

# S42- Medical Imaging for the Diagnosis and Treatment of Spinal Compression Fractures

## Objectives

- Define spinal compression fractures and identify common etiology
- Assess the roles of imaging modalities in diagnosis and medical interventions

## Define Spinal Compression Fractures

- Vertebral Compression Fractures (VCF) occur when one or more vertebrae collapse on the anterior aspect of the vertebral body, usually presenting as a wedge-shaped deformity
- A spinal compression fracture is often a sign of bone weakness
- Approximately 1.5 million adults in the U.S. are affected by VCFs annually (Hoyt et al., 2020)
- Vertebral body weakens and collapses most commonly occur in the thoracolumbar region (T12 - L2), accounting for 60-75% of cases, with another 30% occurring in the L2-L5 region (Donnally et al., 2025)

## Causes of Spinal Compression Fractures

### Osteoporosis

- According to the American Academy of Family Physicians, 700,000 Americans are affected by VCFs annually due to osteoporosis, the leading cause of spinal compression fractures (McCarthy & Davis, 2016)
- Four in then Caucasian women over age 50 will experience a vertebral fracture due to age-related bone weakness (McCarthy & Davis, 2016)

### Trauma

- Trauma sustained to the spine from falls, accidents, and sports injuries can cause VCFs
- In younger patients, 50% are caused by motor vehicle accident and 25% by falls (Hoyt et al., 2020)

### Cancer

- Tumors that originate in the spine or metastasize from another location can weaken the vertebrae

## Symptoms of Spinal Compression Fractures

- More than two-thirds of patients are asymptomatic and diagnosed incidentally on imaging. (Alexandru & So, 2012)
- If a fracture is caused by osteoporosis, symptoms may be absent. However, may develop:
  - back pain when walking
  - loss of height
  - Kyphosis, which can cause spinal cord compression, leading to numbness, difficulty walking, and loss of bladder control
- Approximately 30% of compression fractures in patients with osteoporosis occur while in bed (Donnally et al., 2025)
- Severe back pain with position changes, lifting, coughing or sneezing can occur with patients with acute VCFs (McCarthy & Davis, 2016)

## Diagnosing with Imaging

### X-RAY



<https://www.nature.com/articles/441598-024-79610-w>

- Used as the initial imaging modality
- Projections used to evaluate spinal compression fracture include AP, Lateral, flexion/extension views
- Asymptomatic VCFs are often found incidentally on lateral projection (Hoyt et al., 2020)

### MAGNETIC RESONANCE IMAGING - MRI



<https://www.aans.org/patients/conditions-treatments/vertebral-compression-fractures/>

- Used if a tumor is suspected
- Can determine age of the fracture; recent fractures show signs of edema (McCarthy & Davis, 2016)
- Visualizes spinal cord compression and ligament disruption

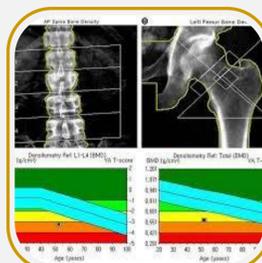
### COMPUTED TOMOGRAPHY - CT



<https://www.cambridge.org/core/books/obs/clinical-imaging-of-spinal-trauma/malignant-compression-fractures/49A38277C3209C885037AD8E0A92830>

- Used to assess nerve damage and complex fractures
- Provides detailed analysis of fracture configuration and extension into the vertebral canal (Donnally et al., 2025)

### DEXA



<https://prognosismri.com/en/dexa/>

- Used to evaluate for osteoporosis
- If bone mineral density is decreased by two standard deviations, the risk of developing VCF increases by six. (Alexandru & So, 2012)

## Treatment

### Conservative Management

- Pain medication to treat acute VCFs
  - acetaminophen, non-steroidal anti-inflammatory drugs (NSAIDs), narcotics, lidocaine patches, and calcitonin
- Physical therapy with back extensor strengthening
- Immobilization with bracing

(McCarthy & Davis, 2016)

### Minimally Invasive Procedures (if pain persists)

- Considered after severe, disabling pain persists for more than 2 months
- Often performed with interventional radiography with fluoroscopy

#### vertebroplasty

- imaging-guided (fluoroscopy) cement injection into the fractured vertebral body
- 75-100% of patients experience good to moderate pain relief

#### kyphoplasty

- A balloon is used to create a cavity to restore vertebral body height before cement injection
- 85-100% of patients experience good to moderate pain relief following the procedure and improved functionality compared to the conservative treatment
- Most successful for height restoration if performed within 3 months of symptom onset

(Alexandru & So, 2012)

## Prevention

- Weight-bearing & strengthening exercise
- Medication & supplements to increase bone density:
  - Bisphosphonates – approximately 50% effective in patients with prior VCFs.
  - Parathyroid hormone – reduces VCF risk by approximately 65%
  - Calcium & Vitamin D
- Osteoporosis screening for women over age 65

(Donnally et al., 2025)

## Conclusion

Advances in diagnostic imaging and medical interventions have revolutionized the approach to spinal compression fractures. These medical advancements allow for earlier detection, precise classification, and more effective treatment strategies that enhance patient recovery and reduce long-term complications.