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ORIGINAL STUDY

Sacral insufficiency fracture diagnosed after vertebroplasty for L2 and L3 compression fractures : A case report

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Vertebroplasty for osteoporotic thoracolumbar vertebral compression fractures usually results in complete and immediate cessation of pain symptoms. Occasionally the procedure does not relieve pain and further intervention is required. We herein report the case of a 62-year-old female with L2 and L3 vertebral compression fractures treated with vertebroplasty. Her symptoms did not improve and subsequent magnetic resonance imaging showed focal changes in the S1 and S2 vertebral bodies ; bone scintigraphy showed the characteristic Honda sign of a sacral insufficiency fracture. Sacroplasty at S1 and S2 completely relieved the patient's back pain. If a vertebroplasty fails to relieve back pain immediately after the procedure as expected, surgeons should be aware of the possibility of a concomitant sacral insufficiency fracture.

Keywords : sacral insufficiency fracture ; sacroplasty ; vertebroplasty.

INTRODUCTION

Sacral insufficiency fractures (SIFs) are not uncommon, and the most frequent cause is osteoporosis (*15,19*). These fractures can cause lower back pain that is debilitating (*18*). In patients with SIFs, plain film radiographic findings are often normal. Magnetic resonance imaging (MRI) can be useful in the diagnosis because it can show marrow edema, and computed tomography (CT) can also be useful because it can reveal cortical disruption. Bone scintigraphy provides the most sensitive type of information, showing increased activity and may even show the characteristic Honda sign or H-shape uptake (*18*).

The severe lower back pain caused by sacral insufficiency fractures is usually treated conservatively with bed rest (*18*). However, in some cases the surgical procedure of sacroplasty has been used (*8, 18*). This procedure is similar to the much more common procedure of vertebroplasty, and involves injection of polymethylmethacrylate (PMMA) cement into the fractured area of the bone (*4,18*).

We report the case of a patient who, following a minor fall, was diagnosed with a vertebral compression fracture and underwent L2 and L3 vertebroplasties which failed to provide pain relief. She was subsequently diagnosed with a SIF and underwent sacroplasty which provided immediate pain relief. The patient provided consent to publish the report of this case.

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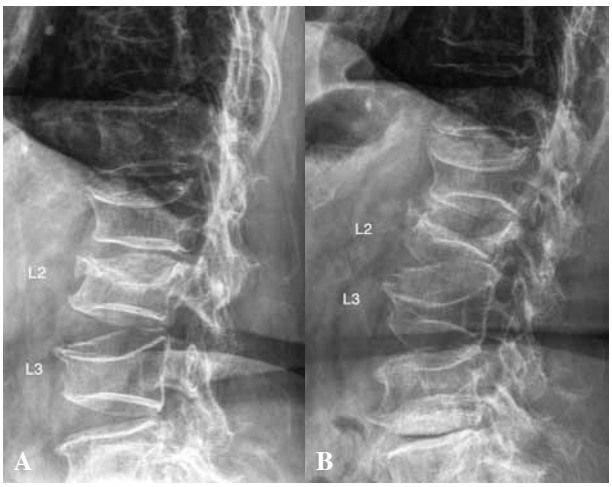

Fig. 1. — Lumbar spine radiography. (A) Lateral view at initial visit revealed a concave deformity at L2 and L3. (B) One month later, further deformity lead to the diagnosis of L2 and L3 vertebral compression fractures, and vertebroplasties were scheduled.

