RADIOLOGICAL AND IMAGING STUDY OF CERVICAL SPINAL CANAL STENOSIS

Thesis

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in Radiodiagnosis

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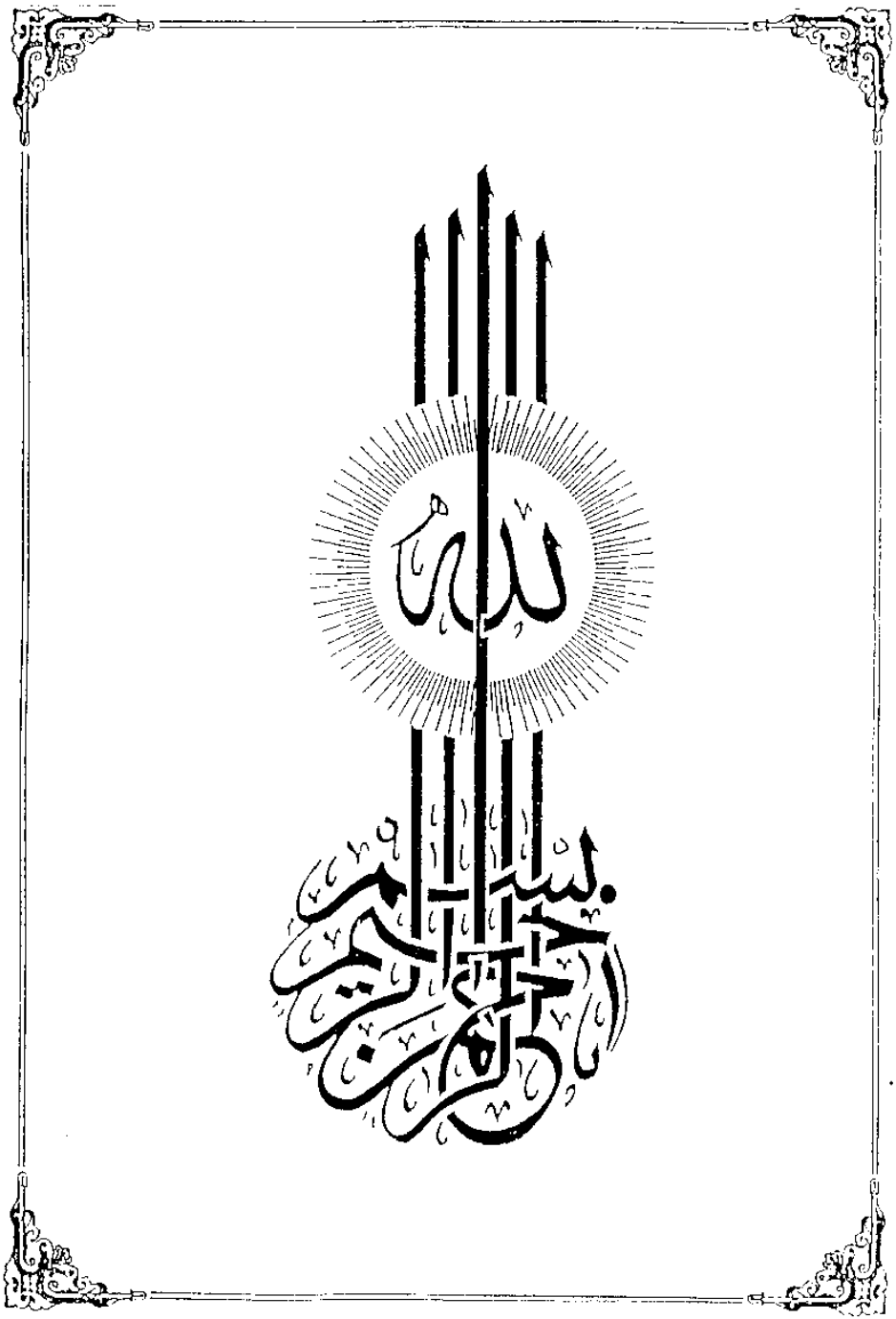

DEDICATED TO MY WIFE

ACKNOWLEDGEMENT

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First of all I thank "God the Almighty", Father of all knowledge and wisdom, without whose light, no mind could ever have grasped His wonderful work in that complex creature ... Man.

