



Vikas K. Parmar and Daniel K. Resnick

Introduction

Vertebral body compression fractures affect more than 750,000 American patients every year. They are painful and often debilitating. Conservative treatment including bracing and physical therapy is effective for most patients. Vertebroplasty and kyphoplasty can be used to treat patients who fail conservative treatment and continue to have severe pain. Vertebroplasty, a procedure which involves injecting cement or PMMA into the vertebral body, dates back to 1987 when Galibert and Deramond first pioneered the approach for a painful C2 vertebral hemangioma. Since then vertebroplasty has been widely employed for selected patients with pain due to vertebral body compression fracture. Kyphoplasty, which is similar to vertebroplasty but uses an inflatable tamp to restore vertebral height prior to cement injection, became popularized in 1998.

Patient Selection

Patients with osteoporotic vertebral bone fracture with associated pain. Some inclusion criteria for osteoporotic vertebral bone fractures include:

- A non-healing vertebral body fracture.
- Pain >6 weeks but <1 year.
- Back pain for greater than 5/10.
- Point tenderness to corresponding location of vertebral body fracture.

Patients with metastatic spinal lesions or primary spinal lesions are often disabled by pain and typically not candidates for open surgery. However, palliative treatment of the pathologic fracture with vertebroplasty is a reasonable way to address the pain.

Vertebroplasty has also been described for patients with Multiple Myeloma. The physiology and pathology of multiple myeloma is different from other tumors as the primary cell source is plasma cells, which invade the bone.

Absolute Contraindications

- Asymptomatic Vertebral body fracture.
- Allergy to PMMA.
- Coagulopathy.
- Unfavorable anatomy.

V. K. Parmar · D. K. Resnick (✉)
Department of Neurosurgery, University of Wisconsin
School of Medicine and Public Health,
Madison, WI, USA
e-mail: resnick@neurosurgery.wisc.edu

Relative contraindications include disorders that interfere with assessment of pain (dementia) and systemic infection.

Vertebroplasty

Vertebroplasty procedures have traditionally been done with fluoroscopy. However, can also be performed using computed tomography (CT) guidance [1]. CT guidance may be most useful for upper thoracic lesions as the shoulder can obscure fluoroscopic views. The patient is positioned prone. Local anesthetic with some mild sedation is often used. General anesthesia is reserved for patients whom cannot tolerate prone position. The entry point for skin incision is marked approximately 1 cm lateral and 0.5 cm rostral to the superior lateral aspect of the pedicle. Local anesthetic is infiltrated in the skin and down to the periosteum. An 11-gauge Jamshidin needle is used to reach the superior lateral aspect of the pedicle. The needle is advanced through the pedicle and the vertebral body is entered. The needle should be advanced to an area slightly anterior to the middle of the vertebral body. In the past, venograms have been used prior to cement injection to identify venous infiltration. However, with the advent of better injectable cements venograms are now less commonly used. Cement (PMMA or other) is injected under fluoroscopic guidance. The stylet is left in place for at least 1.5 min while the cement hardens. The needle is rotated and removed with the stylet (Fig. 191.1).

Balloon Kyphoplasty

Procedure is similar to vertebroplasty but in addition; an inflatable tool is passed through the trocar and inflated under fluoroscopic guidance. Then balloon is removed, cement is mixed and the cement-filled cannula is placed appropriately into the anterior vertebral body. Injecting cement again ends when the cement reaches back about 2/3rds to the posterior cortex of the vertebral body.

Complications

The most frequently reported complication is cement extravasation outside of the treatment area; the rate of extravasation was found to be about 9% [2]. Only 0.001% of these cement leakage patients were found to be symptomatic. Ways to mitigate this complication include single vertebral needle path that avoids the posterior cortex of the vertebral body and cement with a toothpaste consistency. The cement itself can also cause cardiac or pulmonary issues. Fractures are also potential complications. Both rib and pedicle fractures have been reported. Rib fractures were likely due to the patient being in the prone position for an extended period of time.

Outcomes

Osteoporotic/Non-healing Fractures

In the osteoporotic vertebral compression fractures (Vertos II) trial, Klazen et al. had 431

