

# **THE VALUE OF CT SPINE WITH METRIZAMIDE IN DIAGNOSIS OF SPINAL LESIONS**

**Thesis**

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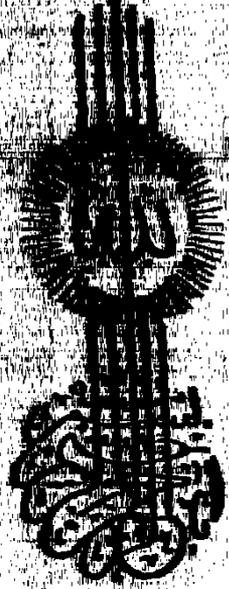
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وَسَيُجَنَّبُكَ لِأَعْلَانَا إِمَامًا مَدِينًا  
أَنْتَ أَنْتَ الْعَالِي الْعِلْمِ  
صِدْقَ اللَّهِ الْعَظِيمِ

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**INTRODUCTION  
AND  
AIM OF THE WORK**

## INTRODUCTION AND AIM OF THE WORK

With the progress of new procedures in surgery, spinal lesions are becoming in many circumstances a treatable condition. The presence of an accurate method for their diagnosis is an essential need in order to intervene early before the occurrence of permanent neurological damage.

Although myelography specially after the introduction of water soluble contrast media and small bore needles has become a relatively simple procedure, adding much information to the diagnostic tools in spinal imaging, yet it is not conclusive in many spinal lesions.

Computed tomography (CT) which is gradually assuming a larger share of the diagnostic imaging workload, is now used more often to evaluate the spinal problems.

When combined with metrizamide, CT provides a maximum discrimination between different compartments of the spinal canal, thus helping in defining the origin of the pathology, its extent and its effects on different neurological structures.

Hence, the aim of this work is to throw some light on the role of CT of the spine with metrizamide in the evaluation of spinal lesions (congenital, traumatic, inflammatory, degenerative and neoplastic) and its limitations.

In order to fulfill this aim, some anatomical considerations of the spine as well as pathology of the spinal lesions is first given.

# **ANATOMY OF THE SPINE**

## RADIOLOGICAL ANATOMY OF THE SPINE

The normal adult vertebral column consists of 7 cervical, 12 thoracic, and 5 lumbar vertebrae. The sacrum derived from 5 fused segments and a small coccyx articulating with the sacrum, made up of 4 fused segments. Each vertebra consists of a body and a neural arch which encloses the spinal canal. The neural arch is subdivided into paired pedicles, laminae, transverse, superior and inferior processes and a single spinous process (Du Boulay, 1984).

In the erect posture the vertebral column has 2 primary and 2 secondary curves. The primary curves, which are developmentally determined, are the dorsal convexity in the thoracic and sacral regions. The secondary curves which develop in the cervical and lumbar regions are compensatory and to some extent influenced by posture (Du Boulay, 1984).

### The cervical spine

On the lateral projection, the anterior and posterior borders of the cervical vertebral bodies describe a lordotic curve convex anteriorly. The upper surfaces of the bodies are flat or slightly convex and the lower surfaces are slightly concave. The anterior arch of atlas has a D shaped profile, convex anteriorly. The gap between this and the anterior aspect of the odontoid process represents the anterior atlantoaxial joint. Superimposed upon the vertebral bodies are the transverse process. the superior and inferior articular processes are visible as are the transversely aligned apophyseal joints. The laminae although foreshortened, are visible between the posterior margin of the inferior articular process and the base of the spinous process. The point of fusion of the laminae in the midline, the spinolaminar

line marks the posterior limit of the spinal canal. This line runs in continuity with the cortex on the upper and lower surfaces of the spinous process. The horizontal distance between the posterior margin of the vertebral body and the upper part of the corresponding spinolaminar line represents the anteroposterior diameter of the cervical spinal canal (Du Boulay, 1984) (Fig. 1).

### The thoracic spine

On the lateral projection, the upper 3 or 4 thoracic vertebrae are not normally visible due to superimposition of the shoulders. The thoracic spine normally describes a smooth curve, convex posteriorly. The paired pedicles, partly superimposed, project back from the posterior aspect of the vertebral bodies. The upper border of the pedicles is continuous with the anterior aspect of the superior articular facets. Together with the posterior aspect of the intervertebral disc these structures form the inferior boundary of the intervertebral foramen. The inferior border of the pedicle, the posterior aspect of the vertebral body and the anterior aspect of the inferior articular process form the boundary of the upper 2/3 of the intervertebral foramen. The apophyseal joints are partly obscured by the overlying ribs as are the transverse and spinous process (Du Boulay, 1984) (Fig. 2).

