

Case Report

Vertebral compression fracture within a solid fusion mass without trauma after removal of pedicle screws

Sung Kyu Kim, MD, Jae Yoon Chung, MD, PhD, Hyoung Yeon Seo, MD, PhD,
Won Gyun Lee, MD*

Department of Orthopedic Surgery, Chonnam National University Hospital, 8 Hakdong, Donggu, Gwangju, 501-757, Republic of Korea

Received 29 April 2015; revised 8 October 2015; accepted 19 November 2015

Abstract

BACKGROUND CONTEXT: Many complications of lumbar fusion have been reported. However, reports of complications related to implant removal after solid fusion are rare. In addition, there are almost no reports of compression fractures occurring within a fusion mass.

PURPOSE: This work aimed to report a case of vertebral body compression fracture within a solid lumbar fusion mass after removal of fusion instrumentation, and to investigate the contributing factors.

STUDY DESIGN: A case report was carried out.

METHODS: A 67-year-old woman presented with gait disturbance and pain radiating from both lower extremities. She had a history of lumbar fusion at L2–L5 because of degenerative stenosis. We found spinal stenosis at L5–S1 and ossification of the ligamentum flavum at T12–L2. Posterior decompression and fusion were performed for the lesion, and previously inserted fusion instrumentation was removed at L2–L5 in accordance with the patient's request. After surgery, her symptoms decreased and she was discharged. Five weeks after surgery, the patient returned with sudden, severe back pain that occurred without trauma. Compression fracture at the L3 lower end plate was observed via magnetic resonance imaging. We treated her back pain with analgesics and a thoracolumbosacral orthosis. After 2 weeks, her back pain had decreased, and she was discharged.

RESULTS: Before removal of instrumentation, we verified complete union using computed tomography. However, an unexpected compression fracture occurred within the fusion mass, without trauma. We suspect that the causes of the compression fracture were the straight sagittal imbalance of the spine, the cantilever motion in the anterior disc after posterior fusion, and decreased bone strength.

CONCLUSIONS: Vertebral compression fracture in a solid fusion mass may occur as a complication of implant removal. Surgeons must take care to maintain normal sagittal alignment during spinal fusion, and they should consider careful removal of instrumentation for patients with risk factors such as osteoporosis, sagittal imbalance, long spine fusion, and certain types of fusion. © 2016 Elsevier Inc. All rights reserved.

Keywords:

Complication; Compression fracture; Fused segment; Implant removal; Spinal fusion

Introduction

Lumbar fusion using pedicle screw fixation is the method most widely used to treat various spine diseases [1–4]. Many complications for this procedure have been reported, such as adjacent-segment pathology, pseudarthrosis, implant failure, and adjacent-segment fracture in patients with osteoporosis.

However, there are a few reports about complications related to implant removal after solid fusion [5,6]. Furthermore, there are few reports of compression fracture occurring within the fusion mass. We report here a case of vertebral body compression fracture in a solid lumbar fusion mass after removal of fusion instrumentation.

Case report

A 67-year-old woman presented to our hospital with gait disturbance and pain radiating from both lower extremities. She had a history of posterior decompression of L3–L4, posterior lumbar interbody fusion of L4–L5 caused by

FDA device/drug status: Not applicable.

Author disclosures: **SKK:** Nothing to disclose. **JYC:** Nothing to disclose. **HYS:** Nothing to disclose. **WGL:** Nothing to disclose.

* Corresponding author. Department of Orthopedic Surgery, Chonnam National University Hospital, 8 Hakdong, Donggu, Gwangju, 501-757, Republic of Korea. Tel.: 062 227 1640; fax: 062 225 7794.

E-mail address: skkim@chonnam.ac.kr (W.G. Lee)

degenerative stenosis of L3–L5 9 years earlier, and posterior decompression and posterolateral fusion caused by adjacent-segment pathology of L2–L4 7 years earlier. The solid dorsal fusion mass of L2–L5 was observed on plain radiographs and on lumbar 3-dimensional computed tomography scans (Fig. 1). In addition, we found spinal stenosis at L5–S1 and ossification of the ligamentum flavum at T12–L2, which we suspected as the reason for her gait disturbance and pain. Posterior decompression and fusion were performed to repair the lesion, and we removed previously inserted fusion instrumentation (L2–L5), in accordance with the patient's request (Fig. 2). The posterior and posterolateral fusion mass of L2–L5 was confirmed during surgery. After surgery, the patient's symptoms gradually decreased, and the patient was discharged from the hospital at 2 weeks. We recommended a rehabilitation program to manage the gait disturbance.

