

Percutaneous vertebroplasty for osteoporotic vertebral body fractures

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Learning objectives

- 1. To learn the indication, technique and prognosis of percutaneous vertebroplasty for osteoporotic vertebral fractures.**
- 2. To understand the medical management and background of the patients who require repeat vertebroplasty**

Osteoporosis: Definition

- **reduction of bone mass (or density)** or
- **presence of a fragility fracture**
 - **T-score of >2.5 SD below** mean for young healthy adults of the same race and gender
 - Osteoporosis
 - **T-score of >1 SD below** mean
 - low bone density
 - increased risk of osteoporosis.

Osteoporosis: introduction

- Chief clinical manifestations
 - **vertebral** and hip fractures
 - affects >10 million in US
 - 55% in US >50y
 - 17 billions/year medical cost
- Symptomatic **vertebral fx**
 - More than hip fx
 - 1.23/1000 person/year
 - 26% in women >50y
 - only a small proportion are diagnosed and treated

Osteoporosis: Fractures Overview

- **Vertebral Fx:** 700,000/year in US
 - rarely require hospitalization
 - long-term morbidity and slight increase in mortality.
 - Thoracic Fx: restrictive lung disease
 - Lumbar Fx: abdominal symptoms (distention, early satiety, and constipation)
- **Distal radius Fx**
 - increase before age 50 and plateau by age 60
- **Hip Fx:** doubles every 5 years after age 70
 - The probability is 14% for women and 5% for men
 - the risk for African Americans is lower (about half these rates)

Osteoporosis

Approach to the patient (1/2)

- **Routine Laboratory Evaluation**
 - No established algorithm for osteoporosis
- **CBC, serum (urine) calcium**
 - **Serum Ca \uparrow** : hyperparathyroidism or malignancy
 - PTH \uparrow : hyperparathyroidism
 - PTHrP \uparrow : humoral hypercalcemia of malignancy
 - **Serum Ca \downarrow** : malnutrition and osteomalacia.
 - **Urine Ca \downarrow** : osteomalacia, malnutrition, or malabsorption
 - **Urine Ca \uparrow** :
 - renal calcium leak-males with osteoporosis
 - absorptive hypercalciuria- idiopathic or associated with increased 1,25(OH) $_2$ D in granulomatous disease
 - hematologic malignancies or excessive bone turn over (Paget's disease, hyperparathyroidism, and hyperthyroidism)

Osteoporosis

Approach to the patient (2/2)

- **TSH**
 - hyperthyroidism
- **Cortisol**
 - Cushing's syndrome
- **Albumin, Cholesterol, CBC**
 - bowel disease, malabsorption, or malnutrition
- **Antigliadin, Antiendomysial, or transglutaminase antibodies**
 - Celiac disease (may require endoscopic biopsy)
- **Histamine or tryptase**
 - Mastocytosis
- **X-ray, light chains**
 - Myeloma

Osteoporosis: Fx management

- **Hip or long bone Fxs**
 - surgical repair if the patient is to become ambulatory again
- **Other Fxs (e.g., vertebra, rib, and pelvis)**
 - supportive care
 - analgesics including NSAIDS and/or acetaminophen
 - Sometimes narcotic agent (codeine or oxycodone)
 - vertebroplasty or kyphoplasty; significant immediate pain relief in the majority of patients. Long-term effects are unknown
 - elastic-style brace
 - muscle relaxants and heat treatments.
- **Severe pain usually resolves within 6 to 10 weeks**

Osteoporosis: Risk factors

- Age
- Gender
- Family history
- Race
- Small body size
- Early menopause
- Smoking
- Alcohol
- No exercise
- Steroids
- Anticonvulsant
- Methotrexate
- Cyclosporin
- Heparin

Osteoporosis: Underlying disease

- Reduce risk factors
 - **Glucocorticoid** and **thyroid** hormone should be as low as possible
 - **smoking** cessation
 - **alcohol** abuse treatment
 - review of the medical regimen
 - orthostatic hypotension and/or sedation

