Case Report

Vertebroplasty for the Compression of the Dorsal Root Ganglion Due to Spinal Metastasis

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Background: Radicular pain has been considered to be a relative contraindication to vertebroplasty. It was reported by some authors in the literature that percutaneous vertebroplasty (PV) in these conditions were performed without complications.

Objective: We describe a patient with radicular pain related to compression of the dorsal root ganglion by malignant tumor which was relieved after PV.

Study Design: Case report.

Setting: Pain management clinic.

Case Report: A 52-year-old man with spine metastasis involving the dorsal root ganglion of the left L4 nerve was admitted to the pain clinic with a tingling sensation and pain in both legs for 6 months. He was not able to lie on his back with his left leg extended or stand without weakness. The transforaminal epidural block had only a transient effect. The patient planned to undergo PV. He complained of severe radicular pain in his left leg approximately 5 minutes after the vertebroplasty. A left L4/5 transforaminal epidural block was performed. The next day, the patient's pain was relieved without any complications. He underwent palliative radiation therapy for multiple metastases of the thoracolumbar spine. At 5 months follow-up, he could lie on his back without recurrence of radicular pain.

Limitations: This report describes a single case report.

Conclusion: We suggest that carefully performed PV is an option for terminally ill patients with epidural and dorsal root ganglion involvement who do not respond to conservative treatment or cannot undergo radiation therapy and surgery. PV is minimally invasive compared to open surgery and may merit serious consideration in patients with limited physiologic reserves.

Key words: Vertebroplasty, radiculopathy, dorsal root ganglion, spinal metastasis

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Percutaneous vertebroplasty (PV) was first reported in patients with vertebral hemangioma (1). Use of the procedure was extended to multiple myeloma, malignant tumors, and eventually osteoporotic vertebral compression fracture (1,2). Radicular pain that is more severe than the axial pain is considered a relative contraindication to PV (3-6) and may be better treated by surgery, radiation therapy, or both (7). To our knowledge, there have been no reports of PV performed in the presence of symptomatic compression of the dorsal root ganglion. We describe a case of successful PV to relieve severe radicular pain related to the compression of the dorsal root ganglion due to malignant tumors.

Case Report

A 52-year-old man with hepatitis C was admitted to the hospital with a chief complaint of a 3-month history of lower-back pain and tingling sensation and pain in both legs, but especially the left. Magnetic resonance imaging (MRI) and computed tomography (CT) showed 2 masses that extended to the posteroinferior portion of the L4 vertebral body and the lowest level of left pedicle, with compression of the left L4 nerve root in the left foraminal region, which suggested a plasmocytoma or metastatic mass (Fig. 1). Results of serum/urine protein electrophoresis were normal. Abdominal CT imaging revealed liver cirrhosis and hepatocellular carcinoma or cholangiocarci-

