

# **Comparative Study Between Different Minimally Invasive Techniques for Lumbar Interbody Fusion**

*Essay*

*Submitted for Fulfillment of Master Degree in Orthopedic Surgery*

*By*

HOSSAM EDDIN ALY ABDELKADER  
*M.B., B.Ch*

Supervised by:

**Prof. Dr. TALAAT TAHER AL HADIDI**

Professor of Orthopedic Surgery,  
Cairo University

**Prof. Dr. AHMED MAHMOUD ATTIA**

Professor of Orthopedic Surgery,  
Cairo University

**Dr. ABDALLAH MOHAMMED AHMED**

Lecturer of Orthopedic Surgery,  
Cairo University

Cairo University  
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# Abstract

This manipulation can lead to nerve damage or neurogenic pain. Additionally, PLIF usually is limited to L3–S1 because of the increased risk of damage to the conus medullaris and cauda equine resulting from the need for retraction above these levels. Recent evolution in minimally invasive techniques has generated much interest in the TLIF procedure, and has led spine surgeons to consider it to be less invasive.

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## Key word

Minimally Invasive Techniques- Biomechanics of -Interbody Fusion  
lumbar- MOTLIF

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# *Table of contents*

| Chapter | Description                                                                     | page |
|---------|---------------------------------------------------------------------------------|------|
| 1       | Anatomical consideration and access to lumbar spine.                            | 4    |
| 2       | Biomechanics of lumbar spine.                                                   | 28   |
| 3       | Indications, advantages and disadvantages of lumbar intrbody fusion techniques. | 47   |
| 4       | Types and techniques of minimally invasive lumbar interbody fusion.             | 52   |
| 5       | Outcome of minimally invasive lumbar interbody fusion.                          | 86   |
| 6       | Summary.                                                                        | 104  |
| 7       | References.                                                                     | 108  |
| 8       | Arabic summary.                                                                 | 118  |

## *List of abbreviations*

| Abbreviation | Description                                      |
|--------------|--------------------------------------------------|
| IAR          | Instantaneous axis of rotation                   |
| ALL          | Anterior longitudinal ligament                   |
| ODI          | Oswestry disability index                        |
| ALIF         | Anterior lumbar interbody fusion                 |
| EMG          | Electromyography                                 |
| PLIF         | Posterior lumbar interbody fusion                |
| TLIF         | Transforaminal lumbar interbody fusion           |
| MISS         | Minimally invasive spine surgery                 |
| MRI          | Magnetic resonance imaging                       |
| AP           | Anteroposterior                                  |
| XLIF         | Xtreme lateral interbody fusion                  |
| MOTLIF       | Mini open transforaminal lumbar interbody fusion |

## *List of tables*

| Table | Description                                               | Page |
|-------|-----------------------------------------------------------|------|
| 1     | Comparison between ALIF,PLIF and TLIF                     | 86   |
| 2     | Epidemiological characteristics and perioperative results | 88   |
| 3     | Oswestry Disability Index                                 | 88   |
| 4     | Physical scale score                                      | 88   |
| 5     | Spine specific complications of PLIF                      | 94   |
| 6     | Summary of clinical and radiological results of PLIF      | 95   |
| 7     | Advantages and disadvantages of TLIF and PLIF             | 99   |

## *List of figures*

| <b>Figure</b> | <b>Description</b>                                           | <b>page</b> |
|---------------|--------------------------------------------------------------|-------------|
| 1             | Vertebral column                                             | 5           |
| 2             | Third lumbar vertebra (superior aspect)                      | 7           |
| 3             | Third lumbar vertebra (lateral view)                         | 7           |
| 4             | Superior view of an isolated lumbar vertebra                 | 8           |
| 5             | Intervertebral foramen                                       | 11          |
| 6             | Anterior longitudinal ligament and ligamentum flavum         | 12          |
| 7             | Posterior longitudinal ligament                              | 14          |
| 8             | Intervertebral disc, ligamentum flavum and articular capsule | 15          |
| 9             | Median section of vertebral column                           | 15          |
| 10            | The Sinuvertebral nerves                                     | 16          |
| 11            | Transverse section at intervertebral disc and ligaments      | 18          |
| 12            | Diagram shows blood supply to a vertebra                     | 19          |

|    |                                                             |    |
|----|-------------------------------------------------------------|----|
| 13 | Spinal cord within its membranes                            | 22 |
| 14 | Inferior end of dural sac                                   | 23 |
| 15 | Spinal cord and prevertebral structures                     | 23 |
| 16 | Transverse section through spinal cord                      | 25 |
| 17 | Blood supply to a spinal segment                            | 26 |
| 18 | Diagrammatic axial section of the spinal cord               | 30 |
| 19 | Axial stress to the disc                                    | 32 |
| 20 | Lever arm length of the ligaments                           | 34 |
| 21 | The components of the three columns of thoracolumbar spine  | 40 |
| 22 | Small skin incision resulting from TLIF                     | 50 |
| 23 | Ziess NC 33 surgical microscope                             | 53 |
| 24 | Positioning of the patient during ALIF                      | 53 |
| 25 | Incision and dissection of the psoas muscle to lumbar spine | 55 |
| 26 | Anatomical situation at L4-L5                               | 56 |
| 27 | Insertion of anchoring screws                               | 57 |
| 28 | Blades inserted onto the vertebral body screws              | 57 |
| 29 | Self-retaining frame retractor                              | 57 |