Osteoporosis Recommendation

- **Nutrition**
 - Calcium
 - Vitamin D

- **Exercise**

Osteoporosis

Tx for Underlying disease

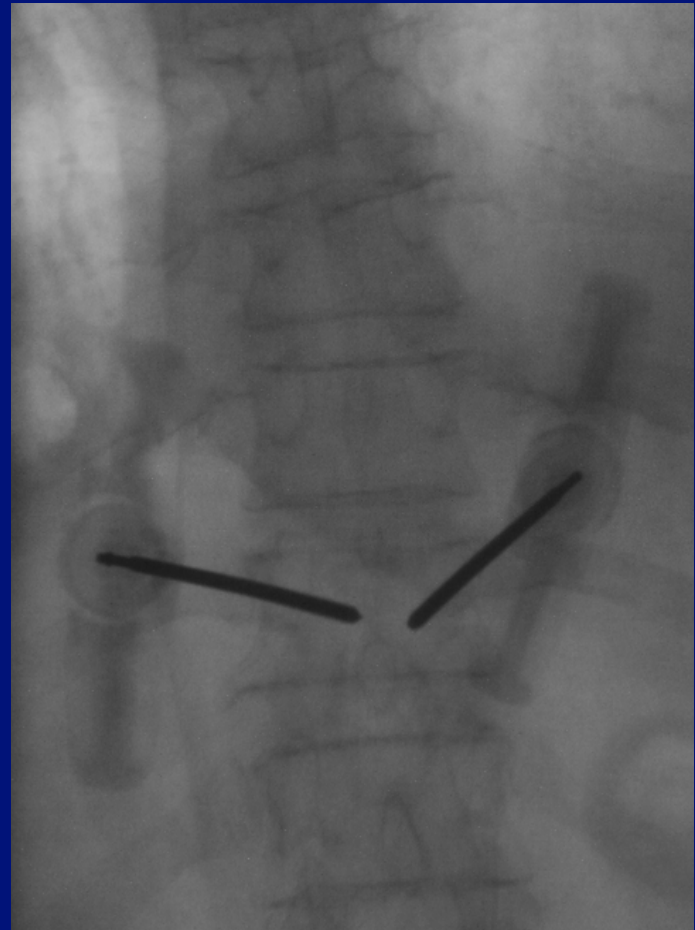
- **Estrogen**
 - oral or transdermal
- **Progestin**
 - In women with a uterus (To reduce uterine cancer)
 - daily or cyclical at least 12 days per month
 - On breast tissue, progestins may increase the risk of breast cancer.
- **Bisphosphonates**
 - Alendronate
 - Risedronate
- **Calcitonin**
- **Parathyroid hormone**
- **Selective estrogen response modulators (SERMs)**
 - Raloxifene
 - osteoporosis
 - Tamoxifen
 - breast cancer.

Osteoporosis: Steroid

- **Widely used**
 - COPD, RA, IBD, and posttransplantation
- **Mechanisms**
 - inhibition of osteoblast function and an increase in osteoblast apoptosis, resulting in impaired synthesis of new bone
 - stimulation of bone resorption
 - impairment of the absorption of calcium
 - increase of urinary calcium loss
 - reduction of adrenal androgens and suppression of ovarian and testicular estrogens and androgens
 - induction of glucocorticoid myopathy
- **Tx**
 - bisphosphonates
 - Risedronate
 - Alendronate
 - Etidronate

Vertebroplasty Background

- First reported in 1984 for aggressive hemangioma
- Expanded to osteoporosis, metastasis, tumor



Vertebroplasty Indication (PE)

- Patients who **failed conservative Tx**
 - most patients were treated 6–12 weeks
- **Focal discomfort** at palpation
- **Absence** of radicular symptoms or neurologic deficits
- Vertebral **osteonecrosis** (Kummell Disease)

Vertebroplasty

Preoperative Imaging

- Plain Film
- CT
- MR
 - edema/enhance
- Bone scan
 - uptake

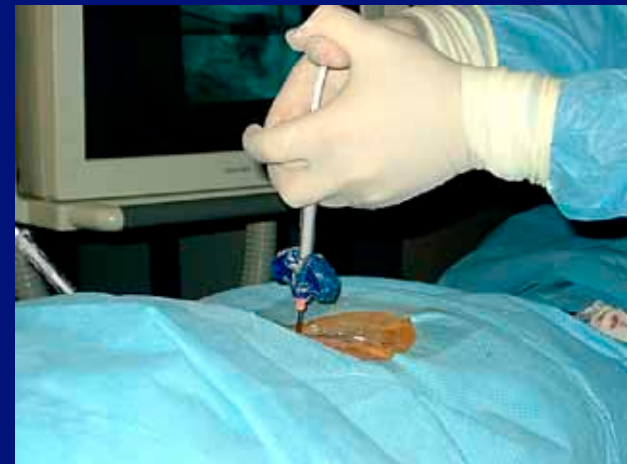
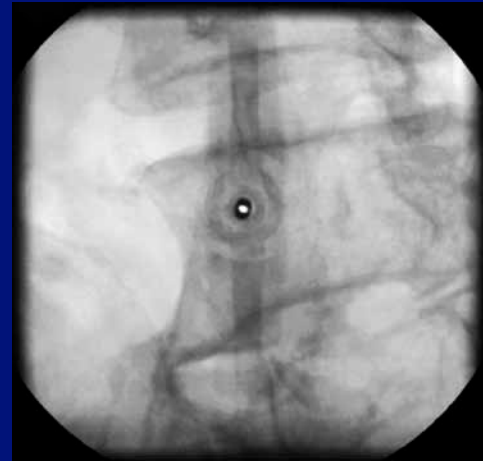


