ROLE OF C.T AND MRI IN EVALUATION OF RECURRENT SYMPTOMS AFTER LUMBAR DISC OPERATIONS

ESSAY
Submitted In partial fulfillment
of Master Degree
of
Radiodiagnosis

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1994

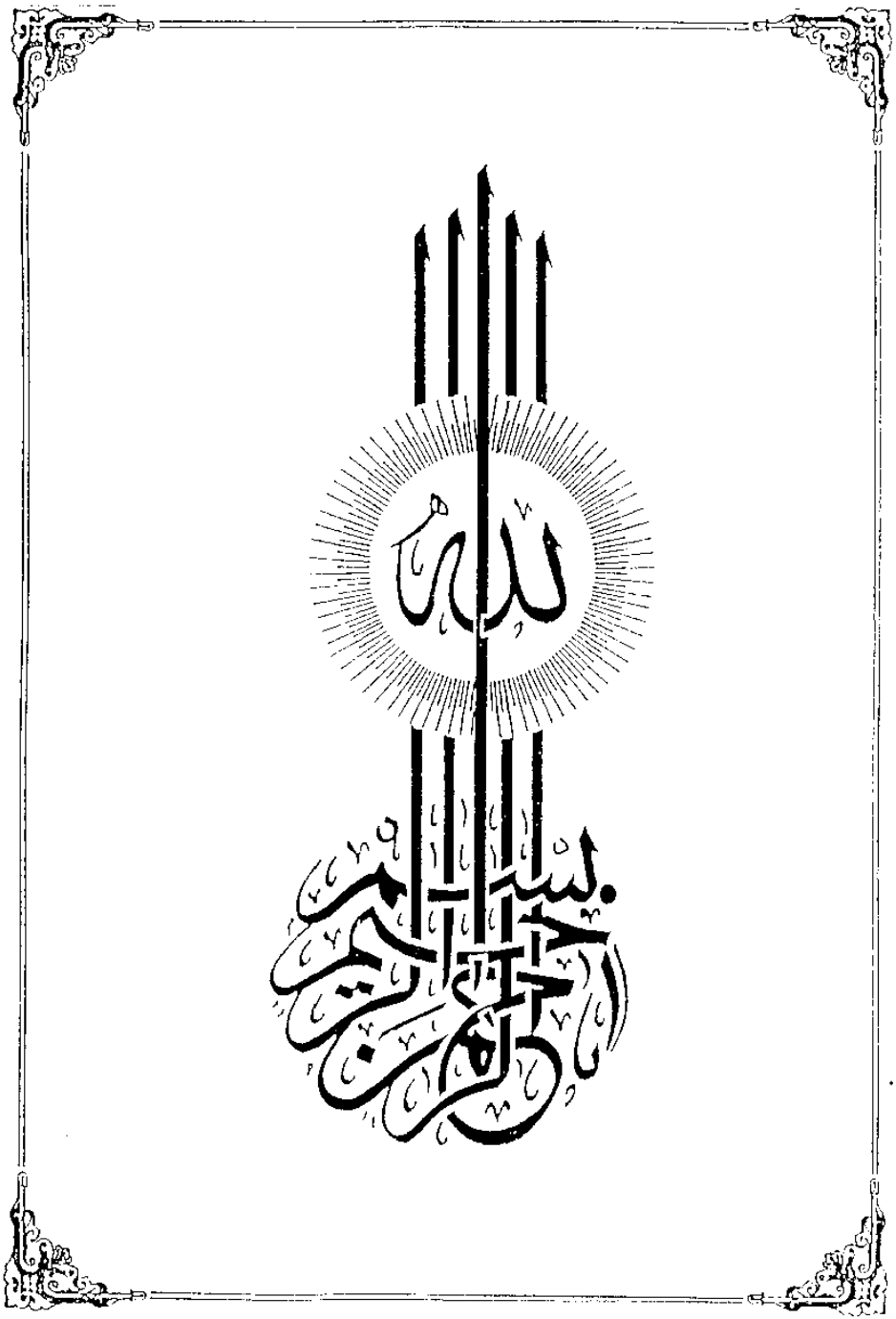
AKNOWLEDGEMENT

Impressed with the motherly encouragement of *Prof. Dr. Nawal Zakaria,* Professor of Radiodiagnosis, Ain Shams University, I wish to thank her for her time, interest and commitment. I am also grateful to her for her insightful supervision and valuable comments which helped me most to complete this work in its present form.

Special thanks are also due to *Dr. Yasser Abd El-Azem,* Lecturer of Radiodiagnosis, Ain Shams University who gave me generously of his time and provided detailed criticisms to which I tried to respond and which helped me most to clarify many hazy areas.

Many thanks to all staff members and residents in the department of Radiodiagnosis, Ain Shams University .

Finally, no words can express the warmth of my feelings to my family for their understanding and patience.



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Abbreviations

CSF	= Cerebrospinal Fluid
CT	= Computed Tomography
DTPA	= Diethylene triamine Penta acetic acid
Gd	= Gadolinium
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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Persistent or recurrent symptoms following spinal surgery has become known as the failed back surgery syndrome (FBSS).

The failed back surgery syndrome is an acronym for a heterogenous group of disorders whose hallmark is back pain, sciatica and functional impairment.

The failed post operative back represents a major clinical problem for both the patient and health care system.

