Spinal injuries affecting the thoracic and thoracolumbar spine

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Abstract

Thoracic and thoracolumbar fractures range from low impact osteoporotic compression injuries to high-energy fracture/dislocations with spinal cord injury. Assessment can be broadly divided into two sections. Primary assessment should follow the principles of Advanced Trauma Life Support. The secondary assessment should relate to the spinal fracture itself. In determining the optimal treatment, the stability of the injury must be assessed by following a complete clinical and radiographic evaluation.

The thoracolumbar junction (T10–L2) is a transitional region between the rigid thoracic spine and the more flexible lumbar spine and hence is susceptible to injury. The thoracic spine (T1–T9) is relatively protected area, due to the rib cage; when injuries do occur they commonly involve visceral and spinal cord injury.

Many classifications exist, however the AO and Thoracolumbar Injury Classification and Severity (TLICS) systems are the most clinically useful. Although they are based on thoracolumbar injuries they are commonly extended to thoracic fractures.

The majority of fractures can be managed non-operatively with early mobilization and bracing. Surgical stabilization is indicated in unstable fractures. Posterior stabilization with pedicle screws is the most widely used technique; simultaneous decompression can also be achieved with this approach. Anterior surgery has biomechanical advantages and has been shown to be equally effective.

Keywords orthopaedic procedures; pedicle screws; spinal cord injuries; spinal fractures; thoracic injuries

Introduction

Approximately 75–90% of all spinal fractures occur in the thoracic and lumbar spine, with most of these occurring at the thoracolumbar junction.[1,2] Thoracic and lumbar fractures range from low impact osteoporotic compression injuries to high-energy fracture/dislocations with associated spinal cord injury (SCI).[1] These injuries can been subdivided anatomically as either thoracic (T1–T9) or thoracolumbar (T10–L2).[3,4]

Contiguous and non-contiguous spine injuries are present in 6–15% of patients. Depending on the type of fracture, associated injuries occur in up to 50% of patients, mainly as the result of a distraction force; these include visceral injuries, vascular disruption and pulmonary injuries. Thoracic fractures can be accompanied by sternal fractures, diaphragmatic injuries and haemo-pneumothoraces. Despite the high incidence of thoracolumbar fractures, there is a wide range of opinion regarding injury classification and management.[5]

Initial management

Assessment could be broadly divided into two sections in order of priority. Primary assessment should concern the patient as a whole, and follow the principles of Advanced Trauma Life Support (ATLS).[6] Airway, ventilation and cardiovascular support are vital to maintaining organ perfusion and mitigating a 'secondary insult' to the cord and neurological elements. Along with this the patient should have adequate analgesia.

If possible a history should be ascertained; high-energy mechanisms should be treated with a high index of suspicion for both unstable fractures and neurological injuries. During this time the patient should be immobilized using the standard triple immobilization of the cervical spine on a spinal board until radiological and clinical clearance. A neurological examination is essential; both of upper and lower limbs, preferably this should be documented on an American Spinal Injury Association (ASIA) chart (Figure 1).[7]

The patient should be log-rolled to look for bruising, lacerations or mal-alignment, followed by palpation of the spinous process and paraspinal muscles. During the roll the anal tone and sensation can be assessed.

Sometimes due to other factors such as head injury or long bone fractures a complete assessment is not always possible; however this should also be documented in the notes and the examination completed at the earliest opportunity.

Immobilization has been shown experimentally to help limit further damage to the injured spinal cord and is often beneficial in controlling the pain associated with a spinal column injury.[8] An oscillating bed is useful for shifting the patient's body weight without moving the patient.

The secondary assessment should relate to the spinal fracture itself. Plain radiographs and CT scans will demonstrate most bony injuries. Most Major Trauma Centres are now equipped with rapid high resolution CT. Helical CT is faster, identifies and describes the bony detail of fractures more accurately, with no more radiation than plain radiographs and hence decreases time spent in fracture precautions.[9]

Helical truncal CT is 99% accurate in identifying acute spinal fractures versus 87% when plain radiographs are used.[9] Computed tomography imaging of the bony spine can allow reformatted axial collimation of images into 2D and 3D images. Considering most trauma patients require CT to screen for other injuries, this modality appears to be the most effective and cost-efficient.

Stable fractures such as compression fractures and minor burst fractures often need little other imaging.[10] Soft-tissue disruptions however can be missed by CT, which cannot adequately visualize the spinal cord and other associated ligamentous structures. Dai et al. described missed diagnosis of thoracolumbar fractures in a

