Posttraumatic Thoracolumbar Kyphosis

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The thoracolumbar junction is located at the junction of the kyphotic thoracic spine and lordotic lumbar spine and is quite commonly subject to trauma secondary to a higher concentration of forces (Fig. 45-1). Following an injury resulting in a vertebral body fracture with or without concomitant posterior element injury, this region is at risk for developing a static or progressive deformity. This results in a sagittal spinal imbalance with deformity and pain.

◆ Classification

The cause of the deformity may be the following:

1. Posttraumatic: occurring after high-energy burst and compression fractures (motor vehicle accidents, falls from heights) or after low-energy osteoporotic fractures (compression and burst)
2. Infectious (tuberculosis, pyogenic organisms, etc.)
3. Neuropathic (Charcot’s spine following a spinal cord injury)
4. Iatrogenic (postsurgical); examples include postlaminctomy kyphosis, and flatback deformity from distraction instrumentation in the lumbar spine.

The deformity may be classified as follows: type I, segmental deformity (segmentally out of balance/globally in balance); or type II, global deformity (segmentally and globally out of balance). C7 plumb line falls in front of L5-S1 interspace at opposed to the normal location falling through or just posterior to the L5-S1 intervertebral disk space.
Workup

History

A thorough history and physical examination must be taken, searching for the likely cause of the deformity. The most common complaint of the patients with posttraumatic thoracolumbar kyphosis is pain at the apex of the deformity, which may be exacerbated with bending, walking, lifting, twisting and prolonged sitting or standing.

Physical Examination

A thorough physical examination must be performed. There may be an obvious postural deformity. Rarely, a new onset or progressive neurologic symptoms involving the lower extremities may occur.

Spinal Imaging

Plain radiographs, including 36-inch cassette standing posteroanterior (PA) and lateral radiographs should be obtained to measure the magnitude of the deformity.
In addition, lateral flexion/extension views are helpful to assess instability or rigidity of the deformity. The global sagittal balance is obtained by dropping a C7 vertebral body plumb line that should fall within the L5-S1 disk space or just behind it. The Cobb’s method is used to assess the amount of local kyphosis by measuring the angle between the superior end plate of the vertebra above and the inferior end plate of the vertebra below.

It is important to compare with previous radiographic studies to assess any progression of the deformity. A computed tomography (CT) scan (3-mm axial images, and sagittal and coronal reconstructions) provides the best assessment of spinal bony architecture and the position of spinal implants if present, whereas magnetic resonance imaging (MRI) or CT myelogram provides the best assessment of symptomatic neural compression (Fig. 45-2).

**Special Diagnostic Tests**

If infection is a concern, then gallium/technetium bone scans and appropriate blood tests (white blood count, erythrocyte sedimentation rate, C-reactive protein, cultures) are indicated.
TREATMENT

Patients with mild deformities and symptoms that are controlled with nonoperative measures can be managed nonoperatively. Surgical indications include:

1. Continued unrelenting pain/disability recalcitrant to conservative management
2. Progression of the deformity (or absolute kyphosis >30 degrees at the thoracolumbar junction)
3. New onset or progressive neurologic deficit
4. Poor cosmesis (deformity with or without pain)

There are several surgical approaches that may be considered. The choice of approach depends on the type of curve (segmental or global), the rigidity and magnitude of the kyphosis (as assessed on preoperative static and dynamic films), and the nature and extent of any previous procedures. Ultimately, the choice of the approach is also determined by the surgeon's experience and preference. Approaches include posterior only, anterior only, or a same-day or staged combined anterior and posterior approach. A common strategy would be to perform anterior releases and fusion and/or a posterior osteotomy with segmental instrumentation and fusion. Video-assisted thoracoscopic (VATS) is becoming an alternative to open thoracotomy for anterior releases and bone grafting for selected curves. Anterior column defects should be treated with structural grafting. A posterior stabilization with segmental instrumentation is generally performed when the deformity is chronic or rigid.

