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VERTEBRAL BODY FRACTURE IN THE MIDDLE OF FUSED SEGMENTS AFTER REMOVAL OF PEDICLE SCREWS WITHOUT A HISTORY OF INJURY: A REPORT OF TWO CASES

TRAVMA ÖYKÜSÜ OLMAKSIZIN PEDİKÜL VİDALARININ ÇIKARTILMASI SONRASINDA OLUŞAN FÜZYONE SEGMENTİN ORTASINDA YER ALAN VERTEBRAL CİSİM KIRIĞI: 2 OLGU SUNUMU

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SUMMARY:

While the risks of pedicle screw insertion in the management of a wide variety of spinal disorders are well established, there is a paucity of reports on complications associated with implant removal after short-segmented spinal fusion. We report two rare cases of acute osteoporotic vertebral body fractures that occurred within fused segments due to the pedicle screw removal in two female patients previously treated for the degenerative spinal disorders. One patient had experienced the critical motional pain at low back and motor weakness of left leg, and the other patient had experienced the severe low back pain after spinal fusion surgery at the adjacent segment due to osteoporotic vertebral body fracture within fused segments. Patients must be thoroughly informed of potential risks after the spinal implant removal, particularly in cases of osteoporosis. Vertebral body fracture in solid fused segments may occur as one of the complications of the previous implant removal. If the previous spinal implant removal would be needed, surgeons should be careful about this critical complication.

Key Words: Spinal fusion; implant removal; spinal fracture; complication

Level of evidence: Case report, Level IV

ÖZET:

Birçok omurga problemindeki pedikül vida uygulamalarının riskleri literatürde iyi tanımlanmış olmasına rağmen, kısa-segment spinal füzyonndan sonra implant çıkartılmasıyla ilgili komplikasyonlar hakkında kısıtlı sayıda yayın mevcuttur. Biz bu vaka bildiriminde daha önce dejeneratif spinal problemler nedeniyle ameliyat edilmiş iki kadın hastada, pedikül vida çıkartılmasına bağlı gelişen füze edilmiş segmentlerde oluşan akut iki adet osteoporotik vertebra kırığı vakası bildirmekteyiz. Bir hasta hareket ile ilişkili kritik düzeyde bel ağrısı ve sol bacakta motor güçsüzlük, diğer hasta ise spinal füzyon sonrası füze edilen bölümdeki osteoporotik vertebra kırığına bağlı, komşu segmetteki bel ağrısı ile başvurmuştur. Özellikle osteoporotik hastalar spinal implantların çıkartılması sonrası oluşabilecek potansiyel riskler konusunda ayrıntılı olarak bilgilendirilmelidirler. Solid füzyon segmenti içinde vertebra cisim kırığı implant çıkartılması sonrası komplikasyon olarak gelişebilir. Eğer spinal implant çıkartılması gerekiyorsa cerrahlar bu önemli komplikasyon konusunda dikkatli olmalıdırlar.

Anahtar Kelimeler: Spinal füzyon, implant çıkartılması, omurga kırığı, komplikasyon

Kanıt Düzeyi: Olgu sunumu, Düzey IV.

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INTRODUCTION:

Posterior spinal fusion is one of the most common types of spine surgeries and is a valuable tool in the management of a wide variety of spinal disorders in which there are short-term risks such as neural injury, wound problems, pseudoarthrosis and implant failure[9-10].

However, the long-term effects of spinal fusion still remain incompletely documented[9-10]. Among the various long-term risks of spinal fusion, the symptomatic adjacent segment disease (ASD) and progressive local osteoporosis in the spine have been a concern of spinal surgeons for a long time.

Many surgeons have a dilemma as to whether screws should be reinserted into the previous existing screw holes during treatment of the symptomatic ASD after short-segment spinal fusion. The effects of the previous spinal implant removal continue to be confused regarding the management of the symptomatic ASD after short-segmented spinal fusion. Accordingly, many clinical and biomechanical studies have been conducted on degeneration or fractures occurring at adjacent segments[1,3,5,11].