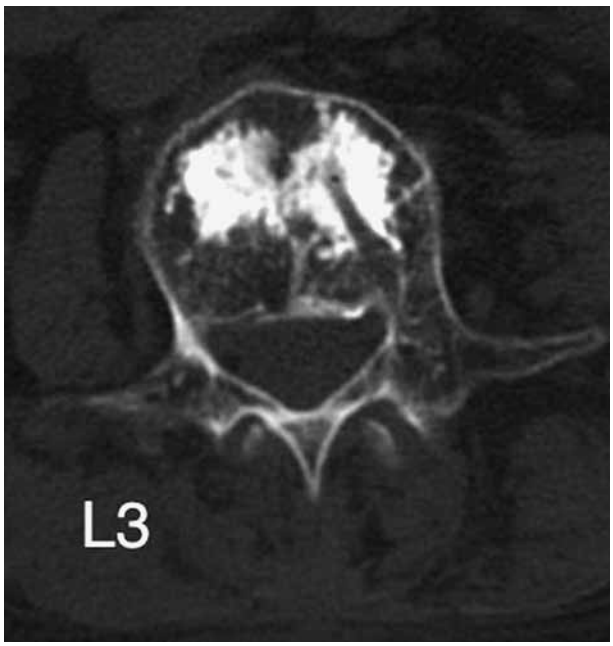

Fig. 2. — Computed tomography scan of L3 level after vertebroplasty. No cement leakage, new adjacent fracture, or haematoma was noted.

CASE REPORT

A 62-year-old female had a minor fall from her height, landing on her hip. She visited our outpatient clinic complaining of severe back pain in the middle of the lumbar spine. Physical examination revealed a knocking pain over the lumbosacral junction, and no radicular sign. Radiographs of the lumbar spine showed concave deformity of the upper end plates at L2 and L3 (Fig. 1A). Calcitonin nasal spray (Miacalcin, Novartis Pharmaceuticals, Basel, Switzerland) and non-steroidal anti-inflammatory drugs (NSAIDs) were given to treat osteoporosis and relieve the pain (*6*). After 4 weeks of conservative treatment, radiographs showed the height of L2 and L3 had decreased significantly, consistent with vertebral compression fractures with significant collapse (Fig. 1B). There was no evidence of callus formation or sclerotic changes in the vertebral bodies. Because the patient's back pain was disabling, vertebroplasty for both L2 and L3 was advised.

Vertebroplasty was performed according to the accepted technique under general anaesthesia (*5*). A percutaneous left side unilateral extrapedicular approach was used. Jamshidi® needles (CareFusion, San Diego, CA) were used to inject 3 and 3.5 ml of PMMA into the L2 and L3 vertebral bodies, respectively. The procedure proceeded smoothly, however, the next morning the patient continued to complain of back pain. A computed tomography (CT) scan of the lumbar spine did not reveal any leakage of cement, a haematoma, or new fractures in the adjacent structures (Fig. 2). The patient was discharged and instructed to return for regular outpatient checkups.

After 6 months, she continued to experience persistent, intractable, and unexplained back pain. A bone scan showed increased uptake in both sacroiliac (SI) joints and in the sacrum (Fig. 3). The characteristic H-shape uptake (or Honda sign) at the SI joint and sacrum (*1*) was compatible with a SIF. MRI of the lumbar spine showed focal areas of bone marrow change in the S1 and S2 vertebral bodies (Fig. 4).

Fluoroscopy-guided sacroplasty was performed according to the established procedure (*2*). Preoperatively, the bony anatomy was delineated

Fig. 3. — Bone scan showing marrow oedema bilaterally in the sacral alae at 6 months postoperatively. The typical Honda sign implied sacral insufficiency fracture.

Fig. 4. — Magnetic resonance imaging 6 months after vertebroplasties revealed focal areas of bone marrow change in the S1 and S2 vertebral bodies, and a sacral fracture was suspected.

by MRI and the desired depth and angle of penetration into the S1 and S2 bodies were marked and recorded. After induction of general anaesthesia, the patient was placed prone on the radiolucent table. Two image intensifiers (PHILIPS, Best, The Netherlands) were used to provide anteroposterior and lateral views during surgery. The skin on her back was prepared and draped. Four single-use Jamshidi® needles were inserted into S1 and S2 bilaterally near the SI joints. The non-ionic iodinated contrast medium iopromide (Ultravist, Berlex Laboratories, Inc., Montville, NJ, USA) (*16*) was injected to confirm absence of extravasation into the epidural space or retroperitoneum. PMMA was injected bilaterally into S1 and S2, one milliliter per needle, and the entire procedure was monitored with the image intensifiers (Fig. 5). On the first postoperative morning, the patient reported pain relief. During 18 months of follow-up she experienced no recurrence of pain or functional impairment.

