RADIOLOGICAL INVESTIGATIONS IN THE SPINAL LESIONS

THESIS

Submitted in Partial Fulfilment for
The Degree of M. S. in
Radiodiagnosis

By

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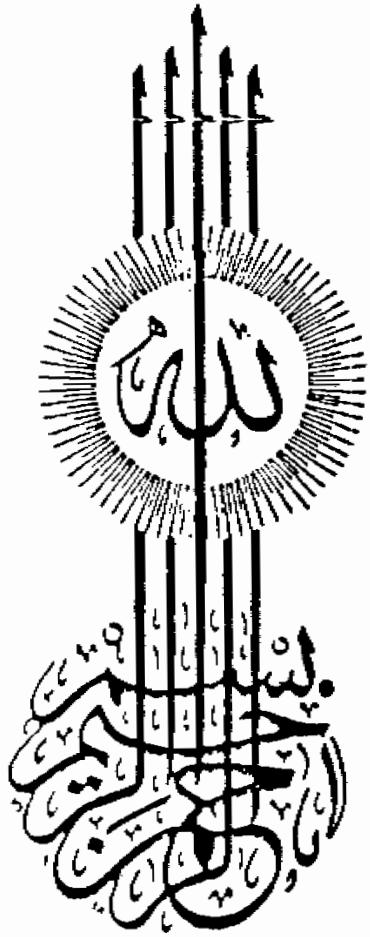
1986



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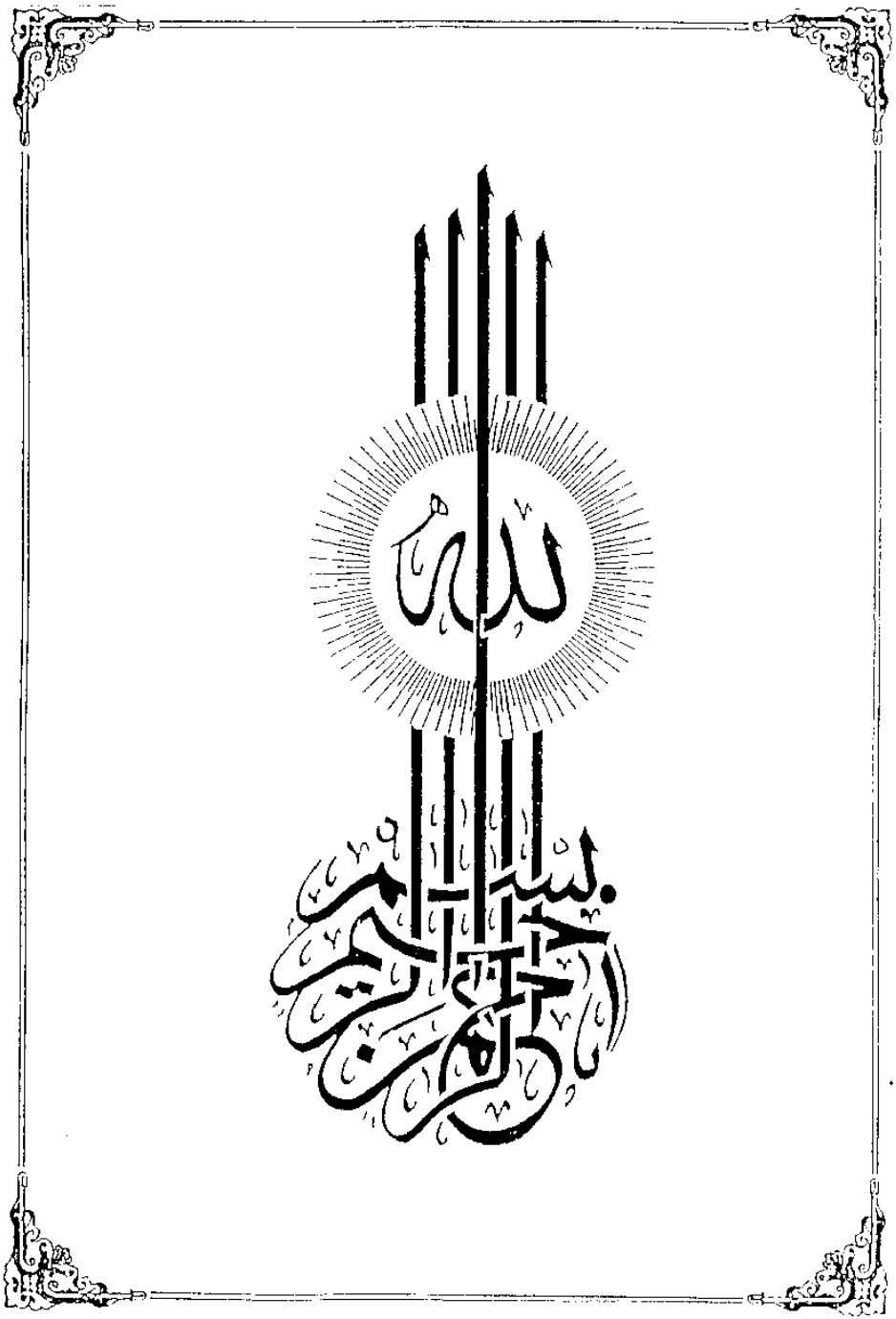