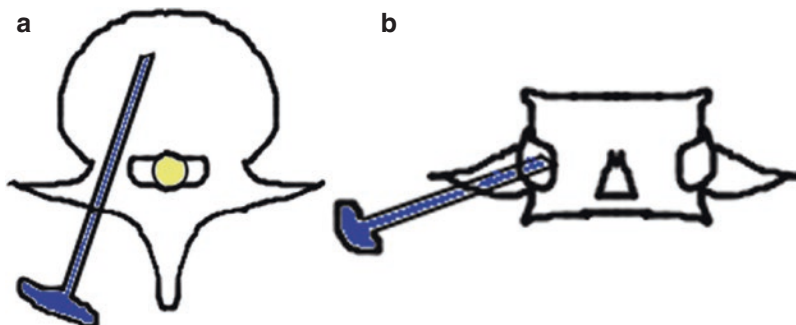


Fig. 191.1 Kyphoplasty/Vertebroplasty cannula placement

patients and stated that the mean pain score in the vertebroplasty arm decreased by 5.7 point while the pain score in the medical management arm decreased by 3.7 points in 1 year [2]. At 1 month, the vertebroplasty group had a decrease of 5.2 points compared to the 2.7 decrease in the conservative group. This was statistically significant. Other studies have demonstrated decreased pain at 1 week in the vertebroplasty group by 5.1. This difference in pain reduction between the two groups was significant at 2 and 6 months. However, after 1 year, the difference between the two groups was no longer statistically significant.

Vertebroplasty has been compared to sham surgery in randomized control trial fashion. The Investigational Vertebroplasty Safety and Efficacy Trial (INVEST) randomized 68 patients to vertebroplasty and 63 patients to sham surgery [3]. For the sham surgery group, vertebroplasty was simulated in all areas except actually needle insertion into the compression fracture site. At 1 year there was no significant difference in pain or pain-related disability. Another study by Buchbinder et al. compared 38 patients randomized to vertebroplasty and 40 patients randomized to sham surgery [4]. Assessment at 3 months demonstrated a drop by 2.6 in the vertebroplasty group compared to 1.9 in the sham-surgery group, which was statistically significant. However, at 2 years demonstrated no significant difference between the two groups.

For kyphoplasty, studies are very similar to that of vertebroplasty with improvement of mean SF-36 score by 7.2 points when compared to the nonsurgical arm of which the SF-36 scores improved only slightly after 1 month.

Overall the data for vertebroplasty for osteoporotic and non-healing fractures is mixed. Some good randomized control trials (RCTs) demonstrate some statistically significant benefit while some other RCTs comparing it to sham surgery demonstrate no benefit. The authors believe that with carefully selected patients who have pain in the appropriate place for the appropriate amount of time and who have the appropriate imaging findings, vertebroplasty can provide significant pain relief.

Spinal Metastases

The first few studies regarding spinal metastases and the benefit of vertebroplasty/kyphoplasty reported statistically significant improvement in pain based at 1, 3, and 6 months. The Cancer patient fracture evaluation (CAFÉ) trial was a randomized multicenter trial that enrolled 134 patients with painful vertebral body fractures due to metastases into a kyphoplasty arm and a non-surgical arm [5]. There was statistically significant improvement of pain at 1 week and 1 month in the kyphoplasty arm when compared to the nonsurgical arm. Of note, there was also statistically significant improvement of Roland Morris disability questionnaire, Mean Karnofsky performance scores, and improvement in quality of life as measured in Short form Health Survey (SF-36) in the kyphoplasty group at 1 month.

Multiple Myeloma

Some groups reported improved in pain at 1 week, 1 month, 6 months, and 1 year for patients who underwent vertebroplasty.

High Yield Points

- Vertebroplasty/kyphoplasty are indicated for a non-healing vertebral body fracture in patients with significant pain lasting >6 weeks but <1 year and with point tenderness corresponding to the location of vertebral body fracture. The use of MRI to demonstrate failure to heal is also suggested.
- Contraindications include asymptomatic vertebral compression fracture, allergy to PMMA, coagulopathy, and a relative contraindication of not being able to tolerate prone position.
- Complications to be wary of include cement extravasation into spinal canal, cardiac/pulmonary issues from cement emboli, and pedicle/rib fractures.

- The outcomes for these procedures compared to sham injections of anesthetics are not clear.
- The procedure does demonstrate some benefit for spinal metastasis and multiple myeloma.

- C. Consider Vertebroplasty or Kyphoplasty
- D. Consider Decompression and fusion.

Answer: C

3. Kyphoplasty and vertebroplasty have a very low but potential risk of neural foraminal compression

- A. True
- B. False

Answer: A

Questions

1. A 75 year old female presents with a fall from standing. She has significant lower back pain but is neurologically intact. She has no significant past medical history. CT of the lumbar spine demonstrates a L1 compression fracture with 30% height loss but no spinal canal compromise. Initial treatment plan?

- A. Pain control alone with Tylenol and low dose opioids
- B. Thoracolumbar brace and pain control
- C. Vertebroplasty or kyphoplasty
- D. Decompression and fusion

Answer: B

2. If patient above still has significant point tenderness pain at the L1 level about 2 months later and now has height loss of about 50%. Any changes to treatment plan?

- A. No changes
- B. Now give patient a Thoracolumbar brace

References

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