|    |                                                                                   |    |
|----|-----------------------------------------------------------------------------------|----|
| 30 | Smoothing of graft bed with high speed burr                                       | 58 |
| 31 | Sextant percutaneous rod placement system                                         | 61 |
| 32 | Sextant percutaneous pedicle screw system                                         | 62 |
| 33 | Incision necessary for PLIF procedure                                             | 63 |
| 34 | Vertelink cannulated percutaneous pedicle screw system                            | 63 |
| 35 | Expandable tubular dilator retractors                                             | 64 |
| 36 | Axial view of Wilts intermuscular approach to access the pedicle screw entry site | 65 |
| 37 | Positioning of the patient during TLIF                                            | 67 |
| 38 | Incision planning of TLIF                                                         | 68 |
| 39 | Dilatation tube placement                                                         | 68 |
| 40 | Intra-operative fluoroscopic images for TLIF                                      | 69 |
| 41 | Positioning of the patient during XLIF procedure                                  | 73 |
| 42 | Lateral fluoroscopic image for XLIF                                               | 74 |
| 43 | XLIF procedure                                                                    | 75 |
| 44 | Incision of XLIF                                                                  | 75 |

|    |                                                                                                 |    |
|----|-------------------------------------------------------------------------------------------------|----|
| 45 | The initial dilator used in XLIF                                                                | 76 |
| 46 | Lateral and anteroposterior fluoroscopic images during XLIF procedure                           | 76 |
| 47 | Real time neurovision EMG monitoring                                                            | 77 |
| 48 | Retractor is placed over the largest dilator and docked on the lateral aspect of the disc space | 78 |
| 49 | Complete discectomy is carried out using a series of pituitary rongeurs and curetts             | 78 |
| 50 | Interbody cage filled with the surgeon's choice of bone graft                                   | 79 |
| 51 | Intra-operative photograph during XLIF                                                          | 79 |
| 52 | The implant should rest on the outer rim of the endplate to minimize the risk of subsidence     | 80 |
| 53 | Appearance of the incisions following closure                                                   | 80 |
| 54 | Axial lumbar interbody fusion                                                                   | 85 |

Conventional lumbar fusion is associated with significant muscle stripping and retraction that can adversely affect both short and long term patient outcomes.<sup>(30)</sup>

In contrast, minimally invasive lumbar fusion is performed via a muscle dilating approach and significantly diminishes the amount of iatrogenic soft tissue injury. As a result, the new procedures have shown the potential to reduce the amount of intra operative blood loss, the intensity of postoperative pain and the duration of hospital stays.<sup>(113)</sup>

The goal of any minimally invasive procedure is to achieve the same surgical objectives as the corresponding open procedure through a less traumatic approach. It is believed that these less invasive approaches will result in decreased intra operative blood loss, less postoperative pain, and shorter hospital stays without compromising the efficacy of the procedure.<sup>(28)</sup>

Conventional anterior approach fell out of favor because of vessel injuries, presacral plexus injuries, urinary retention, retrograde ejaculation and abdominal muscle weakness, because of large incision and extensive anatomical dissection. The development of minimally invasive techniques such as endoscopic surgery and mini open surgery has revived anterior lumbar spinal surgery. The advantages of anterior spinal fusion

can be achieved easily and safely.<sup>(110)</sup> The mini open anterior spine surgery technique is feasible, effective and safe for patients with various anterior lumbar diseases; including vertebral fractures, failed back surgery, segmental instability or spondylolisthesis, infections, herniated disc and undetermined lesion for biopsy etc.

Posterior lumbar interbody fusion is an effective treatment option for patients with symptomatic degenerative disc disease, spondylolisthesis and other painful lumbar spinal pathologies that have failed with conservative medical treatment modalities. Fusion of the pathologically unstable lumbar spine segment can offer significant relief from this often progressive and debilitating medical condition.<sup>(35)</sup>

Transforaminal lumbar interbody fusion procedure was first introduced by Harms and colleagues as an alternative to posterior lumbar interbody fusion for the management of a variety of spinal disorders that require Lumbar fusion.<sup>(36)</sup> This procedure offers some distinct advantages to posterior lumbar interbody fusion; including unilateral exposure, decreased neural retraction and a more lateral angle of the approach that facilitates revision surgery.<sup>(74)</sup> Because access is obtained via a transforaminal approach, little if any neural retraction is required to enter the disc space. In contrast, posterior lumbar interbody fusion almost always requires neural manipulation