However, few reports are available regarding the complications occurring within fused segments after implant removal[4,5,13]. We report two rare cases of acute osteoporotic vertebral body fractures that occurred within fused segments due to pedicle screw removal in two female patients previously treated for the degenerative spinal disorders.

CASE REPORTS:

Case-1:

A 76-year-old woman visited our institute with low back pain and radiating pain in both legs, which were aggravated during walking. Her medical history revealed wide decompressive laminectomy and posterolateral fusion with pedicle screws from L3 to S1 at another institute in 2000. She was satisfied with the surgery and performed her own activity without restrictions. Eleven years later, she underwent a decompressive laminectomy with instrumented fusion of L2-L3 for spinal stenosis adjacent to the fused segments in our institute (Fig. 1. a-b).

Qauntitative computed tomography (QCT) showed osteoporosis of -5.7 SD on L1 and L2 vertebral bodies. At that time, plain radiography and computed tomography (CT) showed solid union at the previous fused segments from L3 to S1 with bilateral screws fracture at S1, and gross union was confirmed during the operation time. After removal of the previously inserted instruments, decompressive laminectomy, transforaminal lumbar interbody fusion and re-instrumentation from L2 to L3 were performed (Fig. 1. c), and after revision surgery, the radiating pain into both legs was resolved. We recommended an LSO custom brace for 3 months after surgery.

However, on the 7th postoperative day, the patient experienced acute low back pain and motor weakness at the left leg without history of trauma.

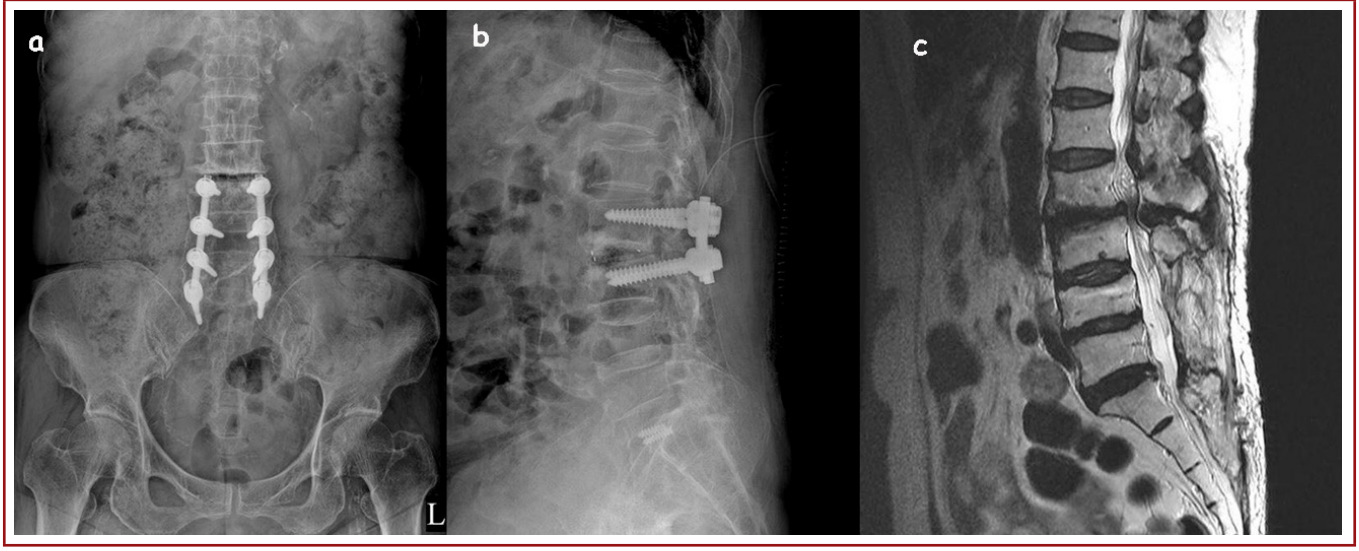

Figure-1. a) Preoperative radiograph of 76-year-old female showed a solid posterolateral fusion from L3 to S1. **b)** Preoperative magnetic resonance imaging (MRI) scan showed a severe spinal stenosis at L2. **c)** After spinal implant removal, decompressive laminectomy and reimplantation were performed from L2-L3.