Vertebroplasty Complications

- **< 5%**
 - **Bleeding**
 - **Infection**
 - **Damage**
 - **Fx of pedicle, ribs**
 - **Compression of nerve roots/spinal cord**
 - **Pulmonary embolism**

Vertebroplasty Technique

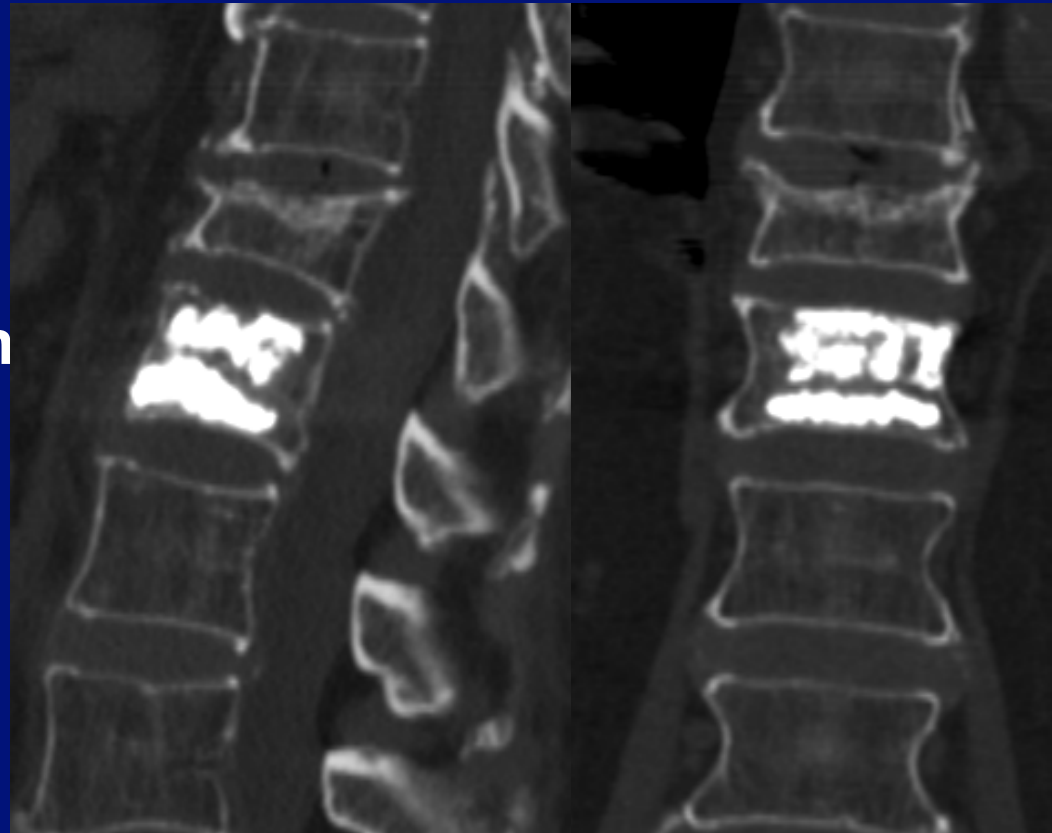
- **Fluoroscopy (or CT)**
- **bipedicular or monopedicular approach**
- **13-gauge bone biopsy needle(s) placed into the anterior 1/3 of the vertebral body**
- **polymethylmethacrylate**
- **barium sulfate**
- **Antibiotics (e.g. tobramycin)**
- **until the vertebral body was filled toward the posterior 20% of the vertebral body or leakage**
- **Patient remains prone until the cement will be hard**



Vertebroplasty

Postoperative imaging

- Plain Film
- CT
 - Most useful
 - Leakage evaluation
- MRI
- Bone scan



Vertebroplasty mechanism for pain relief

- **Stabilization preventing intravertebral motion**
- **Chemical destruction of nocicepters**
- **Thermal destruction of nocicepters**

Vertebroplasty Outcome

- **73-95% of pain relief**
- **10-25% developed new vertebral body fractures following treatment**
 - **Often seen in adjacent vertebrae**

Vertebroplasty

Cause for repeat Tx

- 53 pts (36 F and 17 M; mean 79 years)
 - 35 pts treated once
 - 18 pts treated more than once
- Main difference
 - presence of **chronic steroid use**
 - no significant differences
 - Age
 - Gender
 - Use of medical treatment

Take home message

- **Vertebroplasty is a safe and effective for treatment of osteoporotic vertebral fracture**
- **Chronic steroid use can cause repeat fractures**

Suggested readings

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