DISCUSSION

Vertebroplasty has become a common procedure to treat compression fractures ; a survey of 525 cases showed that 89% of patients had pain resolution or improvement after vertebroplasty (*10*) ; however, the reason for failure in some patients was not clear. Despite the increased use of the procedure, two recently published randomized trials of

Fig. 5. — Radiograph after sacroplasty showing cement injected at the S1 and S2 levels.

the treatment of osteoporotic spinal fractures with vertebroplasty indicated no difference in improvement of pain or pain-related disability between the treatment groups and control groups (*3,11*).

SIFs are difficult to diagnose, and the sacral anatomy contributes to this difficulty (*17*). First, the trabeculae are denser underneath the endplates and are arranged in a cruciate fashion. Individual sacral bodies are uniform in cortical thickness throughout, including in the region of the first sacral pedicle, and lose bone density uniformly (*1*). These characteristics, along with underlying osteoporosis and soft tissue damage, complicate detection (*19*).

Routine radiographs are not usually sufficient for the diagnosis of SIFs, and combined CT imaging and MRI is not routinely performed (*14*). MRI may reveal marrow oedema, but this cannot be used to conclude there is a fracture, while CT may show cortical disruption (*9,14*). Bone scintigraphy may show the typical Honda sign or H-shape activity, which is characteristic of a sacral insufficiency fracture (*1*). There is debate as to whether MRI with fat suppression sequences and gadolinium contrast or bone scintigraphy is the preferred method for diagnosing SIFs (*1,9,14*), and in the case presented herein the diagnosis was made using MRI followed by a bone scan.

Yang *et al* (*21*) identified 22 (1.4%) cases of salvage procedures in a series of 1,525 vertebroplasties, but none of the 22 cases included additional sacral fractures. However, SIFs occurring concomitantly with throracolumbar compression fractures are not uncommon. Kong *et al* (*12*) studied 160 patients with thoracolumbar compression fractures not due to trauma or malignancy diagnosed by MRI and found that 10.6% also had SIFs. In a similar study, Lee *et al* (*13*) found that out of 252 patients studied with thoracolumbar compression fractures, 18 (7.1%) also had SIFs. Complications are associated with conservative management of patients with SIFs. Prolonged bed rest may lead to muscle loss and immobility (*1,7*). Sacroplasty is a relatively new treatment for sacral body fractures. It is comparable to vertebroplasty with respect to improvement of pain, mobility, and performance of activities of daily living (*20*). It has been demonstrated that 3-dimensional CT-guided sacroplasty is safe, practical, and effective for treating sacral body fractures (*8,18*). Brook *et al* (*2*) used axial CT with coronal reformatted CT to guide and confirm PMMA injection in sacroplasty. Pommersheim *et al* (*18*) found that combining MRI and CT to perform sacroplasty improved accuracy.

In this case, we did not rule out a SIF during the initial examination. Whole spine radiographs are not routinely performed in patients with symptoms as those of our patient, and radiographic findings were compatible with the initial examintion, thus we treated the L2 and L3 fractures. Though there are many reports of the success rates of vertebroplasty in the literature, few of them discuss reasons for failure and we believed that our patient was one of the failures. There are no guidelines regarding how to manage failed vertebroplasties, therefore we believed that conservative management was appropriate and no further imaging studies or work-up was performed until it became apparent that the pain was not resolving with conservative management.

In summary, SIFs are not uncommon, and may be seen in 10% of patients with thoracolumbar compression fractures. Surgeons should be aware of the possibility of associated SIFs in patients with compression fractures at the thoracolumbar junction. While MRI is the gold standard for identifying fractures at the thoracolumbar junction, a bone scan may be necessary to check for a neglected sacral lesion, especially in cases where vertebroplasty does not relieve a patient's symptoms.

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