

Case Report

Percutaneous kyphoplasty for the treatment of osteoporotic thoracolumbar fractures with neurological deficit: radicular pain can mimic disc herniation

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Abstract: Osteoporotic vertebral fractures (OVFs) are the common disease found in elderly population. Neurological deficit in OVF is rare despite the involved posterior cortex of the fractured vertebral body, severe kyphotic deformity, or the instability at the fracture site. OVF with resulting neurological deficit was considered as a contraindication for vertebral augmentation techniques. We reported a rare case of a 75-year-old woman with L1, L2 osteoporotic vertebral fractures and L5/S1 disc herniation who presented with back pain and radicular pain extending along the posterior aspect of the left leg. Physical examination showed slight weakness of her flexor hallucis longus and absence of ankle jerk on her left leg. The result of a straight leg-raising test was limited to an angle of 50 degrees. The radiographs showed that the nerve root was compressed by the retropulsed bone fragment of the L2 vertebral body and a herniated disc at the level of L5/S1 on the left side. After L1 and L2 kyphoplasty the radicular pain as well as the back pain was completely disappeared. At her two-year follow-up examination, the patient was completely symptom free and reported no radicular pain. This case suggested that minimally invasive techniques such as kyphoplasty or vertebroplasty are effective in certain OVF patients with neurological deficit. Radicular pain could be caused by osteoporotic fracture that involves the posterior cortex of the vertebral body. Understanding the anatomy of nerve roots and pathogenetic mechanism of radicular pain is particularly important for treatment option.

Keywords: Osteoporotic vertebral fractures, disc herniation, radicular pain, percutaneous kyphoplasty

Introduction

OVFs are a common presentation of senile osteoporosis. These fractures most commonly occur at the thoracolumbar junction. Though the incidence of vertebral fractures in the aging population is very high, resulting neurological deficits are extremely rare [1, 2]. These deficits may be as minor as localized nerve root damage or as severe as spinal cord injury. OVF with resulting neurological deficit was considered as a contraindication for vertebral augmentation techniques [3, 4]. We reported a rare case of L1 and L2 osteoporotic vertebral compression fractures causing S1 radiculopathy combined with L5/S1 disc herniation; the radicular pain as well as the back pain completely disappeared following L1 and L2 kyphoplasty.

Case report

The patient and their families were informed that data from the case would be submitted for

publication, and gave their consent. A 75-year-old woman presented with a one-month history of back pain before admission but without a history of trauma. Two weeks after the onset of back pain, she felt the radicular pain extending along the posterior aspect of the left leg when standing and walking, but reported no radicular pain while in supine position, and the leg pain seemed equal to the degree of the back pain. The visual analogue scale score was approximately 6 (where 0 represents no pain and 10 represents the worst pain). The bowel and bladder functions were normal. The patient had a history of hypertension and L5/S1 disc herniation which relieved completely after conservative treatment when she was about 40-year-old. Following the initial physical examination, pain was mainly localized to the thoracolumbar region, and the radicular pain along the left S1 dermatome was observed when percussing the lumbosacral region. She had slight weakness of her flexor hallucis longus and absence of ankle



Figure 1. Preoperative T2-weighted sagittal (A) and transverse (B) MRI images showing the herniated L5/S1 disc compressed the left S1 nerve root (white arrow). Preoperative transverse (C) and sagittally reconstructed (D) CT images showing the retropulsed bone fragment of L2 vertebral body compressed the spinal canal and the left nerve root (black arrow).

jerk on her left leg. The result of a straight leg-raising test was limited to an angle of 50 degrees.

Preoperative CT and MRI images showed L1, L2 vertebral fractures with retropulsed bone fragment of L2 vertebral body compromising the spinal canal and a herniated disc compressing the left S1 nerve root at the level of L5/S1 (**Figure 1**). The T-score of this patient was -3.2 as measured from the lumbar spine using dual energy X-ray absorptiometry. Before operation we considered that the radicular pain could be caused by L5/S1 herniated disc or the retropulsed bone fragment of the L2 vertebral body, either of which could compress or irritate the S1 nerve root. However, open surgery was not a possibility due to the old age and poor cardiac function, therefore L1 and L2 kyphoplasty was planned. If the radicular pain still existed following the procedure, a further oper-

ation would be considered for the herniated disc. This patient was positioned prone with the spine extended by chest and pelvic bolsters, kyphoplasty was performed under local anesthesia. The patient's back pain was relieved dramatically after the procedure. To our astonishment, the radicular pain also completely disappeared during walking and standing the next day. The postoperative X-ray images showed that the cement distributed well and there was no cement leakage (**Figure 2**). She was completely symptom free and reported no radicular pain during her two-year follow-up examination.