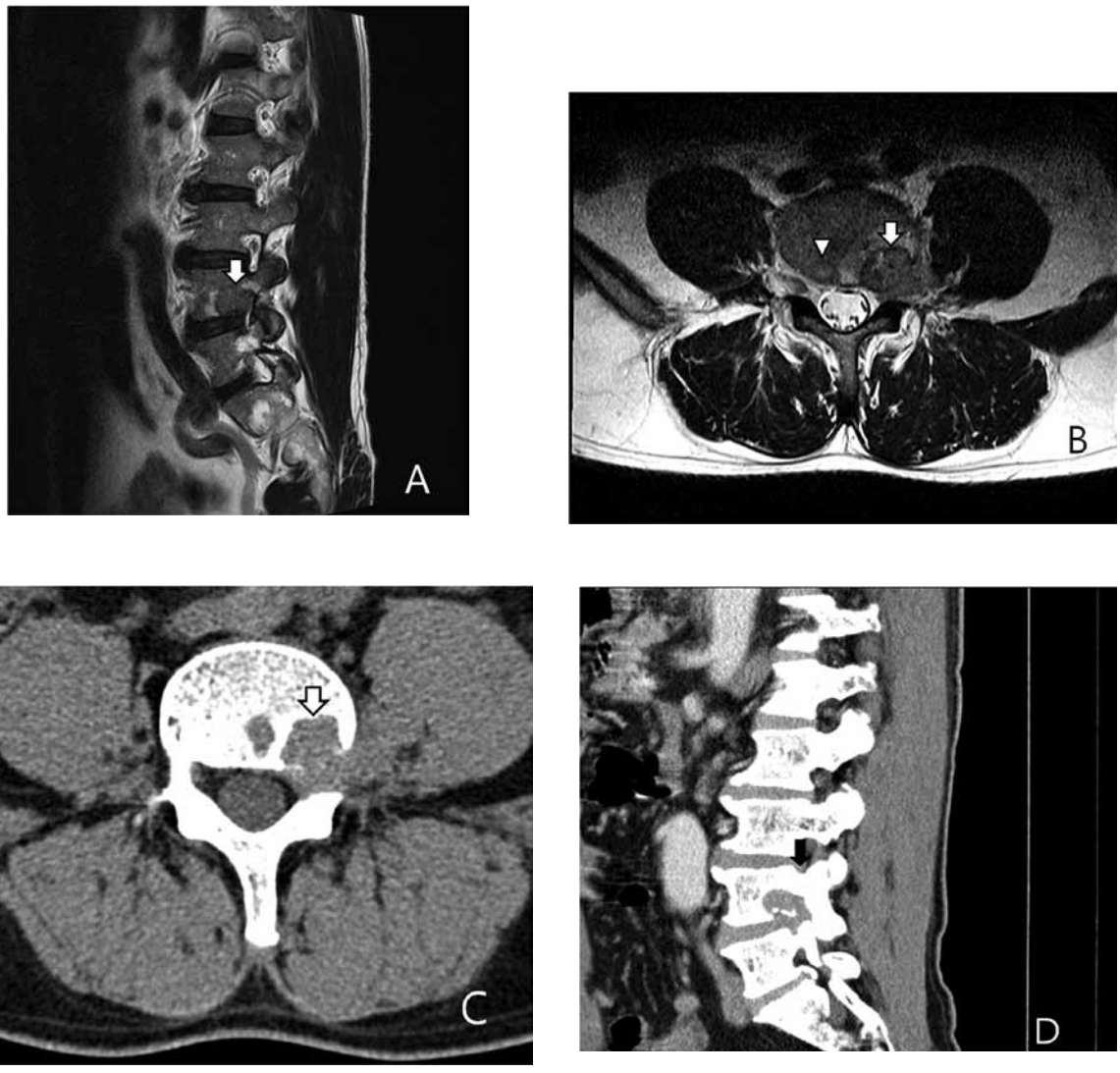

Fig. 1. *Lumbar MRI and CT.*
T2-weighted sagittal MRI (A) showed a well-defined mass (white arrow) at the left posteroinferior portion of the L4 vertebral body. It occupies more than half of the vertebral height, extending posteriorly into the neural foramen and compressing the left L4 nerve root. The outline can be seen between the mass and the nerve root in axial MRI (B). There is an additional mass (triangle) at the central, right posterior wall of L4 vertebral body. Axial CT (C) showed the left mass (white arrow) involving the lowest part of the left pedicle. Most of the left pedicle is intact (black arrow) as shown in sagittal CT (D).

noma. Liver needle biopsy and torso positron emission tomography-computerized tomography (PET-CT) revealed cholangiocarcinoma with metastasis to T6, T12, L3, L4, L5, the left ilium, the para-aortic area of the mediastinum, and the left 6th rib. The patient had no motor deficit of either leg and underwent a bilateral L4/5 transforaminal epidural block. Significant pain relief in both legs was achieved, but radiating pain in the left leg occurred again a few hours following the procedure. He underwent a left L4/5 transforaminal epidural block (Fig. 2) again, but the result was the same. He had radiating pain in the left L4 dermatome at the level of 8/10, by visual analog scale (VAS). He was not able to lie supine with his left leg extended because of radiating pain. He remained seated with his left leg flexed, leaning forward, and he was not able to stand despite a lack of weakness. Because the pain subsided after the transforaminal epidural block, the cause of the pain was believed to be due to the soft, metastatic mass compressing and irritating the dorsal root ganglion according to the patient posture. The patient, who had a short life expectancy, was regarded as inoperable by both his neurosurgeon and oncologist. Radiation therapy was also not feasible due to his inability to remain supine. Therefore, the patient was scheduled to undergo PV. The needle was passed along the upper half and lateral border of the left pedicle with extreme caution so as not to violate the disrupted lower cortex of the pedicle. A total of 4 cubic centimeters of a mixture of sterile polymethyl methacrylate (PMMA) powder (Exolent Spine, Elmdown, Ltd, London, England) and the liquid component was injected. A small incremental dose was injected from the anterior third of L4 vertebral body, checking for posterior spreading of the cement without further spread to the disrupted posterior wall, without incident under fluoroscopy (Fig. 3). After the delivery system was removed, pressure was maintained on the incision sites until the cement became firm at room temperature. He complained of severe radicular pain in his left leg approximately 5 minutes after the procedure. No cement leakage was seen on radiograph and he had normal motor control of both legs. A left L4/5 transforaminal epidural block was performed.

