# MANAGEMENT OF LUMBAR SPINAL STENOSIS

## THESIS

Submitted in partial fulfilment
for the M.D. degree
(Orthopaedic Surgery)

## By


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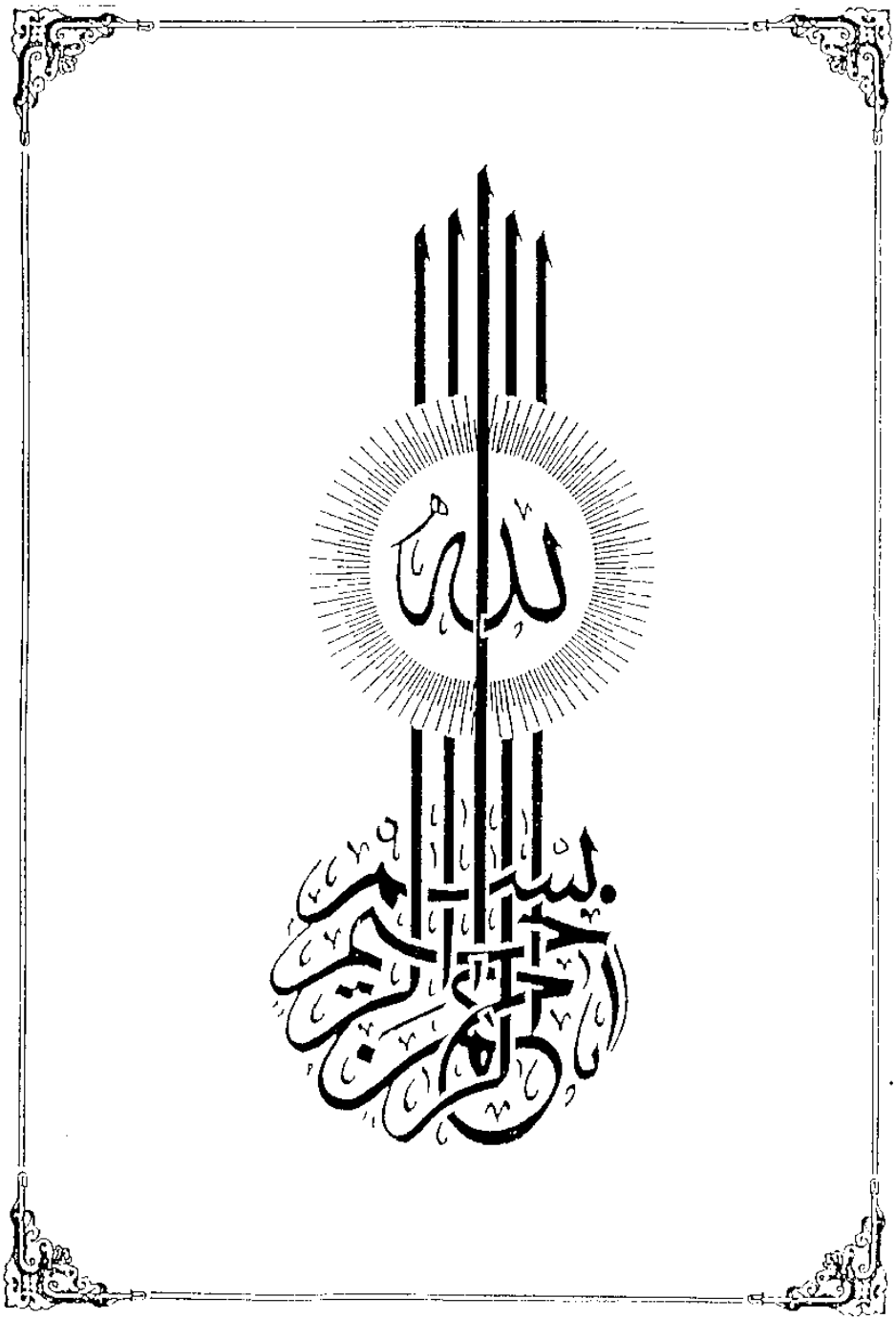
1988

## ACKNOWLEDGEMENT

I would like to express my deepest gratitude to professor doctor **MOHAMED HAMED EL-GHAWABI** and consultant doctor **MAHMOUD AKL**, to whom I am deeply indebted for their contineous guidance, encouragement, supervision and valuable advice.