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Introduction And Aim Of Work

INTRODUCTION AND AIM OF WORK

Stenosis of the cervical canal of sufficient severity to produce neural signs and symptoms is encountered in a variety of conditions, either congenital or acquired.

Cervical spinal stenosis can present clinically by myelopathy due to compression of the cord, or radiculopathy due to compression of the spinal nerves. Regardless of the precipitating entity, a common picture may be recognized featuring profound neurologic disturbance in case of cord compression. Some variations according to the individual disturbance may also be identified.

The outstanding feature is the creeping or insidious onset of symptoms that for some time may not be identified as coming from cervical cord involvement. Weakness in the lower limbs, and a creeping spasticity that gradually interfere profoundly with gait are salient findings. In contrast, sensory changes are sparse.

As for root compression, dermatomal pain, sensory and motor signs are encountered.

Transient cervical spinal neurapraxia, with sensory and or motor changes in both arms , both legs or all four extremities can also occur. These changes are precipitated by trauma or sudden movements, especially hyperextension or hyperflexion.

Definite diagnosis of cervical canal stenosis rests on radiological and imaging techniques. A narrow sagittal diameter of the osseous canal, classically establishes the diagnosis.

The role of the radiological and imaging techniques surpasses this, by clearly showing the effect of the compromised canal on the spinal cord and spinal nerves.

The aim of this study is to emphasize the role of different radiological and imaging techniques in the diagnosis of cervical spinal canal stenosis.

Normal Radiological And Imaging Anatomy Of The Cervical Spine

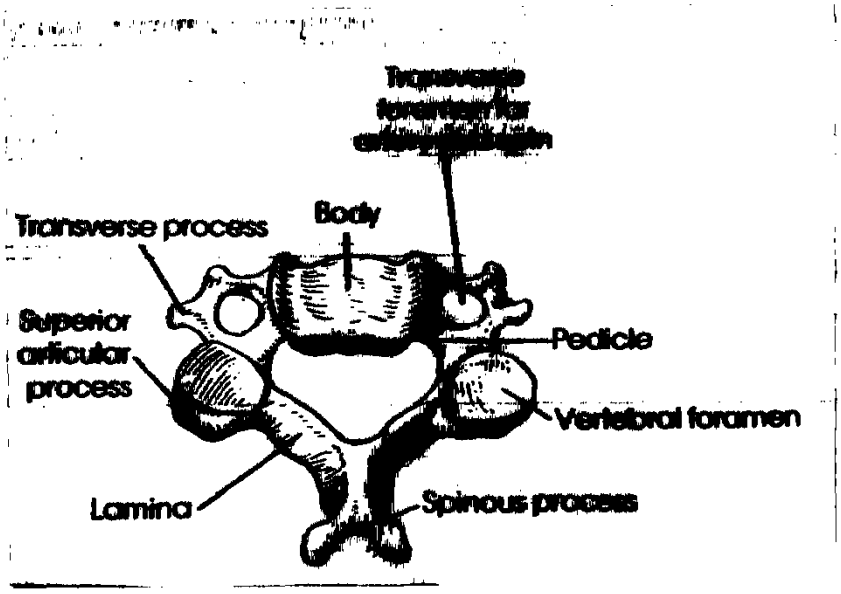

Fig. (1): Superior aspect of typical cervical vertebra **(After Ballinger, 1986).**