The day after the procedure, the patient's pain was relieved at the level of 1/10, by VAS, without any complications, and he was able to walk without radic-

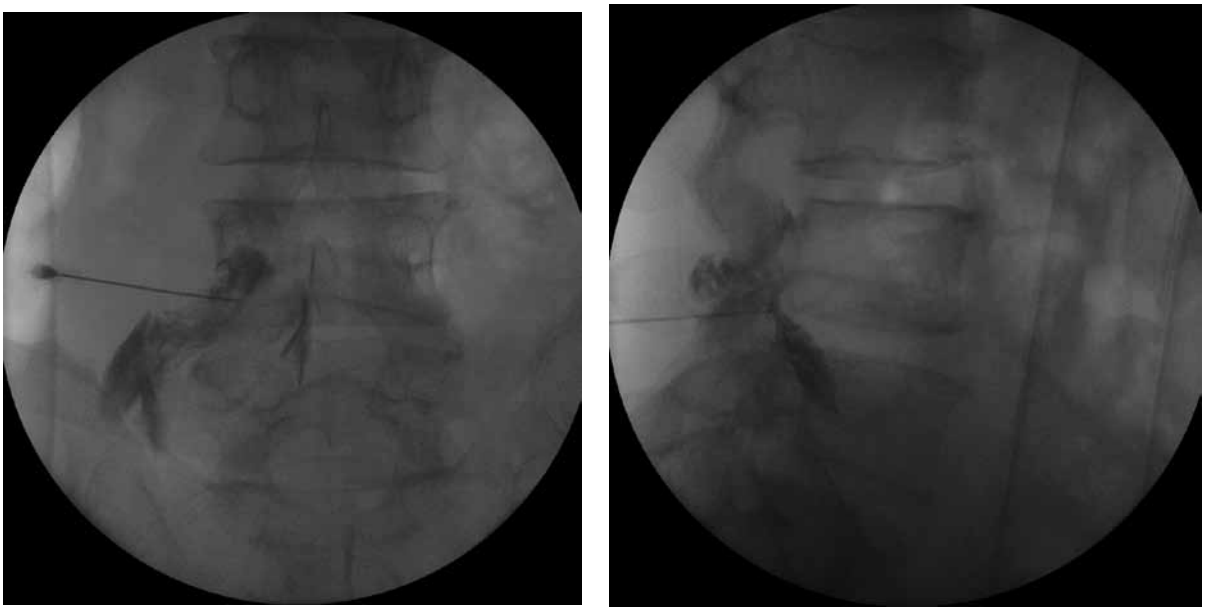

Fig. 2. *Fluoroscopic images of left L4/5 transforaminal epidural block.*
The needle tip is located below the left pedicle of the L4. The post-contrast images show successful spread along the epidural space and the left L4 nerve root. The patient's radiating pain was relieved dramatically after the block.

