Case 7

Vertebral Refracture After Percutaneous Vertebroplasty

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Clinical Presentation

The patient is an 81-year-old male who experienced good pain relief with percutaneous vertebroplasty (PV) of two lumbar vertebrae (L1–L2). Two weeks following the procedure, the patient experienced recurrence of pain after a mild traumatic event. He described severe pain in the upper lumbar region that worsened on standing and ambulation.

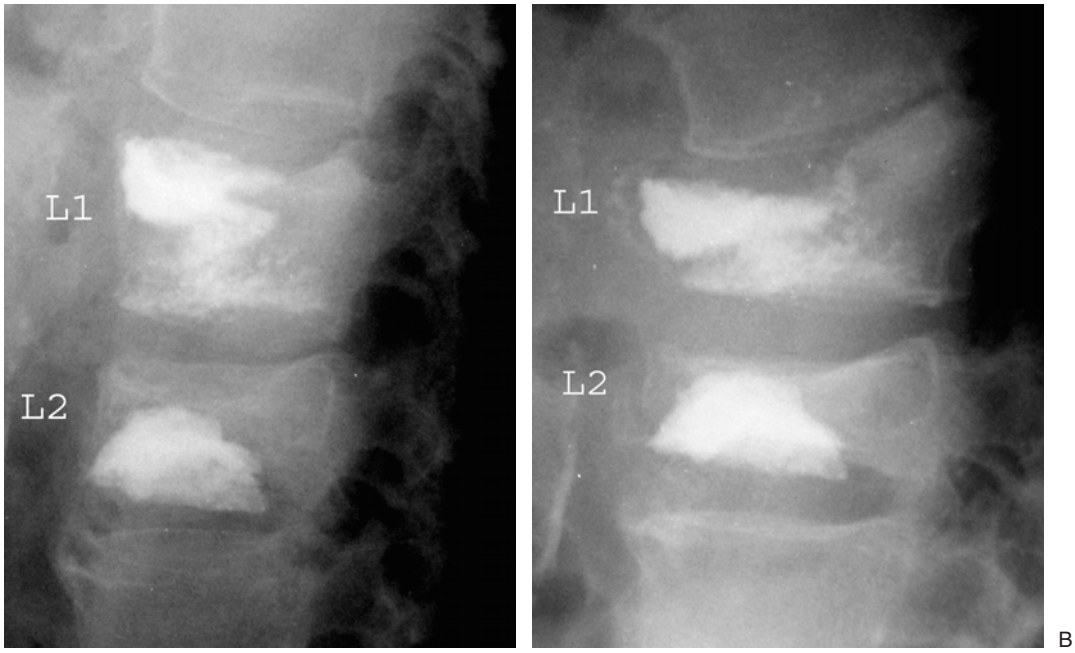
Imaging Findings

Initial post-PV radiographs demonstrated typical PV filling of L1 and L2 with no cement leak or apparent complication (Case Figure 7.1A). A repeat set of radiographs was obtained after the onset of new pain. Both vertebrae had lost additional height since the PV, with a fracture line extending through the superior-anterior aspect of L1 suggesting there may be a bone fragment (Case Figure 7.1B). Magnetic resonance images (MRI) were obtained to look for additional sites of injury not apparent on the radiographs. No other abnormalities were found, and the presumption was that the patient had refractured L1 and L2 and that this was the source of his recurrent pain.

Procedure

Prior to the procedure, 1 gram of cefazolin was administered intravenously to the patient for antibiotic prophylaxis. The patient was given intravenous procedural sedation with fentanyl and Versed, titrated for comfort.