There are several possible options for posterior-only procedures that often include osteotomies such as a pedicle subtraction osteotomy or Smith-Petersen osteotomy to restore sagittal balance, combined with a posterior instrumented fusion.

OUTCOMES

The outcomes reported in the literature are quite variable and mostly represent either small case series or retrospective reviews. Domanic et al have reported on 32 patients with rigid posttraumatic thoracolumbar kyphosis managed surgically with a posterior corrective osteotomy and instrumentation. The mean preoperative and postoperative kyphosis was 72 degrees and 23 degrees, respectively with a 100% union rate. One patient suffered irreversible paraplegia and two patients sustained a transient nerve root injury. Wu et al reported on 13 patients with a mean thoracolumbar kyphosis of 40 degrees managed with a posterior osteotomy (PSO) and fusion with instrumentation one level above and one below the osteotomy site. The mean postoperative correction was 38.8 degrees. Weinstein et al reported on 42 patients following a thoracolumbar burst fractures treated nonoperatively at a mean follow-up of 20.2 years. The mean thoracolumbar kyphosis at follow-up was 26.4 degrees. Furthermore, the authors concluded that the degree of posttraumatic kyphosis did not correlate with pain or function, and no patient developed neurologic deterioration. This is similar to the outcomes reported by Folman et al. Kostuk and Matsuaki reported on 37 patients with posttraumatic thoracolumbar kyphosis managed surgically through an anteriorly strut grafting procedure only. A stable fusion with correction of the deformity was obtained in 36 of 37 patients and back pain was substantially reduced in 78%.
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Complications

- Neurologic deficits (transoperative somatosensory evoked potentials (SSEPs), motor-evoked potentials (MEPs), and electromyography (EMG) should be utilized and are becoming the standard; a wake-up test is always available)
- Painful pseudarthrosis (utilize autogenous bone or biologic extenders)
- Adjacent level degeneration (preserve soft adjacent level soft tissues; include all levels in the deformity)
- Curve decompensation (avoid inadequate selection of fusion levels; asymmetric osteotomies)
- Superior mesenteric artery syndrome/celiac trunk stenosis (hepatic ischemia) (do not overlengthen the anterior column, especially in patients with obvious calcified vessels)
- Dural tear (direct repair, sealants or patches; watertight fascial closure; bedrest for 24 hours; consider lumbar drain in recalcitrant scenarios)
- Excessive bleeding (especially with PSO; use cell saver; have blood available; consider preoperative hemodilution)
- Infection/wound problems (optimize nutrition; avoid prominent hardware; aggressive irrigation and debridement)

Suggested Readings


An analysis of 28 patients treated successfully with posterior osteotomies for sagittal imbalance. Five treatment groups were evaluated based on osteotomy type and use of anterior structural grafting.


The positive results of a posterior wedge osteotomy and instrumentation in 32 patients with rigid kyphosis.


A retrospective review of 85 patients with thoracolumbar burst fractures assessing pain, disability, and litigation claims. The authors concluded that patients could be adequately managed nonoperatively with bedrest alone.


Thirty-seven patients with posttraumatic kyphosis corrected anteriorly only. Stable arthrodesis with correction of the deformity was obtained in 36 of 37 patients and the pain was substantially reduced in 78% of patients.


In a retrospective review, 26 patients with posttraumatic kyphosis and neurologic compromise secondary to an osteoporotic fracture underwent a posterior closing wedge osteotomy procedure and demonstrated a better surgical result with significantly less mean operative time and mean blood loss.

A comprehensive review on the subject.


A 20-year follow-up of 42 patients with thoracolumbar burst fractures treated successfully nonoperatively.


The positive results of posterior wedge osteotomy in 13 patients.
Thoracolumbar Kyphosis

Mild, flexible

Exercise or bracing

Severe (>30 degrees), associated with intractable pain or neurologic deficit

Consider surgical correction