Nonconsecutive Pars Interarticularis Defects

Hossein Elgafy, MD, FRCSEd, FRCSC, Ryan C. Hart, MD, and Mina Tanios, MD

Abstract

Lumbar spondylolysis is a well-recognized condition occurring in adolescents because of repetitive overuse in sports. Nonconsecutive spondylolysis involving the lumbar spine is rare. In contrast to single-level pars defects that respond well to conservative treatment, there is no consensus about the management of multiple-level pars fractures; a few reports indicated that conservative management is successful, and the majority acknowledged that surgery is often required. The current study presents a rare case of pars fracture involving nonconsecutive segments and discusses the management options.

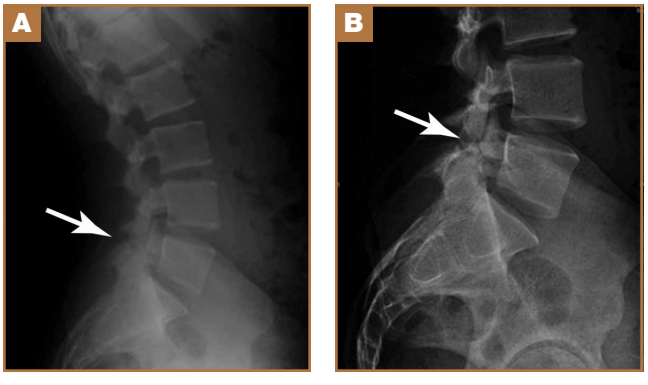
In this case report, we review the patient's history, clinical examination, radiologic findings, and management, as well as the relevant literature. An 18-year-old man presented to the clinic with worsening lower back pain related to nonconsecutive pars fractures at L2 and L5. After 6 months of conservative management, diagnostic computed tomography–guided pars block was used to localize the symptomatic level at L2, which was treated surgically; the L5 asymptomatic pars fracture did not require surgery. At the last follow-up 2 years after surgery, the patient was playing baseball and basketball, and denied any back pain.

This article reports a case of rare nonconsecutive pars fractures. Conservative management for at least 6 months is recommended. Successful management depends on the choice of appropriate treatment for each level. Single-photon emission computed tomography scan, and computed tomography–guided pars block are valuable preoperative tools to identify the symptomatic level in such a case.

Spondylolysis is a bone defect of the pars interarticularis. It is usually seen in adolescents who participate in sporting activities that involve repetitive axial loads to a hyperextended lower back, such as football offensive lineman, throwing athletes, and gymnasts. It occurs frequently in the L5 pars and can be unilateral or bilateral. The majority of reported multiple-level spondylolysis is at consecutive lumbar segments.[1-6] Rarely, it affects noncontiguous levels. Most patients respond well to conservative treatment in the form of activity modification and orthosis.[7] Surgical intervention is considered if 6 months of conservative management fails, spondylolisthesis develops, or intractable neurologic symptoms arise.

This case report presents an 18-year-old man with noncontiguous spondylolysis at L2 and L5 who was successfully treated with a 1-level pars repair at L2 after failed conservative management. This unique case highlights the importance of using single-photon emission computed tomography (SPECT) scan and diagnostic pars block when planning for surgical treatment in the rare cases of noncontiguous spondylolysis. The patient provided written informed consent for print and electronic publication of this case report.

Figure 1. Lateral radiographs of the (A) whole lumbar spine and (B) spot lateral of the lower lumbar spine show L5 pars defect (arrow). No pars defect seen at L2.



Case Report

An 18-year-old man presented to the clinic with worsening lower back pain for the previous 4 weeks. He was playing high school baseball and stated the pain was worse when he swung his bat. He had no history of trauma or back pain. Rest was the only alleviating factor, and he was beginning to experience pain when he stood after sitting. He denied any radicular pain. On examination, he had midline tenderness along the upper lumbar spine and pain with lumbar spine extension. His neurologic examination showed normal sensation with 5/5 strength in all key muscle groups. Plain radiograph of the lumbar spine showed an L5 pars defect (**Figures 1A, 1B**).

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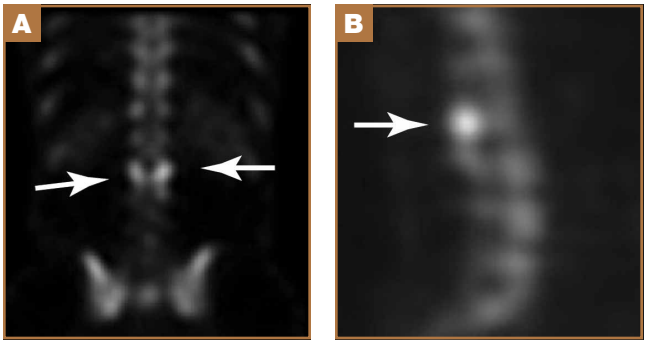

Figure 2. (A) Anteroposterior and (B) lateral single-photon emission computed tomography scans show increased uptake at L2 pars bilaterally (arrows).

