Hyperextension injuries of the cervical spine

Magnetic resonance findings

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Abstract. Eleven patients with acute cervical hyperextension injury underwent magnetic resonance examination. Magnetic resonance was particularly helpful in diagnosing both intrinsic cord contusion and extradural compression. When spinal cord compromise was present, surgery was undertaken without resort to myelography.

Key words: Magnetic resonance – Hyperextension injury – Cervical spine

Hyperextension injuries constitute a substantial proportion of cervical spine trauma [5]. Recognition of these injuries can be difficult because of confusing clinical signs and the absence of plain radiographic abnormalities such as crushed vertebral bodies and anterolisthesis. In cases of hyperextension sprain alone, no fractures are present and, in many elderly patients, degenerative spondylosis may make it difficult to distinguish acute from chronic changes.

To evaluate the utility of magnetic resonance (MR) in assessing cervical hyperextension injuries, we reviewed 11 cases which we believed to be representative of a hyperextension mechanism of injury according to accepted criteria [2]. The MR findings were reviewed retrospectively and correlated with the admission radiographs and computed tomography (CT) scans.

Subjects and methods

The 11 patients in this series were examined over a 2 year period (1986–1988) and ranged in age from 19 to 77 years. Seven patients were victims of motor vehicle accidents; four suffered falls. In all cases MR was obtained within 36 h of admission. In general, spinal CT was performed before MR in cases of motor vehicle accidents, and a cranial CT scan was also obtained. In other cases, particularly those involving low velocity injuries such as falls, MR was performed before CT. In these cases, CT was obtained subsequently for better assessment of the bony framework.

Treatment in 10 cases consisted of stabilization by a collar and/or halo vest. One patient died within 24 hours of admission, and an autopsy was performed confirming acute hyperextension sprain with spinal cord contusion. Five patients went on to surgical intervention: decompressive laminectomy in three cases, microdiscectomy with anterior cervical fusion in one case, and posterior fusion of C1–2 in one case.

All cases were scanned in a Siemens Magnetom. The initial ten cases were scanned on a 0.5 Tesla imager; a 1.5 Tesla unit was used on the last case. A head coil (27 cm diameter) was used in 8 cases. The presence of a trauma backboard necessitated the use of a body coil in two cases. The final case was scanned with a cervical surface coil (12 × 21 cm).

Standard protocol consisted of a short TR sagittal spin echo sequence: TR = 500, TE = 17. A long TR sagittal sequence was also obtained if tolerated. Standard section thickness was 10 mm and matrix size 256 × 256. Following introduction of a 1.5 Tesla scanner, the protocol was modified to include a rapid gradient echo sequence (FISP TR = 0.20, TE = 10, flip angle = 10°). A transaxial short TR sequence was performed if possible when a focal abnormality was identified on the sagittal sequences.

Results

Of the 11 cases included in this series, 3 involved the upper cervical spine (C1, C2) and the other 8 involved the remainder of the cervical spine (C3–C7).

Acute hematoma

All cases showed an associated prevertebral hematoma. The largest hematoma was noted in the high cervical region remote from a T4–5 fracture dislocation (Fig. 1). This hematoma suggested a flexion...
Fig. 1. The sagittal image (TR = 2100, TE = 90) shows a fracture dislocation (hyperflexion injury) at T4-T5 (arrow). The MR scan also shows a large high cervical prevertebral hematoma (arrowheads) secondary to an associated hyperextension injury of the cervical spine.

Fig. 2. An odontoid fracture is seen on this midline sagittal image (TR = 300, TE = 17). The posterior displacement and angulation of the dens is consistent with a hyperextension mechanism. Unlike the plain radiographs, however, the MR scan also shows compression of the cord by an epidural hematoma (arrows).

Fig. 3A. Lateral radiographs shows diffuse skeletal hyperostosis from C2-C6. There is retrolisthesis of C2 on C3 with anterior gaping of the C2-C3 interspace. B MR image in the sagittal plane (TR = 1.5, TE = 90) confirms the presence of an acute prevertebral hematoma. There is disruption of the anterior longitudinal ligament with extension of the hematoma into the disc space (curved arrow).