

Advanced Pain Management

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Osteoporosis, Vertebroplasty, Kyphoplasty Sacroplasty

Osteoporosis

Pathophysiology

Osteoporotic fractures are estimated to occur at an annual rate of 1.5 million new fractures per year. Of these, 500,000 to 700,000 are vertebral fractures. The annual health care cost have been estimated at \$13.8 billion.

Vertebral compression fractures (VCF) are defined as a minimum of 20% or 4 mm reduction in vertebral body height. The incidence of VCF increases with increased age. Women over the age of 50 have a 26% prevalence. Women over the age of 80 have as much as a 40% prevalence. The levels of T12 and L1 are most commonly involved (Fig. 1). Pain from VCF has been estimated to occur in 84% of patients.

The mortality rate after 5 years following a vertebral compression fracture is 20% higher. After the initial VCF, there is a 20% chance of a repeat VCF within 1 year.

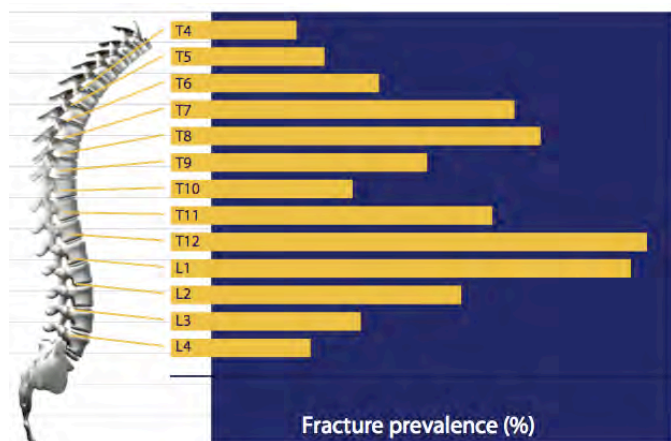


Fig. 1. Incidence of vertebral fractures in the spine.

Risk Factors

- History of fracture as an adult
- Low Body Weight (<130 lbs.)
- Current Smoking
- Use of steroids for greater than three months
- Immobility
- Estrogen deficiency at an age less than 45
- Low physical activity
- Low lifelong calcium intake
- Alcohol consumption greater than 2 drinks per day

Diagnosis

A frequently noted difficulty in diagnosing symptomatic vertebral compression fractures is the presence of multiple vertebral fractures.

The most commonly used procedure for bone mass evaluation is a dual-energy x-ray absorptiometry (DXA). The results are reported in terms of T-Scores or Z-scores. T-scores express result in terms of standard deviation from young adult norm. Z-scores are standard deviation from individuals of the same sex, age and body size. Most vertebral compression fractures occur in women with a T-score > -2.5.

Classification	Bone Mineral Density	T-score
Normal	Within 1 SD of reference mean	-1 or above
Osteopenia	>1 but 2.5 below reference mean	Below -1 but above -2.5
Osteoporosis	2.5 below reference mean	-2.5 or below
Severe Osteoporosis	2.5 Sd below reference mean plus at least 1 fragility fracture	-2.5 or below

On physical exam these patients may have tenderness over the involved segment however this is not very reliable. There is increased pain noted with standing or axial loading.

Diagnostic Studies (All MRIs are not created equal)

MRI with sagittal Short Tau Inversion Recovery (STIR)

Acute fractures produce low signal on T2 images and high signal STIR sequences (Fig. 2, page 2). This test is sensitive from a few hours to 3-4 months after a fracture. T2 weighted shows high intensity for conditions that increase free water such as acute fracture. STIR MRI sequence is the most sensitive for water content when assessing fractures. A high STIR signal predicts pain relief after treatment with vertebroplasty and kyphoplasty.

over

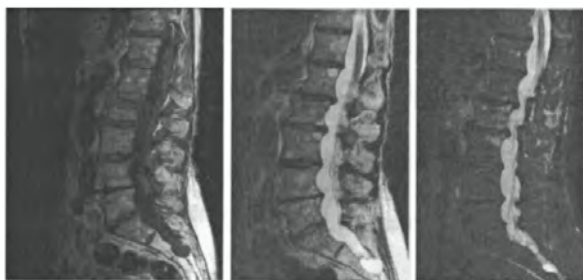


Fig. 2. Sagittal Short Tau Inversion Recovery

Technetium bone scan/CT

This test is more sensitive for non-healed fractures that respond to vertebroplasty than MRI after three months. This test is recommended for patients with pain for longer than three months .