Knee flexion and extension power of left leg revealed grade II by manual muscle power test.

And ankle dorsiflexion of left leg was grade II to III. A physical examination showed severe low back tenderness. Plain radiographs demonstrated compression fracture at L4 (Fig. 2. a).

A magnetic resolution imaging (MRI) scan performed to evaluate the fusion and the position of pedicle screws showed a bursting fracture at L4 with epidural hematoma and a compression fracture at L5 (Fig. 2. b, c). She underwent extended laminectomy at 62 L4, removal of epidural hematoma, and pedicle screw re-instrumentation from L2 to S1 (Fig. 2. d). After 3rd postoperative day of revision surgery, she experienced full-recovery of motor power and reduced low back pain.

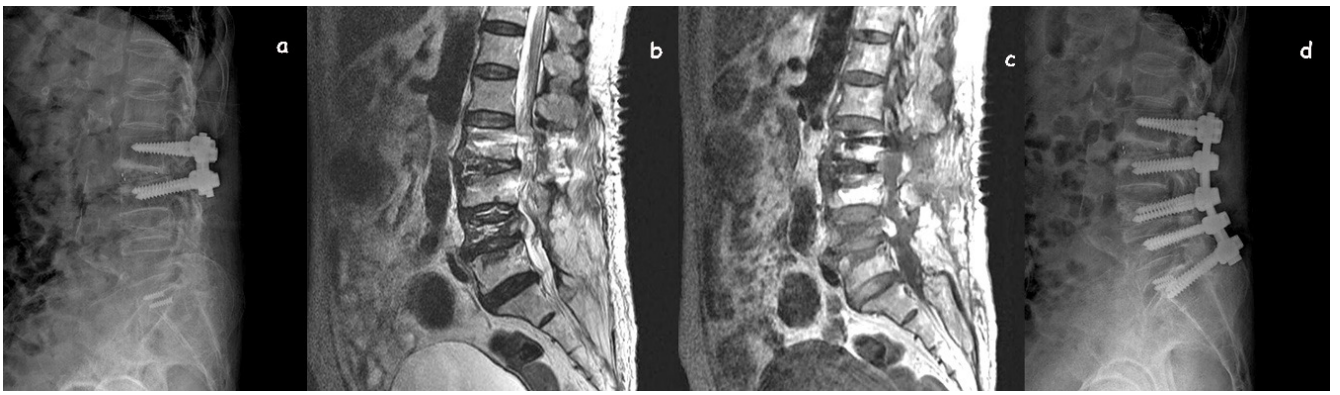

Figure-2. a) At 7 days after surgery, decreased vertebral body height in lateral plain X-ray was found at L4. **b-c)** At 7 days after surgery, MRI scans showed a bursting fracture at L4 with epidural hematoma and a compression fracture at L5. **d)** She underwent extended laminectomy at L4, removal of epidural hematoma, and re-instrumentation with pedicular screws from L2 to S1.

Case-2:

A 73-year-old woman with low back pain and radiating pain in right leg, which were aggravated by walking, visited in our institute. Her medical records revealed wide decompressive laminectomy and posterolateral fusion with pedicle screws from L3 to L5 at another institute in 2000. She was satisfied with the surgery and performed her own activity without restrictions.

Qauntitative computed tomography (QCT) showed osteoporosis of -5.2 SD on L1 and L2 vertebral body. With the impression of the adjacent segment degeneration, several studies, including CT and MRI, were performed. Degeneration and stenosis were found at L2-L3, the level adjacent to the fused segments (Fig. 3. a-b).

At that time, plain radiography and computed tomography (CT) showed solid union at the previous fused segments from L3 to L5, and gross union was confirmed during the operation time. We performed a revision decompressive laminectomy with instrumented fusion of L2-L3 for spinal stenosis adjacent to the fused segments after removal of the previously inserted instruments (Fig. 3. c).

After the revision surgery, the radiating pain into b 78 oth legs was resolved. We recommended an LSO custom brace for 3 months after surgery. However, she revisited our institute 5 months later with severe low back pain and radiating pain in both legs without no history of trauma. A physical examination showed severe low back tenderness. Plain radiographs demonstrated L4 compression fracture (Fig. 4. a).

