



**Outcomes of Anterior Lumbar Interbody
Fusion versus Transforaminal Lumbar
Interbody Fusion in Degenerative Spine
Diseases at Lumbosacral Junction;
Systematic Review**

*Submitted for Partial Fulfillment of the Master
Degree in Orthopaedic Surgery*

Submitted by

Bishoy Emil Naguib

(M.B.B.CH)

Faculty of Medicine – Ain Shams University

Supervised by

Prof. Dr. Magdy Gamal Youssef

Professor of Orthopaedic Surgery Department

Faculty of Medicine – Ain Shams University

Dr. Tameem Mohamed Elkhateeb

Lecturer of Orthopaedic Surgery Department

Faculty of Medicine – Ain Shams University

*Faculty of Medicine
Ain Shams University*

2017



*First thanks to **God** to whom I relate any achievement in my life*

*I wish to express my deepest thanks, gratitude and appreciation to **Prof. Dr. Magdy Gamal Youssef**, Professor of Orthopaedic Surgery Department Faculty of Medicine – Ain Shams University for his meticulous supervision, kind guidance, valuable instructions and generous help.*

*Special thanks are due to **Dr. Tameem Mohamed Elkhateeb**, Lecturer of Orthopaedic Surgery Department Faculty of Medicine – Ain Shams University for his sincere efforts, fruitful encouragement.*

*Last but not least I wish to thank **The Department of Orthopaedic Surgery – Ain Shams University** for the continuous support and providing the proper environment for learning and research.*

Bishoy Emil Maguib

List of Contents

Title	Page No.
List of Tables	i
List of Figures	ii
List of abbreviations	iv
Abstract	v
Introduction	1
Methods	5
Results	8
Discussion	28
Conclusion	38
References	39
Arabic summary	—

List of Tables

Table No.	Title	Page No.
Table (1):	Number of cohorts in each group.....	9
Table (2):	The study design and follow up duration.....	10
Table (3):	Fusion rates for ALIF versus TLIF.....	11
Table (4):	Sagittal alignment for ALIF versus TLIF.	13
Table (5):	Clinical outcomes for ALIF versus TLIF.....	15
Table (6):	The incidence of the neurological deficits.	17
Table (7):	The rate of infection.	19
Table (8):	The incidence of dural injury.	21
Table (9):	The incidence of blood vessel injury.	23
Table (10):	The rates of adjacent segment degeneration.....	25

List of Figures

Fig. No.	Title	Page No.
Figure (1):	Surgical approaches to the lumbar spine for interbody fusion techniques.	1
Figure (2):	Exposure of disc space in ALIF at L4 L5 (right) and L5 S1 (left).	2
Figure (3):	Schematic representation of the approach for graft placement in PLIF (above, right) and in TLIF (below, left).	3
Figure (4):	Schematic representation of the outcomes of interest.	6
Figure (5):	Flowchart of the electronic literature search.	8
Figure (6):	Schematic representation of fusion rates for ALIF versus TLIF.	12
Figure (7):	Schematic representation of sagittal alignment for ALIF versus TLIF.	14
Figure (8):	Schematic representation of clinical outcomes for ALIF versus TLIF.	16
Figure (9):	Schematic representation of the incidence of the neurological deficits.	18
Figure (10):	Schematic representation of the rate of infection.	20
Figure (11):	Schematic representation of the incidence of dural injury.	22
Figure (12):	Schematic representation of the incidence of blood vessel injury.	24
Figure (13):	Schematic representation of the rates of adjacent segment degeneration.	26

List of Figures cont...

Fig. No.	Title	Page No.
Figure (14):	CT scans lumbar spine after TLIF. (A) Showing pseudoarthrosis and (B) Showing solid fusion.....	29
Figure (15):	Consequences of hypolordosis.	30
Figure (16):	Sagittal pelvic parameters based on standing radiograph.	31
Figure (17):	The relationship between the lumbar lordosis (LL) and the pelvic incidence (PI)	32

