Thoracolumbar Spine Trauma

Christopher R. Good, M.D., F.A.C.S.

Thoracolumbar spine injuries are commonly related to high energy accidents including falls or motor vehicle accidents. Patients with thoracolumbar injuries commonly have other injuries including injuries to the abdomen, chest, extremities, or other spinal injuries. The typical “ABC” (airway, breathing, and circulation) evaluation is needed for all patients seen in the emergency room after a thoracolumbar spine trauma. Appropriate evaluation of the thoracolumbar spine trauma requires complete and thorough clinical and radiographic examination, which begins only after ensuring the patient’s other vital organ systems are intact.

Examination of the spine includes careful visual inspection as well as palpation of the spine and a complete neurologic evaluation including assessment of the patient’s strength, skin, sensation, and reflexes.

Careful evaluation can be performed in patients who are awake and are comfortable enough for the examination. For patients who are sedated or have changes in mental status, there is a need for additional imaging modalities including CT scan and MRI scan to look for other injuries. In these patients it is critical to perform repeat evaluation as the patient’s condition stabilizes. It is not uncommon for additional injuries to be identified once the patient is able to report.

Neurologic Evaluation

Assessment of a patient’s strength and sensation at and below the level of spinal injury is critical, including evaluating the function of each of the nerves at the specific level injured. “Spinal shock” is a condition where paralysis may occur as a result of disruption of spinal cord function. This typically occurs at or just below the level of an injury. Spinal shock typically resolves within 48 hours after an accident. It is important to realize that full assessment of a patient’s neurologic status can only be made when a patient has recovered from spinal shock. Resolution of spinal shock is confirmed when certain reflexes that are mediated through the spinal cord return, particularly the bulbocavernous reflex.

Thoracolumbar spine trauma and fractures may be associated with neurologic injuries. A “complete” neurologic injury signifies the complete absence of any sensation or motor function below the level of the injury. An “incomplete” neurologic injury means that there is some residual spinal cord and nerve function below the level of the injury and has better prognosis for potential recovery. Spinal cord injury has been classified by a level of injury as defined by the American Spinal Injury Association (ASIA). Incomplete spinal cord injuries may fit into one of four typically described patterns, and the type of neurologic deficit usually correlates with the location of the injury within the spinal cord (Figure 1).

Central Cord Syndrome

Central cord syndrome is the most common spinal cord injury pattern. Patients with central cord syndrome typically have greater loss of motor function in the hips and thighs with relative sparing of the function in the feet and ankles. Prognosis for some recovery after this injury is good with approximately 75% of cases having some improvement.

Figure 1. Types of spinal cord injury (shaded zones) that produce the four main incomplete injury patterns seen clinically. (A) Central cord syndrome. (B) Anterior cord syndrome. (C) Posterior cord syndrome. (D) Brown-Séquard syndrome. © 1995 American Academy of Orthopaedic Surgeons. Reprinted from the Journal of the American Academy of Orthopaedic Surgeons, Volume 3(6), pp. 345–352 with permission.
Anterior Cord Syndrome

Patients with anterior spinal cord syndrome usually have complete loss of muscle function as well as loss of pain and temperature sensation below the level of the injury. In this situation, the nerves that provide the sensation of vibration and light touch are spared. The prognosis for recovery in this situation is unfortunately very poor, with approximately 10% of patients having significant recovery.

Posterior Cord Syndrome

Posterior cord syndrome is the least common spinal cord injury pattern. In this situation there is typically a decrease in sensations such as vibration and light touch, but muscle function is usually preserved.

Brown-Sequard Syndrome

Brown-Sequard syndrome is an unusual situation where function in one half of the spinal cord is disrupted. Patients with Brown-Sequard syndrome find that the sensations of touch and vibration are lost on one side of the body while sensation of deep pain and temperature are lost on the opposite side of the body. While this is rare, the prognosis for recovery is good in over 80% of patients.

