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CASE REPORT

Surgical treatment of four segment lumbar spondylolysis: A case report

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Abstract

BACKGROUND

Four-level lumbar spondylolysis is extremely rare. So far, only 1 case has been reported in the literature.

CASE SUMMARY

A 19-year-old man presented with severe back pain irresponsive to conservative therapies for 2 years. Lumbar radiographs and two-dimensional computed tomography scan showed four segment lumbar spondylolysis on both sides of L2-L5. Lumbar magnetic resonance imaging showed normal signal in all lumbar discs. Because daily activities were severely limited, surgery was recommended for the case. The patient underwent four-level bilateral isthmic repair at L2-L5. During surgery, L2-L5 isthmi were curetted bilaterally, freshened, and then grafted with autologous iliac bone that was bridged and compressed with a pedicular screw connected to a sub-laminar hook by a short rod. The symptoms of back pain almost disappeared. He has been followed-up for 96 mo, and his symptoms have never recurred. Fusion was found in all repaired isthmi 14 mo after surgery according to evaluation of lumbar radiography and computed tomography scan.

CONCLUSION

We report here 1 case of four-level lumbar spondylolysis that was treated successfully with direct isthmic repair.

Key Words: Lumbar spondylolysis; Isthmic repair; Pedicle screw-hook system; Case report

Core Tip: Four-level lumbar spondylolysis is extremely rare. So far, only 1 case has

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reported in the literature. In the present study, we report 1 case of four-level lumbar spondylolysis that was treated successfully with direct isthmic repair.

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INTRODUCTION

Four-level lumbar spondylolysis is extremely rare[1-3]. So far, only 1 case has been reported in the literature[4]. We report here 1 case of four-level lumbar spondylolysis that was treated successfully with direct isthmic repair.

CASE PRESENTATION

Chief complaints

A 19-year-old man presented with low back pain without radicular pain in both lower extremities for 2 years.

History of present illness

His back pain worsened from stretching and standing for a long time. He had no history of trauma. He rated himself as 7 on a 10-point visual analogue scale. Conservative treatment, such as rest, lumbosacral brace immobilization, oral non-steroidal anti-inflammatory drugs, and physical therapy, did not relieve his back pain, which seriously affected his daily activities.

History of past illness

He had no relevant traumatic history.

Physical examination

Physical examination revealed a reduced range of motion in the lumbar spine, especially with limited lumbar extension. Tenderness was noted over and beside L2-L5 spinous processes. Bilateral straight leg raising test was negative. The sensory, motor, and tendon reflexes of both lower limbs were normal.

Imaging examinations

Lumbar dynamic radiographs showed no instability (Figure 1), two-dimensional computed tomography (CT) scan showed lumbar spondylolysis at bilateral L2-L5 levels (Figure 2), and lumbar magnetic resonance imaging showed no signs of lumbar disc degeneration (Figure 3). Because daily activities were severely limited, surgery was recommended for the case.

FINAL DIAGNOSIS

Four segment lumbar spondylolysis.

TREATMENT

This case underwent a surgery of direct isthmic repair in eight lytic defects at bilateral L2-L5 levels. Under general anesthesia, the conventional posterior midline approach was used to expose L2-L5 spinous processes, lamina, and facet joints. Firstly, under the guidance of fluoroscopy, a 6.0 mm × 45 mm pedicle screw was implanted into the vertebral body. Secondly, the involved lysis area was scraped and freshened, and

