Role of Radiology and Imaging Modalities in Diagnosis of Disc Fragment Migration

Essay

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Master Degree of **Radiodiagnosis**

By

Hanan Abdulaziz Amro
M.B.,B.Ch.

Under the Supervision of

Prof. Dr. Ahmed Abd El-Tawab Mohamed
Assistant Professor of Radiodiagnosis
Faculty of Medicine
Ain Shams University

Dr. Hesham Mahmoud Ahmed Mansour
Lecturer of Radiodiagnosis
Faculty of Medicine
Ain Shams University

FACULTY OF MEDICINE
AIN SHAMS UNIVERSITY
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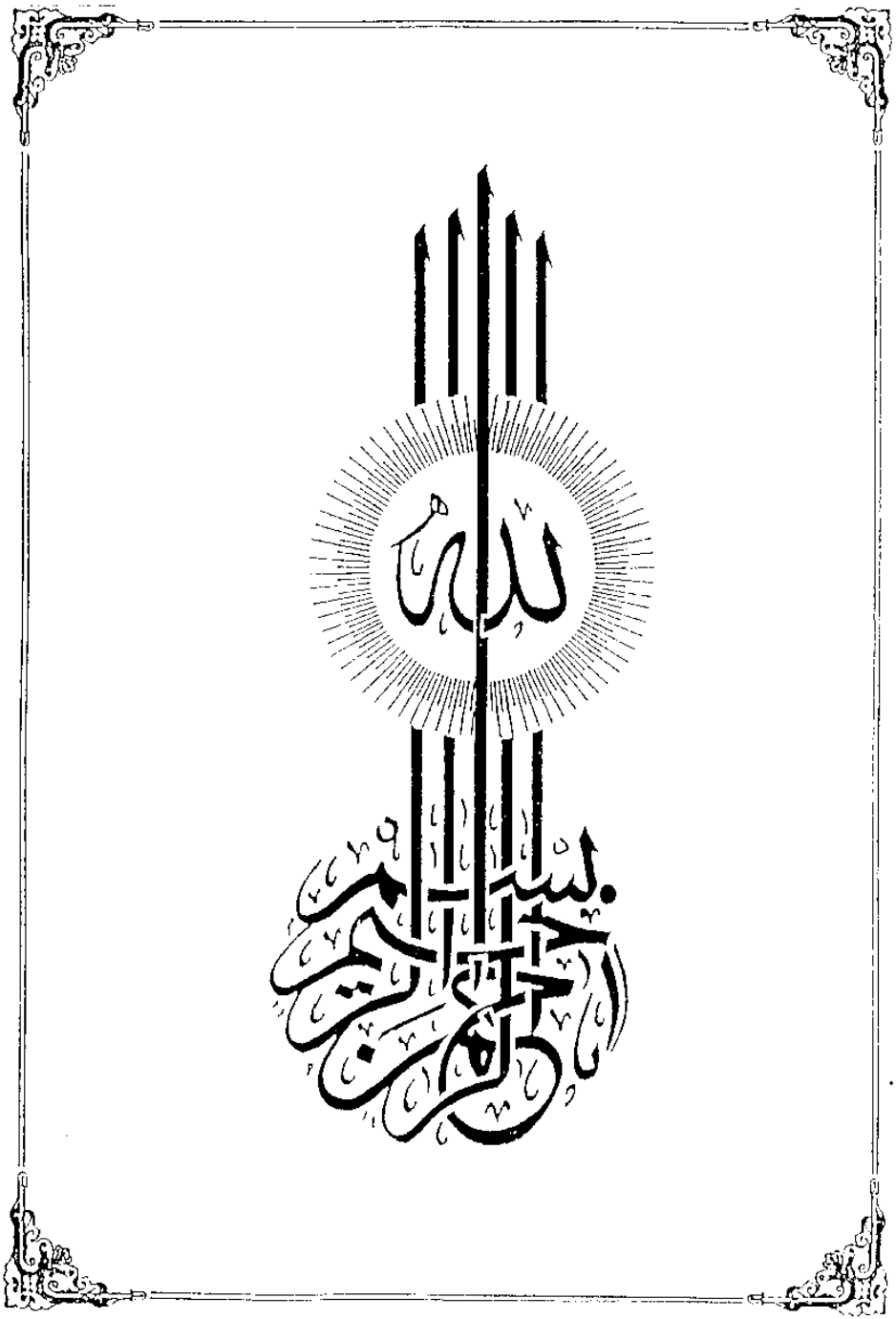

Contents

Abbreviations

CSF = Cerebrospinal Fluid
CT = Computed Tomography
DTPA = Diethylene triamine Penta acetic acid
Gd = Gadolinium
GRE = Gradient repitation Echo
H.Us. = Hounsfield Unit
HNP = Herniated nucleus pulposus
I = Iodine
iv = intravenous
MR = Magnetic Resonance
SNR = Signal to noise ratio
TE = The Time to echo in the spin-echo sequence
TR = Repetition Time
WI = Weighted Image

INTRODUCTION AND AIM OF WORK

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This work analyzes the most frequently observed migration paths of disc fragments and reviews the most common neurodiagnostic techniques used in evaluating patients with suspected herniated disc disease.