All patients with acute thoracolumbar trauma require full evaluation in order to rule out injury inside the abdomen or chest, including the possibility of major bleeding, bowel rupture or other abdominal injuries. Patients with thoracolumbar spine injuries may also suffer from “neurogenic shock.” This is a state of low blood pressure that results in the loss of normal function of the sympathetic nervous system. When the nervous system is not functioning properly, the patient will typically have low blood pressure as well as a decreased heart rate. This is a different type of shock than seen in most traumas where a high heart rate is seen with low blood pressure.

Patients with thoracolumbar spine injury require radiographic evaluation to start with x-rays of the spine from the front and side. Other evaluation is based on the presence of additional injury and trauma. Most patients also get x-rays of the chest as well as pelvis, in this situation. CT scan has proven to be very valuable for the evaluation of thoracolumbar injury. A CT scan provides the best possible understanding.

Figure 2. X-ray of the thoracolumbar spine in a 24 year old woman after falling off a bicycle. Her x-rays show a fracture at L1 (red arrow). The bone at the first lumbar vertebra (L1) is compressed down, compared to the square shape seen at the other vertebrae.

Figure 3. CT scan of the same patient showing the broken bone at L1. A small amount of buckling can be seen at the back edge of the bone (red arrows).
of the anatomy of the bones and location of fracture. MRI is another form of spine imaging that allows for visualization of the “soft tissues” including the spinal cord, intervertebral discs, as well as the ligaments. An MRI scan is indicated in all patients with neurologic deficit after trauma in order to evaluate for spinal cord compression or other neural injury. An MRI scan can also be used to look for bruising of the spinal cord or the possibility of bleeding or hematoma around the spinal cord that may occur as a result of a fracture.

It is important to realize that at some point imaging must be used for the entire spine for patients with thoracolumbar injury. Patients with thoracolumbar fracture have been noted to have fractures at other levels of the spine in 5% to 30% of cases. There should be a high index of suspicion in these situations in order to avoid missed or delayed diagnosis of injury.

Thoracolumbar Spine Trauma Classification

Thoracolumbar spine trauma is one of the most common musculoskeletal injuries in the world. However, there is a wide variability in the management, largely because of a lack of an accepted classification system. Spine fractures account for a large portion of musculoskeletal injuries. Approximately 70% to 90% of spinal fractures occur in the thoracic or lumbar spine, most of which occur at the junction between the two (T10 to L2).

Thoracolumbar spine trauma has been classified using multiple schemes over time. At this time, the Thoracolumbar Injury Classification system seems to be the best classification available to guide decision making for patients with thoracolumbar spine injury. Although a number of classification systems have been used to aid surgeons in treating patients, only the Thoracolumbar Injury Classification and Severity Score (TLICS) has been evaluated by a rigorous process where clinical experts have worked to form a classification system which uses prospective protocols.

TLICS was developed by an international team of spine surgeons by the name of Spine Trauma Study Group. In this system, the patient’s injury is given a score based on the spinal injury severity score (ISS). The injury is classified based on (1) the mechanism and type of injury, (2) the presence or absence of neurologic deficit, and (3) the stability of the ligamentous complex that supports the spine.

1. Injury morphology is divided into three types, compression, rotation/translation, and distraction. Compression injury is defined by the loss of height of the vertebral body including compression and burst fractures. Rotation/translation is defined as horizontal movement of one vertebral body on top of another, typically noted with dislocations or fracture/dislocations. Distraction is defined as disassociation of the vertical access, commonly seen with ligamentous
rupture and hyperextension injuries with widening distraction of the spinal elements.

2. Neurologic injury is an important indicator of the severity of the spinal injury. The presence of a neurologic deficit is a strong indicator for surgical intervention. In the TLICS classification system, the neurologic status is described from better to worse prognosis, that is, from neurologically intact to nerve root injury, complete spinal cord or cauda equina injury and incomplete spinal cord or cauda equina injury.

3. Rupture of the posterior ligamentous complex (PLC) has been associated with increased spinal instability which may indicate the need for surgical intervention, as these structures have poor healing ability. In the TLICS, the PLC is categorized as intact, indeterminate, or disrupted. Patients with obvious rupture or gapping of the posterior structure are given the highest score.