I wish also to thank professor doctor **MAMDOUH HEFNY**, chairman of the orthopaedic surgery, department, faculty of medicine, Ain Shams University, for his kind approval to register the subject of this thesis.

The candidate would also like to thank doctor NABIL GOBARA chairman of the orthopaedic department at AHMED MAHER Hospital and all members of the orthopaedic and radiology departments for their sincere assisstance and support.



CONTENTS

# INTRODUCTION AND AIM OF THE STUDY

The historic paper of mixter and Barr in 1934, has led to the universal acceptance of the concept of an intervertebral disc herniation as the major cause of lumbar nerve root involvement and sciatic pain. In the opinion of choudhury and Taylor (1976) , preoccupation with the intervertebral disc lesion and it's surgical access via the limited interlaminar approach , has been responsible for the neglect or overlooking of other causes of nerve root entrapment.

Pathological changes involving the spinal canal, other than simple herniation of the nucleus pulposus, have been recorded by numerous authers. The first traceable reference to the subject is that of Sachs and frankel in 1900, writing on progressive ankylotic rigidity of the spine, they recorded the case of one patient with sacral and lumbar pain, relieved by laminectomy , in which there was marked thickening of the laminae.

Bailey and Casmajor (1911) referred to one patient with pain and weakness of the legs relieved by laminectomy. They thought that thickening of the laminae and ligamenta flava were responsible for compression of the cauda equina.

Elsberg ( 1913) , reported 60 laminectomies in which he thought good results were due to improved circulation of blood to the cauda equina .

Sarpeyener ( 1945 ) , described congenital stricture of the spinal canal and Verbiest (1956), reported the clinical observation of cauda equina claudication , which he believed was due to developmental narrowing of the spinal canal. Since that time , stenosis of the lumbar spinal canal has been gradually emphasized as an important cause of cauda equina and nerve root compression.

In the present study , thirty cases with lumbar spinal stenosis were studied prospectively and three cases retrospectively. The aim was to assess the correlation between the preoperative clinical picture, radiological findings, the type of surgical treatment performed and the postoperative results, in search for factors that influence the prognosis of such cases.

# REVIEW OF LITERATURE

## ANATOMY OF THE LUMBAR SPINE

The Spine is composed of 33 units which share the common characteristics as vertebrae, and yet are grouped in five groups according to their site and specific characteristics .

Although there are generally 7 cervical, 12 thoracic. 5 lumbar, 5 sacral and three to five coccygeal vertebrae, the total number can vary as well as the proportionate numbers in each group.

The adult sacral and coccygeal vertebrae are fused or united to form 2 bones, the sacrum and the coccyx.

A lateral view of the vertebral column reveals several curves which are identified by the predominant region in which each curve occurs.

The primary curves of the dorsal and sacral region, concave forwards and correspond to the embryonic axis, are due to the shape of the vertebral bodies, which are deeper posteriorly than anteriorly .

The secondary curves are convex forwards to permit the assumption of the erect position and are largely due to the shape of the intervertebral discs.

In the cervical region, the secondary curve begins to develop during late foetal life and is well established at four months when the infant is able to hold his head. It extends from the first cervical to the second thoracic vertebra.

The Secondary lumbar curve , developing after birth with ' extension of the legs and later with the assumption of the sitting and standing position , is largely caused by the shape of the intervertebral discs .

The pelvic curve begins at the lumbosacral junction and ends at the termination of the coccyx. It is concave anteriorly and inclines in a somewhat downward direction, whereas the lumbosacral junction displays a prominent anterior angle known as the lumbosacral angle of the promontory measuring from 120 - 130°.

The lumbar segment averages 18 Cm. in length, and accounts for 25 % of the height of the spinal column by virtue of its larger and heavier vertebrae.