Five weeks after surgery, the patient returned to our hospital with sudden, severe back pain that occurred without trauma. On physical examination, severe tenderness was observed in her back, and a compression fracture at the L3 lower end plate was observed on magnetic resonance images (Fig. 3). The preoperative T-score on dual energy X-ray absorptiometry of the femoral neck was -1.8 , which indicated osteopenia. We had been treating her back pain with analgesics and a thoracolumbosacral orthosis, but because of discomfort, she did not tolerate the orthosis well. After 2 weeks, her back pain was nearly alleviated, and she was discharged from the hospital.

After 3 months, height reduction and collapse of the L3 vertebral body were observed on plain radiographs (Fig. 4), but the patient had no back pain. She did not return to our hospital again until 3 years after surgery. At the most recent

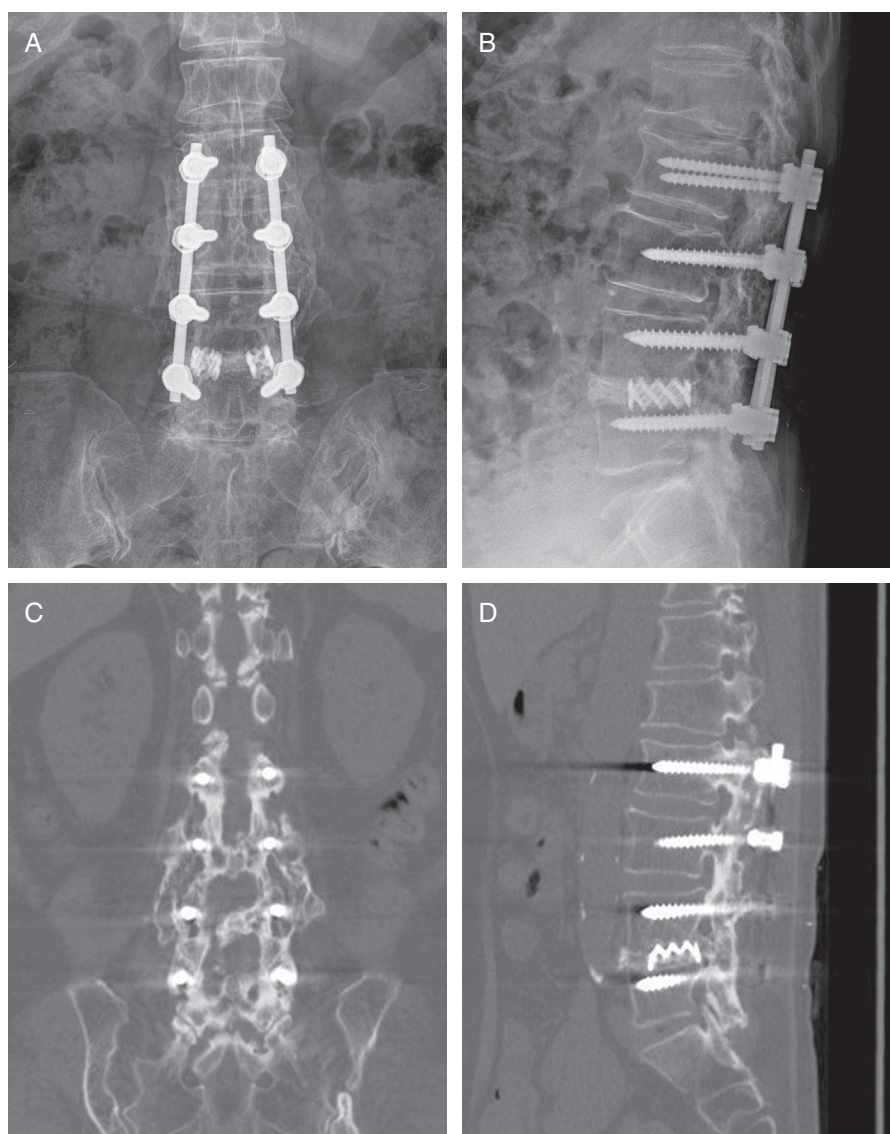


Fig. 1. (A) Preoperative lumbar anteroposterior and (B) lateral plain radiographs. Preoperative lumbar three-dimensional computed tomography scans showing solid fusion from L2 to L5: (C) coronal view; (D) sagittal view.

