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Anesthesia in interventional radiology

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CASE

An 88 year old female, 62 kg, with a past medical history significant for early Alzheimer's disease, hypothyroidism, gastroesophageal reflux disease and osteoporosis presented for percutaneous vertebroplasty. She had painfully disabling osteoporotic at T12-L2 fractures. She was scheduled as a same day admit for a 23 hour hospital stay

Osteoporosis

- Causes 1 million vertebral fractures annually in the US, affects 10 million
- Characterized by low bone mass and structural deterioration of bone tissue
- Mainly elderly, white women
- Risk factors: poor nutrition, smoking, alcohol, steroids
- Diagnose by bone density scan

Vertebroplasty (PV)

- Described in 1984 by Deramond
- Palliative treatment for osteoporosis
- Minimally invasive, needs sedation
- Injection of polymethylmethacrylate to vertebral body
- Fluoroscopic guidance
- Dramatic decrease of pain in > 2000 case studies

Selection criteria

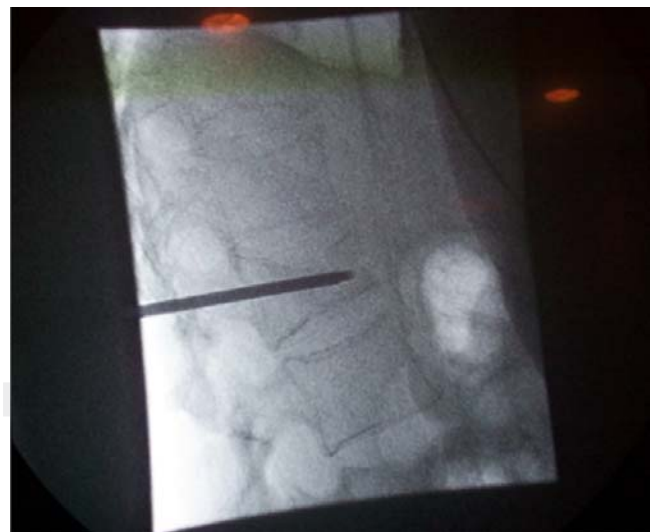
- New fracture
- Pain refractory to medical management
- Respiratory compromise
- Potential for worsening of disease

Exclusion criteria

- Vertebral body height loss 100%
- Posterior wall involvement
- Involvement of the spinal cord
- Osteolytic metastatic lesion
- Bleeding diathesis
- Inability to undergo emergency decompressive surgery

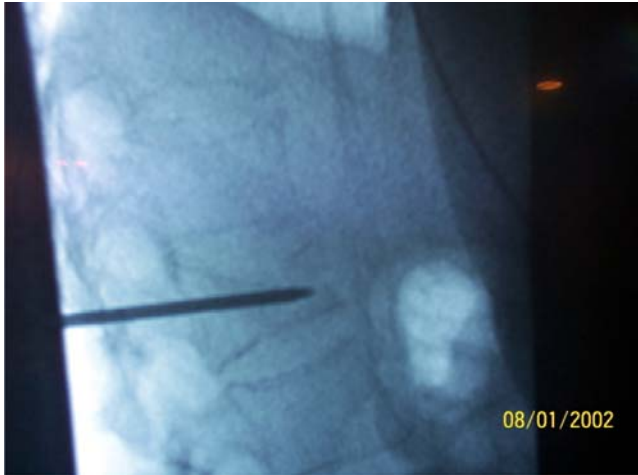
Stages of PV

- Vertebral puncture (access site)
- Spinal biopsy (rule out metastasis)

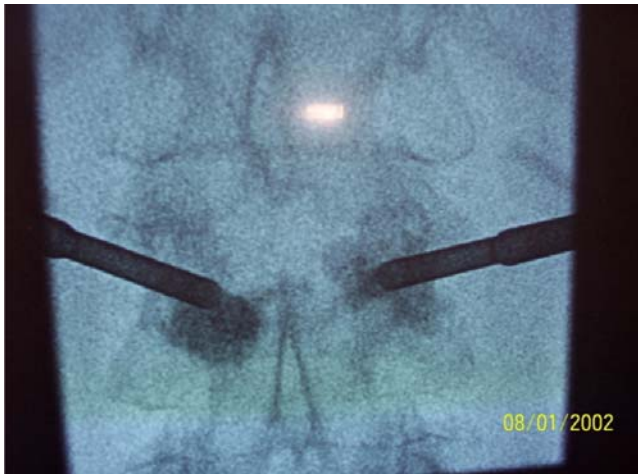


Vertebral body puncture

- Vertebral venography (identify drainage and extravasation of cement)
- Injection of PMMA



Vertebral puncture



Injection of PMMA

Complications

- PMMA leakage into perivertebral veins causing radiculopathy or embolization (pulse oxymetry may be disturbed)
- Puncture can cause hematoma, injure internal cortex of pedicle
- Hypotension, hypoxemia, cardiac dysrhythmias