The three factors within the TLICS are all given a score and then the scores are totaled to help guide final treatment. A score greater than 4 suggests the need for surgical treatment, indicating significant instability, whereas a score of less than 4 suggests the need for nonsurgical treatment. Patients with a score of 4 could be treated with either surgical or nonsurgical treatment. For patients with multiple fractures, the area with the highest severity score is utilized to guide treatment.

The thoracolumbar injury classification seems to be the best system available to guide decision making at this time. However, ongoing studies are needed to determine if the use of classification leads to better agreement among surgeons or better outcomes for patients.3-5
Initial treatment for patients with thoracolumbar trauma involves immobilization of the spine. The goal is to limit further damage to the injured spinal cord during the early stages of recovery. Bed rest with log rolling may be used. In some patients traction has been deemed desirable to achieve additional spine immobilization. Medical stabilization of a patient with thoracolumbar trauma is of paramount importance through the management of blood pressure and other injuries which may be immediately life threatening.

In some centers, high dose steroid (methylprednisolone) is routinely administered to all patients with spinal cord injury. When steroid is used in this situation, it is administered as a bolus of 30 mg per kilogram of body weight followed by 5.4 milligram/kilogram/hour for a total of 23 hours. The efficacy of this treatment has only been shown when treatment is started within eight hours of the injury and, at this time, considerable debate exists as to the efficacy of the treatment. Higher rates of complication have been noted in patients treated with steroids including postoperative infection, gastric ulcers, and pulmonary complications.6

Nonoperative treatment in patients with thoracolumbar trauma is used for injuries that are considered to be stable without potential for progressive neurologic compromise or spinal deformity during the healing period. Injuries are classified as either stable or unstable. In most cases a stable injury is treated with a rigid cast or removable orthosis which is maintained until the fracture has healed. Healing typically takes place between eight and twelve weeks. For fractures involving the lower thoracic spine and lumbar spine, additional treatment may be required based on the level of injury and time toward healing. Non-operative treatment is typically not recommended for patients with significant instability or neurologic compression.

Operative management of thoracolumbar injuries is usually considered for fractures that are unstable or have the potential for further neurologic deficit. For patients with significant neurologic compromise, early intervention and stabilization can lead to improved patient mobilization and potentially allow for higher rates of neurologic recovery. For patients with significant compression of the spinal cord or neural elements, any surgical intervention needs to achieve full decompression of any bone or soft tissue that is intruding upon the spinal cord. Decompression of the spinal cord may lead to improved recovery and afford functional benefits for patients long term.

For patients with spinal instability, the use of instrumentation and fusion of the spine at the level of fracture is warranted. Surgery is typically delayed until the patient is medically stabilized to allow the active bleeding or trauma to be managed. Surgery is performed emergently

![Figure 9](image9.png) **Figure 9.** MRI scan shows the fracture at T12 with evidence of compression of the spinal cord (red arrow).

![Figure 10](image10.png) **Figure 10.** Cross sectional MRI scan on the same patient. On the right, a normal amount of space exists around the spinal cord (red dots). On the left view, bone has retrogressed back into the spinal canal causing compression of the spinal cord (red arrow).
Trauma and Tumors of the Spine

Christopher R. Good, M.D., F.A.C.S.

Dr. Good is a spine surgeon at The Virginia Spine Institute. He has extensive training and experience in the treatment of complex spinal disorders with special expertise in non-operative and operative treatment of adult and pediatric spinal deformities including scoliosis, kyphosis, flatback, and spondylolisthesis. Dr. Good has co-authored numerous articles and has been invited to lecture nationally and internationally at the Scoliosis Research Society, the International Meeting on Advanced Spinal Techniques, the American Academy of Orthopaedic Surgeons, and the North American Spine Society.

Summary

The goal of management of thoracolumbar spine injuries is to prevent further deformity and neurologic deficit while achieving a stable spine. Most patients with thoracolumbar fractures are treated with nonoperative treatment, i.e., a cast or brace and ambulation. Recommendations vary based on the type and location of the fracture as well as the presence or absence of neurologic injury. Operative treatment to decompress neural compression and stabilize the spine is most commonly recommended. Details of the surgical procedure are based on the location of the fracture and neurologic compromise.

REFERENCES