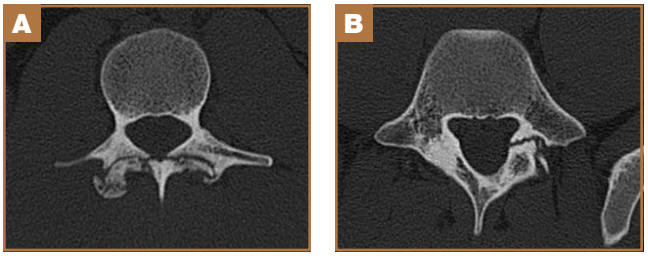

Figure 4. Axial computed tomography scans at (A) L2 and (B) L5 show marginal sclerosis at the L5 pars but not at the L2 pars, suggesting that the L2 fracture was acute while the L5 fracture was chronic.

A SPECT scan showed increased uptake at L2 pars bilaterally; the L5 pars did not show increased uptake (**Figures 2A, 2B**). A computed tomography (CT) scan confirmed bilateral L2 pars fractures and a left L5 pars fracture (**Figures 3A, 3B**). Bony changes in the form of marginal sclerosis at the L5, but not the L2, pars suggested that the L2 fracture was acute while the L5 fracture was chronic (**Figures 4A, 4B**).

The patient had conservative management for 6 months in the form of lumbosacral orthosis (LSO), cessation of sports activities, and physical therapy. The patient was initially treated with an LSO brace for 3 months, after which he had physical therapy. At 6 month follow-up, he reported continuing, significant back pain. A repeat CT scan of the lumbar spine showed no interval healing of the bilateral L2 or the unilateral L5 pars fractures. As a result of the patient's noncontiguous pars fractures, a diagnostic CT-guided block of L2 pars was performed to identify which level was his main pain generator (**Figure 5**). He reported a brief period of complete pain relief after the L2 pars block. With failure of 6 months' conservative management and positive SPECT scan and diagnostic block, surgical treatment was recommended. Prior to surgical intervention, magnetic resonance imaging was obtained to rule out pathology (eg, disc degeneration, infection, or tumor) other than the pars defect that could require fusion instead of pars repair (**Figures 6A, 6B**). Because of the patient's young age, bilateral L2 pars repair rather than fusion was indicated. After 8 months of

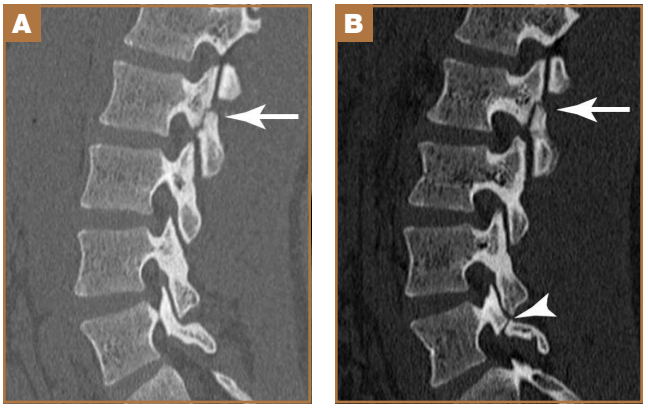

Figure 3. (A) Right and (B) left parasagittal computed tomography scans show bilateral L2 pars fracture (arrows) and left L5 pars fracture (arrowhead).

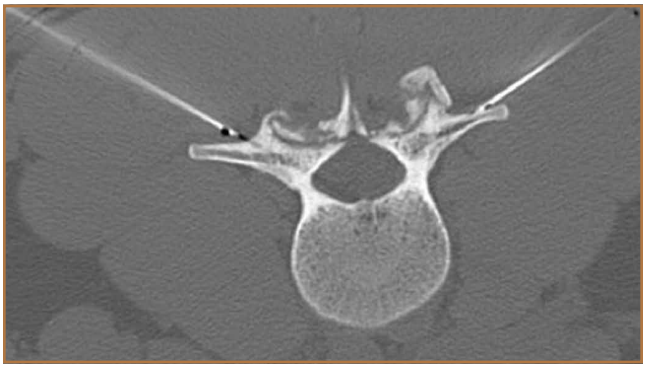

Figure 5. Computed tomography scan–guided injection of L2 pars on both sides.