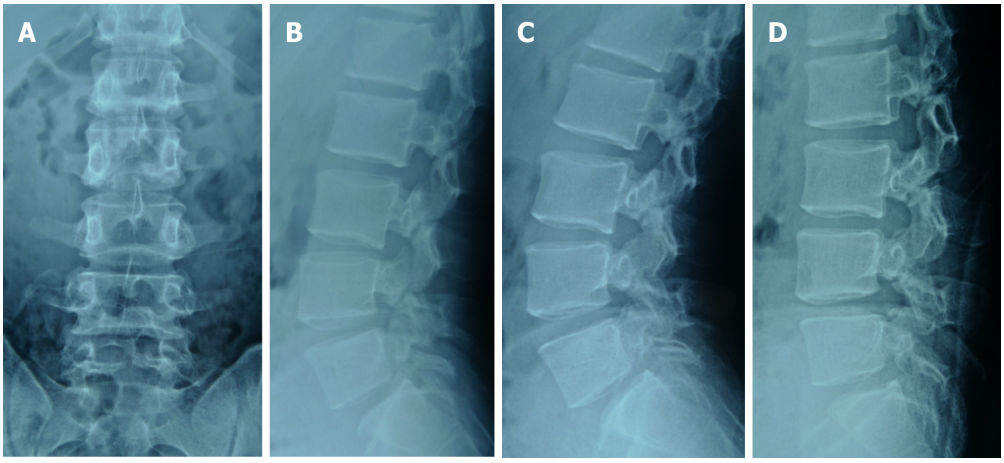

Figure 1 Lumbar radiographs. A: Anteroposterior radiograph; B: Lateral radiograph showed L2-L5 spondylolysis; C: Lateral radiograph of lumbar extension position; D: Lateral radiograph of lumbar flexion position. Note that lumbar dynamic radiographs showed no instability.

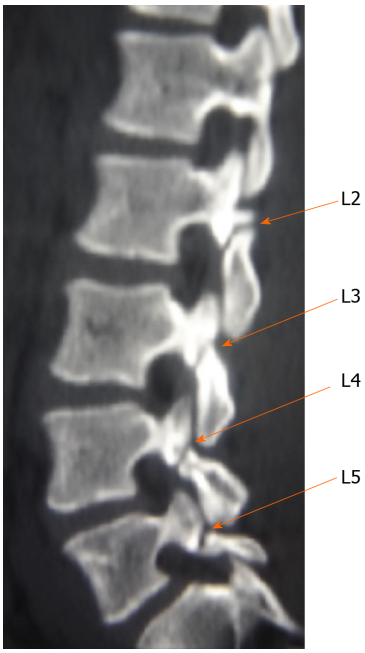

Figure 2 Two-dimensional computed tomography scan shows lumbar spondylolysis at bilateral L2-L5 levels.

autologous iliac bone grafting was performed. Finally, the sub-laminar hook was placed and connected through a short rod under compression with corresponding pedicle screw. Subsequently, the remaining repair of seven lyses was completed in the same manner. Total operation time was 3.5 h, and blood loss was 350 mL. The neurological function of the patient remained intact after operation. A lumbosacral-brace was used for 3 mo.

OUTCOME AND FOLLOW-UP

After the operation, the patient's back pain disappeared, and he returned to work 3 mo later. During the 8-year follow-up, he had no complaints of low back pain. The dynamic plain films showed that movement was retained (Figure 4). Bone healing was found in all eight lytic defects (Figure 5). After the donor site of iliac crest was filled with allogeneic bone, osteogenesis was formed (Figure 6).

Figure 3 Magnetic resonance imaging showed no signs of lumbar disc degeneration.

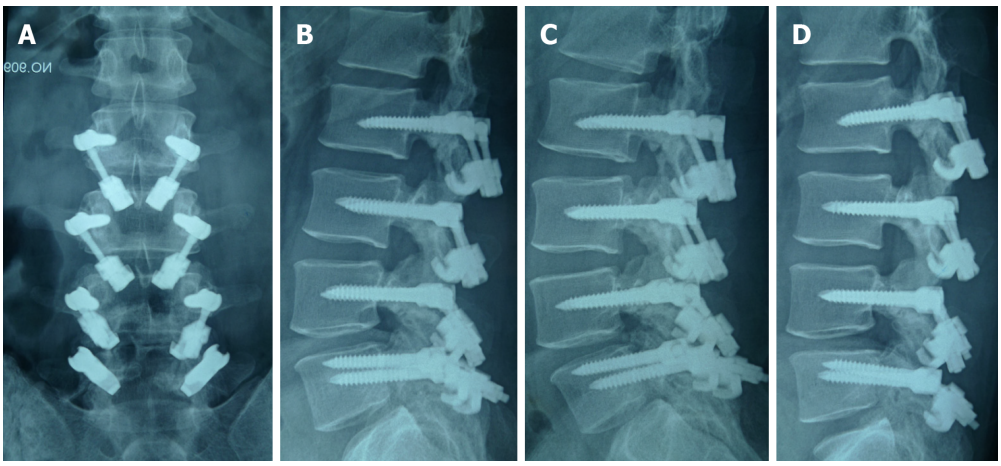

Figure 4 Lumbar dynamic radiographs after operation showed that lumbar movement was retained. A: Anteroposterior radiograph; B: Lateral radiograph; C: Lateral radiograph of lumbar extension position; D: Lateral radiograph of lumbar flexion position. Note that lumbar dynamic radiographs show that movement was retained.

