

Spinal Compression Fracture Repair and Rehabilitation

Surgical Indications and Considerations

Anatomical Considerations: Compression fractures are characterized by anterior compression of the vertebral body. Posterior elements of the vertebral body may also be involved but the posterior body remains intact.

Pathogenesis: Spinal compression fractures are caused by axial loading on a flexed spine. The most common pathology behind these fractures is osteoporosis. Compression fractures are a major contributor to both the substantial morbidity and the cost associated with osteoporosis. The spinal deformity caused by vertebral compression fractures (VCFs), whether painful or not, has significant impact on the longevity and quality of life of VCF patients. Compression of the abdominal viscera by the rib cage or loss of lumbar spine height leads to decreased appetite, early satiety and weight loss. Similarly, thoracic hyperkyphosis compresses the lungs and results in a reduction of forced vital capacity (FVC) and forced expiratory volume (FEV₁). Additionally, these patients may suffer from chronic pain, sleep disorders, clinical depression, and anxiety.

Epidemiology: The number of osteoporotic vertebral compression fractures (700,000) per year easily outnumbers fractures of the hip and ankle combined. The five-year survival rate for a patient with a vertebral body compression fracture is lower than an individual with a hip fracture. Patients with VCF have a 23% increased risk of mortality compared to aged matched controls without VCF. The increased mortality is primarily related to pulmonary complications. Mortality increases with the number of fractures and the degree of kyphosis. After the first compression fracture, the risk of additional vertebral fractures increases 5 to 25 times above baseline. Osteoporotic vertebral compression fractures are associated with debilitating psychological effects, including impaired body image and self esteem. The percentage of women with clinical depression increases with number of spinal fracture deformities. Patients report a fear of falling, further fracture and a loss of independence. Additionally, patients with increasing numbers of VCF demonstrate decreased functional status as recorded in physical function tests.

Diagnosis:

- A spinal compression fracture can be readily diagnosed on plain radiographs and with computed tomography
- The pain associated with the fracture is typically localized at the apex of the fracture
- MRI may be used to assist in differentiation between acute and chronic fractures

Nonoperative Versus Operative Management: Open surgical intervention in this frail population, with osteoporotic spinal compression fractures, is fraught with morbidity and implant failure. Therefore, nonoperative management including narcotic pain medication, bed rest and bracing has been historically recommended for the vast majority of patients. Traditionally surgery has been limited to those who have neurologic complications.

Unfortunately, large numbers of patients report intractable pain and an inability to return to their prior level of function. The recommended and frequently self imposed bed rest leads to accelerated bone mineral loss and diminishing muscle mass, which exacerbates the disease process and increases the risk of additional fractures. Neurological deficits often develop months after the index fracture, as the spinal cord drapes over the apex of the deformity. When neurologic complications occur, open surgical intervention is usually an anterior decompression and fusion, coupled with posterior instrumentation and fusion. However, two new noninvasive techniques (first used in the United States in 1993) offer rapid pain relief and return to routine activities through percutaneous bone augmentation: vertebroplasty and balloon kyphoplasty.

Surgical Procedure: The noninvasive surgical techniques of percutaneous vertebroplasty and balloon kyphoplasty both internally stabilize the fractured vertebral body through injection of polymethylmethacrylate (PMMA) and are typically performed within three months of the fracture. Both procedures are performed with imaging guidance in the radiology suite or operating room and can be done under local anesthesia with conscious sedation, or with general anesthetic. Kyphoplasty is distinctly different from vertebroplasty by its ability to reduce the fracture using an inflatable balloon tamp to create a void within the vertebral body that allows for injection of PMMA in a thick, doughy state under low pressure, thereby reducing the risk of emboli and extrusion outside the vertebral body. Theoretically, kyphoplasty should have long-term benefits beyond those of pain relief provided by vertebroplasty by avoiding the pulmonary and gastrointestinal complications through improved spinal alignment.

Preoperative Rehabilitation

- Pain management with narcotics
- Bracing and instruction on body mechanics
- Appropriate treatment for the underlying osteoporosis

POSTOPERATIVE REHABILITATION

Treatment Goals: The goals of nonoperative and operative management of vertebral compression fractures are the same and include the restoration of a painless, balanced, stable spinal column with optimal neurologic function and minimal treatment morbidity.

Following a vertebroplasty or kyphoplasty the patient is instructed to remain supine for 1 hour to allow the cement to harden. Observation in the hospital for 1 to 2 hours post procedure is typical, at which time most patients will be able to stand and walk with minimal or no pain. Some practitioners request a physical therapy consult for patients on the day of surgery to assist in early mobilization, as necessary, and for the instruction of body mechanics to avoid heavy lifting, bending and twisting. Early return to daily activities is encouraged.

All osteoporotic patients with VCFs should have an appropriate evaluation and treatment of their underlying osteoporosis. Medical management can include medications to increase bone mineral density and physical therapy can assist in establishing an appropriate strengthening and weight bearing exercise program to stimulate an increase in bone density. If the compression fracture is secondary to a fall, the patient's balance systems also need to be addressed.

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