Abstract  The clinician managing patients who have suffered trauma to the spine requires several questions answered from imaging studies. In the acute stage, a full assessment of the complete injury to the bony, ligamentous, disc and neural tissues will determine the stability of the injury and help decide the nature of clinical management, either conservative or surgical, and also help in determining the surgical approach. Magnetic resonance imaging (MRI) is established as a vital imaging technique and can answer many of the questions posed above. The purpose of this article is to review the current status of MRI in the assessment of acute spinal trauma.

Keywords  MRI · Spine · Spinal Cord · Trauma · Injury

Introduction

The clinician managing patients who have suffered trauma to the spine requires to have several questions answered by imaging studies. In the acute stage, a complete assessment of the injury to the bony, ligamentous, disc and neural tissues will determine the stability of the injury and help decide the nature of clinical management, either conservative or surgical, and, if the latter, also help in determining the surgical approach. In the long term, imaging may be required to assess the success or otherwise of any surgical intervention and to investigate post-traumatic complications such as progressive deformity, pain or worsening neurology. Magnetic resonance imaging (MRI) is established as a vital imaging technique and can answer many of the questions posed above [1, 2, 3, 4, 5, 6, 7]. The purpose of this article is to review the current status of MRI in the assessment of acute spinal trauma.

MRI technique

MR studies of patients with spinal trauma should include sagittal T1-weighted spin echo (SE) and T2-weighted fast spin echo (FSE) sequences covering the site of primary trauma, with axial T1-weighted SE sequences covering at least the vertebral body above to the vertebral body below the injured level (Fig. 1). The addition of fat saturation to the T2-weighted FSE sequences, or the use of a STIR sequence, is important to highlight subtle bone oedema (Fig. 2) and to aid assessment of the interspinous ligament (Fig. 3) [3, 8]. It has been suggested that the addition of a T2-weighted gradient echo sequence will enhance the detection of cord haematoma (Fig. 4) [6].

Diffusion imaging of the brain is a well-established technique that has proven clinical value. Attempts at diffusion imaging of the cervical cord are limited by various factors, including the small size of the cord. Little is published on diffusion imaging in patients with acute spinal cord trauma, but in animal models changes within the cord have been identified which were not seen on conventional T2-weighted sequences [9].

Indications for MRI in acute spinal trauma

The indications for MRI in patients who have suffered acute spinal trauma depend to an extent on the management policy of individual Spinal Injury Units. In those Units where patients are treated conservatively, it can...
Fig. 1A, B L1 burst fracture. A The level of the injury is covered using a sagittal T1-weighted SE (left) and T2-weighted FSE (right) sequence. B Axial T1-weighted SE sequence should cover the vertebral level above to the vertebral level below the fracture to ensure that the pedicles of adjacent vertebrae are intact.

Fig. 2A, B A 19-year-old man who sustained a burst fracture of L1. A Anteroposterior and lateral radiographs demonstrate a burst fracture of L1. No other injury is apparent. B Sagittal T1-weighted SE and T2-weighted FSE sequence with fat saturation performed 2 days after the injury. Bone oedema is identified in L3, L4 and L5, probably due to mild trauma.

Fig. 3 Fracture-dislocation of T4, with interspinous ligament rupture at the T4/5 level. Sagittal T2-weighted FSE (left) and T2-weighted FSE sequence with fat saturation (right). On the former sequence, hyperintense fat in the interspinous space masks the oedema associated with interspinous ligament rupture, which becomes clearly evident with the use of fat saturation. Oedema in the cord is also better appreciated. Wedge compression injury of T6 is also evident, with fracture of the superior end-plate.

Fig. 4 A 21-year-old man who suffered a cervical hyperextension injury. Note the pre-vertebral oedema/haemorrhage. Sagittal T2-weighted FSE (left) and axial T2-weighted GRE sequence (right) demonstrate central hypointensity in the cord at the C3/4 level, surrounded by an area of hyperintensity (Type 3 cord injury). The intramedullary haematoma is more clearly visualised on the GRE sequence.