Treatment

- Inflammatory reaction to cement responds to NSAIDs
- Supportive for cardiovascular compromise
- Emergency decompression if spinal cord compromise (very rare)



PMMA filling vertebral body

Kyphoplasty

- Stops further compression and fixes spinal deformity
- Creates better structure for metastatic lesions
- Insertion of tamponading balloon to vertebral body to compact bone and reexpand body
- PMMA into cavity created

Complications

- Less than with PV, greater containment of cement
- Epidural hematoma (rare) associated with heparin administration
- Lower extremity motor loss from cement extravasation to spinal column
- Anterior cord syndrome

Anesthetic considerations

- Geriatric co-morbidities (cardio respiratory)
- Multiple medications (including herbals)
- Metastatic disease
- Poor nutritional status
- Narcotic dependency
- Limited mobility, fragile bones



View of the radiology suite



Patient positioned on the table

Management; positioning

- Sedation prior to positioning, assess range of motion preop.
- Radiolucent bolsters, air mattresses
- Vertebrae should be lined up
- Avoid stretching of brachial plexus, limb girdle
- Hands and feet in anatomically neutral positions

Anesthetic management

- Midazolam 0.5-1 mg increments
- Fentanyl 25 mg-50 mg
- Propofol infusion 20-50 mg/kg/min
- Dexmedetomidine 0.1-0.2 mg/kg/min
- General endotracheal anesthesia
- Have supraglottic devices present if using sedation
- Use standard ASA monitors

Post anesthetic management

- Pain often relieved immediately
- May not require narcotics
- Vertebral height may be increased
- Observe for neurologic changes for a few hours
- May be suitable for same day discharge

Aneurysms

Surgical ablation (Dandy 1937)

vs

Endovascular clipping (Guglielmi 1991)

Pulmonary function concerns

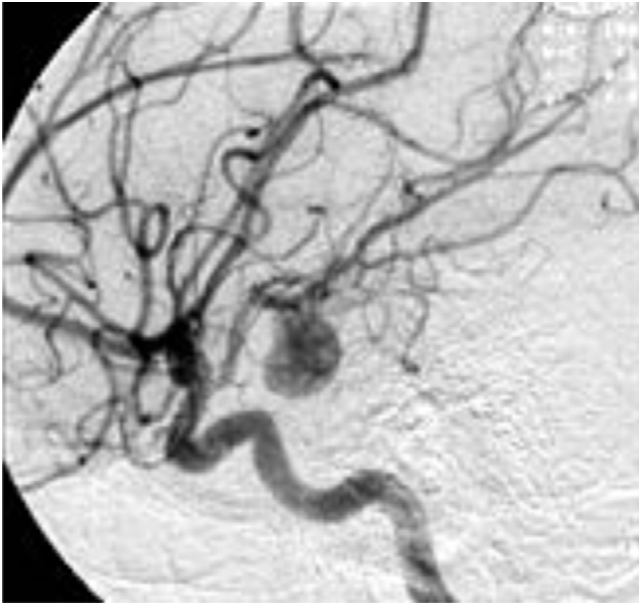
- Decreased function due to vertebral fracture
- Reduced CR reserve in elderly
- Restrictive lung pattern (VC, FEV1 decreased)
- Prone position
- Pain

Gastrointestinal function

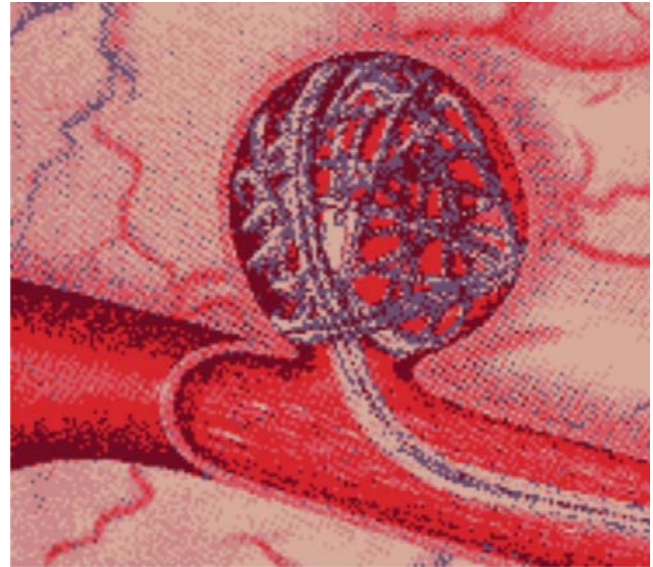
- Abdominal space decreased by vertebral fractures
- Opioid use causes constipation and decreases nutrient absorption
- Insomnia and depressive effects of pain



All Cured!



