Compression fracture in the middle of a chronic instrumented fusion that developed into pseudarthrosis after balloon kyphoplasty

Case report

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There are only 2 documented cases of vertebral compression fractures occurring within a solid lumbar fusion mass: one within the fusion mass after hardware removal and the other within the levels of the existing instrumentation 1 year postoperatively. The authors report a case of fracture occurring in a chronic (>30 years) solid instrumented fusion mass in a patient who underwent kyphoplasty. The pain did not improve after the kyphoplasty procedure, and the patient developed a posterior cleft in the fusion mass postoperatively. The patient, a 46-year-old woman, had undergone a T4–L4 instrumented fusion with placement of a Harrington rod when she was 12 years old. Adjacent-segment breakdown developed, and her fusion was extended to the pelvis, with pedicle screws placed up to L-3 to capture the existing fusion mass. Almost 2 years after fusion extension, she fell down the stairs and suffered an L-2 compression fracture, which is when kyphoplasty was performed without pain relief, and she then developed a cleft in the posterior fusion mass that was previously intact. She refused further surgical options. This case report is meant to alert surgeons of this possibility and allow them to consider the rare occurrence of fracture within the fusion mass when planning extension of chronic spinal fusions.

(keywords: spinal fracture, spinal fusion, kyphoplasty, arthrodesis, instrumentation, thoracic spine)

Case Report

At 12 years of age, with a history of idiopathic scoliosis, this female patient, now 46, underwent a T4–L4 fusion with a Harrington rod. At 43 years of age, she was experiencing increasing back and leg pain, and imaging revealed adjacent-segment disease; disc bulge at L-4, L-5, and S-1; and severe foraminal stenosis. Sagittal balance was noted to be within normal limits. An L3-ileum posterolateral arthrodesis and a left-sided decompression were performed. The surgical dissection and bony decortication were limited to the spine distal to the L-3 pedicles. A solid fusion mass was confirmed by CT scan 14 months later. The patient was functioning well at home and had returned to performing household chores and caring for her animals. Eight months later, she suffered a fall down the stairway, landed on her back, and was markedly debilitated with severe pain. Radiography, CT, and MRI confirmed an endplate fracture superiorly at L-2 within the chronically fused segments that had been stabilized with the Harrington rod, adjacent to the pedicle screw construct, when the patient was 12 years old (Figs. 1–3). The dorsal fusion mass was shown to be solid on CT scans (Fig. 2 right) and dynamic flexion-extension radiographs, which demonstrated that the Harrington rod was intact. Bone density testing revealed osteopenia in the hip but normal values in the radius. The spinal bone density was not reported due to artifactual findings from the metallic instrumentation. Infection was not considered as part of

Abbreviation used in this paper: VCF = vertebral compression fracture.
the differential diagnosis because all of the patient’s pain occurred after the traumatic fall. After 2 weeks of observation, balloon kyphoplasty was performed bilaterally at L-2. The kyphoplasty procedure was difficult due to her rotatory scoliosis. It required multiple initial attempts with the osteointroducer before the pedicles could be appropriately and safely cannulated. In the immediate postoperative period, the patient’s pain worsened. A CT scan obtained in the immediate period after the kyphoplasty procedure displayed the course of the needle through the pedicles bilaterally, but the dorsal fusion mass appeared to be intact. The L1–3 sagittal kyphotic angle on this CT scan was 9.1°. Six weeks after kyphoplasty, the patient’s pain was only partially relieved compared with her prekyphoplasty status. Radiographs revealed a fracture through the posterior elements at L-2 and the kyphotic L1–3 angle increased to 21.5° on radiographs obtained 2 months later (Fig. 4). The rod remained intact. The patient was offered a procedure to extend the posterior pedicle screw fusion construct to the thoracic spine and the possibility of rod removal (or cutting) and osteotomy for sagittal balance correction (Fig. 5). Her pain has been slowly dissipating during the observation period. At 5 months postkyphoplasty, the patient is not in pain when in a recliner, but the pain becomes 6 of 10 when ambulating in public. She refused further surgery and was referred for a multidisciplinary pain rehabilitation program.

Discussion

The biomechanical stresses adjacent to an instrumented fusion have been well described.\(^1,3,6,8,10,11\) We report a case of a patient who suffered a vertebral body fracture at a level adjacent to a relatively recent instrumented fusion construct, within a chronic instrumented fusion construct. Clearly, there are differing biomechanical forces applied to the vertebrae within the overall T4-ileum instrumented fusion. The most likely level for a
Compression fracture in a chronic instrumented fusion mass

fracture would be L-2 since all levels distal to L-3 were supported by pedicle screws, while L-2 and superior vertebrae were only stabilized with a posterior Harrington rod. The biomechanical support of the 3-column pedicle screws is different than that of the single-column Harrington rod. Therefore, even with instrumentation into the existing fusion mass, a fracture occurred after a fall. The fracture then developed into a pseudarthrosis posterior to the level of VCF following kyphoplasty.

Balloon kyphoplasty is often used to treat VCF. Percutaneous balloon kyphoplasty can provide short-term pain relief; however, there is inconclusive evidence to support a difference in long-term outcome.²⁷¹² We currently lack evidence for the appropriate management of a VCF within a solid fusion mass.

The authors question whether access through the fusion mass created a weakness that led to breakdown of the dorsal fusion mass. Our literature search did not uncover any previous reports of this complication. Patients

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**Fig. 3.** Sagittal contrast-enhanced MR image showing diffuse enhancement of the L-2 vertebral body consistent with the acute fracture. There is artifact from the Harrington rod, but no clear enhancement or edema is noted in the dorsal fusion mass.

**Fig. 4.** Lateral lumbar radiograph 2 months after kyphoplasty showing a cleft in the dorsal fusion mass that was not present prior to kyphoplasty.
with idiopathic scoliosis often have small pedicles, especially in the concavity of the curvature. However, this patient’s L-2 pedicles were both greater than 5 mm wide in the axial plane and at least 9 mm wide in the sagittal plane. That being said, we believe it is plausible that the needle cannulation may have contributed to the posterior column instability, which eventually led to the pseudarthrosis cleft. The dorsal fusion mass did not show any abnormalities on the prekyphoplasty CT or MRI studies.

Conclusions

This case report is meant to alert surgeons of this complication and allow them to consider the rare occurrence of fracture within the fusion mass and development of a pseudarthrosis when planning extension of chronic spinal fusions.

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Disclosure

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

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