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BACK PAIN

Percutaneous Vertebroplasty

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BACK PAIN

Percutaneous Vertebroplasty

by Huy M. Do, MD

Prevalence of Osteoporosis

Osteoporosis is responsible for more than 1.5 million fractures per year in the United States; approximately 700,000 of these are vertebral compression fractures.[1] Osteoporosis is a major public health threat for 44 million Americans, 80% of whom are women.[1] It is estimated that in the United States, 10 million individuals have the disease and 18 million have low bone mass, placing them at increased risk for osteoporosis and the fractures it causes.[1] One in two women age 50 or older can be expected to suffer an osteoporotic fracture in their remaining life.[1]

Vertebral Compression Fractures

A vertebral body is made up of cortical bone, like you are used to seeing on a skeletal model, and cancellous bone, which looks like a porous or spongy structure comprised of widely spaced lamellae and red and yellow marrow in the center of the bone. Vertebral compression fractures are the result of bone that has been weakened, most commonly by osteoporosis and in rare cases by cancers, benign tumors, or trauma. In some cases, the fracture heals with little treatment and the pain subsides. In others, the bone remains unstable, causing persistent pain. For many patients, this pain severely limits their activities and reduces their quality of life.

Current Treatments for Vertebral Compression Fractures

Percutaneous Vertebroplasty

Historically, patients with vertebral compression fractures were treated with strong pain medications, prolonged bed-rest, external bracing, or major spine surgery. Long recovery times and the ill effects on quality of life limit these treatments. Percutaneous vertebroplasty was introduced in the United States in 1993 by Jacques Dion, MD (Emory University) and Mary E. (Lee) Jensen, MD (University of Virginia) as an alternative option to failed conservative treatment for vertebral compression fractures.

Percutaneous vertebroplasty is typically an outpatient procedure, though in instances where additional complications are present, an overnight stay may be required. Physicians proficient in needle placement such as interventional radiologists, neuroradiologists, neurosurgeons, spine surgeons, and interventional pain management physicians perform this minimally invasive procedure.

Percutaneous vertebroplasty is performed using x-ray guidance to accurately place specially formulated acrylic bone cement into a partially compressed vertebral body, thereby strengthening the vertebra. The vertebral body is typically accessed through a percutaneous, posterior, transpediculate approach—a needle is used to go through the skin and into one or both pedicles of the vertebral body. The bone cement is then injected in fluid form through the needles into the vertebral body. The cement interdigitates (interweaves) throughout the cancellous bone that makes up the center of the vertebral body before it hardens into solid form, stabilizing the spinal fracture. Multiple vertebrae may be treated in a procedure.

Kyphoplasty

Percutaneous vertebroplasty and kyphoplasty are both minimally invasive procedures for treating vertebral compression fractures, but unlike vertebroplasty that uses patient positioning to gain height restoration, kyphoplasty uses a balloon to gain height restoration. In a kyphoplasty procedure, the physician places a small incision in the back through which a needle is inserted to gain access to the vertebral body through the pedicle using live x-ray guidance. Once the vertebral body is accessed and placement is confirmed, the physician places a small balloon into the vertebral body through the needle. The balloon is then slowly expanded, compacting the bone and possibly restoring vertebral body height. The balloon is then deflated and

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removed from the vertebral body. Cement is then injected into the vertebral body through the needle to fill the void left by the balloon and stabilize the fracture. Kyphoplasty is significantly more expensive than vertebroplasty due to the addition of the balloon. Kyphoplasty procedures take longer to perform than vertebroplasty procedures. Kyphoplasty procedures are also generally done with the patient intubated under general anesthesia whereas vertebroplasty procedures are done with the patient only needing mild conscious sedation and local anesthesia.

Clinical Data on Percutaneous Vertebroplasty

The most recent studies on percutaneous vertebroplasty indicate success rates of 90% and greater for significantly relieving pain in patients with vertebral compression fractures.[2,3] Treatment of vertebral compression fractures with percutaneous vertebroplasty results in substantial, immediate pain reduction, and an increased ability to perform activities of daily living (ADL).[4] The vast majority of patients show significant pain relief as quickly as 24 hours following a percutaneous vertebroplasty procedure,[3] allowing patients to regain their quality of life quickly. Long-term follow-up data on percutaneous vertebroplasty (6–44 months) shows durable pain relief and high patient satisfaction in patients treated,[2,3] establishing percutaneous vertebroplasty as a key component to the treatment algorithm of vertebral compression fractures. Complications from the procedure are rare, affecting only about 1-3% of patients with osteoporotic compression fractures.[2] Potential complications include infection, bleeding, increased back pain, numbness, tingling, another fracture in the spine or ribs, cement leakage, or paralysis.

Patient Selection for Percutaneous Vertebroplasty

Patient selection is increasingly discussed as a critical element in the high success and low complication rates for percutaneous vertebroplasty. A study conducted by Teng et al, patient selection criteria they used for percutaneous verebroplasty in their study.[3] Patients were included if they had the following: "a painful vertebral compression fracture refractory to medical therapy, depiction of the fracture on plain radiographs, and tenderness elicited at the spinous process corresponding to the fractured segment." Patients were excluded from treatment for:

- Compromise of the spinal canal by more that 20%, as a result of retropulsed fragments
- Collapse of the vertebral body with a height loss of more than 90%, so that there was no place for a needle to enter the vertebral body between the endplates
- An old fracture with long-standing back pain of longer than 1 year (with the exception of vertebral bodies containing gas or movement at the fractured vertebral body on flexion and extension lateral views)

Levels for treatment were identified by X-ray, and confirmed by bone scan and MRI.

Technique Considerations for Percutaneous Vertebroplasty

Teng et al wanted to look at percutaneous vertebroplasty's effect, not only as a pain-relieving procedure, but also the kyphosis angle, wedge angle, and height of the fractured vertebral body. This is important, as height restoration may be not only a cosmetic consideration for patients (some lose height or have a "hump"), but also a functional consideration due to complications with kyphosis of the spine.

A key aspect to the study was the patient positioning they used during the procedure to gain height restoration. The physicians did this by propping the patient (using pillows under the upper chest and lower abdomen) to reposition the vertebral body as close as possible to a healthy formation (reducing wedge and kyphosis). Seventy-three osteoporotic vertebral compression fractures were treated in 53 patients, which showed reduction in the kyphosis angle and in the wedge angle and gain in height of the vertebral body, results similar to those found in kyphoplasty.

Reduction of the wedge angle is partially attributed to positioning of the patient. The authors also attribute it to deposition of cement primarily in the anterior four-fifths of the collapsed vertebral body. Anterior placement of cement, along with significantly increased anterior vertebral body height (16.7% average) resulted in reduced wedge deformity, which is highly desirable. Patients were kept in the prone position 30 minutes post-procedure, then turned supine and kept still another 30 minutes. It is possible that the initial 30 minutes prone, still propped by pillows, helped the overall benefits. Without a control group to examine, we can only speculate on this.

Conclusion

Percutaneous vertebroplasty is a well-established treatment for vertebral compression fractures that relieves pain in the majority of patients almost immediately. This outpatient procedure allows patients to return home the same day with significant reduction in pain and a better ability to perform daily tasks. This economic treatment for vertebral compression fractures will be very beneficial for the aging population in the United States suffering from osteoporosis. DMD

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continued on page 4

Percutaneous Vertebroplasty

continued from page 3

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