Following sterile preparation and local anesthesia, 13-gauge needles were introduced into the vertebral bodies using a transpedicular route under fluoroscopic guidance (Case Figure 7.2B). Once the needles were in place, bone cement (polymethylmethacrylate with 30% barium



A B

Case Figure 7.1. (A) Lateral radiograph post-PV at L1 and L2. **(B)** Lateral radiograph obtained following the onset of new pain. This examination shows loss of height of both L1 and L2 since PV was performed, consistent with the diagnosis of refracture of both of these vertebral levels. (From Mathis [1], with permission.)

sulfate) was prepared and injected into L1 and L2, again with fluoroscopic guidance. The previously nonfilled portions of the vertebrae were filled (Case Figure 7.2C). There were no leaks of cement, and the patient tolerated the procedure well.

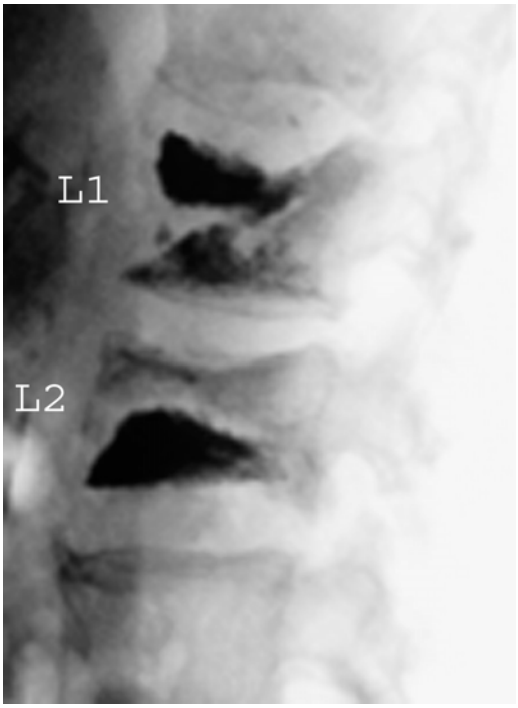
Results

When the patient was placed prone on the operative table, sufficient pull on the spine was created to open up the previously recompressed vertebra (Case Figure 7.2A). The original post-treatment height of both vertebrae was recovered and maintained with retreatment (Case Figure 7.2B,C).

After a 2-hour observation period, the patient was released home with essentially total pain relief. The patient has been monitored for over 2 years postprocedure with no recurrence or additional fracture.

Discussion

The literature contains little discussion of vertebral refracture following PV (1). Fracture of other vertebrae after PV can occur and is the most common cause of recurrent fracture-related pain after PV.



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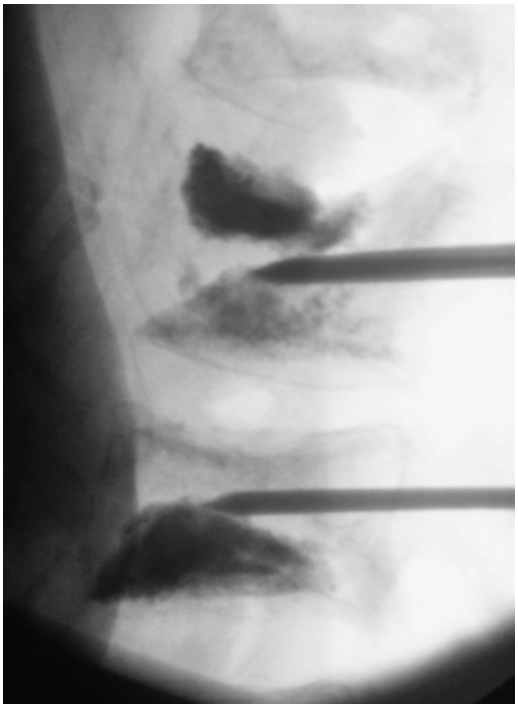

