ABC of Spinal Cord Injury

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RADIOLOGICAL INVESTIGATIONS

Radiological investigation of a high standard is crucial to the correct diagnosis of a spinal injury. It is most important that the attending doctor should supervise all movement of the patient during radiological examination of the spine. Sandbags and collars are not always radiolucent, and clearer radiographs may be obtained if these are removed after preliminary films have been taken. Most accident departments rely on the use of mobile x ray equipment for investigating seriously ill patients, but the quality of films obtained in this way is invariably inferior. If the patient's condition is otherwise satisfactory radiographs should be taken in the radiology department with a doctor in attendance.

Cervical injuries

Fracture of odontoid process. The diagnosis is not obvious on the standard views (left) because of poor definition, but a clue is the obvious posterior displacement of the anterior arch of the atlas on the lateral radiograph. Tomography (right) clearly shows the fracture.

The first and most important radiograph to be taken in a patient with a suspected cervical cord injury is the lateral view. This is more likely to reveal spinal damage than the anteroposterior view and can be taken in the accident department without moving the supine patient. Other views are best obtained in the radiology department under medical supervision to ensure that spinal movement is minimised. Anteroposterior radiographs must be taken, including an open mouth view of the odontoid process.

Compression fracture of C7, missed initially because of failure to show the entire cervical spine.

With the near shoulder depressed and the arm next to the cassette abducted, abnormalities as far down as the first or second thoracic vertebra will usually be revealed. Occasionally lateral tomography is necessary to show the cervicothoracic junction.

Right: swimmer's view. The patient is supine. Far right: swimmer's view. Note dislocation of C6-7, seen immediately below clavicular shadow.

In the cervical spine both dislocation and fractures may be seen on the lateral radiograph. Anterior vertebral displacement of less than half the diameter of the vertebral body suggests unilateral facet dislocation; displacement greater than this indicates a bilateral facet dislocation. Displacement of a spinous process from the midline on the anteroposterior film is explained by vertebral rotation secondary to unilateral facet dislocation, the spinous process being displaced towards the side of the dislocation. In bilateral facet dislocation the spinous processes are in line. When there is a unilateral facet dislocation the spine is relatively stable, especially if maintained in extension. With a bilateral facet dislocation the spine is always unstable, and the patient therefore requires extreme care when being handled.

Lateral and anteroposterior films in C5-6 unilateral facet dislocation. Note less than half vertebral body slip in lateral view, and lack of alignment of spinous processes, owing to rotation, in anteroposterior view.

Left: C3-4 dislocation, post reduction film showing continuing instability because of posterior ligamentous damage. Above: central cord syndrome without bony damage, in a patient with cervical spondylosis.

The 22 1/2° oblique view of the right facet joints (left) clearly shows the facet dislocation at the C5-6 level, less obvious in the 45° oblique view (right), which however shows a malalignment of the intervertebral foramina.

Other useful radiological signs should be sought when bony abnormalities are minimal or absent. Thus on the lateral radiograph the soft tissue shadow of a prevertebral haematoma may be evident, and a widened gap between adjacent spinous processes denotes rupture of the posterior cervical ligamentous complex. This is an unstable injury, often associated with vertebral subluxation and crush fracture of the vertebral body. Atlantoaxial subluxation may be identified by an increased gap (greater than 2.5 mm in adults and 4 mm in children) between the odontoid process and the anterior arch of the atlas on the lateral radiograph.

In older patients with cervical spondylosis and tetraplegia resulting from a hyperextension injury, there is often no fracture or dislocation to be seen. Likewise in children, owing to the increased mobility of their spine, traction injury to the spinal cord may occur without evidence of bony damage. Pathological changes in the

Transverse fracture through C3 in ankylosing spondylitis.

spine—for example, ankylosing spondylitis, rheumatoid arthritis—may predispose to bony damage after relatively minor trauma.

Oblique radiographs are not routinely obtained but they do help to confirm the presence of subluxation or dislocation and indicate whether the right or left facets (apophyseal joints), or both, are affected. The 45° supine oblique view shows the intervertebral foramina and the facets but a better view for the facets is one taken at 22.5° to the horizontal.

Thoracolumbar injuries

Severe trauma is required to damage the thoracic, lumbar, and sacral segments of the spinal cord, and usually the skeletal injury is evident on the standard anteroposterior and horizontal beam lateral radiographs. Signs of instability, particularly fracture through the posterior facet joints or pedicles, are more easily seen on the lateral radiograph. However, demonstration of detail in the thoracic spine can be extremely difficult, particularly in the upper four vertebrae, and lateral tomography is sometimes required for better definition. Instability in thoracic spinal injuries may also be caused by sternal or bilateral rib fractures, as the anterior splinting effect of these structures will be lost.

A haematoma in the posterior mediastinum is often seen around the fracture site, particularly in the anteroposterior view, and if there is any suspicion that these appearances might be due to traumatic aortic dissection an arch aortogram will be required.

Patient with fracture of T5 with widening of mediastinum due to a prevertebral haematoma, initially diagnosed as traumatic dissection of the aorta, for which he underwent aortography.

Other investigations

Myelogram of a child aged 3 showing tearing of dura at site of injury. The fracture of T4, not obvious on standard views, was revealed by tomography.

Emergency myelography after spinal cord injury is of limited value, particularly since the procedure may require the patient to be turned into different positions, with risk of further trauma to the spinal cord. Myelography has been used to try to identify causes of cord compression, particularly in patients with progressive neurological deficit, or those with no radiological evidence of trauma. However, interpretation is difficult, and with the advent of computed tomography myelography is rarely indicated, particularly since computed tomography can show traumatic disc prolapse and identify loose bony fragments within the spinal canal.

Computed tomogram of T12 showing a compression fracture of the vertebral body with displacement of bony fragments into the spinal canal and damage in region of posterior facet joints.

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