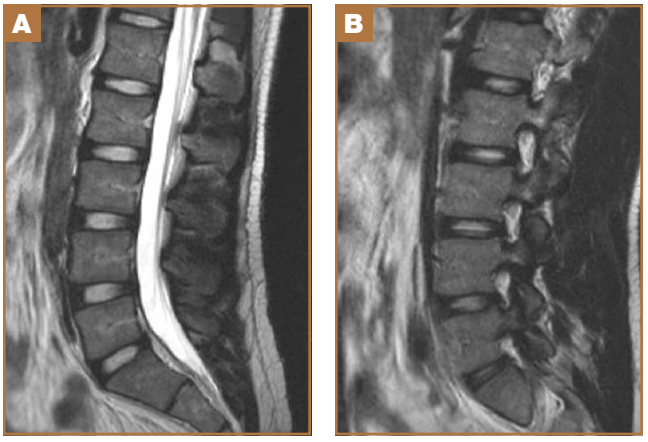

Figure 6. (A) Midsagittal and (B) parasagittal magnetic resonance T2-weighted images of the lumbar spine show normal disc with no spinal canal or foraminal stenosis.

persistent back pain, he underwent bilateral L2 pars repair with iliac crest autograft, pedicle screws, and sublaminar hook fixation (**Figures 7A, 7B**). The patient had an uneventful immedi-

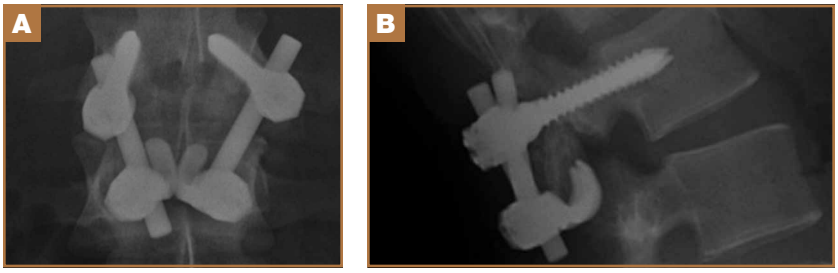

Figure 7. Postoperative (A) anteroposterior and (B) lateral radiographs after stabilization of L2 pars using iliac crest autograft, pedicle screw, and sublaminar hook construct.

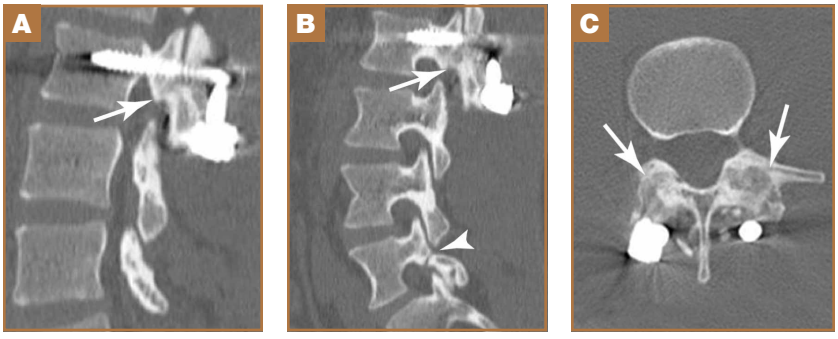

Figure 8. Six-month postoperative (A) right and (B) left parasagittal and (C) axial computed tomography scans show bridging callus at L2 pars on both sides (arrows), confirming successful repair. The left L5 pars fracture was still visible (arrowhead).

ate postoperative course. A 6-month postoperative CT scan showed bridging callus at the L2 pars; however, the left L5 pars fracture was still visible (**Figures 8A-8C**). Over a 6-month postoperative period, the patient had continued improvement in his back pain, advanced his activity as tolerated without problem, and was allowed to resume his sports activities. At 2-year follow-up, he was playing baseball and basketball, and denied any back pain.

Discussion

Lumbar spondylolysis is commonly seen at the fourth and fifth lumbar vertebrae, and accounts for more than 95% of spondylolysis cases.[8] Multiple-level spondylolysis is a relatively rare finding with an incidence varying between 1.2% and 5.6%. The majority of the reported multiple-level cases are adjacent.[1-3,6] Adolescents often present with a history of insidious-onset low back pain without radicular symptoms that is exacerbated by activity. Occasionally, an acute injury may elicit the onset of pain. A thorough history with emphasis on pain in relation to activity and sports involvement is beneficial. The patient in the current study was a throwing athlete and presented with 4 weeks of back pain that worsened with activity; he had no history of trauma.

