Role of Transpedicular Screw Fixation with and without interbody fusion in management of degenerative lumbar disease

ThesisSubmitted for fulfillment of Master Degree in**Neurosurgery**

By

Mohamed Abdel Moaty Mohamed

M.B., B.Ch.(Ain Shams university)

(El Matariyah Teaching Hospital)

Under Supervision Of

Dr. Esam Eldeen Emara

Professor of Neurosurgery

Faculty of Medicine

Ain Shams University

Dr.Mohamed Alaa El Din Habib

Ass.Professor of Neurosurgery

Faculty of Medicine

Ain Shams University

Dr. Ahmed ElSayed Abd El Bar Lecture of NeurosurgeryFaculty of MedicineAin Shams University

Faculty of Medicine

Ain Shams University

201٢


بسم الله الرحمن الرحيم

بسم الله الرحمن الرحيم

﴿قُلْ إِنَّ صَلَاتِي وَنُسُكِي وَمَحْيَايَ وَمَمَاتِي لِلَّهِ رَبِّ الْعَالَمِينَ

لَا شَرِيكَ لَهُ وَبِذَلِكَ أُمِرْتُ وَأَنَا أَوَّلُ الْمُسْلِمِينَ﴾

صدق الله العظيم

سورة الانعام ١٦٣

Acknowledgement

To **Allah,**goes all my deepest gratitude and thanks for achieving any work in my life.

I wish to express my cordial appreciation and utmost gratitude to **Prof. Dr.Esam elden Abdelrahman Emara,**Professor of Neurosurgery, Ain Shams University, for sincere guidance, supervision and kind encouragement throughout the whole thesis. My sincere thanks to **Dr. Mohamed Alaa elden Habib** Associate Professor of Neurosurgery, Ain Shams University, **and Dr., Ahmed Elsayed Abdelbar** lecture of Neurosurgery, Ain Shams University, **for** their relentless support, splendid efforts, and creative thoughts as well as providing an invaluable criticism and direction.

Last but not least, my deep appreciation is expressed to all the staff of Neurosurgery Department, Matariah Teaching Hospital as well as to all members of my family **(my father, my mother,my two sisters and my brother)** for their cooperation and encouragement.

CONTENTS

LIST OF ABBREVIATIONS

ALIF Anterolateral interbody fusion
CSF Cerebrospinal fluid
CT Computed tomography
DDD Degenerative Disc Disease
DSDegenerative Spondylolithisis
EMG Electromyography
IDETIntra Discal Electrothermal Annuloplasty
IVD Inter Vertebral Disc
JOA Japanese orthopedic association scale
LSS Lumbo-sacral spine
MRI Magnetic resonance imaging
NSAIDs Non-steroidal anti-inflammatory drugs
ODI Oswestry disability index
PLIF Posteriolateral Interbody Fusion
SEPs Somatosensory evoked potentials
TENS Transcutaneous electrical nerve stimulation
TLIF Transforaminal interbody fusion
TNF-α Tissue necrotizing factor alpha
VAS Visual analogue score
XLIF Extreme Lateral Interbody fusion

Introduction

Chronic back pain disables millions of people around the world every year. It considered as the most common cause for activity limitation. There are nearly 15 million physician office visit each year for low back pain of which 90% of patients improve within 1 month without treatment***(Hart LG, 2005)***.

The cause of chronic low back pain includes various causes like: degenerated disc diseases, spondylosis, spondylolisthesis, spinal canal stenosis and osteophytes***(Mick j, 2006)***.

The clinical presentation differs from mild low back pain that occasionally radiates into the buttocks and posterior thighs, especially during high levels of activity. The patient with degenerative spondylolisthesis is typically older and presents with back pain, radiculopathy, neurogenic claudication, or a combination of these symptoms ***(Vokshoor, 2009).***

The treatment modalities of chronic back pain differ from simple medical treatment and physiotherapy to surgery and lumbar fixation.

