Bilateral L5 Radiculopathy Due to Osteoporotic L1 Vertebral Fracture: A Case Report

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Abstract

Background: The true incidence of osteoporotic vertebral fractures is not well defined because many osteoporotic vertebral fractures are asymptomatic. Although the true incidence of neurological compromise as a result of osteoporotic vertebral fractures is not known, it is thought to be low. In this case report, we present a case of L1 osteoporotic vertebral fracture causing bilateral L5 nerve root compression and manifestation of bilateral foot-drop.

Methods: Pedicle screws were inserted in the vertebrae, 2 above and 2 below the L1 vertebra. A temporary rod was placed on the left. An L1 right hemilaminectomy via a posterior approach and a corpectomy were performed. The spinal cord was decompressed. Anterior fusion was carried out by placing titanium mesh cage into the vertebrectomy site as a strut graft via posterior approach, and posterolateral fusion with spongyous allografts were added to the procedure.

Results: Two years later the patient was completely symptom free and receiving medical treatment for osteoporosis, which was diagnosed as primary type.

Conclusion: If a fracture is detected on the posterior wall of the vertebral body in computerized tomography (CT) examination with plain radiographs, a magnetic resonance imaging (MRI) examination should be conducted in the presence of symptoms and physical findings suggestive of neurological compression. Follow-up neurological examinations should be carried out, and it should be kept in mind that most of the neurological symptoms may develop late and manifest as radiculopathy. The majority of the osteoporotic vertebral fractures can be managed conservatively with bed rest and orthosis, but cases with accompanying neurological deficit should be managed surgically using decompression and stabilization by fusion and instrumentation.

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Key Words: Osteoporosis; Osteoporotic vertebral fracture; Radiculopathy; Neurological deficit; Nerve root compression; Foot drop; Posterior decompression

INTRODUCTION

Osteoporotic vertebral fractures are frequent complications of osteoporosis. Osteoporotic vertebral compression fracture occurs most often in postmenopausal women age 60 years and older, either after minimal trauma or spontaneously (1). It usually causes acute symptoms associated with pain of variable intensity localized at the fracture site. These symptoms improve in 3 to 6 weeks, but severe back pain may persist for many weeks to months (2–4).

The true incidence of osteoporotic vertebral fractures is not well defined because many osteoporotic vertebral fractures are asymptomatic. Although the true incidence of neurological compromise as a result of osteoporotic vertebral fractures is not known, it is thought to be low (5). Glaser and Kaplan (6) believed that involvement of the spinal cord or cauda equina should suggest other conditions, including infection, metastatic or primary bone tumors, myeloma, Paget's disease, or lymphoma. Parfitt and Duncan (7) suggested the complete absence of risk of spinal cord involvement in cases of vertebral fracture secondary to osteoporosis. In contrast, Shikata et al (8) found that 12.1% of fractures required operative treatment because of neurological sequelae. Multiple case reports support the contention that insufficiency fractures of the spine can lead to collapse, kyphosis,

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retropulsion, and delayed onset of neurologic symptoms (9–13). Compressive failure of the middle vertebral column can lead to retropulsion of vertebral body fragments with significant canal compromise and neurological injury. We present a case of L1 osteoporotic vertebral fracture causing bilateral L5 nerve root compression and manifestation of bilateral foot-drop. To the best of our knowledge, isolated bilateral L5 root compression due to osteoporotic burst fracture of L1 vertebra and the associated bilateral foot-drop have not been reported in literature.

CASE REPORT

A 67-year-old woman presented with back pain and bilateral radicular leg pain as chief complaints after a simple fall at home 1 month ago with a diagnosis of L1 osteoporotic compression fracture. She was treated conservatively in another center, and after her symptoms worsened, she was admitted to our center. Although she had almost no pain while supine, when the patient stood up or walked, the radicular pain became severe, making it impossible for her to walk. The bilateral radicular pain appeared on the L5 dermatome. On physical examination, mild tenderness of the lower back, hypoesthesia along bilateral L5 dermatomes, and bilateral foot-drop were noticed.

Direct radiographs showed L1 osteoporotic compression fracture with reduction in local kyphosis angle (Figure 1). Three-dimensional CT showed the spinal canal compromise (Figure 2) and MRI revealed acute compression fractures in L1 with medullary compression (Figure 3). Electromyography showed severe bilateral L5 radiculopathy. Other neurological and systemic examinations did not reveal any significant characteristics. The T-score was -3.05 by lumbar bone densitometry.

Surgery was planned, and we decided to perform posterior surgery rather than thoracoabdominal access to minimize respiratory compromise because she was suffering from chronic obstructive lung disease. Pedicle screws were inserted in the vertebrae, 2 above and 2 below the L1 vertebra. A temporary rod was placed on the left. L1 right hemilaminectomy via posterior approach and corpectomy were performed. The spinal cord was decompressed. Anterior fusion was carried out by placing titanium mesh cage into the vertebrectomy site as a strut graft via posterior approach, and posterolateral fusion with spongyous allografts was added to the procedure (Figure 4). We performed biopsy intraoperatively to establish the diagnosis and rule out metastatic involvement. The biopsy result was consistent with a diagnosis of osteoporotic vertebral fracture.

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Figure 1. Direct lateral radiograph showed L1 osteoporotic compression fracture with reduction in local kyphosis angle.