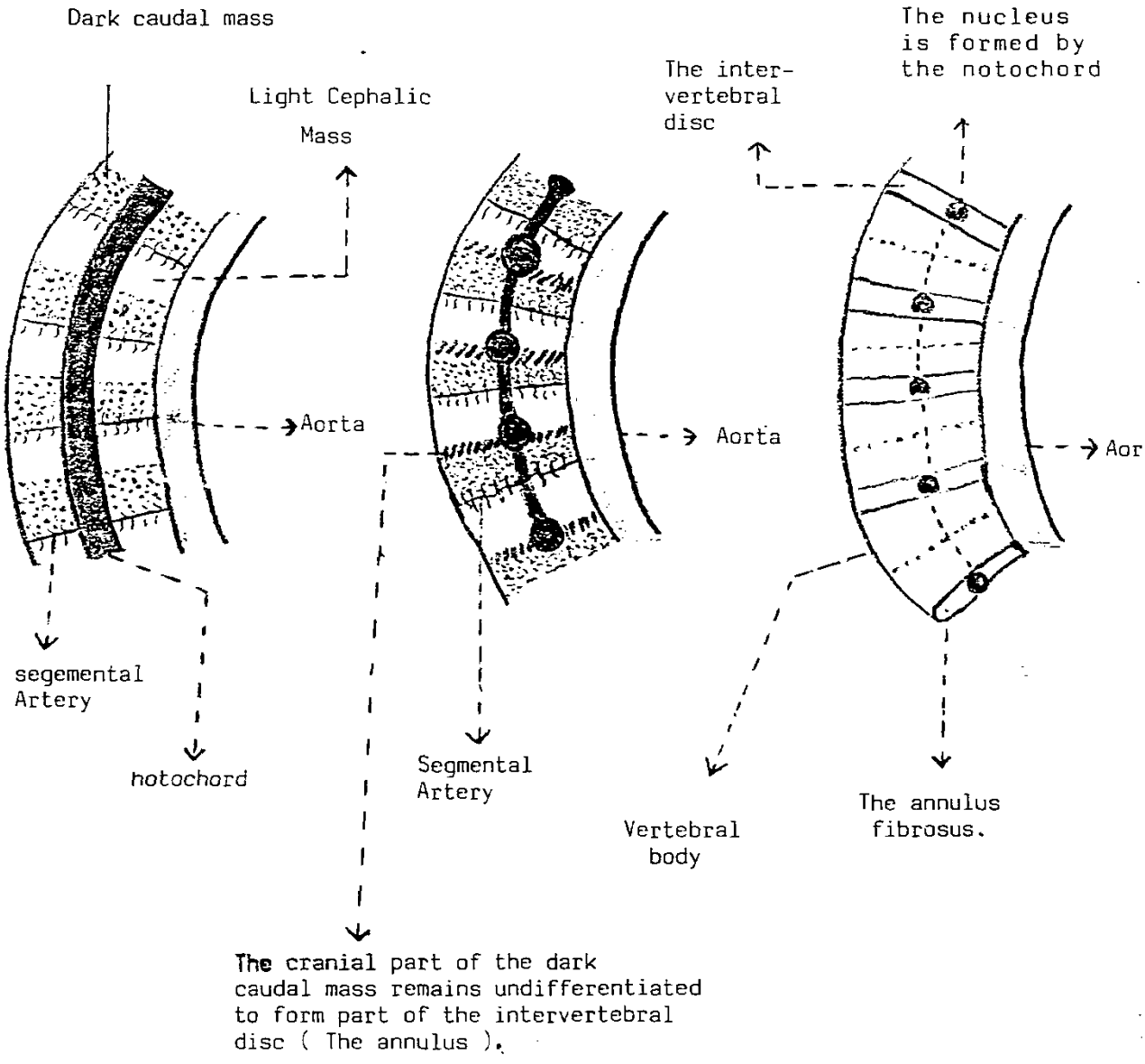
**Development of the lumbar Spine :**

The Vertebral Column owes its segmentation to the fact that it is derived from the segmental mesoderm or

(Fig. 1)

Development of the lumbar spine

( After Armstrong , 1967)



somites which are the precursors of body segmentation for skeletal , muscular and nervous systems.

During the second week of intrauterine life , after embedding of the fertilized ovum , a flat embryonic disc forms.

