Management Of Symptomatic De Novo Adult Scoliosis Of The Lumbar Spine Caused By Progressive Hemi-Vertebral Compression Fractures Following Long-Term Glucocorticoid Therapy: A Case Report

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Citation

Abstract
This report describes the management of a significant lumbar spinal deformity caused by progressive hemi-vertebral compression fractures associated with steroid induced osteoporosis. Loss of spinal balance accelerated the progression of the compression fractures. The spinal column was reconstructed posteriorly with pedicle screw instrumentation and supplemental sublaminar hooks. Hydroxyapatite sticks were used to enhance the pedicle screw fixation, because of the fragility of the bones. This case demonstrates that in this type of complex situation surgeons should be prepared to use a variety of approaches to achieve a restoration of spinal balance and so relieve pain and restore function.

INTRODUCTION
Loss of spinal balance can cause progression of compression fractures in the spines of osteoporotic patients (1,2,3,4). The surgical goal is not only the relief of the presenting complaint, usually pain and deformity, but also the prevention of further complications after the surgical intervention. Careful consideration must be given to the surgical strategy that is adopted for the restoration of spinal alignment because of the fragility of the spinal column in these patients.

CASE REPORT
A sixty-four-year-old woman, treated with 10mg of prednisolone a day for nineteen years for autoimmune hemolytic anemia (AIHA), had no treatment to prevent or manage osteoporosis during that period. She presented with persistent left anterior thigh pain and severe low back pain. The first episode of acute low back pain had occurred when she was 58 years old after a fall. X-rays showed a lumbar scoliosis of 6 degrees with vertebral fractures on the left side of L1 and L2 (Fig.1a). She was treated with non-steroidal anti-inflammatories (NSAIDs) and exercises. Her acute clinical symptoms settled, but the discomfort in the back persisted. At the age of 64 she once again presented with severe low back pain and pain radiating to the left anterior thigh. On physical examination her gait was compromised because she could not maintain a single leg stance due to severe low back pain. She had a positive femoral nerve stretch test, but no formal loss of neurological function. The lumbar scoliosis on x-ray examination (Fig.1b) had significantly progressed with a left L3 hemi-vertebral fracture in addition to the previous L1 and L2 fractures. Osteoporosis was assessed as being Grade 2 according to the Jikei scale (5). Cobb's angle had progressed from 6 degrees to 18 degrees in the intervening six years.
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Figure 1
Figure 1a: Vertebral compression fractures of L1 and L2, Cobb angle 6 degrees (L1-L3).

Figure 2
Figure 1b: X-ray shows progressive hemi-vertebral compression fracture on the left side and scoliosis. Cobb angle 18 degrees (L1-L4).

Magnetic resonance imaging (MRI) showed foraminal stenosis on the left at L3/4 caused by a combination of protruding disc material and the deformity of the L3 vertebral body (Fig.2).
Myelography and radiculography confirmed the left L3 nerve root entrapment at L3/4 (Fig.3).

She was treated with a combination of epidural steroids and NSAIDs but this was only effective in controlling her pain for three months. As a result she consented to undergo a surgical correction of the deformity and spinal fusion.

In order to relieve the entrapment of the L3 nerve root a posterior vertebral osteotomy with total facetectomies and interbody fusion was performed using a combination of Brantigan I/F cages (DePuy Spine) filled with cancellous bone and two bicortical bone grafts harvested from posterior iliac crest. The coronal and sagittal plane alignment was corrected with posterior pedicle screws and rods (Moss Miami, DePuy Spine) with intrapedicle enhancement by hydroxyapatite (HA) granule sticks (PENTAX Co. Japan, Fig.4) and additional sublaminar hooks.

Figure 3
Figure 2: MRI (T2w.i.) shows the L1, L2 and L3 vertebral fractures and kyphotic deformity.

Figure 4
Figure 3: L3 radiculography showed the entrapment of L3 nerve root in the sub-pedicular region. The radicular pain was relieved after injection of 1.0 ml xylocaine.
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Figure 5
Figure 4; HA stick (hydroxyapatite stick) HA stick (PENTAX Co. Japan) has been developed for enhancement of pedicle screw fixation in osteoporotic pedicles and vertebrae. It is a stick made of hydroxyapatite (Ca (PO)(OH)) granules. The pore size of the granules ranges from 600 to 1000 Åm. The granules have a high density with 15% volume / porosity. The dimensions of the sticks are 4mm x 40mm and the weight of one stick is 1.5g.