In this article a comparison between MR, CT, and metrizamide myelography in the evaluation of disc herniation was done, the techniques, appearances, sources of erroneous interpretation, and scan deficiencies will be the main topics of our presentation.

Also, the advantages and limitations of each examination will be discussed.

The aim of this work is to find out the role of radiology and different imaging modalities in diagnosis of disc fragment migration.

ANATOMICAL CONSIDERATIONS

ANATOMICAL CONSIDERATION OF THE SPINE

Gross anatomy of the intervertebral discs and spinal canal

Intervertebral discs:

The vertebrae articulate anteriorly through their bodies by the interposition of fibrocartilagenous discs. In the aggregate these discs form a fifth of the postaxial vertebral column, cervical and lumbar regions having, in proportion to length, more discs than the thoracic and hence being more pliant.

Thickness vary in different regions and parts of the same disc; they are thicker anteriorly in cervical and lumbar regions, contributing here to anterior convexity, but nearly uniform in the thoracic region, anterior concavity here being largely due to vertebral bodies. Discs are thinnest in upper thoracic, thickest in lumbar regions.

Discal outlines correspond with the bodies which they connect, *(Gray, 1989)*.

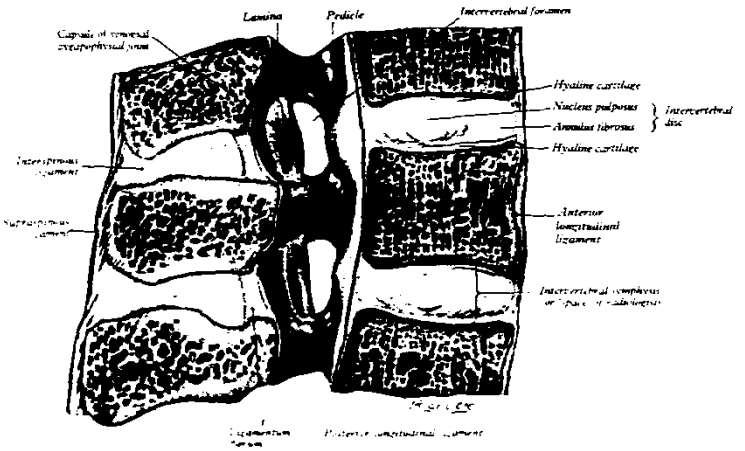

Fig. (l): Median sagittal section through part of the lumbar region of the vertebral column, *(Quoted from Gray, l989).*

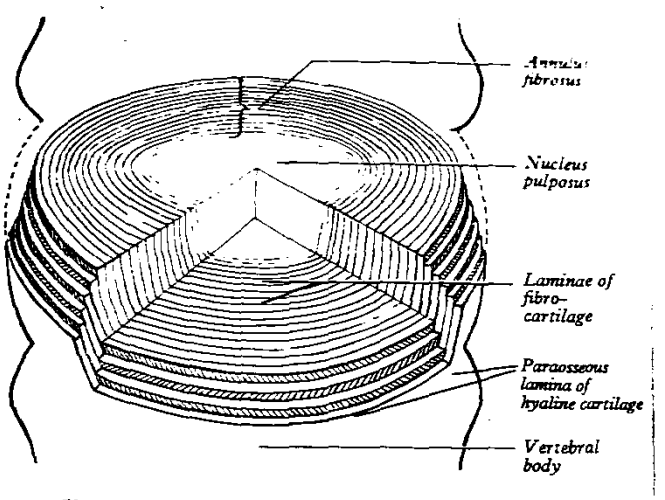

Fig. (2); Simplified scheme of the main structural features of an intervertebral disc. The fibrocellular structure of the nucleus pulposus is omitted. Note alternating obliquity of collagen fascicles in adjacent laminae, *(Quoted from Gray, l989).*

Each disc is attached intimately to the compact rim of the superjacent and subjacent vertebral bodies, and is connected loosely to the limiting cartilagenous plates over their sievelike surfaces, *(Mc Vay, 1984).*

Discs are maintained in their position principally by the anterior and posterior longitudinal vertebral ligaments, the posterior ligament being the weaker of the two, (Fig.1), *(Mc Vay, 1984)* at the thoracic level they are tied laterally by intra-articular ligaments to the heads of ribs articulating with adjacent vertebrae, *(Gray, 1989).*

The middle of such a disc is filled with a soft gelatinous matrix described as the nucleus pulposus, the periphery of the disc, on the other hand, is a strong ring like collar of fibrocartilage termed the annulus fibrosus, (Fig. 2), *(Cormack, 1987).*

The annulus fibrosus, a concentric series of collagenous and fibrocartilageous lamellae, surrounds and contains the nucleus pulposus, limits distraction of the vertebral bodies, and, togeher with the nucleus, counteracts the compressive forces of weight bearing.