The primitive groove occupies the caudal portion of the embryonic disc. At the cephalic end of the primitive groove, the primitive node forms. This node forms a special column of cells in the midline which becomes the notochord.

When the embryo is three weeks old, the column of mesoderm, which lies along both sides of the notochord, becomes organised into regularly arranged somites or primitive segments. These segments are separated by the intersegmental arteries which are direct branches of the aorta.

Each segment consists of a dark caudal and a light cephalic half .

The cephalic and caudal halves of the adjacent segments fuse to form the precursor of the vertebral body .

The cells nearest to the intersegmental vessels recieve most nutrition while the cranial portion of the

caudal mass, which is the part farthest from the segmental artery, remains undifferentiated and forms part of the intervertebral disc.

With fusion of the cephalic and caudal masses of the adjacent segments to form the vertebral body, the notochord in these regions becomes attenuated and notochordal cells migrate or get squeezed into the intervertebral region.

After ten weeks, the cells around the periphery of the intervertebral region begin to differentiate into an elongated fibroblastic type of cells and are arranged along a vertical axis attaching above and below to the vertebral bodies. These cells are formed from the cranial portion of the dark caudal mass and develop into the annulus fibrosus.

The adult nucleus pulposus has double origin, from the notochord and from fibrous ingrowths of the annulus fibrosus. This double origin explains the absence of any clear line of demarcation between the annulus and the nucleus in an adult disc ( Davis , 1967) .

At birth the vertebral bodies are bi-convex, having well rounded upper and lower Surfaces. These Surfaces

are covered by cartilagenous end plates and bone growth takes place over the whole of the subcartilagenous area.

The vertebral bodies gradually become flatter, and about puberty secondary centers of ossification appear in the peripheral part of the cartilagenous end-plates. From these Centers ossification spreads to form a bony ring which is partially incomplete posteriorly .

With cessation of growth of the vertebrae, between 16 and 21 years and earlier in the female than in the male, this ring fuses with the vertebral body. The cartilagenous plate covers the bony surface, separating it from the nucleus pulposus, and gives attachment to the fibres of the nucleus and annulus.

## THE LUMBAR VERTEBRA

### The Lumbar Vertebral Body :

This consists largely of a centrum of softer cancellous bone, which may collapse with trauma or osteoporosis, surrounded by a thin shell of more dense and firm cortical bone which proliferates at the sites of disc and ligament attachment to form marginal osteophytes in lumbar spondylosis.

The vertebral body is capped at both ends by hyaline Cartilage which adjoins the intervertebral disc.

The discal Surface of an adult vertebral body demonstrates on its periphery a ring of cortical bone. This ring, the epiphyseal ring, acts as a growth zone in the young, and in the adult it acts as an anchoring ring for the attachement of the fibres of the annulus.

## The neural arch :

The neural arch is formed by the pedicle and superior facet complex laterally and superiorly which becomes continuous with the lamina Posteriorly and the inferior facet below, on each side .

## The Pedicle :

The pedicle arises from the entire superior half of the dorsolateral surface of the vertebral body. The changing shape, dimension and orientation of the pedicle at different vertebral levels, exert substantial effects on the shape of the spinal canal, the dimensions and relations of the nerve root canals, and the dimensions of the intervertebral foramina ( Schneck, 1985 ) .

In general, from the upper to the lower lumbar levels, the pedicles get larger in their cross sectional areas, in the coronal plane, and shorter in their antero-Posterior dimenions.

Viewed laterally , the lumbar pedicle is more deeply notched inferiorly than superiorly . This creates asymmetry in the anterior wall of the lumbar intervertebral foramen, with the back of the body of the upper vertebra contributing more to the upper part of the anterior wall than the back of the body of the vertebra below.

The articular Processes:

The articular processes arise from the junction of the pedicles and laminae behind the transverse processes.

The superior facet is smaller than the inferior facet, its concave cartilagenous surface faces medially. It forms the roof of the lateral recess, where the nerve root leaves the canal entering its foramen.

The superior facet is rarely visualized during a routine interlaminar exposure for discectomy. It is covered by the inferior facet which is situated posterior and medial to it.