An Anatomical Study of the Role of the Dentate Ligaments in the Cervical Spinal Canal

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Cervical spondylosis has been increasingly recognized as a cause of spinal cord myelopathy and nerve root irritation in elderly patients.2,3,19,11 The pathology seen in the spinal cord has been well described by Wilkinson14 and Mair and Druckman.8 In their specimens the cords were flatter than normal from compression in their anteroposterior diameter. Swelling of the myelin and of the axons and demyelination were noted in the posterolateral columns and in the anterior parts of the cuneate fasciculi. In many of the specimens the anterior and posterior grey horns showed neural loss. Brain et al.,2 described “saucer-shaped and oval indentations” of the anterior aspect of the spinal cord corresponding to the bosses and transverse bars found on the vertebral bodies.

There is continuing debate as to what mechanisms are responsible for the myelopathy found in the spinal cord. Kahn7 and Bedford et al.1 stressed the role of the dentate ligaments which, they believed, anchored the spinal cord in the cervical spinal canal. These ligaments prevented posterior migration of the spinal cord when pressure was exerted on its ventral surface by extradural masses. Mair and Druckman3 implicated pressure on the anterior spinal artery and its distal ramifications as the cause of the pathological changes seen in their specimens. Taylor12 believed that the lesions found in the spinal cord were ischemic and due to compression, by osteophytes, of the cervical radicular arteries, in their passage through the cervical foramina. StolTMann and Blackwood11 emphasized that mechanical compression of the spinal cord in the cervical spinal canal was “one of the main mechanisms responsible for the myelopathy found in cervical spondylosis.”

In the clinical management of the ventrally placed extradural lesion which is commonly found in cervical spondylosis, surgical operation has varied from laminectomy and foraminotomy to section of the dentate ligaments. StolTMann and Blackwood12 noted in their specimens that the “dentate ligaments within the confines of the spinal canal did not limit the excursion of the spinal cord in an antero-posterior direction.” In the standard texts of anatomy,9,3 the role of the dentate ligaments is defined as anchoring the spinal cord in the fluid media of the spinal canal and providing an important fixation for the cord.

We have made further anatomical studies of the dentate ligaments to delineate more clearly their ability to anchor the spinal cord in the spinal canal and to study their possible role in the myelopathy found in many patients with cervical spondylosis.

Materials and Methods

At autopsy the cervical and upper thoracic vertebral columns were removed en bloc with the spinal cord in situ. A number of specimens were refrigerated at minus 10°C. Other specimens were fixed in formalin prior to their dissection. None of the patients had had clinical evidence of cervical spondylosis or myelopathy.

In the specimens fixed in formalin the spinous processes, laminae and ligamenta flava, were dissected as far laterally as the articulating facets to expose the dorsal aspect of the dura mater. The dura mater was then split longitudinally in the midline along its dorsal aspect and reflected laterally to expose the intradural contents of the cervical spinal canal. The dentate ligaments were examined in particular with reference to their attachments to the dura mater laterally and spinal cord medially.

Other specimens fixed in formalin were dissected from the ventral aspect. The vertebral bodies were removed as far laterally as the pedicles to expose the ventral aspect of the dura mater. The dura mater was split longitudinally in the midline along its ventral aspect and reflected

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In the specimens fixed in formalin the spinal cord was no longer pliable in the spinal canal so that fresh specimens were examined immediately upon removal at autopsy. The vertebral bodies were removed and the dura mater was exposed and split longitudinally in the midline along its ventral aspect and reflected laterally to expose the intradural contents. The dorsal and ventral nerve roots were cut at the medial end of the intervertebral foramina and the only attachment of the spinal cord to the dura mater was by the dentate ligaments. The limitations imposed on the movement of the spinal cord by the dentate ligaments were studied. A number of frozen specimens were cut horizontally at varying levels of the cervical spine. The dentate ligaments were studied after the specimens had defrosted and the limitations imposed on the movement of the spinal cord by the dentate ligaments were examined.

Results

When viewed in the coronal plane the dentate ligaments are thin membranous structures which are attached medially to the spinal cord at its equator and laterally to the dura mater by regular digitations (Figs. 1 and 2).

When examined from the dorsum (Fig. 3), each dentate ligament is triangular in shape with the base attached to and running parallel to the lateral margins of the spinal cord. Laterally the apex of the triangle is attached to the dura mater, approximately 2 mm. dorsal and 3 mm. cephalad to the nerve root.