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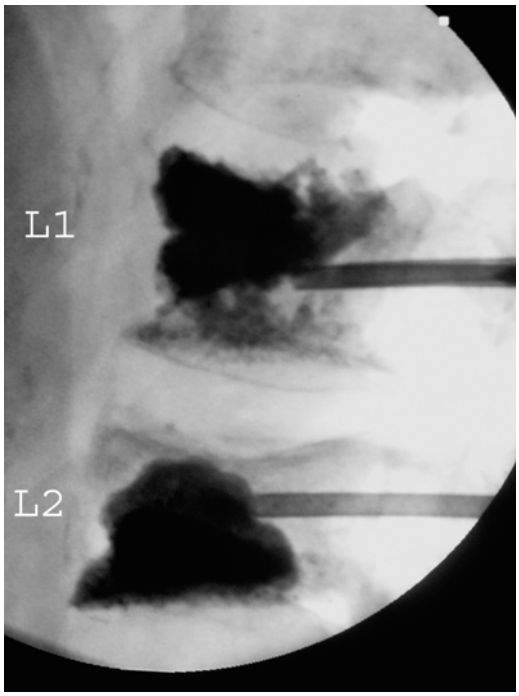

C

Case Figure 7.2. (A) With the patient prone on the operative table, there is natural distraction on the vertebral elements that has produced height restoration in both L1 and L2. This lateral radiograph shows vertebra height and configuration similar to that shown in Case Figure 7.1A (after the initial PV but before refracture). **(B)** Lateral image with needles in place prior to cement injection. **(C)** After cement injection in L1 and L2. Height gain is permanently recaptured. There is no cement leak or other complication. (From Mathis [1], with permission.)

However, as our treatment numbers have increased, we have seen an occasional refracture after treatment with PV. In our first 1,000 patients who underwent PV, we found 3 who experienced refracture in the treated vertebra (incidence of 0.3%). All were successfully retreated with PV with good secondary pain relief.

The cause of refracture is not known. Refracture may occur when insufficient amounts of cement are injected, resulting in suboptimal biomechanical reinforcement of the vertebra. Belkoff et al. (2) performed an ex vivo study on osteoporotic cadaver vertebrae, randomized to various injection volumes, to determine the quantity of cement needed to restore the original vertebral strength after fracture. These amounts were 2.3–3.0 mL in the upper thoracic spine, 3.0–4.0 mL at the thoracolumbar junction, and 6.0–8.0 mL in the lower lumbar spine. We know that pain relief has been poorly correlated (if at all) with the quantity of cement injected. This is not the case with biomechanical reinforcement. Additionally, some vertebrae prove to be so fragile that, even with reasonable amounts of cement injected to produce pain relief, there is still a risk of refracture. Repeat imaging and physical examination are required to exclude a new fracture that would better explain the patient's recurrence of symptoms. When a recurrent fracture is diagnosed, it should be retreated with PV. This can be challenging, because the initial cement can pose a substantial problem for needle placement and injection; however, these vertebrae can be successfully retreated with good pain relief.

The greatest difficulty associated with treatment of refracture is loss of visualization of the anatomic landmarks and the extremely hard cement that is now in place. The first problem can be overcome by needle introduction through the original needle tract, a remnant of the initial PV treatment. The needle tract can usually be seen as a circular defect in the cement in anteroposterior or anteroposterior oblique projection, effectively "looking down the original needle tract." By using the initial tract for needle placement, the operator is not dependent on anatomic landmarks.

Another method to overcome the lack of landmark visualization is to use the interpedicular line. We can approximate the pedicle location of the treated vertebra as it lies on a line between the pedicle of the vertebra above and below. After assessing pedicle location we can then take a parapedicular or transpedicular approach to enter the refractured vertebra. The second method for needle placement is less acceptable, as it will usually place the needle outside the original needle tract. This may result in the needle encountering bone cement, which is very hard and difficult to penetrate.

References

1. Mathis JM. Percutaneous vertebroplasty: complication avoidance and technique optimization. Am J Neuroradiol 2004; 24:1697–1706.
2. Belkoff SM, Mathis JM, Jasper LE, et al. The biomechanics of vertebroplasty: the effect of cement volume on mechanical behavior. Spine 2001; 26: 1537–1541.