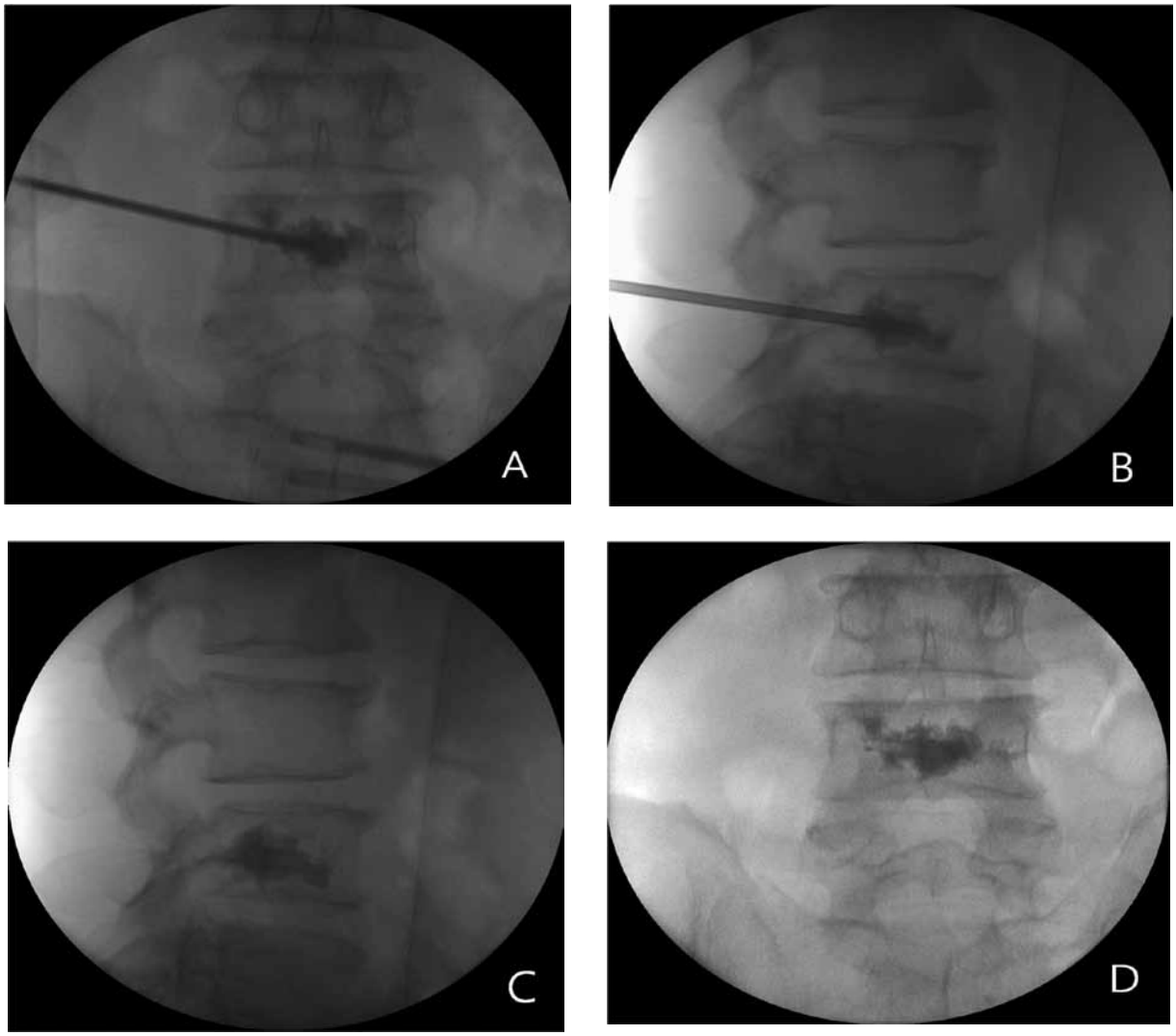

Fig. 3. *Fluoroscopic images during vertebroplasty of the L4 vertebra.*
Fluoroscopic image shows left unipedicular needle cannula (A) within the central to anterior aspect of the L4 vertebral body (B). Under fluoroscopy, we injected a small increment of PMMA with a thick consistency that spread from the anterior third to the posterior part of the vertebral body without any further spread into the posterior wall. There is a loss of the posteroinferior cortical margin on the lateral view; however, there was no cement leakage via the cortical disruption of posteroinferior wall and pedicle (C, D).

ular pain. He underwent palliative radiation therapy for multiple metastases of the thoracolumbar spine. At a 5-month follow-up, he was able to walk and lie on his back without recurrence of radicular pain.

Discussion

This report supports the use of PV for palliative treatment of spine metastasis, even if accompanied by compression of the dorsal root ganglion. Supine MRI and CT imaging of our patient showed a mass in the posteroinferior portion of L4 vertebral body, with the compression of the dorsal root ganglion of the left L4 nerve. A left transforaminal epidural block had only a transient effect, and the pain was related to posture. The metastatic region of the vertebra had decreased stiffness and was softer than normal bone tissue. The

posteroinferior wall, which comprises a large proportion of the intervertebral foramen, was affected. We hypothesized that the mass extended to the foraminal region would make the patient more susceptible to the postural change because its stiffness is lower than the normal bone. In addition, we believed the metastasis would progress, leading to vertebral collapse with spinal cord compression, further increasing lumbar instability. We believed that PV would relieve the existing pain, prevent further exacerbation of the pain, and allow the patient to lie supine for further radiation therapy by increasing the stiffness of the vertebra.

