Delayed Neurological Insufficiency Caused by Transverse Sacral Fracture After Minor Trauma in Elderly Patients
—Two Case Reports—

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Abstract

Sacral fractures in elderly patients with associated lumbosacral lesions can be overlooked easily because of vague symptoms and delayed neurological insufficiency. A 70-year-old female and a 73-year-old female presented with delayed neurological insufficiency caused by transverse sacral fracture after minor trauma. Both patients had suffered from lower extremity symptoms with dysuresia and dyschezia for more than a month. Coexisting lumbosacral pathological lesions may confuse the correct diagnosis for sacral fractures. Decompressive sacral laminectomy was performed, and the patients showed relatively favorable outcomes.

Key words: neurological insufficiency, sacral fracture, osteoporosis

Introduction

Vertebral fractures are a common source of back pain in elderly patients with osteoporosis. Sacral fractures are usually associated with multiple traumas caused by high energy injuries. Isolated sacral fractures are relatively rare.1) Spontaneous osteoporotic fracture of the sacrum in elderly patients was first described in 1982.2) Sacral fractures in elderly patients are usually difficult to diagnose due to vague histories of trauma, inadequate radiologic studies, various distributions of sensorimotor signs in the lower extremities, and often other comorbid lumbosacral lesions. We report two cases of delayed sacral root injury caused by direct sacral root compression after sacral body fractures. Both patients underwent sacral laminectomy and showed relatively favorable clinical recovery.

Case Reports

Case 1: A 73-year-old female presented with low back pain, pelvic pain, and constipation persisting for a month. Her pain radiated along the posterior aspect of her left thigh to the calf (S1 dermatome). Physical examination observed perineal numbness (S3, S4, and S5 dermatomes) and tenderness in the right pubic and sacral areas. She had sustained an injury in a fall 3 months earlier, when she fell onto her buttocks from a standing position.

Lumbosacral magnetic resonance (MR) imaging showed a disc herniation in the central to left zone at the L5-S1 level with S1 nerve root compression, and bone contusion of the S2 and S3 bodies with lower sacral nerve root compression (Fig. 1). Pelvic bone computed tomography (CT) revealed a right pubic bone fracture and an S3 body fracture. However, no symptoms related to the pubic bone fracture such as localized pain or tenderness were observed. This lesion caused a flexion deformity with posterior displacement of the S2 body. Lumbopelvic spinal CT showed the fractured body compressing the sacral

Fig. 1 Case 1. Preoperative sagittal (A) and axial (B) lumbosacral T2-weighted magnetic resonance (MR) images showing disc herniation on the central to left side at the L5-S1 level with left S1 nerve root compression, and S3 sacral body fracture with collapsed sacral canal due to kyphotic displacement at the fractured level. The S3 and S4 roots seen at the S2 level (C) are severely compressed at the S3 level (D) on axial T2-weighted MR images.
neural canal (Fig. 2).

Left laminotomy at the L5-S1 level and bilateral laminectomies at the S3-4 level were performed simultaneously. A large extruded disc fragment was removed through the L5-S1 laminotomy site. The S3, S4, and S5 nerve roots were severely compressed and kinked by the fractured bone fragments, so were decompressed.

After the operation, the patient’s radiating pain and perineal numbness improved markedly, as did her low back and bilateral buttock pain. However, her pelvic pain and constipation improved only slightly. Postoperative MR imaging showed decompressed nerve roots at the L5-S1 and S2-3 levels (Fig. 3).

**Case 2:** A 70-year-old female presented with severe buttock pain and lower extremity numbness. She had suffered from voiding difficulty and constipation for 2 months. She had undergone posterior lumbar interbody fusion L4-L5-S1 6 months previously at another clinic, and her symptoms had aggravated for about 3 months before the initial presentation. Saddle anesthesia and hypesthesia were observed around the bilateral feet, with right dominance. Trauma history was vague except for a minor slip onto her buttocks as she sat down on a chair about a month earlier.

Lumbosacral MR imaging demonstrated sacral fracture of the S3 body with severe compression of the sacral neural canal coexisting with old compression fracture of the T12 body and decompressed state of spinal canal at the L4-L5-S1 levels (Fig. 4). Spinopelvic CT revealed sacral fracture of the S3 body with left pubic rami fracture. She had a history of localized pain around the left pubic area 3 months previously, but no symptoms related to the pubic bone fracture at initial presentation. Transverse sacral body fracture had resulted in flexional deformity and the displaced cranial fractured sacral body was compromising the sacral neural canal (Fig. 5).

Decompressive surgery of the sacral canal was performed. The depressed bone fragments of the laminae were drilled out and the sacral roots were released completely. Postoperative MR imaging and CT showed complete decompression of the sacral canal adjacent to the fractured level (Fig. 6). Postoperatively, her severe buttock pain and numbness of the lower extremities were greatly improved immediately. Saddle anesthesia was slightly improved but still persisted. Although the patient was reported more comfort for walking, hypesthesia of the right foot and voiding difficulty were not much improved. However, the sensibility of urination was recovered so the patient
Transverse Sacral Fracture was referred to the urologist for training in clean intermittent catheterization.