A magnetic resolution imaging (MRI) scan performed to evaluate the fusion and the position of pedicle screws showed compression fractures at T12 and L4 vertebral bodies without another problems (Fig. 4. b-c).

She underwent percutaneous vertebroplasty with polymethyl metacrylate (PMMA) at T12 and L4 vertebral bodies (Fig. 4. d). After revision surgery, her low back pain and radiating pain on both legs were reduced.

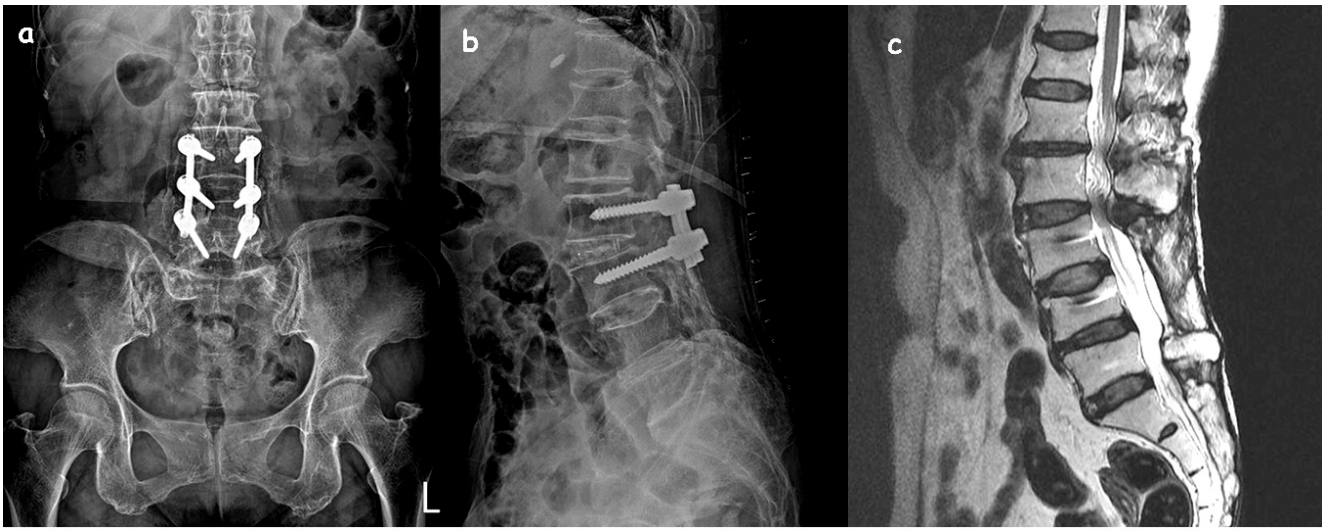

Figure-3. a) Preoperative radiograph of 73-year-old female showed a solid posterolateral fusion from L3 to L5. **b)** Preoperative MRI showed a severe spinal stenosis at L2-3. **c)** After spinal implant removal, decompressive laminectomy and reimplantation were performed from L2-3.

