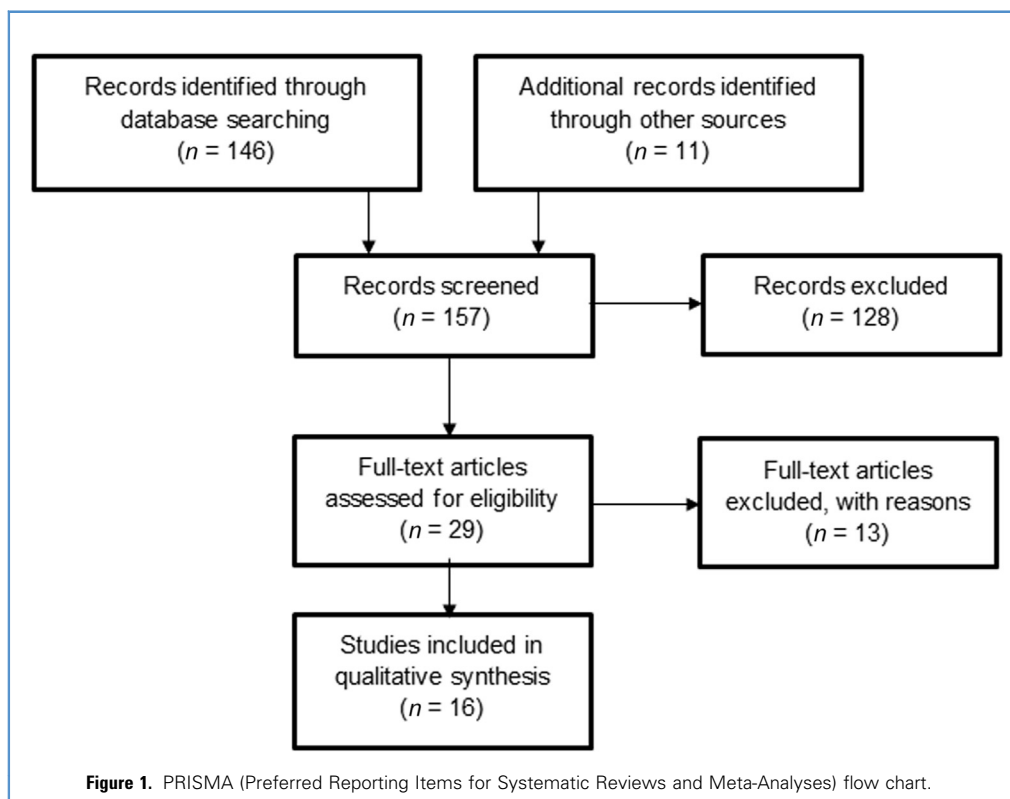
RESULTS

A total of 157 studies were identified using the described methodology. A title and abstract screen excluded 128 duplicate or irrelevant studies, leaving 29 articles for review of the full text. After a detailed screen of the full text, 16 articles were selected for appraisal and inclusion in this review.^{4,15-29} The selection process

is summarized in **Figure 1** and the characteristics of the selected clinical studies are presented in **Table 1**. Of the selected articles, 14 were case series, and 2 were case reports.

From the selected studies, OLIF surgery was performed on 2364 lumbar levels from L1-L5 in a combined sample of 1571 patients with degenerative lumbar spine disease. The mean follow-up was 22.3 months. Patient demographics and operation details are summarized in **Table 2**. The average operating time was 95.2 minutes (**Figure 2A**), mean blood loss was 109.9 mL (**Figure 2B**), and average postoperative length of stay in hospital was 6.3 days (**Figure 2C**). Fusion was achieved in 93% of all levels operated on (**Figure 2D**).

Excluding studies that did not report complications, the incidence of intraoperative and postoperative complications from a pooled sample size of 1453 patients was 1.5% and 9.9%, respectively (**Table 3**). Major vessel injury (0.9%) was the most common intraoperative complication. Other intraoperative complications included peritoneal injury ($n = 1$), dural tear ($n = 5$), and transient motor electrophysiology deficits ($n = 3$). Postoperatively, transient thigh pain and/or numbness occurred in 3.0% of patients, and transient thigh flexion weakness occurred in 1.2% of patients. Other postoperative neurological complications included sympathectomy effect ($n = 6$), worsening radiculopathy ($n = 1$), lateral wall denervation ($n = 2$), and lumbar plexus irritation ($n = 2$). Construct-related and hardware-related complications included hardware failure ($n = 2$), cage subsidence ($n = 3$), and pseudoarthrosis ($n = 2$). Other postoperative complications included graft harvest site pain,



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