The scoliosis was corrected completely in the surgical procedure with a post-operative Cobb angle of 0 degrees. There was no loss of correction on outpatient follow-up x-rays (Fig.5).

Figure 5a & b: AP and lateral views of the lumbar spine showing the posterior correctional osteotomy and interbody fusion with polyaxial pedicle screws and laminar hooks (MOSS Miami, DePuy Spine). Pedicle screws were enhanced by hydroxyapatite granule (HA) sticks. The HA were shown as a soft shadow around screws. The deformity was corrected completely.

Figure 6
Figure 5a
An MRI scan after surgery also showed that a complete decompression of the dura and nerve roots had been achieved, as had an adequate anterior reconstruction with the bone grafts and spacers (Fig. 6).

Figure 7
Figure 5b

Tomography revealed a solid bony fusion in anterior column (Fig. 7) six months after the operation. The severe low back pain and radiating pain in the left thigh were relieved completely by two years after surgery and no further compression fractures occurred.

Figure 8
Figure 6: Post-operative MRI on sagittal view showed the bone grafts and interbody cage between L3 and L4.
Figure 9
Figure 7: Solid fusion observed on tomography six months after surgery. There were no radiolucent lines at the bone-graft interface and no subsidence of the grafted bone or interbody cages.

DISCUSSION

Osteoporotic compression fractures of the spine are very common in postmenopausal women and in patients who take long-term glucocorticoid therapy (6-7,8,9,10). Such fractures often progress in adjacent vertebrae because of an imbalance of spinal alignment (11,12) and this effect may not be easily recognized because of the resultant scoliosis (11). Compression fractures with more than 30 degrees of kyphosis or more than a 30 per cent loss in vertebral height have a significant potential to increase coronal and sagittal plane deformities (11,12). In the case described there was just such a progression of hemi-vertebral compression fractures in a steroid-induced osteoporotic spine because of coronal imbalance of spinal alignment.

Surgical treatment of lumbar deformities in the osteoporotic spine presents unique challenges. Bone quality is poor thus compromising pedicle screw fixation and this becomes crucial when a major, unbalanced, deformity needs correction. Additional methods of spinal fixation should therefore be considered, such as sub-laminar hooks as well as pedicle augmentation with cement, or as in this case a bioactive ceramic (HA). If leg pain is a major pre-operative symptom, decompression of the nerve roots is essential as part of the restoration of vertebral alignment and stabilization. Maintenance of alignment post-operatively is the key to preventing recurrent deformity and implant related complications (13-14). There are few reports of major spinal reconstructions in the osteoporotic lumbar spine (13-14), but what is clear from all authors is that these are complicated cases with a high potential for post-surgical recurrence if balance is not achieved and maintained. We have previously reported the efficacy of modern segmental instrumentation in the osteoporotic spine and the problems that can be encountered with such instrumentation (14). From our previous experience and from what we have learned from this case, we consider it vital that in correcting deformities in the osteoporotic spine, correct sagittal and coronal alignment is achieved to balance the forces acting through the spine in an axial direction. This requires interbody devices such as autografts and spacers, which in this case were able to be implanted from a posterior approach after a posterior osteotomy, rather than in a separate anterior procedure (16,17). The choice of posterior instrumentation is critical since it needs to maintain alignment, but not be so rigid that pedicle screw cutout is likely. As a result, polyaxial rather than monoaxial screws should be used for intrapedicular fixation and supplemental sublaminar hooks are very useful in providing an additional semi-rigid hold (15,16,19,20).

This case and others like it demonstrate that the purpose of treatment of an unbalanced, symptomatic deformity of the osteoporotic lumbar spine is not just to relieve the presenting symptoms, but also to prevent the post-surgical complications of rigid internal fixation (15). Spinal surgeons face increasing numbers of osteoporotic patients with thoraco-lumbar deformities and they need a very full array of surgical tools to be able to cope with this workload. Fundamental to the logical use of such tools is the recognition that axial (i.e. coronal and sagittal) balance must be restored and maintained otherwise the complications of surgery will be worse than the presenting complaint.

References

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