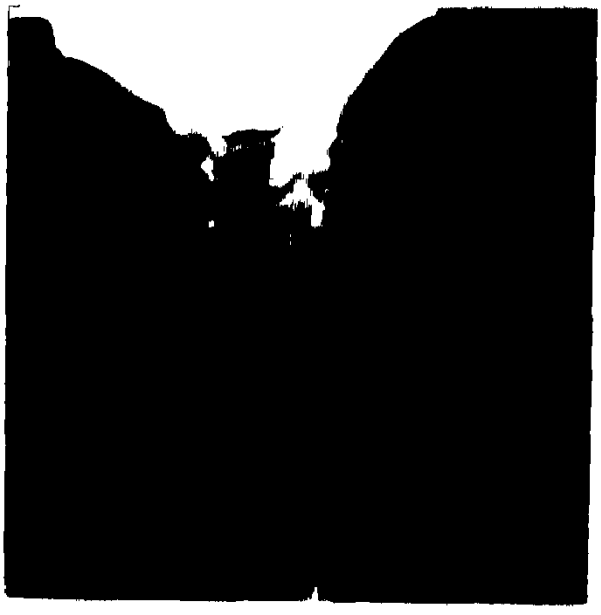

Fig. (2): Cervical spine, A.P. projection. **(Private practice).**

NORMAL RADIOLOGICAL AND IMAGING ANATOMY OF THE CERVICAL SPINE

The seven cervical vertebrae constitute the most superior extension of the vertebral column.

Development of the cervical spine

The vertebrae develop from the sclerotome parts of the mesodermal somites. A vertebra ossifies in three parts, the centrum and the right and left halves of the neural arch, and these are the three morphological parts of a vertebra. In the cervical region, the costal elements become fused to the neural arches and are incorporated as morphological parts of the vertebrae **(Last, 1988)**.

Typical cervical vertebrae

Since the atlas and axis are greatly modified to support the head and permit its rotation at the atlanto-axial joint, and the seventh vertebra is also modified, so the typical vertebrae are the third to the sixth.

The typical cervical vertebrae (Fig. 1) have small, transversely oblong bodies that have slightly prolonged anteroinferior borders, resulting in overlapping of the bodies in the A.P. view **(Ballinger, 1986)**.

The upper end plates present sagittal ridges, the uncinate processes at the postero-lateral margins. Together with corresponding notches of the lower end plate of the vertebra above, they form the uncovertebral joints of Von-Luschka, which are well apparent in the A.P. view (Fig. 2) and in C.T. **(Sherk and Parke, 1983)**.

The margins of the uncinate processes are compact bone and appear as low signal on all MR pulse sequences. This low signal allows the uncinate processes to be discriminated from higher signal disc on T2 weighted and variable flip angle gradient echo images. The base of the uncinate process often contains an extension of vertebral bone marrow, and may appear isointense with the disc on T1 weighted images **(Enzmann et al., 1990)**.

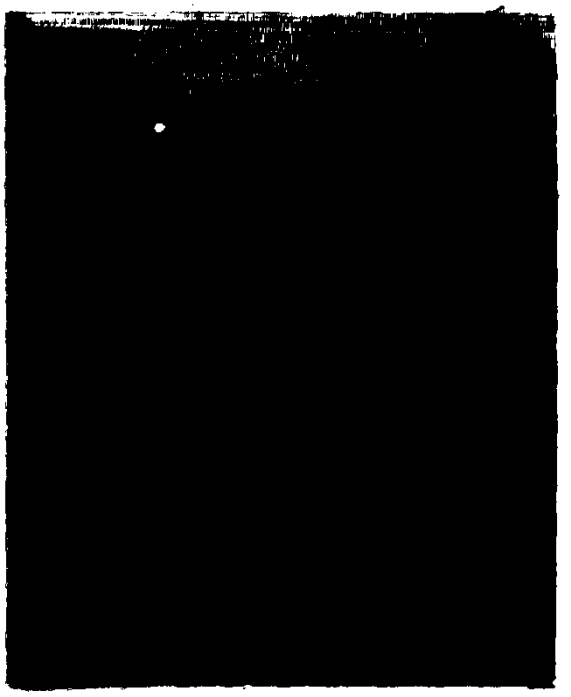

Fig. (3): Cervical spine, left posterior oblique projection, showing the right intervertebral foramina.
(Private practice).