On the first postoperative day, the patient was mobilized with the help of crutches and a pair of ankle-foot orthoses. She also used a thoracolumbosacral orthosis for external support. No postoperative complication developed in the early or late period. In the first postoperative month, the patient's right foot-drop showed full recovery. Dorsiflexion strength of the left foot improved to grade 5 at the 1-year follow-up examination. At the 2-year follow-up examination, she was completely symptom free and remains under medical treatment of osteoporosis, which was diagnosed as primary type.

DISCUSSION

Reduction of the bone mass due to osteoporosis also increases the risk of fracture. Osteoporotic vertebral fractures are often effectively treated by nonoperative means (14). Spinal cord compression resulting from insufficiency fractures of the spine is an uncommon complication that was once thought to be nonexistent (7). Several reports have since been published in the literature documenting the existence of this uncommon clinical entity (8,9,15,16).

Osteoporotic vertebral fractures usually present with simple compression fractures manifesting only pain. Because the middle column is intact in compression fractures, no compression occurs on the neurological tissue. However, in burst fractures, because the middle column is fractured, bone fragments may cause compression on neural structures posteriorly. Due to this angulation, intervertebral foramina constriction may occur, causing root compression on the associated segment. Compression of the cord is generally located at the upper or lower part of the vertebral body with angulation or kyphosis. Additional factors in compression, such as diskal herniation and a narrow spinal canal, have also been encountered. Ischemia of the neural elements due to the compression on the vascular structures may aggravate the condition (2).

The neurological condition may vary according to the level of lesion; it may manifest as paraplegia due to spinal cord compression, various sensory or motor deficits associated with cauda equina or root compression, and as rectal or urinary incontinence (15). Compression may develop on the roots according to the localization of the retropulsed fragment separated from the vertebral body, but bilateral root plegia is a rare pathological condition. In the differential diagnosis, other traumatic conditions,

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Figure 2. (A) An axial CT image through the vertebral body shows the retropulsed fragment. (B) A sagittally reformatted image shows the retropulsed fragment, the intravertebral air (which is Kummel's phenomenon), and the generalized increase density of the collapsed vertebral body (which is typical for an osteoporotic compression fracture).

Figure 3. T2-weighted sagittal (A) and axial (B) magnetic resonance imaging reveal acute compression fractures in L1 with medullary compression.

Figure 4. (A) and (B). Postoperative radiographs.

such as posttraumatic syringomyelia, should be considered.

Radiculopathy associated with isolated L5-root compression may occur as a result of L5-S1 diskal hernia, spinal stenosis or spondylolisthesis, and rare pathologic conditions causing compression on intervertebral foramina at the associated level. To the best of our knowledge, isolated bilateral L5 radiculopathy due to osteoporotic fracture of L1 vertebra has not been reported in the literature. The anatomic studies of Wall et al (17) on axial cross-sections of T12-L1 intervertebral level showed that the spinal cord begins to taper and is surrounded by the first to fifth lumbar nerve roots. Although the entire L1 nerve root is situated laterally, the remaining lumbar ventral and dorsal roots are separated and encircle the lower aspect of the spinal cord in an overlapping fashion (Figure 5). This anatomic study explains how the compression on the L1 level compresses both of the L5 roots and leads to bilateral foot-drop.

The majority of the osteoporotic vertebral fractures can be managed conservatively with bed rest and orthosis. However, cases with accompanying neurological

T₁₂-L₁

Figure 5. Axial cross-sections of T12-L1 intervertebral level show that the spinal cord begins to taper and is surrounded by the first to fifth lumbar nerve roots. Although the entire L1 nerve root is situated laterally, the remaining lumbar ventral and dorsal roots are separated and encircle the lower aspect of the spinal cord in an overlapping fashion. This explains how the compression on the L1 level compresses both of the L5 roots and leads to bilateral foot-drop.

deficit should be managed surgically using decompression and stabilization by fusion and instrumentation (2,15). Fixation of the osteoporotic spine is problematic. Pedicle screw fixation is less reliable in the osteoporotic vertebrae. Several biomechanical studies have indicated that decreased bone mineral density significantly decreases the axial pullout strength of pedicle screws (18–20). It was suggested that sublaminar hooks or wires may be preferable to screws in osteoporotic bone because trabecular bone is more affected by osteoporosis than is cortical bone (21). However, wires and hooks have no purchase in the anterior or middle columns (22) and have a limited ability to control the spine in 3 dimensions. One alternative is to supplement pedicle screw fixation with methylmethacrylate cement, which enhances the pullout strength in osteoporotic bone (23). This technique, however, can lead to extravasations of cement and potential mechanical or thermal injury to the neural elements. Another potential technique is to extend the length of the construct over additional segments to “load share” the force over multiple points of fixation. Additional fixation may be obtained by combining pedicle screws and sublaminar hooks at the same level (19). It was recommended that the caudal end of posterior instrumentation constructs for osteoporotic spine fractures end with multiple screw constructs to help offset the cantilever bending forces acting on the instrumentation (15). Postoperative bracing may also

serve to protect the instrumentation and correction of the deformity while the arthrodesis is healing.

Osteoporotic vertebral fractures are not always benign lesions. If a fracture is detected on the posterior wall of the vertebral body in CT examination with plain radiographs, an MRI examination should be conducted for neurological compression in the presence of symptoms and physical findings suggestive of neurological compression. Follow-up neurological examinations should be carried out, and it should be kept in mind that most of the neurological symptoms may develop late and manifest as radiculopathy (24). Cases with accompanying neurological deficit should be managed surgically by decompression as well as stabilization.

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