Radiographic indicators of malignancy include pedicle involvement, osteoblastic lesions, cortical involvement and soft tissue involvement.

Traditional Management/Limitations

Analgesics

- temporary relief
- side effects

Immobilization

- Variable success
- Demineralization

Bed Rest

- potential for DVT/pneumonia

Surgery

- High failure rates

The Procedures

Vertebroplasty

Vertebroplasty is a FDA approved, effective, and minimally invasive spine procedure where acrylic bone cement is injected into a painful pathologically compressed vertebral body.

Deramond and Galibert, in Amiens, France, first performed a percutaneous vertebral augmentation in 1984. Their patient had severe pain from an aggressive hemangioma involving the C2 vertebra. Using fluoroscopic guidance, Dr. Deramond placed a large bore needle into the C2 vertebral body and infused polymethylmethacrylate, relieving the patient's pain. Subsequently, the indications were broadened to include patients treated for pain resulting from vertebral collapse secondary to both osteoporosis or bony vertebral metastasis. Deramond and Galibert reported their first seven procedures in 1987, and called the procedure "Percutaneous Vertebroplasty. Its was introduced in 1987 Gallbert et al in a patient with painful cervical hemangioma.

The first American case was published by Jansen et al in 1997 at the University of Virginia. Initial publications and presentations at peer reviewed meetings demonstrated an 80 to 90% success in providing immediate and significant pain relief. Medication



Fig. 3. Compression fracture of L3 treated with vertebroplasty

requirements were substantially diminished, and physical and psychosocial well-being were restored.

Kyphoplasty

Like Vertebroplasty, Kyphoplasty is minimally invasive. Kyphoplasty addresses the delivery of the acrylic cement into the vertebral compression fracture site, but in a more controlled space. Needles are percutaneously placed onto the vertebral fracture under fluoroscopic imaging. Balloon catheters are placed within the fracture and then dilated. The cavity created is then injected with cement. Pain relief occurs in as much as 90% of patients in some studies. The decision to treat patients with vertebroplasty or kyphoplasty is up to the practitioner. There is some controversy regarding the added benefit of the more complicated procedure vertebroplasty.

Sacroplasty for the treatment of sacral insufficiency fracture

Insufficiency fractures of the sacrum have been historically difficult to manage. These typically elderly patients will often present with a normal neurologic examination and the inability to ambulate due to hip immobility and back/groin pain.

If suspected, the imaging studies of choice are bone scan and/or MRI. Although the "Honda sign" (Fig. 4) is the hallmark of the bone scan evaluation, atypical patterns may be further evaluated with CT.

Early Intervention Goals

The goal of early intervention with vertebral fractures should be pain control and fracture stabilization. The issue of stabilization may be accomplished by bracing, minimally invasive therapies, or surgical intervention. A huge service to these patients is bracing by Primary Care Physicians as soon as spinal fracture is recognized. These fractures should be considered unstable until further work-up for Interventional Pain Management or Surgical options are explored.

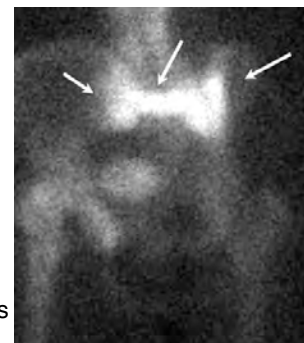


Fig. 4 Bilateral sacral insufficiency fracture with "Honda sign"