SURGICAL MANGEMENT OF DEGENERATIVE SPONDYLOLISTHESIS

Thesis

Submitted for the Fulfillment of the MD degree in Neurosurgery

By

Ahmed Mohamed Zaater

(M.B., B. Ch.) (M.Sc.)

Supervisors

Prof. Dr. Ahmed Mohammed Ahmed Issa

Professor of Neurosurgery

Faculty of Medicine, Cairo University

Prof. Dr. Wael Mokthar Elmahdy

Professor of Neurosurgery

Faculty of Medicine, Cairo University

Prof. Dr. Mohammed M. Mohi Eldeen

Professor of Neurosurgery

Faculty of Medicine, Cairo University

Prof Dr. Yousri Anwar Ahmed Hassan

Assistant Professor of Neurosurgery

Faculty of Medicine, Cairo University

Faculty of Medicine

Cairo University

2009

ACKNOWLEDGEMENT

*First, I would like to express my sincerest gratitude and gratefulness to **Allah** who continues to bless and fill me with hope, faith and patience that enable me to carry out all my daily work.*

*I am greatly honored to express my thanks and gratitude to Prof. Dr. **Ahmed Issa**, Professor and Head of Neurosurgery Department, Faculty of Medicine, Cairo University, for guidance, great help encouragement and his creative support throughout the whole work up of this thesis.*

*I would like to express thanks and gratitude to Professor Dr. **Wael Elmahdy**, Professor of Neurosurgery, Faculty of Medicine, Cairo University, for his valuable help and advice for me to accomplish this work.*

*I am very much indebted to Dr. **Mohamed Mohi Eldeen**, Professor of Neurosurgery, Faculty of Medicine, Cairo University, for his kind supervision, valuable advices, constructive criticism and indispensable help throughout this work.*

*My deep gratitude and appreciation, great thanks to Prof. Dr. **Yousri Anwar**, Assistant Professor of Neurosurgery, Faculty of Medicine, Cairo University, for his generous help and continuous support throughout this work.*

*Last but not least, I would like to thank **my family** for their great help and support and every person who helped me during this work especially **my dear colleagues** in Neurosurgery Department, Faculty of Medicine, Cairo University, for their great help in this work.*

ABSTRACT

IN A SERIES of 63 patients with degenerative spondylolisthesis, methods of surgical treatment were analyzed. Patients were divided into two groups according to surgical treatment. Two kinds of treatment: decompression only (14 patients) & decompression with instrumented (49 patients). We evaluated the surgical method of treatment, clinical and radiological outcome in the two groups. We found that fusion group has nonsignificant better outcome in improvement rate ($P>0.05$) than decompression only group and significantly more hospital stay ($P< 0.05$). And that decompression only group had significant more decrease in angle of lordosis than fusion group ($P< 0.05$).

KEY WORDS: Degenerative spondylolisthesis, lumbar stenosis, posterolateral fusion, transpedicular instrumentation.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

% slip	Degree of the slip
ALIF	Anterior lumbar interbody fusion
ALL	Anterior longitudinal ligament
AP	Anteroposterior
BMI	Body mass index
BMP	Bone morphogenic protein
CT	Computerized tomography
EZ	Elastic zone
FSU	Functional spinal unit
h	Disc height
H	Posterior wall height of the proximal vertebral body
h/H	Disc height%
Ht	Body height
JOA	Japanese orthopedic association
LL	Lumbar lordosis
MRI	Magnetic resonance image
Mo	Months
n	Number
No	Number
NS	Non Significant
NZ	Neutral zone
P	Probability Value
PLIF	Posterior lumbar interbody fusion
PLL	Posterior longitudinal ligament
PZ	Plastic zone
RCT	Randomized control study
rhBMP-2	Recombinant human bone morphogenetic protein-2
S	Slippage
SA	Slip angle
SCS	Spinal canal stenosis
TENS	Transcutaneous electrical nerve stimulation
TLIF	Transforaminal lumbar interbody fusion
Wt	Body weight
yr	Years

INTRODUCTION

Spondylolisthesis refers to the forward displacement of one vertebra relative to another. Five types of listhesis have been described according to the Wiltse-Newman-MacNab classification system and include the isthmic, degenerative, dysplastic, traumatic, and pathologic forms. ***(Guiot & Mendel, 2005)***

Degenerative spondylolisthesis was first described by Junghans in 1931 as a specific form of listhesis with an intact neural arch. ***(Bennett, 2004)***