The diagnostic evaluation of patients presenting with FBSS is a major challenge to both radiologists and surgeons.

Clinical assessment is difficult since the physical signs and sensory symptoms are frequently non-specific. Electromyography, selective nerve root blocks and discography have all been used in evaluation of FBSS with only moderate success.

CT of the lumbar spine and specially I.V. iodine contrast enhanced CT have led to a dramatic expansion in the understanding and knowledge of normal and pathologic spinal anatomy and it represents a major improvement in the diagnosis of the disease.

Today, MRI is establishing itself as the modality of choice for imaging the post-operative spine, its major advantages are its multiplaner capability, superior soft tissue contrast resolution and excellent tissue characterization.

The aim of this work is to differentiate between the different causes of FBSS using CT and MRI in order to reach the proper diagnosis, so that the patient could recieve the proper management of his condition.

In order to fulfill this aim, some anatomical and pathological considerations are first given.

ANATOMICAL CONSIDERATIONS

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Gross anatomy of the intervertebral discs and spinal canal:

Intervertebral Discs:

The vertebrae articulate anteriorly through their bodies by the interposition of fibrocartilagenous discs. Intervertebral 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.

Discal outlines correspond with the bodies which they connect, thickness varying 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 thickest in lumbar region *(Gray, 1989).*

Each disc is attached intimately to the compact rim of the superjacent and subjacent vertebral bodies and is connected loosly to the limiting cartilagenous plates over their sieve like surface.

Discs are maintained in their position principally by the anterior and posterior longitudinal ligaments, the posterior ligament being the weaker of the two (Fig. 1) *(Mc Vay, 1984).*

Each disc is a fibrocartilagenous complex that consists of two components, the internal semi-fluid mass, the nucleus pulposus and its laminar fibrous container, the annulus fibrosus, (Fig.2). Typically, the nucleus occupies an eccentric position within the confines of the annulus, usually being closer to the posterior margin of the disc.

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

These obliquly oriented lamellae are enchored in the hyaline cartilage endplates and as sharpey's fibers actually penetrate the ring apophysis, the outer most fibers of the annulus blend with the vertebral periosteum and posterior longitudinal ligament (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 and the bulk of the annulus (both of which are loaded in tension) contain mainly type I collagen, the type found in tendons and bones. This combination of the incompressible gelatinous nucleus pulposus and inextensible annulus fibrosus at its periphery provides a cushion between adjacent vertebral bodies that permits slight movement between them *(Cormack, 1987).*

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 discs, and the 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 spinal canal is approximatly 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 (Fig.4). Within the sacrum, the canal flattens and expands laterally in the form of a crescent. In the flexible cervical and lumbar regions the canal has distinct enlargement to accomodate the cervical and lumbar enlargement of the cord. The spinal canal contains the spinal cord, spinal meninges and the epidural space *(Mc Vay, 1984).*

The spinal meninges :

Are the direct downward continuation of the cranial meninges, at the formen magnum the outer dural layer blends with the periosteal and ligamentous lining of the spinal canal. The inner layer is tough and fibrous, it forms the dural sac investing the more delicate meninges and cord and the emerging nerve roots. It also sends out expansions over the spinal nerves emerging through the intervertebral foramina.

The spinal arachnoid, a delicate, non vascular sac lining the dural tube and intimately connected with it.

The dura and arachnoid move freely upon one another, the space between them is a potential cavity. The delicate arachnoid sac invests the cord loosly and its deep space forms the outer limit of the subarachnoid space.

The pia matter is a delicate vascular membrane closely attached to the fissures and surfaces of the cord and carrying blood vessels to its substance. It gives off numerous lateral septal prolongations to the arachnoid and adhers closely to the nerve roots investing them with delicate sheaths which accompany the nerves across the subarachnoid space to blend with the dural sheath *(Mc Vay, 1984).*

The subarachnoid space :

Containing CSF usually extends down to the second segment of the sacrum but it may terminate at any level between the fifth lumbar and the fourth sacral segments (Fig. 5) *(Sutton, 1987).*

The extradural space :

Between the dural sac and the walls of the vertebral canal, this is filled loosly with fatty areolar tissue and venous plexuses, and the whole is supported by connective tissue bands holding the dural envelope to the anterior and posterior walls of the vertebral canal *(Mc Vay, 1984).*

Lumbar vertebral characteristics:

A typical vertebra (Fig.6) is composed of two main portions, namely a body and an arch. The arch consists of two pedicles and a pair of laminae, the space enclosed by the body and the arch is the spinal (vertebral) canal. The arch supports seven processes, four articular, two transverse and one spinous.

The vertebral bodies increase progressively in size from cervical to lumbar regions to become larger in the lumbar region. The laminae of a lumbar vertebra are short and strong and the surfaces of their articular processes lie in a sagittal plane. The transverse process of a lumbar vertebra is long, slender and horizontal. The spinous process of a lumbar vertebra is thick , broad, quadrilateral and horizontal (Fig.6) *(Mc Vay, 1984).*

Vertebral bodies are united by anterior and posterior longitudinal ligaments and by fibrocartilagenous intervertebral discs between laminae of hyaline cartilage, together forming symphyses. The laminae, spinous and transverse processes are connected through syndesmoses constituted by ligamenta flava, interspinous, supraspinous and intertransverse ligaments and ligamentum nuchae *(Gray, 1989).*