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↑: hyperparathyroidism or malignancy
    • PTH↑: hyperparathyroidism
    • PTHrP ↑: humoral hypercalcemia of malignancy
  – Serum Ca↓: malnutrition and osteomalacia.
  – Urine Ca↓: osteomalacia, malnutrition, or malabsorption
  – Urine Ca↑:
    • renal calcium leak-males with osteoporosis
    • absorptive hypercalciuria- idiopathic or associated with increased 1,25(OH)2D in granulomatous disease
    • hematologic malignancies or excessive bone turn over (Paget's disease, hyperparathyroidism, and hyperthyroidism)
• 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

- Harrison's Principles of Internal Medicine, 16th Edition