**Discussion**

Sacral fractures can be classified into three types according to their location involving neural foramen (zones 1–3). Transverse sacral fracture has low incidence and accounts for only 2–5% of all sacral fractures. Transverse sacral fractures occur in zone 3 and are usually associated with significant bilateral neurological deficits such as saddle anesthesia and the loss of sphincter tone. In high-energy trauma such as traffic accidents, major forces to the transverse sacral fracture may consist of flexion, extension, or flexion with angulation according to the direction of the external forces. However, in low-energy trauma as in the present cases, the mechanism of injury seems to be mainly flexional force with angulation. In both our cases, contralateral pubic rami fractures were diagnosed simultaneously, and the cranially fractured sacral bodies were slightly rotated.

Pathophysiological mechanisms of transverse sacral fractures with minor trauma can be explained by the biomechanical failure of the pelvic ring resulting from sacral insufficiency fractures of the osteoporotic sacrum. The dominant predisposing factor for transverse sacral fractures appears to be postmenopausal osteoporosis. Age-matched T-score of bone mineral density was $-2.3$ and $-3.2$ in our Cases 1 and 2, respectively. Both patients were postmenopausal (age over 70 years) without other disease. Recent studies have demonstrated that osteomalacia, rheumatoid arthritis, and previous lumbosacral fusion are also significant predisposing factors for sacral fractures.

Clinical presentations often vary with dysfunctions of sensory, motor, and autonomic components of the sacral nerve roots presenting as pain, lower extremity weakness, saddle anesthesia, and bladder dysfunction. The usual predominant initial presenting symptom is severe pain distributing to the lower back, buttocks, and lower extremities. Neurological deficits such as sphincter dysfunction, hypesthesia, and motor weaknesses are often delayed after the initial trauma. The sacral spinal canal, usually a very narrow space, allows passage for just a few sacral roots. Sacral neural foramens are more confined, progressively narrow spaces from S1 to S4. The sacral roots adhere closely to the anterior surface of the sacrum and cover wide surfaces of the lateral portions of the sacral foramens from the S2 distally. Despite this close anatomical association, neurological deficits associated with injury to sacral roots after transverse sacral fracture are frequently overlooked at neurological examination due to the absence of obvious sensorimotor dermatomal distribution and delayed presentations of neurological deficits.

The S2 root is important in genital, bladder, and anorectal functions as a major part of the pudendal nerve. Ventral rami of S3 and S4 roots also participate in the innervation of the striated muscles that comprise the external urethral and external anal sphincters. Branches of the S2, S3, and S4 roots are also distributed to the bladder and rectum as an autonomic nervous system for coordinated function of the bladder and rectum. Their afferent fibers mainly contribute to the awareness of vesical filling, whereas their efferent fibers initiate detrusor and rectal contraction. The sympathetic functions for pain and thermal sensibilities of the inferior hypogastric plexus are also related to small sacral splanchnic nerves arising from the S2 and S3 sympathetic ganglia.

Neither of our patients suffered sphincter dysfunction after initial trauma. Moreover, in Case 2, for example, no history of trauma was detected at the initial visit to the hospital given that the trauma of falling onto the buttocks while sitting seemed to be so minor and could easily occur during casual activities. Neurological deficits associated with sacral root injury occurred about 2 months after the trauma in both patients. Accompanying relatively definite lumbosacral lesions also contributed to the initial failure to diagnose transverse sacral fractures. Case 1 had a disc.
herniation at the L5-S1 level, and Case 2 had an old compression fracture of T12 along with bilateral foraminal stenosis at L5-S1 level due to spondyloytic spondylolisthesis. Careful physical examinations for tenderness on the sacrum, sacroiliac joint tests, FABER test (flexion, abduction, and external rotation), and Gaenslen’s test should be required standard examinations for spinal lesions. Full inspection of radiologic studies in elderly patients with osteoporosis is essential for the early detection of sacral fractures. Mid-sagittal MR imaging or CT of the routine lumboSacral assessments are useful to exclude sacral fractures.

Sacral laminectomy is indicated for patients with neural compromise of stable sacral fractures. Lower sacral transverse fractures often result in kyphotic deformity at the fractured level, so the narrow sacral spinal canal is easily compressed. The results of sacral laminectomies in cases of acute cauda equina injury are well documented. However, the results of decompressive sacral laminectomy in patients with delayed neurological complications are less known, because favorable recovery cannot be guaranteed if the neural components have been damaged. No statistical benefit was found for either surgical or conservative management in treating cauda equina injury due to transverse sacral fractures, but for minimally displaced fractures without evident neurotmetic MR imaging findings, surgical decompression might be facilitate early recovery of the nerves. Both of our patients also had neurological sequelae: constipation for Case 1 and voiding difficulty for Case 2. However, the decreased perineal sensation and constipation improved after surgery in Case 1, and the weakness of both extremities and urination sensibility improved to allow urination using a catheter after surgery in Case 2. Most importantly, both patients were able to go back to normal daily activities without excessive pain, even if neurological sequelae persisted.

Sacral fractures in elderly patients with osteoporosis can occur after minor trauma and present with variable clinical manifestations including severe pain, weakness, and neurological insufficiencies, which can be easily overlooked in the diagnostic process because of vague symptoms and delayed neurological impairment. Moreover, if the patient has sustained neurological insufficiency, the quality of life deteriorates and the results of the surgery are less favorable. The present two cases of delayed neurological insufficiency caused by transverse sacral fracture after minor trauma were treated by decompressive sacral laminectomies with relatively favorable outcomes.

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References


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