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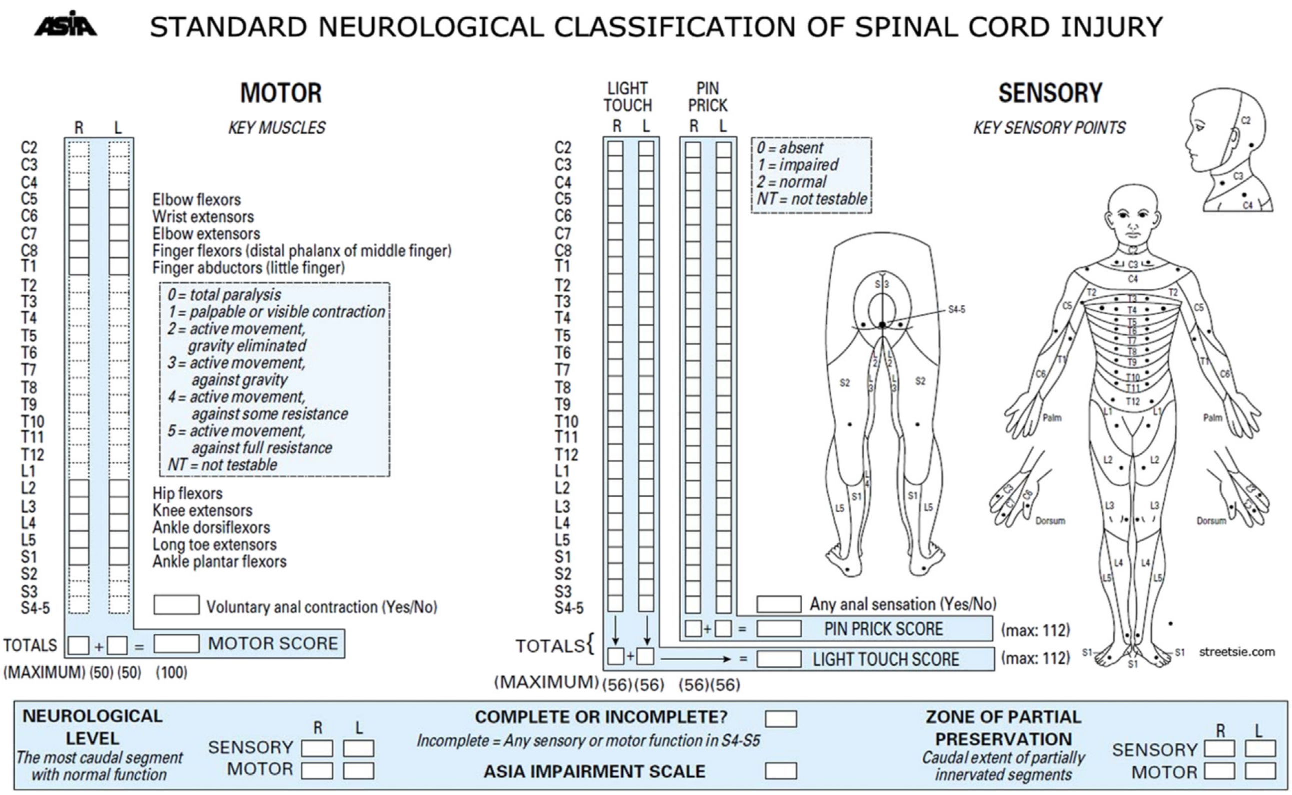

Figure 1 ASIA charts provide a consistent and comprehensive guide to neurological examination and documentation.

polytrauma setting of 19%, leading to a higher incidence of pulmonary complications and lengthened hospital stay.[11]

Magnetic resonance imaging (MRI) gives excellent description of the soft tissue structures including the spinal cord, disks and ligaments. Short Tau Inversion Recovery (STIR) images in particular are useful in picking up non-contiguous injuries. MRI is essential in any patient with neurological deficit and can also be utilised when CT imaging is inconclusive; helping to differentiate between acute and old fractures and coexisting degenerative changes.[12]

DVT/PE prophylaxis

Thromboembolic disease remains a considerable problem in the spinal trauma patient.[13] We aggressively employ mechanical prophylaxis (intermittent external pneumatic compression devices) for the lower-extremity. Routine prophylaxis also includes subcutaneous low-molecular weight heparin. Contraindications to chemoprophylaxis include spinal cord haematoma leading to cord compression and deterioration of neurological function. Strict guidelines on thromboprophylaxis are difficult to write given the lack of good evidence. Ploumis et al. conducted a Spinal Trauma Study Group survey and recommended pharmacologic thromboprophylaxis to be prescribed in cases of delayed surgery for patients with Spinal Cord Injury (SCI) and anterior thoracolumbar procedures with or without SCI; no consensus was agreed regarding preoperative chemoprophylaxis after thoracolumbar fractures without SCI.[14] We make the decision on a case-by-case basis and most of our patients are prescribed daily chemoprophylaxis 24 hours after the injury assuming their neurological function is normal or static.

Thoracolumbar fractures T10–L2

The thoracolumbar junction is a transitional region between the less mobile thoracic spine and the flexible lumbar spine. Decreasing the spinal canal diameter to spinal cord ratio, particularly between T2 and T10, makes this region more susceptible to spinal cord injury. In the upright posture, the thoracolumbar junction has a straight alignment between T10 and L2. The ideal centre of the head, arm and trunk weight is anterior to T10; hence, the thoracolumbar junction is exposed to injury produced by a flexion moment.[15]

Biomechanics and stability

When determining the optimal treatment in cases of spine trauma, the stability of the spinal injury must be carefully assessed following a complete clinical and radiographic evaluation. Instability has been defined by Punjabi and White as 'Loss of the ability of the spine under physiologic loads to maintain relationships between vertebrae in such a way that there is neither damage nor subsequent irritation to the spinal cord or nerve root and, in addition, there is no development of incapacitating deformity or pain from structural changes'.[15]

Although this definition was drawn up to describe instability in the context of degenerative disease, the concepts can be applied in the trauma setting. Any injury that is associated with neurological damage is unstable until proven otherwise, as are injuries that cause significant changes in spinal and vertebral alignment. The mechanism of injury is also helpful in determining stability. Low velocity injuries such as falls from standing height are unlikely to result in unstable injuries compared with road traffic accidents where larger energy transfers are likely to