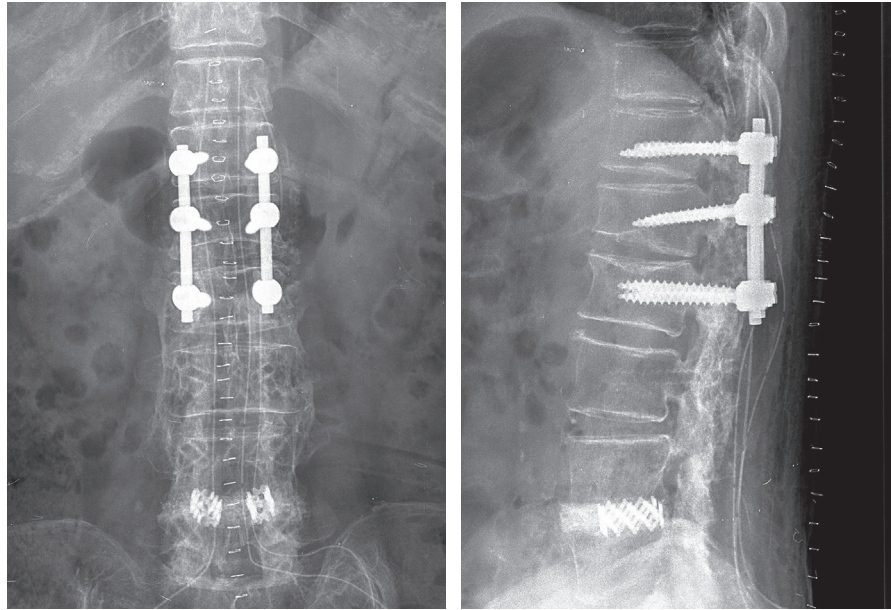


Fig. 2. Immediate postoperative plain radiographs after posterior decompression and fusion at T12–L2: (Left) anteroposterior; (Right) lateral. Previous inserted fusion instrumentation was removed.

follow-up evaluation, plain radiographs showed collapse of the L2–L4 vertebral body (Fig. 5). She had back pain and a stooping gait, and she was using a cane because of the sagittal imbalance arising from lumbar kyphosis. However, she had no tenderness in her lower back and had no history of trauma. We are currently treating her conservatively. We believe that if complete posterior fusion of L2–L5 had not been ob-

tained, fracture or kyphotic deformity would have progressed even more.

Discussion

Spinal fusion is the most common surgical method used to treat various spine diseases such as spinal stenosis,

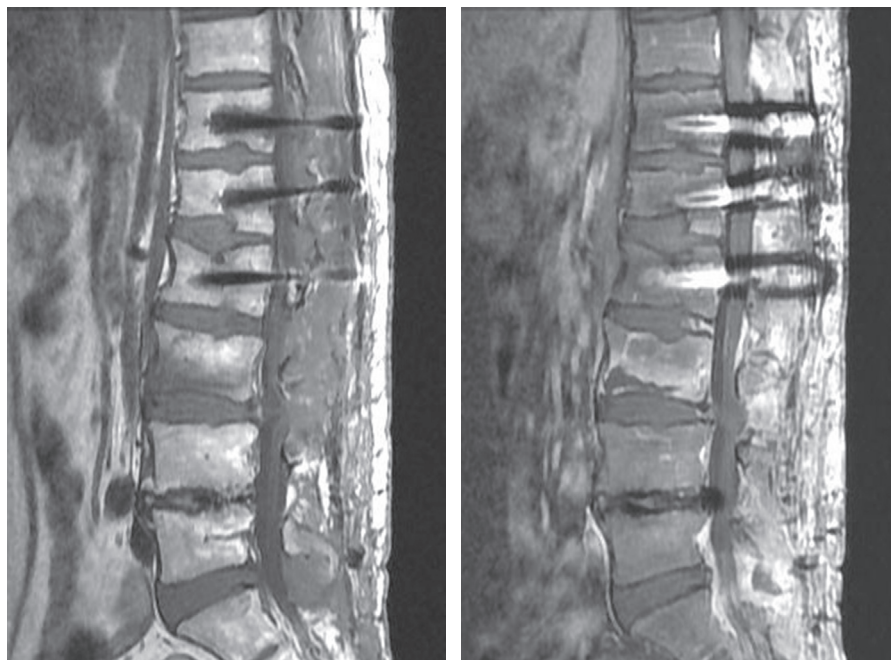


Fig. 3. At 5 weeks after surgery, a compression fracture was observed at the inferior end plate of L3 on (Left) T1-weighted and (Middle) gadolinium-enhanced sagittal lumbar magnetic resonance images and (Right) gadolinium-enhanced axial L3 images.