Fig. (4): Cervical spine, Lateral projection.
(Private practice).

The pedicles project laterally and posteriorly from the body, and their superior and inferior vertebral notches are nearly equal in depth **(Ballinger, 1986)**. As two vertebrae articulate with each other, the superior notch of the lower vertebra and the inferior notch of the upper vertebra form the intervertebral foramen, through which the spinal nerves leave the vertebral canal **(Hiatt and Gartner, 1987)**. The oblique views are utilized primarily to study the intervertebral foramina and surrounding structures. Because the axis of these foramina is directed anterolaterally, in the left posterior oblique position, the right intervertebral foramina are seen and vice versa (Fig.3)**(Mikhael, 1981)**.

The transverse processes of the cervical vertebrae arise partially from the side of the body and partially from the vertebral arch, are short and wide, are perforated by the transverse foramen (foramen transversarium) for the transmission of the vertebral artery and vein, and present a deep concavity on their upper surfaces for the passage of the spinal nerves **(Ballinger, 1986)**.

The broad thin laminae spring from the backs of the lateral articular masses and project postero-medially to unite in the midline to form a short, usually bifid spinous process.

The superior and inferior articular processes are situated behind the transverse process, where, arising at the junction of the pedicle and the lamina, they form a short column of bone that is usually referred to as the articular pillar. The superior and inferior articulating surfaces are directed obliquely posteriorly and inferiorly. The apophyseal joints of the lower six cervical vertebrae are situated at right angles to the midsagittal plane of the body, so that they are clearly demonstrated in a true lateral projection (Fig. 4)**(Ballinger, 1986)**.

Atypical cervical vertebrae

1- **The Atlas**

The first cervical vertebra is a ring-like structure having no body and no spinous process. It consists of an anterior arch, a posterior arch, two lateral masses and two transverse processes (Fig. 5).

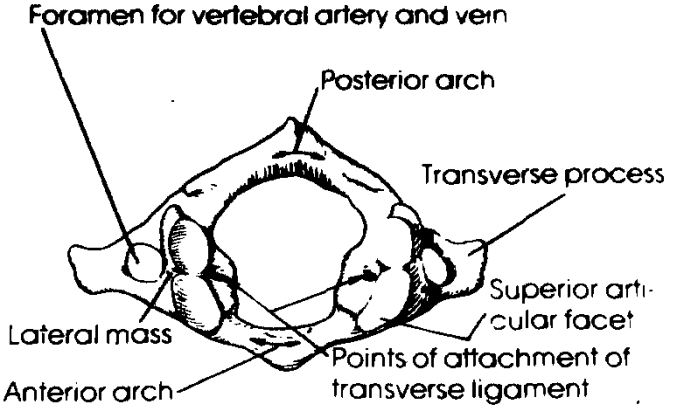

Fig. (5): **Superior aspect of atlas. (After Ballinger, 1986).**

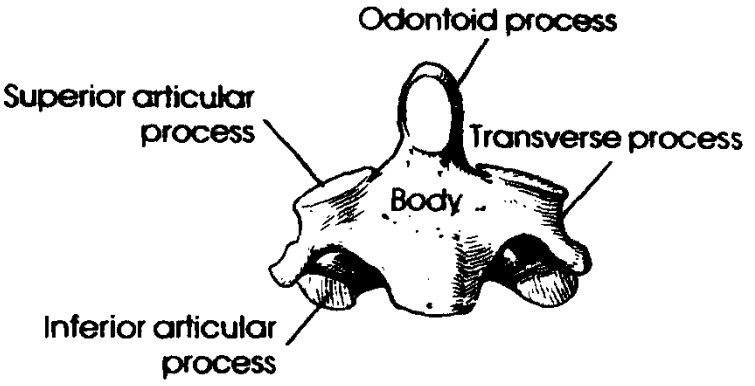

Fig. (6): Anterior aspect of axis.
(After Ballinger, 1986).

Fig. (7): Normal open mouth odontoid view.
(After Berquist, 1988).