Cervical spinal trauma

Abstract Over the past years, significant advances have taken place in basic research, imaging, and in the treatment of cervical spine injuries. The pathophysiological understanding of spinal cord injury has been considerably improved by basic research. Spinal cord damage occurs as a result of primary mechanical insult of secondary ischemic and biochemical tissular alterations. Twenty percent of patients with a major spine injury will have a second spine injury at another level. Such lesions include arterial dissections. These patients often suffer simultaneous but unrelated chest or abdominal injuries.

Current management of spinal trauma is based on four principles: timely diagnosis, fracture reduction, spinal cord decompression, and efficient immobilization to permit healing. Numerous methods of treatment have been developed to achieve anatomical alignment and optimal stability without decreasing vertebral column flexibility. It is still unclear which form of diagnosis and treatment of the primary and secondary damage is best suited to cervical spine trauma.

Key words Spinal · Cervical · Trauma · Diagnosis · Treatment · Spinal cord

Introduction

There is no consensus on the primary care and diagnostic procedures in patients with traumatic lesions of the cervical spine. A survey of the literature shows that there are only few significant studies on this subject. The following five reviewed articles deal with the special anatomical situation of this segment of the spine.

[1] The ligaments and anulus fibrosus of human adult cervical intervertebral discs


Information. The morphology and biochemistry of the lumbar vertebral disc have been analyzed in numerous studies. However, there are no comparable studies on the cervical discs. Instead, the results obtained from lumbar discs have been applied to the cervical spine, although it is known that the flexibility of this segment of the vertebral column, and the pathomechanisms leading to disc degeneration at this level, most probably have their own characteristics. The authors studied the ligaments and the structure of the cervical intervertebral discs in a series of 12 adult spines (patients’ age range 39–83 years).

They describe the point of insertion and the course of the anterior and posterior longitudinal ligaments. The anterior longitudinal ligament covers the front of the disc, while the posterior longitudinal ligament reinforces the deficient posterior anulus fibrosus with longitudinal and alar fibers. In addition, the authors evaluate the
anulus fibrosus, finding that it is broader ventrally, sometimes even disappearing completely dorsally. The three-dimensional architecture of the cervical anulus fibrosus is more like that of a crescentic anterior interosseous ligament than that of a ring of fibers surrounding the nucleus pulposus.

**Analysis.** This interesting publication, well illustrated with 10 figures and 6 diagrams, demonstrates that there are considerable structural differences between the lumbar and the cervical intervertebral discs. The most important is the frequent lack of dorsal closure of the anulus. Mercer and Bogduk describe the unique anatomy of the adult cervical disc in more detail than have previous authors. The description of the longitudinal ligaments is interesting and informative.

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**Information.** In the first part of a two-step study, the authors conducted Medline-based research and analyzed the parameters used to determine the width of the spinal canal and the degree of spinal cord compression following trauma to the cervical spine. Between 1966 and 1997, the authors found 37 articles under the headings “spinal canal, spinal cord compression, magnetic resonance imaging (MRI), computed tomography (CT), myelogram, and radiograph”, supplemented by the terms “cervical diameter, area, ratio, and size”. Of these 37 studies, 18 deal with degenerative diseases and with spondylosis, 12 with cervical trauma, 4 with congenital spinal canal stenosis, 1 with ossification of the posterior longitudinal ligament, 1 with cervical pain, and 1 with multiple post-traumatic complaints. Twenty-six studies were retrospective; only 11 were prospective. This survey showed that only a few studies provide objective and quantifiable parameters valid for evaluating the width of the spinal canal and the degree of medullary compression. From this information, the authors analyzed various parameters used in the literature, e.g., the ratios between anteroposterior (AP) and sagittal diameter, between AP and transverse diameter, between AP canal diameter and AP vertebral body diameter, and cervical spinal cord area.

**Analysis.** The authors focus their attention on a common problem (not only in spinal surgery). From the viewpoint of evidence-based medicine, there is no valid information to justify several of the therapeutic strategies widely used. This led the authors to conduct a subsequent multicenter study [3] in order to investigate the efficacy and the reliability of imaging procedures (CT, T1- and T2-weighted MRI) in such cases.

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**[3] The optimal radiologic method for assessing spinal canal compromise and cord compression in patients with cervical spinal cord injury. II. Results of a multicenter study**

*Spine (1999) 24:605-613*

**Information.** This multicenter study was designed in order to verify the parameters found significant in Part I of this study [2]. The following formula was used to quantify the degree of maximum canal compromise: $1 - [Di/(Da + Db)/2] \times 100\%$, where $Di$ is the AP diameter of the spinal canal at the level of maximum injury, $Da$ is the AP diameter of the spinal canal at the nearest normal level above the level of injury, and $Db$ is the AP diameter of the spinal canal at the nearest normal level below the level of injury.

The following formula was used to quantify the degree of maximum cord compression: $1 - [di/(da + db)/2] \times 100\%$, where $di$ is the anteroposterior cord diameter at the level of maximum injury, $da$ is the AP cord diameter at the nearest normal level above the level of injury, and $db$ is the AP cord diameter at the nearest normal level below the level of injury.

Seventy-one patients who had suffered an acute cervical trauma and/or injury of the cervical spine were included. There was a strong correlation between the results of axial and midsagittal CT and the axial and midsagittal T2-weighted magnetic resonance (MR) images. The diagnostic value of CT in cases of injury and cervical spinal cord compression is inferior to the T2-weighted MRI. It is concluded that in patients with cervical trauma and injury of the cervical spinal cord, the midsagittal T1- and T2-weighted MR images provide reliable information equaled neither by normal X-ray films nor CT.

**Analysis.** The second part of this study is the consequence of the results of the first. It demonstrates that MRI – although more laborious – yields more reliable