List of Abbreviations

<i>Abb.</i>	<i>Full term</i>
<i>ALIF</i>	<i>Anterior Lumbar Interbody Fusion</i>
<i>ASD</i>	<i>Adjacent Segment Degeneration</i>
<i>HS</i>	<i>Highly Significant</i>
<i>LL</i>	<i>Lumbar Lordosis</i>
<i>LLIF or XLIF</i>	<i>Lateral Lumbar Interbody Fusion or Extreme Lateral Lumbar Interbody Fusion</i>
<i>NS</i>	<i>Non Significant</i>
<i>ODI</i>	<i>Oswestry Disability Index</i>
<i>OLIF/ATP</i>	<i>Oblique Lumbar Interbody Fusion/ Anterior to Psoas</i>
<i>PI</i>	<i>Pelvic Incidence</i>
<i>PLIF</i>	<i>Posterior Lumbar Interbody Fusion</i>
<i>PT</i>	<i>Pelvic Tilt</i>
<i>S</i>	<i>Significant</i>
<i>Sig</i>	<i>Significance</i>
<i>SS</i>	<i>Sacral Slope</i>
<i>TLIF</i>	<i>Transforaminal Lumbar Interbody Fusion</i>
<i>VAS</i>	<i>Visual Analogue Scale</i>

Abstract:

Background: degenerative spine diseases are a leading cause of back pain and radiculopathy. Lumbar interbody fusion provides a good treatment modality after failure of other options. Over years several approaches have been developed to achieve interbody fusion.

Methods: searches were conducted in three electronic databases including Ovid Medline, Pubmed and Cochrane.

Results: twelve studies were obtained comparing outcomes of Anterior Lumbar Interbody Fusion and Transforaminal Lumbar Interbody Fusion. There was no significant difference in fusion rates and clinical outcomes between ALIF and TLIF. ALIF was superior in restoring the disc height and lumbar lordosis. Complications were comparable between both approaches except for dural injury which was higher in TLIF and blood vessel injury which was higher in ALIF.

Conclusion: both approaches were similar in achieving fusion and clinical outcomes. Sagittal alignment was better restored in ALIF. Each approach has specific complications related to the exposure.

Keywords: "anterior lumbar interbody fusion" or "ALIF", "transforaminal lumbar interbody fusion" or "TLIF" and "lumbar spondylosis".

INTRODUCTION

Lumbar interbody fusion is a valid option for treating a variety of spine pathologies, especially degenerative spine diseases when conservative management fails.¹

There are many approaches for lumbar interbody fusions (*figure 1*). The main five are anterior (ALIF), transforaminal (TLIF), posterior (PLIF), lateral or extreme lateral (LLIF or XLIF) and oblique/anterior to psoas (OLIF/ATP).²

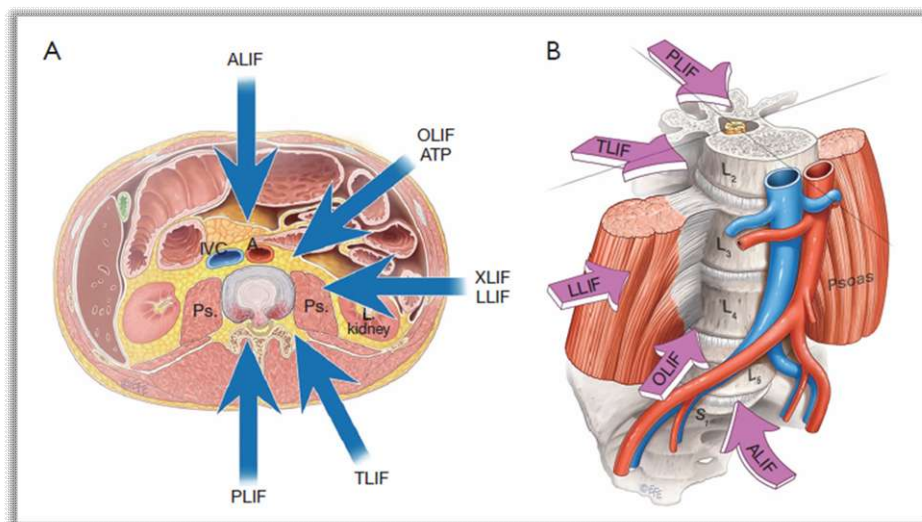


Figure (1): Surgical approaches to the lumbar spine for interbody fusion techniques.²

ALIF and TLIF are the most commonly used approaches for interbody fusion. Both of them include removal of the degenerated disc and insertion of a cage or allograft after distraction of the adjacent vertebral segments with or without pedicle screw insertion and instrumentation.³