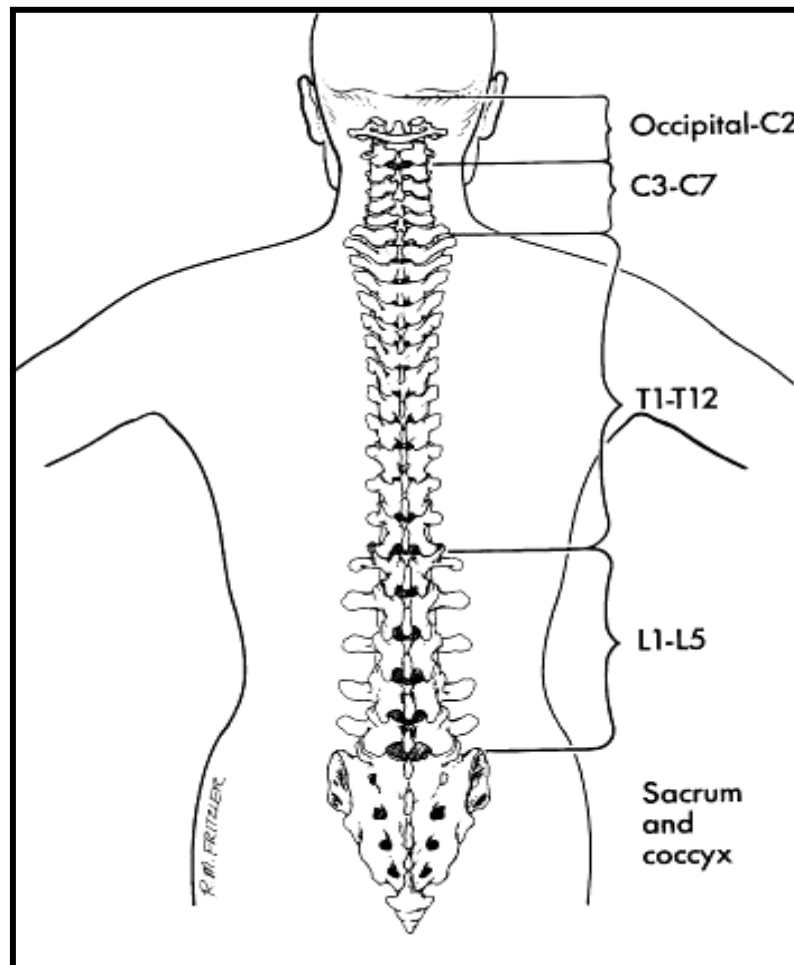
and retraction, so neurological injury is one of the most commonly reported complications of that procedure. <sup>(104)</sup>

Disadvantages and limitations of anterior, posterior, and direct lateral approaches to the lumbar spine have resulted in the development of techniques to address the spine axially (perpendicular to the vertebral endplate along the long axis of the spine). Conceptually, interbody fusions with instrumentation placed along the long axis of the spine have appeal from a biomechanical standpoint because of the ability to place instrumentation close to the bending axis of the spine and in line with the compression movements of the vertebral bodies. This has been recognized for years, and although not a new concept. Para-axial open approaches to the lumbosacral spine have been described through the use of a fibular strut graft from L5 to S1. A true axial approach to the lumbosacral spine has been limited by the availability of appropriate techniques and implants. <sup>(18)(82)(136)</sup>

# **Surgical Anatomy of the Lumbar Vertebrae**

## **Morphology of Individual Vertebra:**

**T**he vertebral column is composed of alternating bony vertebrae and fibrocartilaginous discs that are connected by strong ligaments and supported by musculature that extends from the skull to the pelvis and provides axial support to the body. There are 33 vertebrae (7 cervical, 12 thoracic, 5 lumbar, 5 sacral and 4 coccygeal) (Fig.1). The sacral and coccygeal vertebrae form the sacrum and coccyx. A typical vertebra is composed of an anterior body and a posterior arch made up of two pedicles and two laminae that are united posteriorly to form the spinous process. To either side of the arch of the vertebral body is a transverse process, superior and inferior articular processes. The articular processes articulate with adjacent vertebrae to form synovial joints. The relative orientation of the articular processes accounts for the degree of flexion, extension or rotation possible in each segment of the vertebral column. The spinous and transverse processes serve as levers for the numerous muscles attached to them. The vertebral bodies increase in size from cephalic to caudal, and this is believed to be the result of the increasing weights and stresses borne by successive segments. <sup>(131)</sup>



**Figure (1):** Vertebral column: upper cervical vertebrae (occiput to C2), lower cervical vertebrae (C3-C7), thoracic vertebrae (T1-T12), lumbar vertebrae (L1-L5), sacrum, and coccyx. (131)

The relationship of the synovial joints to the planes of the vertebral body varies from one region to another, but in general the superior articular processes tend to face posteriorly, while the inferior articular processes face inferiorly, and thus from a posterior approach overlies the superior processes this particularly important in the lower lumbar and lumbosacral region, where the tendency of one vertebra to slide forward on the succeeding one is resisted by the overlapping of its inferior articular processes with the superior articular processes of the next vertebra. (116)