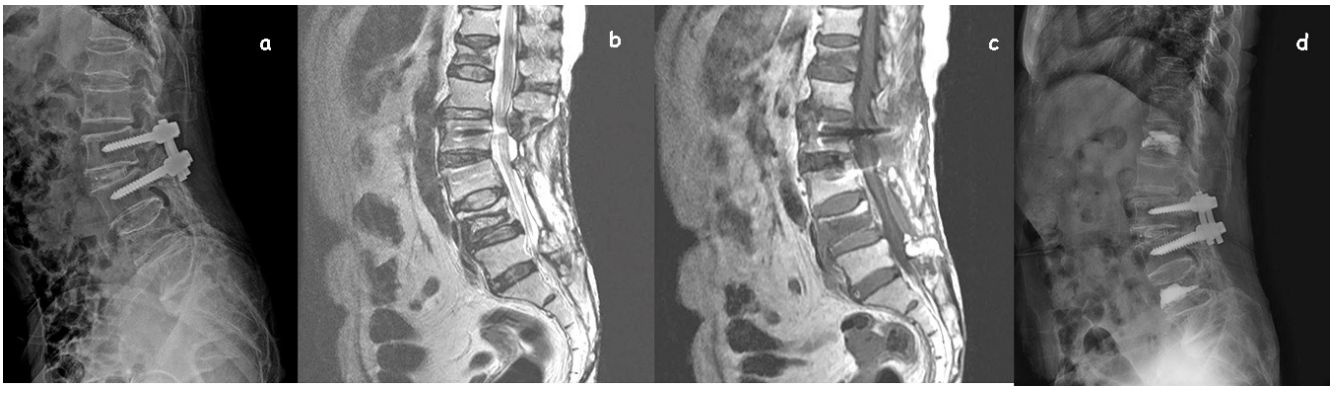

Figure-4. a) At 5 months after surgery, decreased vertebral body height in lateral plain X-ray was found at T12 and L4. **b-c)** At 5 months after surgery, MRI scans showed a compression fracture at T12 and L4. **d)** She underwent percutaneous vertebroplasty with polymethyl metacrylate (PMMA) at T12 and L4.

DISCUSSION:

Posterior spinal fusion is still one of the effective treatment options for various spinal problems. However, the decreased number of motion segments as a result of fusion would suggest some problems, such as adjacent segment diseases and stress fracture of the neural arch[4,7]. Spinal implant removal is sometimes inevitable for the management of adjacent segment degeneration or diseases. But, it is sometimes difficult to decide whether screws should be reinserted into the screw holes previously made by short-segment spinal fusion.

In our cases, removal of instrument was performed because it was thought that solid fusion was achieved at the previous fusion site. Consequently, vertebral body fractures in the middle of fused segment were occurred. Our cases have some interesting points. The fractures in our cases were occurred within the fused segment, not in adjacent fusion segments or unfused segments.

Although the causes of vertebral body fractures among fused segments have not been determined, solid fusion on lateral flexion and extension radiographs allows some sagittal motion of 3° to 5°[5-6]. Ha et al suggested in their case report that bilateral pedicle stress fractures could be caused by stress resulting from cantilever motion in the anterior disc portion after posterolateral lumbar fusion[4].

Previous studies have reported that vertebral body osteopenia may occur as a result of an instrumented spinal fusion[8-9,13]. The use of rigid posterior instrumentation, including pedicle screws, may shield the vertebral body from adequate compression force, preventing proper remodeling and causing decreased bone density[2,12]. After implant removal, a fracture of the posterolateral fusion mass or an undetected pseudoarthrosis may lead to occur vertebral body fracture in the fused segments.

Waelchi et al described that the upper most vertebral fractures in fused segments after implant removal might result from a subcortical substance defect of screw tracks with weakening of osteoporotic vertebral bodies[13].

Initially, this area is protected by the posterior instrumentation. Deckey et al described that the long posterior fusion may function as a large lever, leading to collapse at the junction between fused and unfused anterior segments after implant removal[2]. Our cases were similar to those reported cases, but the fracture in our cases were developed within middle of fused segments.

The most important concern is the stress-shielding effect of rigid implants. Anterior disc can move to an extent despite solid posterolateral fusion. In addition, the previously inserted holes left in the vertebral body after pedicle screw removal could have acted as stress raisers in the vertebral body, which could have been aggravated by anterior motion[5]. In addition, we may consider various treatment options in the patients who have vertebral body fracture at the middle of fused segments after removal of spinal implants. When the patients' symptoms are mild, we may provide the conservative care. However, if the patients have severe low back pain or neurologic deficits, we should consider the additional surgery such as percutaneous vertebroplasty using PMMA or extended spinal fusion.

Vertebral body fractures in the middle of fused segments after implant removal may be developed by persistent anterior disc motion after posterolateral lumbar fusion, osteopenia or osteoporosis, and a subcortical substance defect of the screw holes made by implant removal. Patients must be thoroughly informed of the rare but potential risks of implant removal, particularly if they have osteoporosis. If removal of the previously inserted implant is needed, surgeons should be aware of this significant complication.

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