In 1932, Capener described the anterior approach for lumbar interbody fusion. But recently the ALIF has re-emerged and became increasingly popular noticed by the number of studies discussing its outcomes.⁴

In ALIF, the patient is positioned supine. Midline, paramedian or mini-pfannenstiell incisions are used. At L5 S1, the surgical field is within the bifurcation of Aorta but to access L4 L5 the great vessels have to be retracted to the right (*figure 2*).⁵

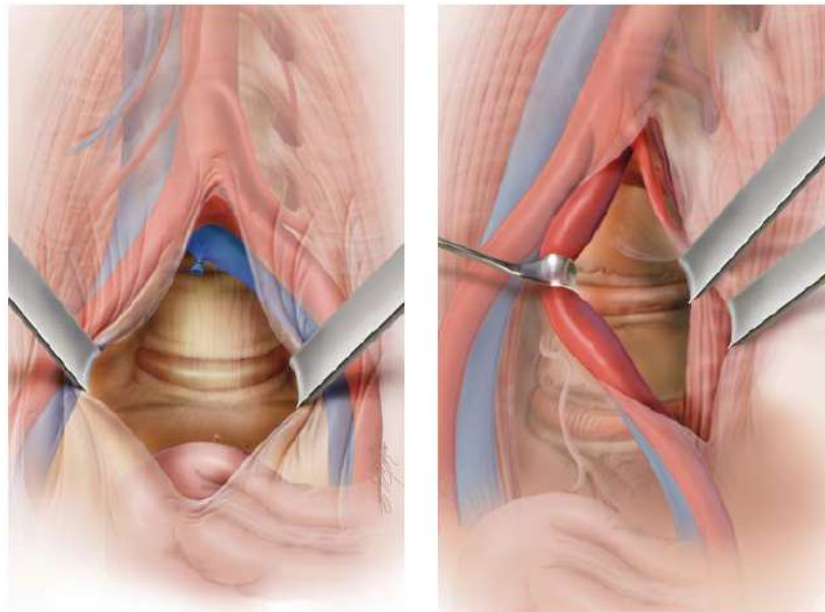


Figure (2): Exposure in ALIF at L4 L5 (right) and L5 S1 (left).⁵

ALIF is a suitable option for degenerative disc disease especially revision after failed posterior spinal fusion.⁵ However, contraindications include major prior abdominal surgery, severe peripheral vascular disease, spinal infections or high-grade spondylolisthesis (without posterior fusion).⁶

Specifically, ALIF provides a wider view to the disc space and allows a good preparation to the end plates. This will maximize the implant size and assist in correction of lordosis and disc height without injury to the paravertebral muscles.⁷ Unfortunately, this approach carries the risk of retrograde ejaculation, vascular or visceral injury.⁸

TLIF was first described in 1982 by Harms as a better alternative to posterior lumbar interbody fusion. In the last 10 years, minimally invasive surgery has developed to decrease the trauma to tissues.⁹

On the other hand, in TLIF the patient is positioned prone. Midline or paramedian incision is used. Exposure to the neural structure is achieved through unilateral laminectomy and inferior facetectomy as shown in (figure 3).¹⁰

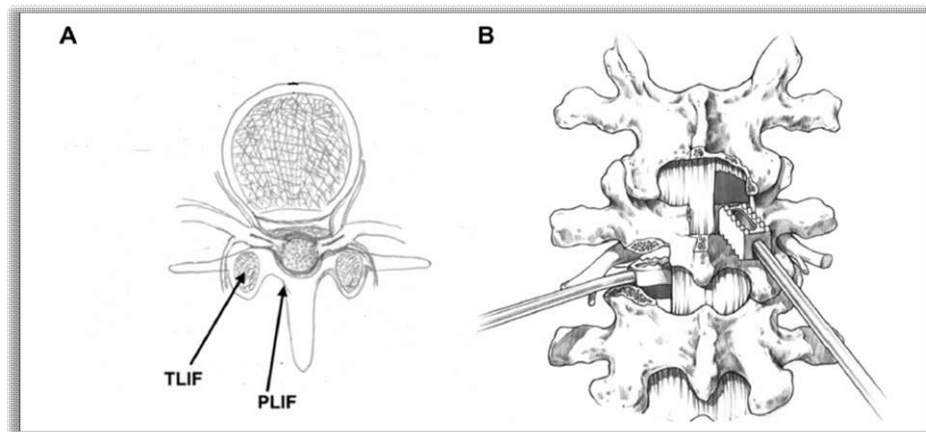


Figure (3): Schematic representation of the approach for graft placement in PLIF (above, right) and in TLIF (below, left).¹⁰