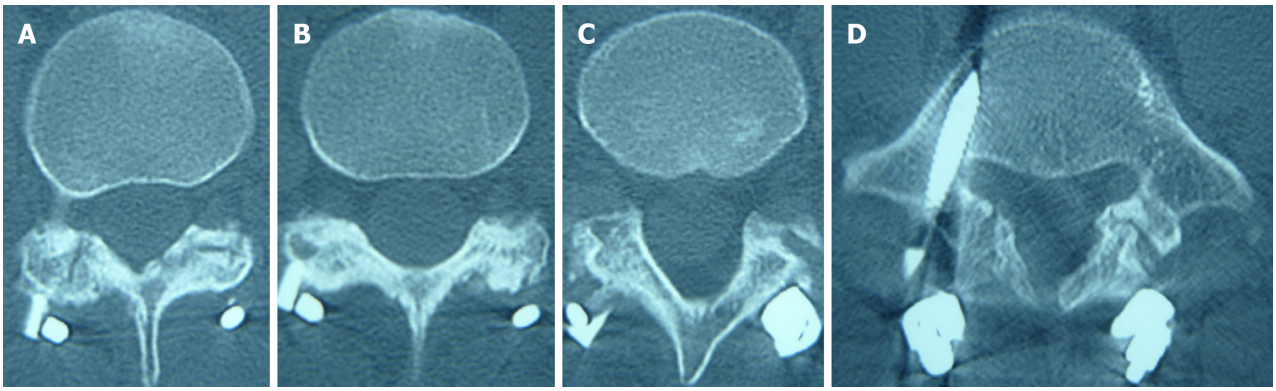

Figure 5 Computed tomography scan showed bone healing in all eight lytic defects at L2-L5. A: L2; B: L3; C: L4; D: L5.

DISCUSSION

Lumbar spondylolysis is a common cause of low back pain in adolescents. It occurs in about 6% of the population and is reported to be more common in men. It usually occurs in L5, accounting for more than 80% of patients with lumbar spondylolysis. Multi-segmental spondylolysis is rare[1]. According to Ravichandran[2], multilevel lumbar spondylolysis only accounts for 1.48% of patients with spondylolysis. The

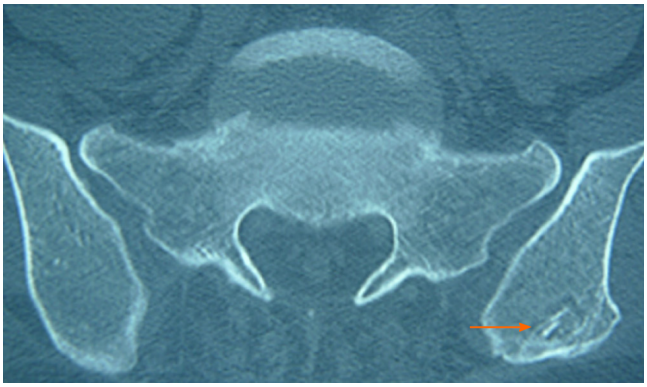

Figure 6 Donor site of iliac crest was filled with allogeneic bone, which resulted in osteogenesis (arrow).

incidence rate of three level lumbar spondylolysis is very low, less than 0.1% of lumbar spondylolysis[3]. To our knowledge, only 1 case of four segment lumbar spondylolysis has been reported in the literature[4]. The possible causes of lumbar spondylolysis include dysplasia, excessive exercise, fatigue fracture, *etc*. The cause of multilevel lumbar spondylolysis is not clear. Ogawa *et al*[5] considered that the causes of multi-segmental lumbar spondylolysis are the same as single segmental lumbar spondylolysis. Ravichandran[2] believed that fatigue fracture is the main cause of multi-segmental lumbar spondylolysis. According to Wiltse[6], genetic factors may also play a role.