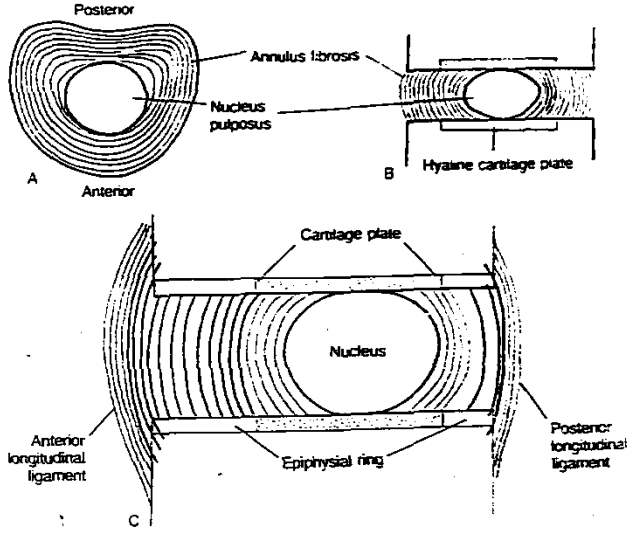

Fig. (3): A, B, and C, Fibers of the annulus fibrosus and their relationship to the vertebrae and nucleus pulposus, *(Quoted from Teplick; and Haskin, 1983).*

These obliquely oriented lamellae are anchord in the hyaline cartilage endplates and, as sharpey's fibers, actually penetrate the ring apophysis. The outermost fibers of the annulus blend with the vertebral periosteum and posterior longitudinal ligament. The thinner, more vertically oriented posterolateral fibers are the weakest, (Fig.3), *(Williams, 1983).*

The central part of the nucleus pulposus and the innermost layers of the annulus fibrosus (both of which are loaded in compression) contain mainly type II collagen. However, the peripheral part of the nucleus pulposus and the bulk of the annulus fibrosus (both of which are loaded in tension) contain mainly type I collagen, the type found in tendons and bone.

This unique combination of the incompressible gelatinous nucleus pulposus and the inextensible annulus fibrosus at its periphery provides a cushion between adjacent vertebral bodies that permits slight movement between them, *(Cormack, 1987).*

Vertebral or spinal canal:

The collective vertebral foramina make a continous central canal in the spinal column.

The anterior wall is closed uniformly by the posterior surfaces of the bodies of the vertebrae and their intervertebral

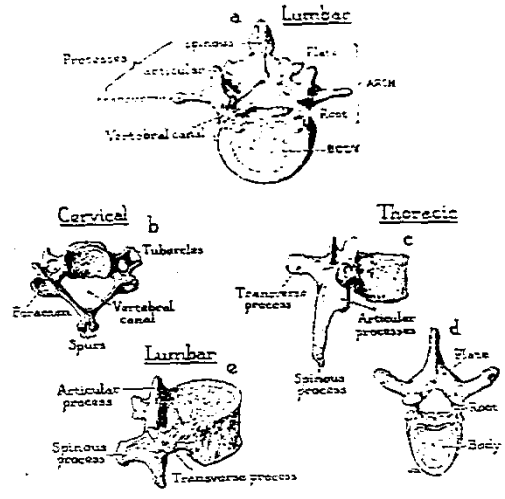

Fig. (4): Typical vertebrae of cervical, Thoracic and lumbar divisions of the spinal column, *(Quoted from McVay, 1984).*

discs, and the common posterior longitudinal ligament passes over them.

The posterior and lateral walls are made up of the superimposed bony arches, the interspace of which are spanned behind by the ligamenta flava and left open laterally as the intervertebral foramina. The whole is lined smoothly by periosteal and ligamentous surfaces, (Fig. 1).

The form of the vertebral canal, although presenting some individual veriations, is fairly constant, (Fig. 4).

It is approximately circular where it is continous with the foramen magnum, assumes a triangular form through the cervical region, becomes round through the thoracic region, and again assumes the triangular form in the lumbar region. Within the sacrum the canal flattens and expands laterally in the form of a crescent. In the flexible cervical and lumber regions the canal has distinct enlargements to accomodate the cervical and lumbar enlargements of the cord, *(Mc Vay, 1984).*

The spinal canal contains: The spinal cord, Spinal meninges, and The epidural space.