Indications include almost all degenerative spine diseases and recurrent disc herniation. Nevertheless, it is contraindicated in extensive epidural scarring, acute infections and severe anterior disc space collapse.¹⁰

TLIF provides an easier access to posterior structure while preserving the interspinous ligament and spinous processes with reduced injury to the paravertebral muscles. However, there is still an iatrogenic injury to the muscles compared to the anterior approach and difficulty in restoring lordosis.

The aim of this review is to compare the most commonly used approaches and correlate between their radiological and functional outcomes.

METHODS

Searches were conducted in three electronic databases including Ovid Medline, Pubmed and Cochrane.

Key words were "anterior lumbar interbody fusion" or "ALIF", "transforaminal lumbar interbody fusion" or "TLIF" and "lumbar spondylosis".

Eligible studies included comparative studies in which patient cohorts underwent ALIF were compared to those who underwent TLIF.

All studies were limited to those involving human and in English language. Reviews, case reports and expert opinion were excluded.

The outcomes of interest were radiological and functional outcomes.

Radiological outcomes included fusion rate and sagittal alignment while functional outcomes included clinical improvement and complications. Figure 4 summarize the outcomes assessed in the review.

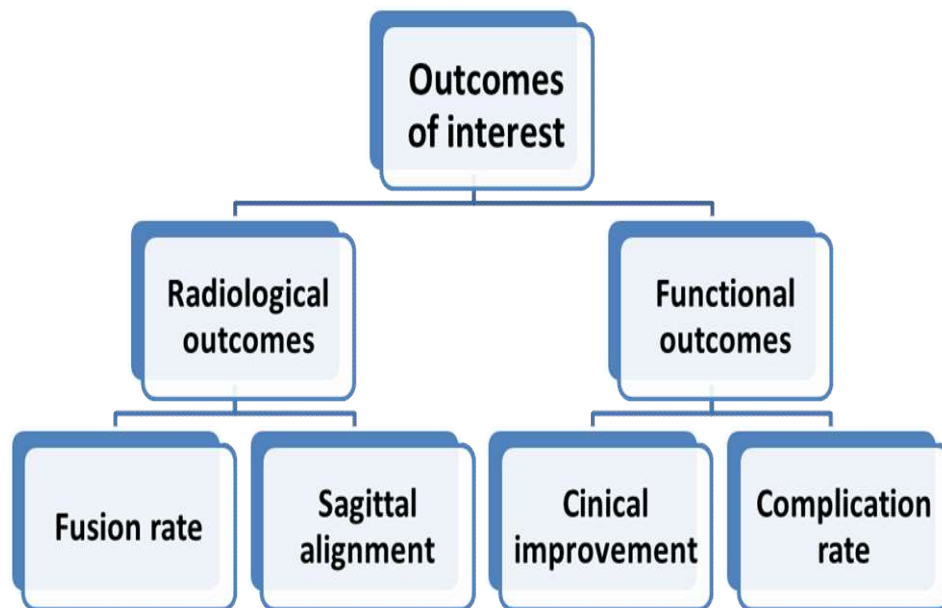


Figure (4): Schematic representation of the outcomes of interest.

Statistical Analysis

Data were collected, revised, coded, and entered to the statistical package for social science (SPSS[®], V. 23 IBM, NY, USA). The qualitative data were presented as number and percentages while quantitative data were presented as mean, control deviations and ranges when parametric.

The comparison between two groups regarding qualitative data was done by using *Chi-square test*.

The comparison between two independent groups regarding quantitative data with parametric distribution was done by using *Independent t-test*.

The confidence interval was set to 95% and the margin of error accepted was set to 5%. So the p-value was considered significant at the level of < 0.05 .

> 0.05 : Non significant

< 0.05 Significant

< 0.01 : Highly significant