Degenerative spondylolisthesis typically occurs at the level of L4-L5. It is then most likely at L3-L4, followed by L5-S1. Older people are most commonly affected; the average age at presentation being 60 years. It is four times more likely to occur in women than men, Parity has been associated with an increase incidence of spondylolisthesis. ***(Guiot & Mendel, 2005)***

Clinically patients frequently complain of intermittent low back pain, symptoms of neurogenic claudication, occasionally radicular pain from compression by the degenerative facet. ***(Guiot & Mendel, 2005)***

Imaging includes plain X-ray standing lateral, anteroposterior, oblique & flexion/extension views of the lumbar spine are helpful in demonstrating a slip, CT or MRI of lumbarer spine. ***(Bennett , 2004)***

Treatment includes nonoperative care and operative intervention indicated for patients with progressive neurological deficit and those who fail to improve on proper nonoperative treatment, specifically, those people with persistent pain, either radicular or claudicatory, that interferes with professional and personal activity as well as quality of life. ***(Schnake et al, 2006)***

Aim of work

- Review of literature and recent publication on degenerative spondylolisthesis and its management.
- Comparing different modalities for surgical management of degenerative spondylolisthesis as regard indications and outcome.
- Finding out optimal surgical management for degenerative spondylolisthesis.

Functional Musculoskeletal Anatomy

There are five lumbar vertebrae and the sacrum making up the lumbar spine. We can consider each vertebra as having three functional components: the vertebral bodies, designed to bear weight; the neural arches, designed to protect the neural elements; and the bony processes (spinous and transverse), designed as outriggers to increase the efficiency of muscle action. ***(Wong & Transfeldt, 2007 A)***

The vertebral bodies are connected together by the intervertebral discs, and the neural arches are joined by the facet (zygapophyseal) joints (Fig. 1). The discal surface of an adult vertebral body demonstrates on its periphery a ring of cortical bone. This ring, the epiphysial ring, acts as a growth zone in the young and in the adult as an anchoring ring for the attachment of the fibers of the annulus. The hyaline cartilage plate lies within the confines of this ring (Fig. 2). The size of the vertebral body increases from L1 to L5, which is indicative of the increasing loads that each lower lumbar vertebral level has to absorb. ***(Wong & Transfeldt, 2007 A)***

The neural arch is composed of two pedicles and two laminae (Fig. 1). The pedicles are anchored to the cephalad half of the vertebral body and form a protective cover for the cauda equina contents of the lumbar spinal canal. The ligamentum flavum (yellow ligament) fills in the interlaminar space at each level.

The outriggers for muscle attachment are the transverse processes and spinous process. ***(Wong & Transfeldt, 2007 A)***

The Intervertebral Disc

The intervertebral discs (Fig. 3) are complicated structures, both anatomically and physiologically. Anatomically, they are constructed in a manner similar to that of a car tire, with a fibrous outer casing, the annulus, containing a gelatinous inner tube, the nucleus pulposus. The fibers of the annulus can be divided into three main groups: the outermost fibers attaching between the vertebral bodies and the undersurface of the epiphysial ring; the middle fibers passing from the epiphysial ring on one vertebral body to the epiphysial ring of the vertebral body below; and the innermost fibers passing from one cartilage endplate to the other. The anterior fibers are strengthened by the powerful anterior longitudinal ligament. The posterior longitudinal ligament affords only weak reinforcement, especially at L4-5 and L5-S1, where it is a midline, narrow, unimportant structure attached to the annulus. The anterior and middle fibers of the annulus are most numerous anteriorly and laterally but are deficient posteriorly, where most of the fibers are attached to the cartilage plate (Fig. 3). ***(Wong & Transfeldt, 2007 A)***

The fibers of the annulus are firmly attached to the vertebral bodies and arranged in lamellae, with the fibers of one layer running at an angle to those of the deeper layer (Fig. 4). This anatomic arrangement permits the annulus to limit vertebral movements. This important function is reinforced by the investing vertebral ligaments. ***(Wong & Transfeldt, 2007 A)***