### The Lumbosacral spine

On the lateral projection of the lumbosacral spine, the vertebral bodies have slightly concave anterior and posterior borders. The upper and lower surfaces are flat or slightly concave. The pedicles, which are short and broad arise from the posterior superior aspect of the body. The notch formed by the inferior border of the pedicle, the back

Fig. (3): Lumbosacral spine. Lateral view



of the vertebral body, the *pars interarticularis* and the inferior process form the upper 2/3 of the boundary of the intervertebral foramen. The superior articular process, the upper border of the pedicle, the posterior superior margin of the body and the intervertebral disc form the boundary of the lower 1/3 of the foramen. The spinous process appears in profile. The junction of the laminae at the base of spinous process, the spinolaminar line, may be identified. The superior articular process of the 1st sacral segment projects upwards and backwards from the back of the 1st sacral segment. The central mass of the sacrum is shown as a curved tapering wedge convex posteriorly. The posterior aspect of the central mass forms the anterior margin of the sacral canal. The fused laminae form the posterior margin of the sacral canal. The superior articular process of the sacrum projects upwards (Du Boulay, 1984) (Fig. 3).

## C T ANATOMY OF THE SPINE

### Bony structure of the spine

For the purpose of description, the osseous structures of the spine are conveniently divided into the atlas (1st cervical vertebra), the axis (2nd cervical vertebra), the third through seventh cervical vertebrae, the thoracic vertebrae, the lumbar vertebrae, the sacrum and the coccyx.

Atlas. Unlike other vertebrae, the atlas has no vertebral body and no contiguous intervertebral discs. The atlas consists of 2 lateral masses and anterior and posterior arches. The lateral masses have concave superior and inferior articular foveae, which articulate, respectively, with the occipital condyles and with the superior articular surface of the axis. The shape of the articular surfaces and synovial capsules of atlanto occipital articulation permit only flexion and extension. A transverse process extends laterally from each lateral mass. A vertebral artery runs through a foramen in each transverse process. On the anterior and posterior arches are small midline tubercles. A midline cleft in the anterior or posterior arch is a normal variant (Lee et al., 1978) (Fig. 4 a & b).

Axis the axis is distinguished from other cervical vertebrae by the odontoid process (dens) projecting superiorly the dens articulates anteriorly with the arch of  $C_1$  and posteriorly with the transverse ligament of  $C_1$ . These 2 synovial joints make up the medial atlanto axial joint. The lateral masses of  $C_2$  have slightly convex superior articular surfaces, which articulate with the inferior articular fovea of  $C_1$ . These lateral atlantoaxial joints permit a gliding motion of

$C_1$  on  $C_2$ . Together the medial and lateral atlantoaxial joints permit essentially only rotation between  $C_1$  and  $C_2$ . A large bifid spinous process projects posteriorly from the neural arch (Lee et al., 1978) (Fig. 5 a & b).

**Third through seventh cervical vertebrae:** The third through seventh cervical vertebrae are similar. These vertebrae have oval bodies that are larger in transverse than anteroposterior diameter and are about 15mm high. The top and bottom of the vertebral bodies have concave cortical surfaces with thin cartilaginous end plates surrounded by the osseous fused ring apophysis. The posterior surface of each vertebral body is penetrated by a basivertebral vein, which interrupts the normal fine pattern of trabeculae in the spongiosa.

Uncinate processes project superiorly from the vertebral bodies of  $C_3$  to  $C_7$  into shallow concavities in the lateral margins of adjacent vertebrae.

The posterior osseous structures of the cervical spine are the pedicles, laminae, lateral masses, spinous and transverse processes. The cervical pedicles are short and approximately perpendicular to each other. The laminae and pedicles give the cervical spinal canal a triangular shape. The transverse processes are short and distinguished by small anterior and posterior tubercles on either side of the foramen transversarium. The cervical spinous processes are small and sometimes bifid (Lee et al., 1978) (Fig. 6 a & b).

**Thoracic vertebrae** the 12 thoracic vertebral bodies are larger and more coarsely trabeculated than the cervical vertebrae. Unlike

the cervical vertebrae, they have shorter transverse than anteroposterior dimensions and a concave posterior surface, their height is on the average 25 mm.

The thoracic pedicles are longer and more nearly in a sagittal plane than the cervical pedicles. The long thoracic laminae project inferiorly to partially overlies the lamina of the succeeding vertebra. The spinous processes are long, slender and overlapping. The transverse processes are also longer than the cervical processes (Lee et al., 1978) (Fig. 7 a & b).

Ribs articulate with facets on the transverse processes and vertebral bodies of the thoracic spine.

The spinal canal is nearly round in the midthoracic region and nearly triangular at either end (Lee et al., 1978).

Lumbar vertebrae the five lumbar vertebral bodies are oval in cross section with a greater transverse than anteroposterior diameter. In the thick trabeculation of the spongiosa, the basivertebral veins are clearly distinguished.

In the lumbar spine, the pedicles, laminae and spinous processes are short and thick, whereas the transverse processes are long, delicate, flat, and in an anteroposterior plane. The lumbar spinal canal is approximately triangular in cross section. The anterolateral margin of the laminae near the superior articular facet, is notched by insertion of the facet joint capsule (Lee et al., 1978) (Fig. 8 a & b).

Sacrum The sacrum consists of 5 fused vertebrae. The sacral hiatus is at the dorsal end of the spinal canal. The sacral foramina