Acknowledgement

In presenting this work, I would like to express my deepest gratitude, indebtness and appreciation to professor **Dr. Gamal Abd El-Kader,** professor of diagnostic radiology Ain Shams University for his guidance, encouregment, and enlightening remarks throughout the achievement of the work.

I am also greatly indebted to **Dr. Saad Aly,** Lecturer of Diagnostic radiology, Ain Shams University for his guidance and willing valuable advice throughout the acheivement of this work.

My sincere and heartful thanks for my collegues in Neuroradiological Unit Ain Shams University for the great facilities they offered me and encouragment.

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INTRODUCTION

AND

AIM OF WORK

Aim of Work

The spine is the seat of many diseases, as well as traumatic injuries.

The conventional radiological tools and scan modalities are of utmost value in the diagnosis of such lesions.

This work aims at demonstrating the role and the value of radiological investigations and imaging modalities in diagnosis of these lesions.

REVIEW OF LITERATURE

Anatomy of the Vertbral Column

The vertebral column is present in all the vertebrate animals forming the central axis of the body.

The human spine is built up of:-

(1) Series of vertebral: 7 cervical, 12 thoracic, 5 lumbar, 5 sacral (fused into the coccyx). This rumber may increase or decrease one vertebra at the expense of the region above or below.

(2) Intervertebral discs of cartilage: in between the bodies of the vertebral. They constitute about 20% of the length of the column.

The vertebral column serves many functions such as:

- Forms the axis of the body.
- Protect the spinal cord.
- Supports the skull and indirectly the upper limbs.
- Transmits the weight of the body of the lower limbs.

The articulated vertebral column:

Its anterior and lateral surfaces:- the bodies of vertebra and intervertebral discs are placed one above the other for the transmission of body weight.

Its posterior surface:- shows in the median plane the spinous processes. Their direction varies in different regions **(a)** The cervical are short, bifid and nearly horizontal (except the 2nd and 7th). **(b)** The thoracic in the upper part oblique and directed downwards. In the lower part horizontal. **(c)** The lumbar are horizontal.

The following are the important landmarks for the vertebral column.

1- 7th cervical spine: felt at lower end of nuchal furrow.

2- 1st thoracic spine felt below the 7th cervical.

3- 3rd thoracic spine oposite root of scapular spine.

4- 7th thoracic spine opposite inferior angle of scapula.

5- 4th lumbar spine opposite highest part of iliac crest.

6- 2nd sacral spine at level with posterior iliac spine which lies in dimple above the medial part of the buttok about 4 cms lateral to the 2nd sacral spine. (Z. Mahran Osteology 1983).

Curves of the vertebarl column

The adult vertebral column when examined from the side, presents a number of curves:-

(a) Cervical curve:- convexity forwards starts from C_1 to T_2 vertebrae.

(b) Thoracic curve:- primary concavity forwards starts from T_2 to T_{12}. This concavity caused by the increased depth of the posterior part of the thoracic vertebral bodies.