Discussion

Osteoporotic vertebral fractures are a common disease in the elderly population whereas neurological deficit is rare despite the involved posterior cortex of the fractured vertebral body, the



Figure 2. Preoperative (A) and postoperative (B) lateral X-ray images showing the cement within the fractured L1 and L2 vertebrae distributed well.

severe spinal deformity, or the instability at the fracture site [1, 2]. Traditional surgical treatment, including reduction and internal fixation using an open anterior or posterior approach, has been performed for vertebral fractures with neurological deficits. However, these techniques are not suitable for elderly patients with obvious osteoporosis because of severe surgical trauma and poor implant fixation [5]. As minimally invasive techniques have evolved, current interest in the treatment of OVFs is focusing on vertebroplasty and kyphoplasty [6, 7]. However, to patients with neurological deficits, these techniques are deemed contraindicated because the decompression of the spinal canal cannot be achieved and the surgery may aggravate the existing neurological deficits [3, 4].

The mechanism of symptom onset in this patient with radicular pain could be explained by the retropulsed bone fragment or the herniated disc. The spinal cord in adults normally ends between L1 and L2 vertebrae. The first sacral nerve root extends downward in the spinal canal from the spinal cord at the level of the

L1/L2 disc to the first sacral foramina. An anatomical study from Wall et al. on axial cross-sections of L1-L2 intervertebral level showed that the dorsal and ventral roots of the first sacral nerve root were slightly separated at this level and the S1 nerve roots encircled the other sacral roots and the terminal cord [8]. The roots of the first through the fifth lumbar nerves overlapped the terminal portion of the spinal cord beside the sacral roots in an organized pattern. This study explained the bone fragment at L1-L2 intervertebral level could compress the S1 root and lead to the radicular pain in the left leg. Radicular pain could be caused anywhere from the compression as the nerve root coursed diagonally downward to its exit.

Meanwhile, this patient had a L5/S1 disc herniation that compressed the left S1 nerve

root (**Figure 1**). Radiculopathy could be the result of mechanical compression or chemical irritation from the herniated disc [9]. A large number of chemical substances such as inflammatory factors and the nucleus pulposus itself have been suggested to play a role in radicular pain [10-12]. These substances could reduce the conduction velocity of the nerve roots, induce degeneration of nerve fibers, and make the compressed nerve root become sensitive to mechanical stimulation. Smyth et al. found that merely touching an inflamed spinal nerve root even with the weight of a suture during surgery for excision of herniated lumbar discs caused low back pain and referred pain into the hip and thigh [13]. Even with the slightest tension on an inflamed nerve could cause radicular pain.

According to this patient, we hypothesized that during standing and walking, the retropulsed bone fragment of L2 vertebral body moved backward and increased the pressure on the sensitive S1 nerve root which was also compressed by the L5/S1 herniated disc and caused radicular pain in the left leg. But when

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she was in the supine position, the intact posterior longitudinal ligament could reduce the retropulsed bone fragment from the spinal canal and achieved indirect reduction, we performed kyphoplasty to restore the vertebral height and stabilize the vertebral body in prone position, and this stabilization effect may stop the bone fragment from moving backward, decrease the pressure on S1 nerve root and relieve the radicular pain when she standing up.

Another interesting feature of this case is the patient's complaint of radicular pain. Radicular pain is not normally seen as a consequence of compression from thoracolumbar spine fractures; the common presenting symptoms are weakness and sensory loss. However, Heggeness et al. described nine patients with OVFs presented with universal complaint of radicular pain without a disc herniation [14]. A possible explanation for this radicular pain may be related to a local healing process within the spinal canal, or the other factors associated with a local vascular or inflammatory process.

This single case suggested that minimally invasive techniques such as kyphoplasty or vertebroplasty are effective in certain OVF patients with neurological deficit. Percutaneous kyphoplasty or vertebroplasty should not be regarded as an absolute contraindication for certain OVF patients with resulting neurological deficit. Radicular pain could be caused by osteoporotic fracture that involves the posterior cortex of the vertebral body. Great care should be taken in OVFs with spinal canal involvement combined with disc herniation. Understanding the anatomy of the nerve roots and pathogenetic mechanism of radicular pain is particularly important for treatment option in these cases.

Disclosure of conflict of interest

None.

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