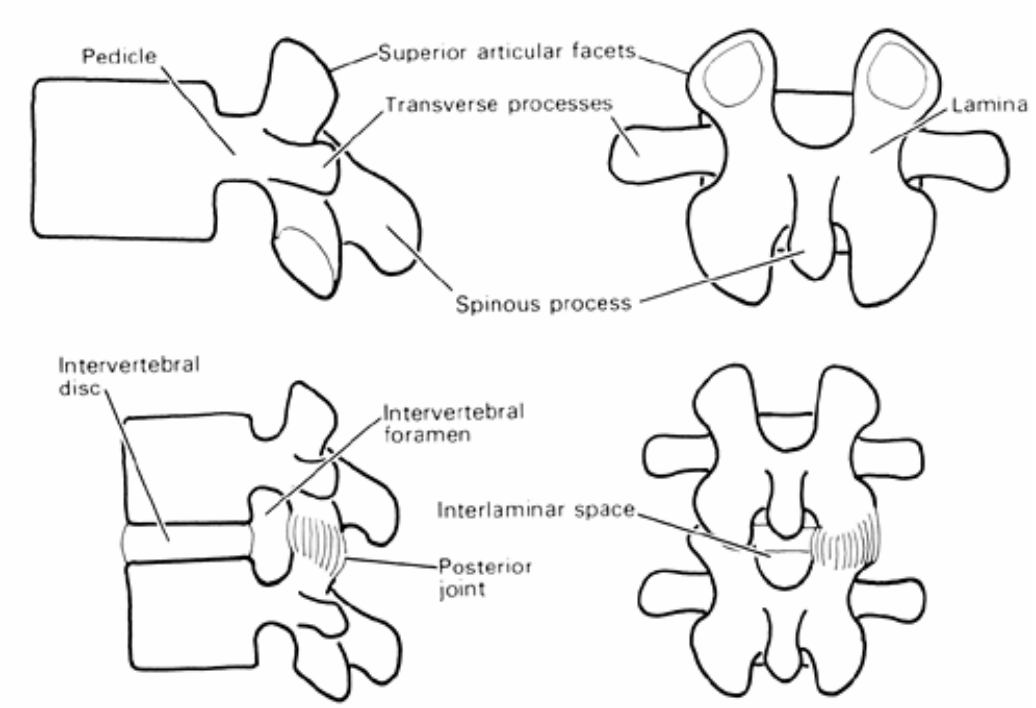

Figure 1: The components of a lumbar vertebra: the body, the pedicle, the superior and inferior facets, the transverse and spinous processes, and the intervertebral foramen and its relationship to the intervertebral disc and the posterior joint.

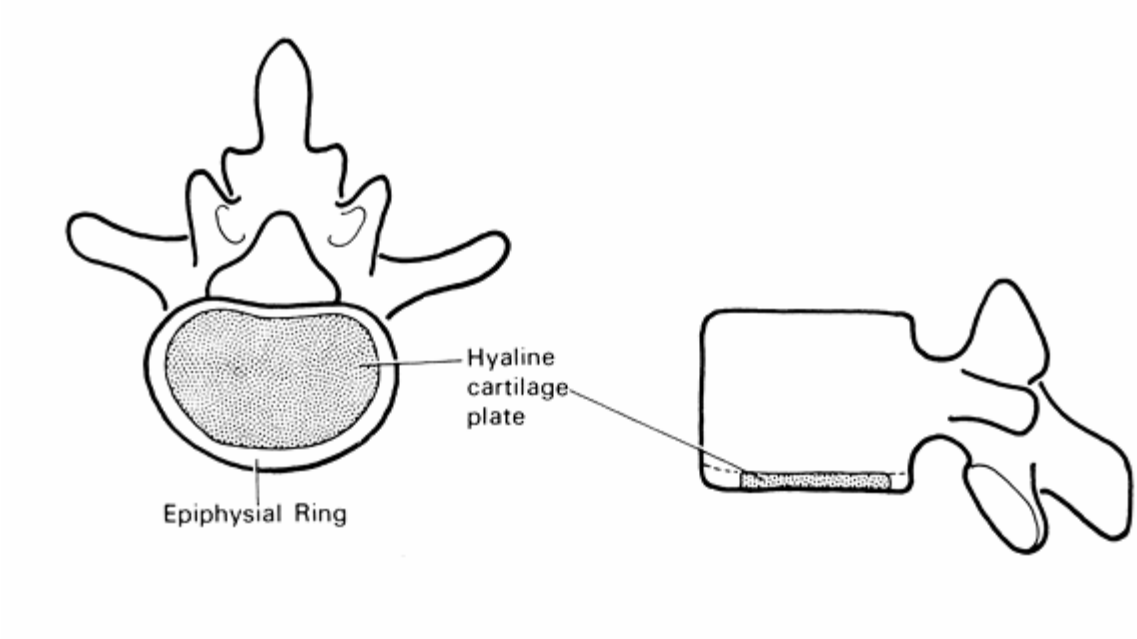

Figure 2: The epiphysial ring is wider anteriorly and surrounds the hyaline cartilaginous plate.