The goal of surgery is to decompress the neural elements and stabilize the unstable segment or segments of the spinal column. This is usually performed with elimination of motion across the facet joint and the intervertebral disc through arthrodesis ***(Yan et al., 2008).***

Some patient will improve after simple decompression, others who will develop radiculopathy or back pain will benefit from posterolateral fusion.

The use of instrumentation as an adjunct to lumbar fusion procedures has increased over the past two decades. Multiple techniques have been described for the surgical treatment of patients with chronic low-back pain***(Katz, 2010)***.

Posterolateral fusion (PLIF) is one of the more widespread techniques and may be performed with or without the use of pedicle screw fixation to provide internal fixation as a surgical adjunct to the fusion procedure.

The addition of instrumentation is associated with higher costs and higher complication rates**.**

Despite an increase in its popularity over the past decade the role of spinal fusion in the management of degenerative conditions of lumbar spine remain somewhat controversial. Improvements in diagnostic imaging, fusion technique and spinal instrumentation systems and accumulating evidence regarding the safety and efficacy of fusion procedures contribute to a more widespread belief that in selected cases, fusion may be superior to non-surgical therapy or decompression alone.***(David.s, 2006)***

Posterolateral and interbody fusion have been used successfully either alone or in combination together.

There has been a recent resurgence of interest in posterior lumbar interbody fusion (PLIF) as a biomechanically and possibly clinically superior fusion technique. Applicable to a variety of degenerative and traumatic conditions.

PLIF offers advantages such as total discectomy, neural decompression, restoration of disc space height and solid mechanical arthrodesis. The addition of segmental instrumentation using a pedicel screw and rod or plate construct adjunct to PLIF may offer stability and enhance fusion rates.***(Brodke, 2007)***

There is other techniques can be used to do fusion such as:Transforaminal Lumbar Interbody Fusion (TLIF) and percutaneous lumbur fixation.

In Transforaminal Lumbar Interbody Fusion (TLIF) the surgical hardware is applied to the spine to help enhance the fusion rate. Pedicle screws and rods are attached to the back of the vertebra and an interbody fusion spacer is inserted into the disc space from one side of the spine.

(TLIF) fuses the anterior (front) and posterior (back) columns of the spine through a single posterior approach.

- The anterior portion of the spine is stabilized by the bone graft and interbody spacer.
- The posterior column is locked in place with pedicle screws, rods, and bone graft.

Cloward developed technical PLIF using grafts after discectomy in 1943. He presented his early result of various meeting between 1945 and 1951 and then published his technical and result in 1953. In series of 321 patients he reported limited complications and satisfactory result in over 85 percent ***(Cloward, 1953).***

Patients and methods

This prospective study will be conducted on 20 patients with degenerative lumbar disease (degenerative disc disease, spondylolisthesis, spinal canal stenosis) divided into two groups:

Group A: 10 patients with degenerative lumbar disease treated by a transpedicular screw fixation alone.

Group B: 10 patients with degenerative lumbar disease treated by a transpedicular screw fixation with interbody fusion.

Inclusion criteria:

• The presence of back pain and radicular pain unresponsive to conservative treatment with presence of fixation indication in the patient e.g:(presence of segmental instability in the images, recurrent surgery at the same level).

Exclusion Criteria:

• Non degenerative lumbur diseases.
• Multiple level herniated discs.
• Any pathology affecting the vertebrae at the level of surgery e.g (haemangioma).
• Prescence of systemic disease making the patient unfit for surgery e.g (coagulation problem).

The study will include:

A. Review of literature.

B. Patients and methods:

And this will include

1) Clinical assessment:

• Thorough medical history.
• Complete general examination.
• Neurological examination.

2) Investigations:

• Routine laboratory investigations.
• Plain x-ray films of lumbosacral spine (antero-posterior, lateral, and dynamic films "flexion/extension).

