Paraplegia (1995) 33, 55–56

Letters

Pathology of hyperextension injuries of the cervical spine, *Paraplegia* 1994; 32: 367–374

I enjoyed this article by Kinoshita. In two of the cases I note that the spine was constricted or compressed 'because of narrowing of the spinal canal' (cases 6 and 7). The author only quotes case 7, when he says that 'the spinal cord was extremely swollen to fill up the spinal canal'. I would like to know how they determined this narrowing because in a study of 44 patients, between 1962 and 1969,[1] narrowing of the spinal canal was a significant feature in the pathogenesis of the tetraplegia.

In 10 cases of extension injury, we determined the diameter of the canal by the direct method and found that in four patients the canals were narrowed.

Direct method Direct measurement required lateral radiographs at a known fixed focal distance (in these cases 1.83 m). This was the shortest distance between the midpoint of the dorsal border of a vertebra's body as seen in the lateral projection and the cortical line at the point of fusion of the corresponding laminae and spinous process, according to the method of Hinck *et al* (1962) Wolf *et al* (1965) and Symon and Lavender (1967).

We found three cases of narrowing using the indirect method of assessment.

Indirect method Chrispin and Lees (1963) developed a method which involved tracing a lateral radiograph of the cervical spine onto X-ray film and cutting out the canal and the bodies and weighing them separately.

It is interesting that in one of Kinoshita's cases (case 7) he described a fusion of C5/6. Was this a congenital fusion? We found that six out of 44 of our cases had fusion of the vertebrae which we thought contributed to the risk of damage to the cord.

The two postmortems that were carried out in our series showed identical findings to theirs and when we surveyed 11 previous postmortems they all showed the same features: pathological dislocation, ruptures of discs, transverse fractures etc.

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1 MacMillan and Silver. Extension injuries of the cervical spine resulting in tetraplegia. *Injury* 1987: **18**: 224–233.
Hinck *et al* (1962), Wolf *et al* (1965) Symon and Lavender (1967) (see MacMillan and Silver)

Reply from Dr Hiroshi Kinoshita

This is my reply in some detail in response to the pertinent questions and comments made by Dr John R Silver concerning the above article.

Dr Silver has stated that spondylosis contributed to the damage to the cord by making the spine rigid and that the majority of the subjects were elderly. In this series, four patients (cases 1, 2, 3 and 4) were over 63 years of age with spondylosis of the cervical spine. I did not determine the narrowing of the cervical canal of these individuals, because autopsies were conducted during the past 30 years.

I have a correction to make to my report. I erroneously referred to case 5 in the table as case 7 in the text. This should be case 5. Osseous fusion of C4–5 of this case is congenital fusion as Dr Silver has indicated, and the rigid spine is due to congenital fusion with spondylosis. In my report, I stated that 'The spinal cord was extremely swollen to fill up the spinal canal', as I had observed on autopsy that the posterior bulging of the intervertebral discs and marginal ridges of the vertebral bodies indented the extremely swollen spinal cord.

Case 6 is a 61-year-old man who fell from a height of 2 m whilst under the influence of alcohol. He was unconscious for 8 h. The bruises around his nose and mouth suggested an extension mechanism. He sustained complete tetraplegia below C5 which remained unchanged until his death from cardiac failure 18 months after the injury. The roentgenograms revealed moderate spondylosis with neither bone injury nor narrowing of the cervical canal (Figure 1).

Autopsy revealed that the cervical spine was rigid except for normal motion of the atlanto-axial joint and slight mobility of C3–4. Partial rupture of the joint capsule of

Figure 1 Case 6. Roentgenogram of moderate spondylosis deformans. There is neither bone injury nor narrowing of the cervical spine

C3–4 was noted. Osseous fusion of the anterior surface of the cervical vertebrae was observed under the intact anterior longitudinal ligament. The spinal cord was crushed and the cord parenchyma was completely severed by the extruded sharp osseous ridge at C3–4 (Figure 2).

