Vertebral Compression Fracture after removing Implants in A Patient undergoing Posterior Lumbar Interbody Fusion: A Case Report and Literature Review

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Posterior lumbar interbody fusion (PLIF) is a well-known method for treating spinal diseases in which adjacent segment disease (ASD) is a representative complication. To correct ASD, posterior fusion is extended to the upper or lower segment, and the previous instruments are removed. However, there have been a few reports of complications after instrument removal. Here, we report on a case of compression fracture that occurred without history of trauma after ASD revision and instrument removal surgery. A 68-year-old woman underwent PLIF at L3-L5 and was hospitalized for treatment of ASD. She underwent oblique lumbar interbody fusion at L2-L3 after removal of the previous screws. One month later, she visited the hospital with sudden lower back pain. Plain radiography revealed a compression fracture of L4. The patient's pain was relieved after conservative treatment. Our findings show that instrument removal during revision operations should be performed carefully because it can lead to compression fracture without history of trauma.

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INTRODUCTION

Interbody fusion using pedicle screws, such as posterior lumbar interbody fusion (PLIF), oblique lumbar interbody fusion (OLIF), direct lateral interbody fusion (DLIF), and transforaminal lumbar interbody fusion (TLIF), is a widely used method in the treatment of spinal diseases^{1,3,5}. However, complications associated with this procedure include adjacent segment disease (ASD), pseudoarthrosis, screw loosening, and infection². In cases of ASD, it is common to extend spine fusion toward the upper or lower segment; however, there have been few reports of complications caused by the removal of previously inserted pedicle screws. Here, we present a case of vertebral compression fracture after removal of pedicle screws in a patient without history of trauma.

CASE REPORT

A 68-year-old woman visited the outpatient clinic with pain in the anterior portion of her right thigh. She had a history of PLIF at L3-L5 due to degenerative spinal stenosis in September 2011. She also complained of severe neurogenic intermittent claudication (NIC) and was unable to walk more than 50 m. Upon physical examination, pain was noted along the right L2 sensory dermatome, and the femoral nerve stretch test result was positive. Due to adjacent segment degeneration from the previous L3-L5 PLIF, a reduction

in disc height, presence of a radiolucent lesion with vacuum inside the disc space, as well as sclerotic changes in both end plates at L2-L3 were observed on plain radiograph images (Figure 1A, B). Computed tomography revealed a solid bony fusion between L3 and L5 without evidence of pedicle screw loosening (Figure 2). Magnetic resonance imaging revealed severe foraminal stenosis on the right side (Figure 3). A bone mineral density (BMD) reading showed a value of -1.5, indicating osteopenia (Figure 4A, B). To treat the right

Figure 1. Preoperative anteroposterior (A) and lateral (B) radiographs showing previous L3-L5 interbody fusion state, reduced disc height, presence of a radiolucent lesion with vacuum inside the disc space, and sclerotic changes in both end plates at L2-L3.

leg pain caused by the adjacent segment degeneration in L2-L3 after the patient's previous PLIF, analgesics were administered and a selective root block was performed. However, as her symptoms continued to worsen, revision surgery was performed in February 2020. Since a solid bony fusion had previously formed between L3 and L5, the oblique lumbar interbody fusion of L2-L3 was performed after removing the previous instruments (Figure 5A, B). She showed good clinical progress and was discharged on postoperative day 14. At 2 months post-discharge, she visited the outpatient clinic complaining of sudden low back pain. She had no history of trauma, but a compression fracture of L4 was observed on plain radiography (Figure 6-A, B). On the laboratory test, the leukocyte count was 5,850 and C-reactive protein (CRP) was 0.26, and there were no

other specific findings. After brace application and teriparatide injection, her back pain was relieved, and she was discharged with good clinical progress.

DISCUSSION

Although spinal fusion is a widely used treatment for various spinal diseases, there are a few reports of complications associated with the removal of fusion implants. For cases of posterolateral fusion, there are several reports of vertebral fractures occurring after screw removal^{8,9,15}. In these cases, it was reported that the bending moment exerted on the pedicle by the cantilever effect may lead to pedicle

Figure 2. Preoperative lumbar spine computed tomography sagittal image showing solid bony fusion between L3 and L5 without evidence of pedicle screw loosening.

Figure 3. Preoperative magnetic resonance image showing severe foraminal stenosis on the right side of L2-L3.

Figure 4. Preoperative bone densitometry taken from hip (A) and lumbar spine (B) showed a value of -1.5 indicating osteopenia.

Figure 5. Postoperative anteroposterior (A) and lateral (B) radiographs showing that solid bony fusion had formed between L3 and L5, the removal of previous instruments, and an oblique lumbar interbody fusion state at L2-L3.

Figure 6. Anteroposterior (A) and lateral (B) radiographs taken at 1 month after surgery showing a compression fracture of L4.

and vertebral body fracture^{4,7,9,10,14}. However, there have been few reports of compression fractures occurring within the fused vertebral body through interbody fusion¹¹. The vertebral body is thought to withstand the cantilever effect and axial force better in cases of interbody fusion than in cases of posterolateral fusion because it is the fused anterior column. However, as seen in our patient, fractures can also occur inside the fused vertebral mass, suggesting that remo-

val of fusion implants may negatively affect patients, even those with interbody fusion. To the best of our knowledge, this is the first case report to describe a vertebral compression fracture in the center of a fused segment through an interbody fusion operation. Mataki et al. suggested that removing pedicle screws while the posterior element is removed due to PLIF increases stress on the vertebral body¹¹. It is also possible that stress shielding-related osteopenia occurred in the patient^{6,12,13}.

This case has several implications for the treatment of patients with ASD. First, in most cases of ASD, such as in this patient, the bone mineral density of the fused vertebral body cannot be directly measured due to fusion from previous instrumentation, despite the possibility of stress shielding-related osteopenia. Vertebral body osteopenia may occur as a result of instrumented spinal fusion. In an experimental environment, osteopenia worsened in proportion to the time at which stress shielding occurred⁶. This suggests that local bone quality, especially in cases of a fused vertebral mass, cannot be guaranteed in patients undergoing long instrumentation times, even in those with healthy bone mineral density. Furthermore, even if computed tomography can indirectly check bone quality, accurate determination is difficult when screws are inserted into the vertebral body due to metallic artifacts. Kim et al. reported that evidence of decreased bone quality on plain lumbar radiographs includes an overall increase in radiolucency of the vertebral body, loss of trabecular bone, thinning of the cortex, and the presence of well-demarcated cortical rim⁹. However, given the fact that many factors can affect the image quality of plain radiographs, the question remains as to whether these findings can be used as a basis for prospective judgment.

CONCLUSION

Vertebral compression fractures in the center of a fused segment, especially in the middle of the fused body in cases of interbody fusion, after removing fusion implants are possible but occur rarely. In patients with osteopenia or long periods of instrumentation, removal of fusion instruments should be seriously considered, and sufficient explanation should be given to the patient.

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