Either one of the following:

- Computerized Tomography C.T.
- Magnetic resonance imaging MRI.

3) Management:

Patients managed by a transpedicular screw fixation with and without interbody fusion.

4) Follow up:

- All patients will be followed up after management
- Clinically by assessing subjective symptoms as (low back pain and radicular pain), clinical signs.
- Radiographic investigations by:
- Plain x-ray lumbosacral spine after surgery (anteroposterior ,lateraland dynamic views) .
- Magnetic resonance image (MRI) and computed tomography (CT) of the lumbosacral spine for all complicated and symptomatic patients.

C. Results and analysis.

D. Discussion

E. Summary and conclusion

F. Arabic summary.

AIM OF THE WORK

To Compare the Role of transpedicular screw fixation with and without interbody fusion in management of degenerative lumbar disease understanding different methods of diagnosis and the both lines of management and the post-operative outcome.

CHAPTER (1)

ANATOMY OF LUMBER SPINE

The spine is a segmental column of similar formed bones that constitutes the major sub cranial part of the axial skeleton. Its individual elements are united by a series of intervertebral articulations that form a flexible, although neuroprotective, support to support to the trunk and limbs.

Vertebrae

The typical vertebra consists of two major components:A roughly cylindrical ventral mass of mostly trabecularized cancellous bone called the body, and a denser, more cortical posterior structure, called the dorsal vertebral arch.

The vertebral arch has a more complex structure. It is attached to the dorsolateral aspects of the body by two stout pillars, called the *pedicles*. These are united dorsally by a pair of arched flat lamina that is surmounted in the midline by a dorsal projection, called the *spinous process****(Ellis et al., 2006).***

The pedicles, lamina, and dorsum of the body form the vertebral foramen, a complete osseous ring that encloses the spinal cord.

The transverse processes and the superior and inferior articular processes are found near the junction of the pedicles and the lamina.

The transverse processes extend laterally from the sides of the vertebral arches, and because all vertebrae are phyletically and ontogenetically associated with some form of costal element, they either articulate with or incorporate a rib component.

The superoinferior dimensions of the pedicles are roughly half that of their corresponding body, so that in their lateral aspect the pedicles and their articulating processes form the superior and inferior vertebral notches. Because the base of the pedicle arises superiorly from the dorsum of the body, particularly in the lumbar spine, the inferior vertebral notch appears more deeply incised. In the articulated spine, the opposing superior and inferior notches form the intervertebral foramina that transmit the neural and vascular structures between

the corresponding levels of the spinal cord and their developmentally related body segments ***(Chaynes P et al., 2001).***

Pars Interarticularis The pars interarticularis defines the parts of the arch that lie between the superior and inferior articular facets of all subatlantal movable vertebral elements.

The term *parsinterarticularis* arose to designate that area of the arch that is most stressed by translational movement between adjacent segments, particularly in the second cervical and fifth lumbar vertebrae, which are susceptible to traumatic and stress fractures in this region (i.e., hangman's fracture of C2 and isthmic spondylolysis of L5)***(Weiner BK et al.,2002).***

In sequential alternation with the intervertebral facet joints, it roofs the lateral recesses of the spinal canal and contributes to the dorsal margins of the intervertebral foramina. In the subcervical vertebrae, it also provides the dorsal part of the base of the transverse process.

Biomechanical forces on the pars interarticularis place it in a position to receive the shearing stresses that occur when translational (spondylolisthetic) forces tend to displace, in a dorsoventral plane, the superior articular processes with respect to their inferior counterparts on the same vertebra ***(Bogduk N et al., 2005).***

The usual site of failure in the pars interarticularis permits the superior articular facets, pedicles, and vertebral body to be ventrally displaced as a unit, while the inferior articular facets remain attached to the dorsal arch components. These tend to retain their articular relationships with the superior facets of the next lower vertebra ***(Weiner BKet al., 2002).***