Case 7 is a 53-year-old woman who fell, striking herself on the face. She developed immediate complete tetraplegia below C6 and was admitted to our hospital 4 days later. The roentgenograms revealed continuous ossification of the posterior longitudinal ligament (OPLL) from C2 to C4 with no bone injury (Figure 3). The sagittal diameter of the cervical canal on tomography was 5 mm at the narrowest portion of C4. She recovered from anaesthesia to develop hypaesthesia, but could move both legs, cubital joints, and her right finger. She retained bladder sensation. She died 49 days after the injury. Autopsy revealed that the spinal cord was contused with a small cavity by OPLL at C4.

OPLL of the cervical spine is a disease causing spinal canal stenosis and thenceforth spinal cord compression. This ossification is found in approximately 3% of adult Japanese and is also present in China, Korea, and Southeast Asia, whereas the incidence among Caucasians has been reported to be significantly low.[1] In Japan a total of 1370 cases of OPLL have been collected up to 1973 and 29 autopsy cases including the present case have been reported up to 1975. The degree of narrowing of the cervical canal is not directly related to the severity of the neurological deficit, but narrowing exceeding 40% (the clinical critical point) significantly increases the severity of neurological deficit. As to the onset of the trauma, it has been observed that 25% of OPLL patients with severe neurological deficit resulted from a minor injury such as falling onto the face.[2–5]

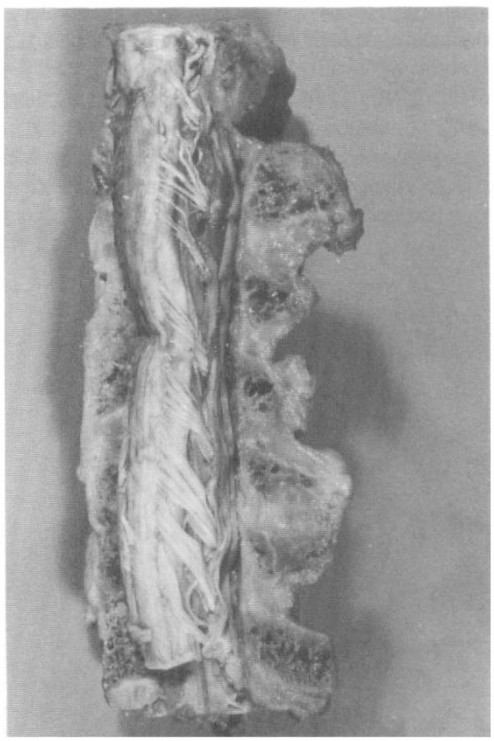

Figure 2 Case 6. The spinal cord was crushed and severed by extruded sharp osseous ridge

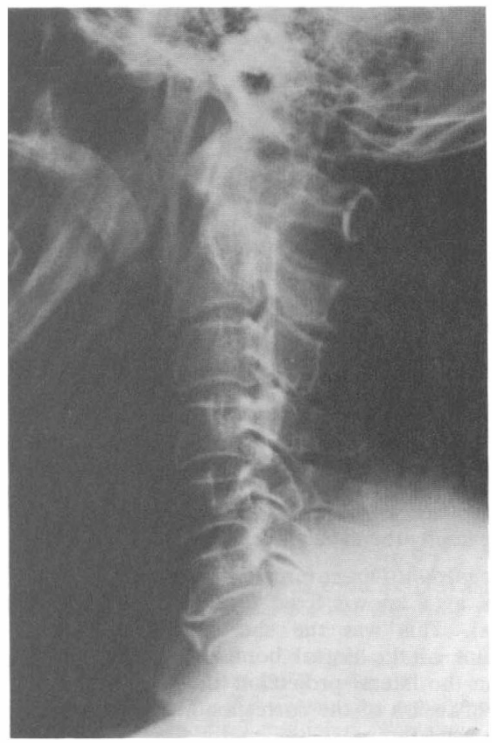

Figure 3 Case 7. Continuous ossification of posterior longitudinal ligament from C2 to C4 with no bone injury

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2 Key CA. On paraplegia depending on disease of the ligaments of the spine. *Guy's Hospital Report* 1838; **3**: 17–34.
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