Treatment for multi-segmental lumbar spondylolysis is still controversial[5,7]. If lumbar spondylolysis occurs in adolescents, conservative treatment is usually the first choice[8]. Clinical observation found that new onset spondylolysis may be cured by restricting lumbar spine movement with a brace[2,5,9,10]. A retrospective study showed that a union rate of conservative treatment in adolescents was 76%[11]. However, about 90% of end-stage L5 spondylolysis patients are first diagnosed in adulthood. In addition, about 40% of cases had no sports history or low back pain experience in their growth period[12]. If patients with lumbar spondylolysis have low back pain, conservative treatment is ineffective, or imaging shows spondylolisthesis, surgical treatment is required[5]. Studies have observed that lumbar spondylolysis is often accompanied by degeneration of adjacent upper and lower discs[13]. Lumbar spondylolysis increases disc stresses at the affected as well as adjacent levels, which may lead to disc degeneration. However, increase in stresses and angular displacement are higher at the adjacent caudal level than at the cranial level, which may explain why isthmic lysis often causes adjacent caudal disc degeneration. Buck's technique can restore the increased disc stress to normal level[14]. Therefore, this technique may be beneficial from a biomechanical point of view. It has been speculated that multi-segment lumbar spondylolysis is more vulnerable to disc degeneration. Some studies have reported that patients with multi-segmental lumbar spondylolysis have poor effect of conservative treatment and are prone to disc degeneration and pseudarthrosis[2,10,15]. Therefore, surgical treatment is recommended for patients with multi-segmental lumbar spondylolysis[16].

For the surgical treatment of lumbar spondylolysis, several techniques have been reported in the literature[2,5,17,18], and these can be divided into two categories: The first is lumbar fusion, including interbody fusion and postero-lateral arthrodesis; the second is direct isthmic repair, bone grafting, fusion, and fixation. Several surgical techniques using various internal fixation devices for direct repair of the pars defect were reported in the literature, including Buck's operation, Morscher's hook-screw system, Scotting's wiring technique, segmental pedicle screw-hook fixation, and Gillet's rod-screw construction[14,19,20].

How to choose the surgical method to treat lumbar spondylolysis is mainly based on whether there is the degeneration of the disc in the pathological segment[19]. If the lumbar disc in the pathological segment is normal, it usually indicates that the back pain is originated from the isthmus region, and the chosen surgical method should be direct isthmus repair. If the disc of the pathological segment is degenerative or protruded or has already had lumbar spondylolisthesis, the lumbar interbody fusion operation should be selected. According to the different conditions of the lumbar intervertebral discs, combination lumbar fusion and isthmus direct repair to treat multi-segmental lumbar spondylolysis should be performed[21]. Preoperative radiog-

raphy and two dimensional CT reconstruction of the lumbar spine confirmed that the patient had L2-L5 bilateral isthmic lyses, without lumbar spondylolisthesis. Lumbar magnetic resonance imaging showed that all lumbar intervertebral disc signals were normal, so this patient underwent four segments of isthmic direct repair and bone grafting and pedicle screw and laminar hook fixation. Autogenous iliac crest bone graft can improve the fusion rate of bone grafting. At the same time, allogeneic bone is filled in the iliac crest to avoid postoperative pain in the donor site[22]. Two points should be paid attention to during the operation: Exposure of entry point and placement of pedicle screw should avoid damage to corresponding facet joint capsule; when placing screw-laminar hook system, mutual interference between the upper level hook and the lower level screw head should be avoided. At the 96 mo follow-up, the visual analogue scale score of low back pain was 1. Dynamic radiographs showed that the lumbar motion was normal. CT scan of the lumbar spine showed that all eight isthmic bone graft areas were fused.

Our clinical results suggest that active surgical treatment should be considered in young patients with multilevel lumbar spondylolysis. According to the different conditions of the upper and lower discs of each damaged segment, the operation methods should be direct isthmic repair or combination direct isthmic repair and lumbar fusion. The incidence rate of multi-segmental lumbar spondylolysis is low in young people. More cases and longer follow-up time are needed to evaluate the curative effect.

CONCLUSION

We report here 1 case of four-level lumbar spondylolysis that was treated successfully with direct isthmic repair and pedicle screw-hook system fixation.

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