(c) Lumbar curve:- convexity forwards, start from T_{12} vertebra to lumbosacral angle.

(d) Pelvic curve:- primary concavity forwards starts from the lumbosacral angle to the lower end of the coccyx.

The Intervertebral Disc

A plate of fibrocartilage which is placed between the bodies of adjacent vertebrae from the axis (2nd cervical)

to the sacrum. The discs act as buffer between the vertebral bodies and neutralises and counteracts the shocks applied to the column. Thickness of disc is variable in diferent regions of the column. In cervical and lumbar, the discs are thicker infront, therefore they share in formation of the convexity in these regions but in thoracic region they are uniform in thickness.

The intervertebral disc consists of:-

1- The thin, hyaline cartilagenous articular plates.
2- The nucleus pulposus.
3- The annulus fibrosus.

Articular plate:- In the growing spine, the cartilagenous articular plate overlaps the anterior and lateral margins of each vertebral body, forming the "epiphyseal ring" (Schmorl). When full growth is attained enchondral bone formation stops and fusion between the epiphyseal ring and vertebral body takes place. In the adult, the epiphyseal ring measures aproximately 2-3 mm. in width and 1.5-2.0 mm in height, projecting above the articular surface of the vertebral body as an incomplete smooth bony ring that encloses disc anteriorly and laterally but not posteriorly. The fibres of the annulus fibrosus

are firmly attached to the compact bony ring). The residual central portion of the articular surface of the vertebral body consists of spongy bone, which abuts on the cartilaginous plate. This spongy surface is subject to erosion by nuclear tissue, which may prolapse into it (Schmorl's nodes).

Nucleus pulposus:- The demarcation between the nucleus pulposus and the annulus fibrosus, although definite, is not sharpely defined. The nucleus pulposus usually occupies a position posterior to the centre of the vertebra. The fibro cartilagenous nuclues has a semigelatinous, white, glistening appearance. The turgor of the rucleus depends on its water content, which dimineshes with age. The decrease in the fluid content normally begins in the third and fourth decades and usually progresses slowly. It may be accelerated by any condition that result in disc degeneration, that is trauma or inflammation.

Annulus fibrosus:- The annulus, the strongest portion of the intervertebral disc, firmly bind the vertebral together. It also determines the size and form of the disc. It consists of variable number of concentric lamellae which encircle the nucleus, extending out over the entire

disc surface. Although the adult intervertebral disc is avascular, it does communicate with the interstitial fluid space by diffusion through the cartilagenous plates. This brone out by the fairly rapid disappearance of aqueous contrast material from the nucleus pulposus after disc puncture.

The General Characteristics of a Vertabra

A typical vertebra:- is made up of two principal parts an anterior, termed the body, and a posterior, termed the vertebral arch; these enclose a foramen which is named the vertebral foramen. The opposed surfaces of the bodies of adjoining vertebrae are firmly connected to each other by the intervertebral discs. The vertebral foramina placed one above another, constitute a canal in which the spinal cord is lodged and protected. Between contiguous vertebrae two intervertebral foramina, one on each side open into the canal and serve for the transmission of the spinal nerves and vesels (Grays Anatomy 1967).

The body: This has a posterior surface which is cancave or flat from side to side and forms part of the vertebral foramen and canal. The anterior and lateral aspect merge

so that the body is convex from side to side but the upper and lower margins are slightly flared to produce a vertical concavity. The superior and inferior surfaces are nearly flat and are rough for the attachement of the discs, except the periphery are smooth (Cunningham's Anatomy 1964).

The arch:- has a pair of pedicles and a pair of laminae; it supports seven processes, one spinous, four articular and two transverse processes.

The pedicles are a pair of short, thick processes which project backward from the body at the junction of its lateral and posterior surfaces. The concavities above and below the pedicles, termed the vertebral notches, and when the vertebrae are articulated, the notches of contiguous vertebrae form the intervertebral foramina.

The laminae are broad plates directed backwards and medially from the pedicles. They fuse in the spinous process posteriorly, and so complete the posterior boundary of the vertebral foramen.

The spinous process is directed backwards and downwards from the junction of the laminae. The processes are subject to great variations in size, shape and direction.