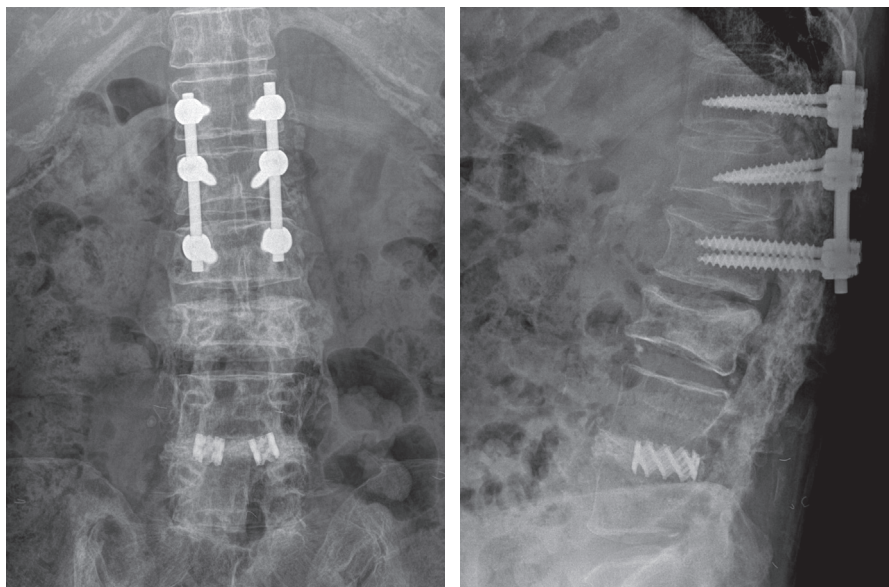


Fig. 4. (Left) Lumbar anteroposterior and (Right) lateral radiographs at 3 months after surgery. The collapse of the L3 body had progressed.

spondylolisthesis, and deformity, but many complications have been reported [1–4]. However, reports about complications related to implant removal after solid fusion are rare. To the best of our knowledge, ours is the fourth case report of a vertebral compression fracture in a fusion mass. Some patients who have undergone spinal fusion want to remove the fusion instrumentation because they believe it to be the cause of their postoperative back discomfort. In this situation, surgeons often wonder whether to proceed with removal because most of the symptoms are unrelated to the implantation. In practice, indications for implant removal after spinal fusion have not been established, so whether to proceed depends on the surgeon's preference. Surgeons may consider implant removal

when the patient has mechanical tissue irritation, when there is adjacent-segment pathology requiring surgery, or patient is insistent on removal. When this happens, it is necessary to confirm the complete union of the fusion mass. In our patient, we identified complete union using computed tomography before removing the instrumentation. However, an unexpected compression fracture occurred within the fusion mass.

Ha and Kim reported a case of bilateral pedicle stress fracture at L4 after removal of instrumentation at the L3–L5 posterolateral fused segment [5]. They also reported a case of compression fracture within the fused segment in a patient with osteopenia [6]. Waelchli et al. reported two cases