Radiographic assessment using standing anteroposterior, lateral, and oblique radiographs of the thoracolumbar spine is useful in the initial assessment. A SPECT scan of the lumbosacral spine is highly sensitive for identifying spondylolytic defects when plain radiographs are within normal limits, yet a high index of suspicion remains given the patient's history and physical examination findings.[9,10] Increased radionuclide uptake within the pars indicates a stress reaction and, possibly, a more acute pathology. The plain radiographs of the patient showed only L5 spondylolysis. However, a SPECT scan showed only increased uptake in L2 pars on both sides. These findings suggested chronic L5 and acute L2 pars defects. A thin-cut CT scan gives the best visualization of pars defect and can help in differentiating chronic defect with sclerotic margins versus acute defect with hazy irregular margins. In the current case, the CT scan showed changes consistent with unilateral chronic L5 and bilateral acute L2 pars defects.

The origin of the pain in spondylolysis is from the tissues rich in nociceptive nerve endings in the loose posterior arch. A CT-guided pars block is a very useful diagnostic preoperative tool that confirms the symptomatic level in cases of multilevel pars defect, especially if they are noncontiguous. In this case, the diagnostic preoperative bilateral L2 pars block confirmed that the pain generator was the acute L2 rather than the chronic L5 pars defect. This step assured that surgical treatment involving only the L2 level would be beneficial in alleviating the patient's back pain after the failure of 6 months of conservative treatment.

Most patients with single-level spondylolysis respond to conservative treatment, especially after early diagnosis and treatment. The traditional nonoperative treatment of children and adolescents with a symptomatic spondylolytic lesion was a period of rest and progressive increased activity with physical therapy. Immobilization with an LSO was reserved for individuals who did not respond to rest and physical therapy.[11] However, multiple studies revealed early immobilization achieved results superior to activity restriction alone, and individuals who underwent a period of activity restriction prior to bracing were more likely to experience persistent symptoms.[12-14] Our patient underwent conservative treatment for 6 months, in the form of LSO, cessation of sport activities, and physical therapy, which failed to give him relief of his back pain.

Surgical intervention is warranted for adolescents with persistent, debilitating pain intractable to at least a 6-month period of nonoperative management. Additional indications for surgical management are those individuals who present with neurologic deficits and isthmic spondylolisthesis. Surgical treatment involves direct pars repair with iliac crest bone graft and use of a sublaminar hook/pedicle screw construct, cerclage wire, or pars screw.[15-18]

In contrast to single-level pars defects that respond well to conservative treatment, there are conflicting reports regarding the management of multiple-level pars fractures; a few reports suggest good outcome with conservative management, but the majority state that surgery is often required and conservative measures are rarely useful.[1-4,6] Nayeemuddin and colleagues[19] reported a case of a 16-year-old football player who presented with a 4-month history of constant low back pain related to bilateral L3 and L5 pars defects that responded to 1 year of conservative management, when the more acute fractures at L3 showed complete bony union and the patient had symptomatic pain relief and was able to return to full sporting activity.

Chang and colleagues[2] reported 10 patients with adjacent 2-level bilateral spondylolysis treated successfully using a pedicle screw–hook construct with autogenous bone grafting. Ogawa and colleagues[5] reported adjacent 2-level spondylolysis in 5 patients and 3-level spondylolysis in 2 patients, who were treated successfully by segmental wire fixation and bone grafting. Ivanic and colleagues[15] retrospectively reviewed 113 patients with spondylolysis who were treated with direct repair using a hook-screw construct and showed a pseudoarthrosis rate of 13.3%. Superior fusion rates were observed in patients 14 years and younger compared with older patients, particularly those 20 years and older.[15] Roca and colleagues[16] prospectively analyzed 19 consecutive cases of spondylolysis that were repaired using a hook-screw construct. Twelve of 13 patients (92%) who were 20 years or younger at the time of the study (average age, 17.2 years) had fusion, whereas, in 6 patients 21 years and older (average age, 27.5 years), no cases of fusion were observed. The patients 20 years or younger had significantly better clinical results than those obtained in the patients 21 years and older. The authors concluded that pedicle screw–hook fixation is a useful alternative in the treatment of spondylolysis in adolescents, but did not recommend this procedure in patients older than 20 years.[16]

Conclusion

The current case demonstrates a unique example of rare noncontiguous pars defects successfully treated with primary repair of 1 level when conservative management failed and the symptomatic defect was isolated. It also highlights the importance of investigating the entirety of the lumbar spine when diagnosis of L5 spondylolysis rules out noncontiguous pars defects. The treatment of noncontiguous pars defects is not well defined; this case showed the importance of using a SPECT scan and a diagnostic pars block to help isolate the symptomatic level when surgical management is considered after a failure of conservative treatment. This case shows 2 possible results: the chronic unilateral L5 defect responded to nonsurgical treatment with asymptomatic fibrous nonunion, while the more acute bilateral L2 defect responded to pars repair with pedicle screw–hook fixation and iliac crest bone graft.

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