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Fracture, Compression

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Introduction

Vertebral compression fractures (VCFs) of the spinal column occur secondary to an axial/compressive (and to a lesser extent, flexion) load with a resultant biomechanical failure of the bone resulting in a fracture. VCFs by definition compromise the anterior column of the spine, thereby resulting in compromise to the anterior half of the vertebral body (VB) and the anterior longitudinal ligament (ALL).

VCFs do not involve the posterior half of the WB and do not involve the posterior osseous ligamentous complex. The former distinguishes a compression fracture from a burst fracture. The implications of these compression fractures are related to the stability of the resulting structure and potential for deformity progression. Compression fractures are usually considered stable and do not require surgical instrumentation.

Etiology

The most common etiology of VCFs is osteoporosis, making these fractures the most common fragility fracture. However, compression fractures demonstrate a bimodal distribution with younger patients sustaining these injuries secondary to high energy mechanisms (fall from a height, MVA, etc.).

Due to the ligamentous and anatomical changes noted as one travels from the thoracic to the lumbar level, inherent areas of instability make this a frequent site of injury.

For the spinal column, traditional teaching is that the column can be divided into three sections: (1) anterior column (anterior longitudinal ligament, anterior annulus, the anterior portion of the vertebral body, (2) middle column (posterior vertebral body, posterior annulus, and posterior longitudinal ligament), and (3) the posterior column (ligamentum flavum, neural arch, facets, posterior ligamentous complex). If two of these three columns are compromised, the injury is considered unstable, and the patient potentially needs surgery.

Compression fractures by definition only involve compromise to the anterior column alone. Thus, VCFs are considered "stable" fracture patterns. When they progress to the middle and/or posterior column, they become burst fractures.

Epidemiology

VCFs are the most common fragility fracture reported in the literature. Approximately 1- to 1.5 million VCFs occur annually in the united states (US) alone. Moreover, it is estimated that 40% to 50% of patients over age 80 years have sustained a VCF either acutely, or recognized incidentally during clinical workup for a separate condition.

Recent reports cite the thoracolumbar junction (i.e., the segment from T12 to L2) as the location afflicted with 60% to 75% of VCFs, and another 30% occur at the L2 to L5 region.

In younger patients, about 50% of spine fractures are due to motor vehicle collisions with another 25% being due to falls.

This is in stark contrast to the elderly mechanism of injury at presentation. Studies have reported an estimate of 30% of VCFs occurring while the patient is in bed. As the population continues to age, the population at risk of sustaining low energy fragility fractures will continue to increase as well. Currently, 10 million Americans are already diagnosed with osteoporosis, and another 34 million have osteopenia. Population studies have shown that the annual incidence of VCFs is 10.7 per 1000 women and 5.7 per 1000 men.

Pathophysiology

During a fall or trauma, the spinal column will rotate around a center of axis for this rotation. There is also an associated axial force applied due to this flexion/extension of the spine. An axial force more than the forces tolerable by the vertebral body leads initially to a compression fracture with more significant forces resulting in a burst fracture. The resulting kyphotic (forward flexion of the spine) deformity of the compression fracture may alter the spine biomechanics, placing additional stresses on other spine levels. The altered biomechanics risk additional fractures and progressive deformity. The occurrence an osteoporotic compression fracture increases the risk of an additional compression fracture.

History and Physical

Initial evaluation of spine fractures, once the patient has been stabilized, includes an evaluation of the neurologic function of the arms, legs, bladder, and bowels. The keys to a thorough exam are organization and patience. Of note, many high-energy compression fractures have associated abdominal, cerebral, and extremity injuries, and these all should be evaluated. One should not only evaluate strength in addition to sensation and reflexes. It is also important to inspect the skin along the back and document the presence of tenderness to compression. Documentation is paramount as these initial findings will likely be used as a baseline for all future evaluations.

Evaluation

Evaluation of patients with suspected back trauma includes anterior-posterior (AP) and lateral radiographs of the impacted area. In the trauma setting these initially, should be obtained supine with spine precautions until cleared by the spine team or bracing has been provided. At some point, standing radiographs in the brace are helpful to guide treatment as a supine position may artificially reduce a displaced fracture.

A CT should also be obtained in all trauma settings. If there is a suspected posterior column injury not able to be confirmed on CT, an MRI will indicate disruption of the posterior ligamentous complex. Radiographs showing 30 degrees of traumatic kyphosis (forward flexion of the spine) and 50% vertebral body height loss are historically thought to be unstable fractures, but new evidence is changing this belief. Furthermore, any neurologic deficit necessitates an MRI for additional evaluation. Elderly patients with low energy compression fractures likely will not require an MRI. Serial standing lateral radiographs obtained in the clinic will help track the fracture progression and healing.

Treatment / Management

Determining the need for surgery is at times controversial. In 2005, a classifications system was introduced to provide more uniformity in management and provide simple treatment recommendations. The Thoracolumbar Injury Classification and Severity (TLICS) Scale uses the

posterior ligamentous complex, injury morphology, and neurological status to provide a score (one to ten) that can guide intervention: less than four favoring non-surgical treatment, more than four surgical, and four being managed by either. Of course, these are general guidelines, predominantly for trauma patients, and each case should be evaluated carefully. Interestingly, newer studies have shown that historical considerations such as loss of vertebral body height, segmental kyphosis, and canal compromise, do not correlate with the need for surgery (in those neurologically intact patients). Of note, currently, there have been no randomized trials evaluating surgery versus brace treatment in “unstable” compression fractures.

Orthosis/bracing modalities accomplish conservative management for a period of four to 12 weeks. Discontinuation of the bracing can be considered when there is radiographic evidence of healing, and the patient no longer is tender over the fracture site. In that bed rest, analgesic medications, and bracing are poorly tolerated in the elderly; many will alternatively consider percutaneous procedures such as kyphoplasties for stabilization of the fracture and faster clinical improvement.

Surgical options are largely dependent on fracture characteristics and neurologic injury. Rarely would compression fractures require instrumented stabilization. For patients with osteoporotic compression fractures, kyphoplasty is a relatively safe and simple procedure relying on the percutaneous insertion of a balloon into the vertebral body to restore the height followed by injection of bone cement to maintain the correction. Recent randomized controlled trials have shown kyphoplasties allowing for significantly more rapid improvement in the quality of life, function, pain, and mobility.

Pearls and Other Issues

The most important consideration when evaluating fractures of the spine should be the neurologic exam as compression of the spinal canal may alter treatment options. Regarding a kyphoplasty treatment for compression fractures, several contraindications should be remembered. These include current neurologic compromise, burst fractures (fractures of the posterior vertebral body wall), spine infections, current sepsis, or underlying bleeding diatheses. Not addressed above are patients with diffuse idiopathic skeletal hyperostosis (DISH) and ankylosing spondylitis (AS). Both of these result in brittle spinal columns and a fracture of any type should be considered unstable and require CT, MRI, and potentially surgery.

Questions

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The Thoracolumbar Injury Classification and Severity (TLICS) Score

Injury Category	Point Value
Injury morphology	
Compression	1
Burst	2
Translation or rotation	3
Distraction	4
PLC status	
Intact	0
Injury suspected or indeterminate	2
Injured	3
Neurologic status	
Intact	0
Nerve root involvement	2
Spinal cord or conus medullaris injury	
Incomplete	3
Complete	2
Cauda equina syndrome	3

Figure

The Thoracolumbar Injury Classification and Severity (TLICS) Score. Contributed by Chester J Donnally III, MD

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