Thoracolumbar Spine Trauma

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13.1 Introduction

The thoracolumbar spine refers to the region encompassing the thoracic (T1–T12) and lumbar (L1–L5) spinal segments. The most commonly injured region of the spine is the thoracolumbar junction (T10–L2). About 16% of thoracolumbar injuries occur between T1 and T10, 52% between T11 and L1, and 32% between L1 and L5 (Burgos et al. 1988; Carpenter 1991; Kraus et al. 1975). Typically, the injuries are sustained by middle-aged and younger individuals and are caused by high energy trauma such as motor vehicle accidents. Less often, the injuries are due to a fall from a height or industrial accidents (Burgos et al. 1988; Carpenter 1991). Males have a four-fold higher risk than females. Injuries due to sports and recreational activities are more common in children and adolescents (Hubbard 1974; Keene 1987). Low energy injuries resulting in osteoporotic compression fractures are more common in elderly individuals.

In 5%–20% of patients with a spinal injury, contiguous and non-contiguous spinal injuries are also present (Post and Green 1983; Henderson et al. 1991). Mid and upper thoracic spine fractures are commonly associated with a second fracture at the thoracolumbar junction or in the cervical spine (Hubbard 1974). Fractures at the thoracolumbar junction may be associated with a second injury at L4–L5 (Calenoff 1978). Failure to detect non-contiguous concomitant injuries can lead to delayed instability and additional neurologic deterioration (Calenoff 1978). Thus, in a patient with a thoracic fracture, a careful search should be made to exclude secondary injuries. In such cases, imaging of the entire spine may be necessary. In children, the majority of thoracolumbar fractures occur at the T4, T5, and L2 levels. Contiguous fractures are more common in children than in adults.

Depending on the type of thoracolumbar fracture, associated spinal and non-spinal injuries occur in up to 50% of patients (Cotler et al. 1986; Gertzbein and Court-Brown 1988; Gumley et al. 1982; Saboe et al. 1991; Weinstein et al. 1988). Intrathoracic injuries such as pulmonary contusions, hemothorax or pneumothorax, diaphragmatic rupture, and major vessel disruption occur in approximately 20% of patients while intraabdominal bleeding secondary to liver or splenic injury occurs in about 10%. Associated skeletal injuries are present in up to 20% of cases. The most common of these are calcaneal fractures and vertical

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KEY-POINTS

- T10–L2 most commonly injured
- T1–T10: 16%
- T11–L1: 52%
- L2–L5: 32%

- Typically:
  - Young and middle-aged
  - M:F is 4:1
  - High energy trauma: MVA, less often falls or industrial accident

- Associated injuries:
  - 20% Intrathoracic
  - 10% Intraabdominal
  - 20% Other skeletal, most common calcaneal and pelvis

- Imaging
  - Conventional radiography: initial screening method in most hospitals, but:
    - MDCT, when available:
    - preferred as initial screening in the severely or polytraumatized patient
    - most commonly used in the imaging assessment of thoracolumbar fractures
    - assess spinal stability
    - guide patient management
  - MR: evaluation of spinal cord injury

- Stability: Denis’s three-column theory:
  - anterior: anterior two thirds of vertebral body, adjacent annulus and disc and ALL
  - middle: posterior one third of vertebral body, posterior third of disc and annulus and PLL
  - posterior: neural arch, facets, and posterior ligamentous complex

- Stable:
  - fractures involving only anterior column

- Unstable:
  - fractures involving the anterior and middle column
  - fractures involving all three columns
  - disruption of middle column

- Classification:
  - Minor injuries (>15%): rarely result in significant neurologic injury or progressive deformity, are considered stable and include among others fractures of the:
    - transverse processes
    - spinous processes
    - articular processes
    - facet articulations and the pars interarticularis
  - Major injuries
    - hyperflexion compression - wedge (48%)
    - burst fractures (14%)
    - flexion-distraction (Chance type fractures) (5%)
    - fracture-dislocation (15%)

Spinal conditions predisposing to traumatic lesions:

- Ankylosing spondylitis
  - serious spinal injury even after minor trauma
- Horizontal fractures
- Diffuse idiopathic skeletal hyperostosis

Shear fractures of the pelvis in association with crush fractures of the spine (Holdsworth 1970). The incidence of bowel rupture in pediatric lumbar Chance fractures is 65%.

The anatomic characteristics of the thoracic and lumbar spine, the magnitude and direction of the impact of the force, and the patient’s postural alignment all determine the severity of a spinal injury. Diagnostic imaging of the spine in trauma patients requires thorough knowledge of the regional anatomy, the pathological changes and the mechanisms of injury that determine the final radiographic picture. This knowledge is necessary for optimal management of spinal injuries and the avoidance of surgical complications.

13.2
Anatomical and Biomechanical Considerations

13.2.1
Thoracic Spine

Fractures of the thoracic spine are less common than those involving the cervical or lumbar spine or the thoracolumbar junction.Thoracic spine fractures account for 20% of all spinal fractures. The thoracic spine is more rigid than its cervical or lumbar counterparts because of the structural stability supplied