A case of successful PV in 2 patients suffering from radicular pain with vertebral metastasis has been reported in the literature (5). However, neither patient had nerve root compression imaged with supine MRI. They also had position-dependent, radiating pain in common. The author commented on the extensive bony metastasis and trabecular destruction, which made the affected vertebra more deformable, making the patients susceptible to positional changes in the spinal canal and foraminal geometry. Chung et al (8) reported 7 patients with osteoporotic compression fracture who had radicular pain rather than axial pain. Its character mimicked the pain usually seen in spinal stenosis or disc herniation. The radicular pain was aggravated with weight bearing as in our patient. The authors concluded that PV is beneficial when a compression fracture mainly involves the lower half of the vertebral body, the root compromised by the fractured vertebra is evident at the intervertebral foramen, and radicular distribution of pain is concordant with the impinged nerve root as seen in the MRI. They explained that successful PV might be due to the indirect decompression of the root by increasing the stiffness of the fractured vertebra. They added that compression fracture and impingement of the corresponding nerve root at the intervertebral foramen were evident on MRI, even though vertebral collapse was not definitively seen on plain lumbar radiographs.

PV is known to achieve an analgesic effect within 48 hours; radiation therapy takes 2 weeks to achieve an analgesic effect (9). The effect of PV is attributed to a strengthened vertebral body, which prevents micromovements and progression to vertebral collapse. PMMA destroys nerve endings by an exothermic reaction during polymerization and is also tumoricidal (10).

Major complications occur more frequently in the context of malignant indications, rather than osteoporosis; however, symptomatic complications such as cauda equina and radiculopathy are rare (6). Saliou et al (11) performed PV for 74 vertebrae in 51 patients with epidural involvement, with or without symptoms of the compression of the spinal cord or cauda equina. Cement leakage occurred in 45 of 74 vertebrae but there was only one symptomatic case. They reported a low rate of complications and satisfactory pain relief in 94% of patients and concluded that PV should be considered for patients with malignant fractures with epidural involvement. In their study, spinal canal leakage was more often associated with epidural involvement combined with osteolysis of the posterior wall of the vertebral body. In patients with epidural involvement, CT is preferred because it is superior to fluoroscopy for detecting cement leakages (12). At our institution, a CT-guided procedure was not feasible, so we performed the procedure with great care, as follows. We made the PMMA preparation thicker than usual and injected a small incremental amount with continuous fluoroscopy, then waited a few minutes to allow the cement to harden and prevent undesired spread to the spinal canal. We planned to stop the injection and try to administer it via the contralateral pedicle at the first sign of cement spreading to the disrupted posterior wall.

Our patient complained of unexpected severe left radicular pain approximately 5 minutes after the procedure. Because no cement leakage was observed on radiograph and the pain was relieved by a left L4/5 transforaminal epidural block, we concluded that, as the cement was injected and allowed to harden, inflammatory mediators secreted from the tumor cells in the vertebra were extruded and irritated the adjacent nerve root. PV with biopsy was originally scheduled, but the patient declined the latter for financial reasons. Biopsy or tumor removal via PV channel prior to PV may be able to attenuate the effect of the mass and create room for cement injection (5). It is thought that concurrent biopsy and tissue removal would have reduced procedure pain.

Recent studies (13-15) suggest that a combination of vertebral augmentation and radiation therapy provide long-term improvement in pain. Hirsch et al (9) reported that the timing of radiation treatment, either before or after PV, did not significantly affect pain improvement outcomes. The patient in this report could not receive radiation therapy because he could not lie supine. However, after successful PV he could undergo radiation therapy for the residual lesion and

prevention of disease progression. A multimodal approach including vertebral augmentation and radiation therapy is needed for terminally ill patients with spinal metastasis.

Conclusion

PV is minimally invasive compared to open surgery and may merit consideration in patients with limited physiologic reserves. We suggest that carefully performed PV is an option for terminally ill patients with epidural and dorsal root ganglion involvement who do not respond to conservative treatment or cannot undergo radiation therapy and surgery. Further study is warranted to establish the long-term analgesic effect and safety of PV in patients with radiculopathy due to the compression of the dorsal root ganglion.

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