Intracranial aneurysm



Coil in place

ISAT

- Prospective randomized clinical trial
- > 2,000 patients
- At 1 year, 31% surgical patients dead or dependent: 23.5% coiled patients
- Absolute reduction risk 6.9%
- Advantage evident at 7 years (Lancet. 2002; 360: 1267-74)

Coiling

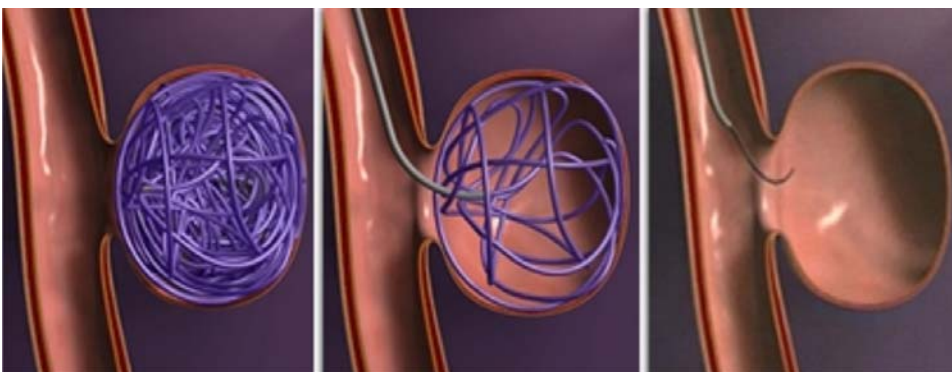
- Pass catheter through femoral artery, up aorta to brain
- Platinum coils pushed into aneurysm and released (may also use cyanoacrylates, onyx embolic material, polyvinyl alcohol)
- Coils cause thrombosis and eliminate aneurysm

Preanesthetic assessment

- Neurologic status (?ICP control)
- Cardiovascular control
- Renal function (contrast material used)
- Allergies (especially dyes)
- Coagulation status (anticoagulation may be indicated)

Intraoperative management

- Usually general anesthesia
- About 2 hours
- Standard monitors, arterial line, BIS®(?)
- Hemodynamic stability
- Normothermia
- Long tubing
- ACT 2-3X baseline
- Smooth emergence with extubation



Placing the Coil

Complications

- Rare
- May be sudden
- Requires effective cooperation with radiologist, anesthesiologist, core coordinator
- Usually hemorrhagic (see on imaging) or occlusive (vasospasm; treat with angioplasty or intraarterial papaverine)

Arteriovenous malformations

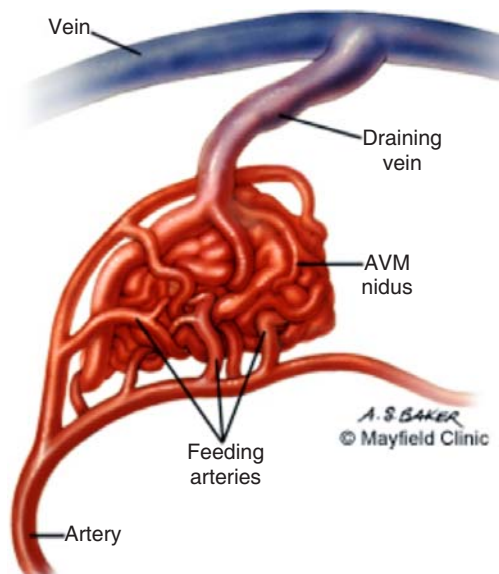
- Vascular convolute with nidus
- Capillary vessels missing and direct arterial venous shunts
- Obliteration of large feeders preoperatively, palliative or curative
- All ages suitable candidates for endovascular embolization

Occlusive agents

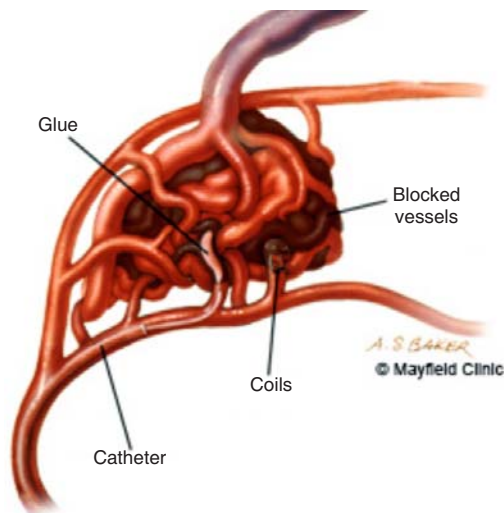
- Detachable thrombosing coils
- Permanent balloons
- Sclerosing agents
- Quick acting glues (liquid polymerizing agents)
- Particulate materials

Anesthetic management

- General anesthesia
- Procedures usually elective



AV malformation



- Ability to provide hemodynamic stability
- Smooth emergence (consider substituting endotracheal tube for supraglottic airway at end)

Complications

- Passage of particulate matter to the systemic circulation
- Inadvertent embolization of a feeder to normal brain
- Pulmonary embolization (especially if vein of Galen involved)
- Angionecrosis, especially with onyx (causes complete obliteration after injection)
- Hemorrhage

Carotid artery stenting

- On going trials
- Use of embolic protection devices (EPD)
- Indicated in higher risk patients
- SAPPHERE (Stenting and angioplasty with protection in patients at high risk for endarterectomy)

Thanks!