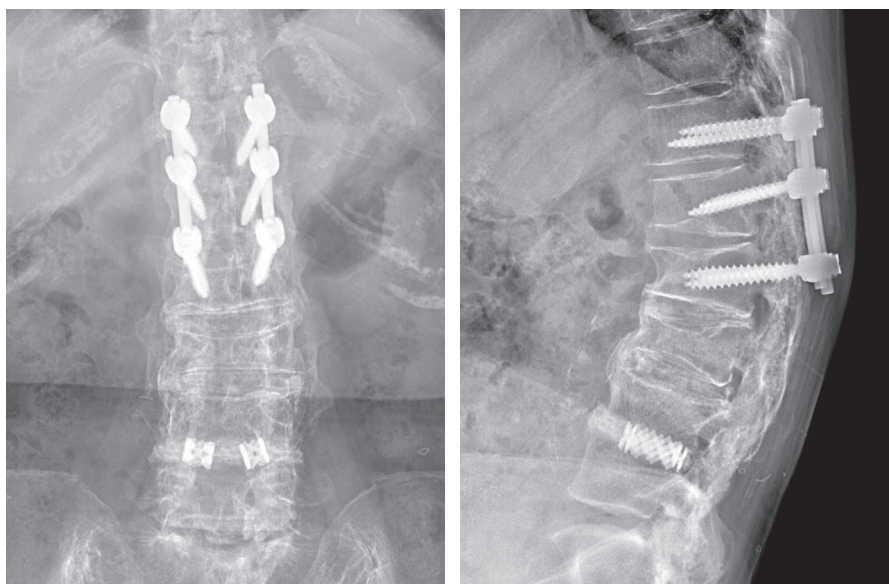


Fig. 5. (Left) Lumbar anteroposterior and (Right) lateral radiographs at 3 years after surgery. The collapse of the L2–L4 body had progressed.

of compression fracture in the uppermost vertebral body of the fusion mass after removal of instrumentation [7]. The common motivation in these cases was the subcortical substance defect of the removed screw track. From a biomechanical perspective, Ha and Kim suggested that the cantilever motion in the anterior disc after posterolateral lumbar fusion is an additional factor causing compression fracture [5].

Our case differs from previously reported cases in that the fracture occurred at the inferior end plate within the fusion mass and at multiple sites since then, rather than at the screw hole after pedicle screw removal. In our patient, lumbar lordosis and thoracic kyphosis decreased after a previous lumbar fusion, creating a straight sagittal imbalance of the whole spine. Then additional thoracolumbar fusion was carried out, and fusion mass support weakened after screw removal. Accordingly, we assume that axial force transmitted to the lower vertebra increased because of a straight sagittal imbalance, and that axial force transmitted to the anterior part of the vertebra increased in the case of posterior fusion relative to interbody fusion. Therefore, the cantilever effect was larger. However, there are few studies of this biomechanical aspect, and thus further studies will be necessary. Another cause of fractures is a decrease in bone strength. Spine bone mineral density could not be measured in our patient because of previous spinal surgery, but osteopenia was observed in the femoral neck. We believe that there might have been weakening of the bone because of fusion and implantation; we were able to identify evidence such as an overall increased radiolucency of the vertebral body, loss of trabecular bone, thinning of the cortex, and a well-demarcated cortical rim as shown on lumbar plain radiographs.

Consequently, a vertebral compression fracture in a solid fusion mass may occur as a complication of implant removal. Preservation of normal sagittal alignment is important in spinal fusion. Therefore, surgeons should make certain to maintain normal sagittal alignment during spinal fusion, and they should consider careful removal of fusion instrumentation when the patient has risk factors such as osteoporosis, sagittal imbalance, long spine fusion, and certain types of fusion.

References

- [1] Boos N, Webb JK. Pedicle screw fixation in spinal disorders: a European view. *Eur Spine J* 1997;6:1–18.
- [2] Crawford MJ, Esses SI. North American Spine Society and Scoliosis Research Society. Indications for pedicle fixation. Results of NASS/SRS faculty questionnaire. *Spine* 1994;19(Suppl.):2584–9.
- [3] Dickman CA, Yaihiro MA, Lu HTC, Melkerson MN. Surgical treatment alternatives for fixation of unstable fractures of the thoracic and lumbar spine. A meta-analysis. *Spine* 1994;20(Suppl.):2266S–73S.
- [4] Yuan HA, Garfin SR, Dickman CA, Mardjetko SM. A historical cohort study of pedicle screw fixation in thoracic, lumbar, and sacral spinal fusions. *Spine* 1994;19(Suppl.):2279S–96S.
- [5] Ha KY, Kim YH. Bilateral pedicle stress fracture after instrumented posterolateral lumbar fusion: a case report. *Spine* 2003;28:E158–60.
- [6] Ha KY, Kwon SE, Kim KW, Oh IS, Lee YM. Vertebral compression fracture in the middle of fused segments without a history of injury: a case report. *Spine* 2010;35:E137–9.
- [7] Waelchli B, Min K, Cathrein P, Boos N. Vertebral body compression fracture after removal of pedicle screws: a report of two cases. *Eur Spine J* 2002;11:504–6.