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Case Report Open Access

Chronic Back Pain from Four-Level Lumbar Spondylolysis with Associated Spondylolisthesis: Case Report and Review of the Literature

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Abstract

Summary There is an abundance of published literature discussing the treatment of single-level lumbar spondylolysis and spondylolisthesis. However, the treatment of patients with chronic back pain and multiple levels of combined lumbar spondylolysis and spondylolisthesis are not well-described in the existing literature.

Introduction The purpose of this case report is to review the literature and describe the successful treatment of a patient who had chronic back pain and multiple levels of lumbar spondylolysis with associated spondylolisthesis.

Methods A 32 year old male soldier had 4 level lumbar spondylolysis and L4-5 spondylolisthesis. He had chronic back pain that was refractory to conservative measures over a period of 3 years. He was treated surgically with single level lumbar fusion at the level of L4-5 spondylolisthesis. The other levels of lumbar spondylolysis were not stabilized. The patient demonstrated an excellent functional outcome at 2 years postop and was able to return to unrestricted military duty. Radiographs at 2-year follow-up showed solid L4-5 fusion with no evidence of spondylolisthesis at any other lumbar level.

Conclusion Single-level lumbar fusion may be an appropriate treatment option for patients with chronic low back pain and multiple levels of spondylolysis. Functional outcome was excellent without evidence of instability at 2 year follow-up.

Significance This case report highlights the effectiveness of single-level lumbar fusion in patients who have multiple levels of preexisting spondylolysis. Further study is recommended.

Keywords: Spondylolysis; Lumbar; Multiple; Spondylolisthesis; Surgery

Introduction

Spondylolisthesis is the forward displacement of a proximal vertebra on its adjacent caudal neighbor. Spondylolysis refers to the defect in the pars interarticularis. The terms are derived from the Greek roots spondylos, which means vertebra, lysis meaning break, and listhesis meaning slippage. The typical pars defect found in spondylolysis has been estimated to be present in about six percent of the population [1].

The common feature of isthmic spondylolisthesis is the site of the lesion. This form is divided into three subtypes. Subtype A, caused by disruption of the pars as a result of the stress fracture, is the most common in people younger than 50 years. Subtype B is caused by elongation of the pars without disruption and is related to repeated microfractures of the pars that heal spontaneously but leave the pars elongated and make the vertebra prone to forward slippage. Subtype C is the result of acute, invariably severe fracture of the pars.

Single level pars defects occur with a prevalence of approximately 6% in the general population. The single level defects are most commonly found at the fifth vertebrae, whereas defects isolated at the fourth and higher vertebrae are rare. Spondylolysis of more than one lumbar vertebrae occurring in the same individual is uncommon, the exact incidence is uncertain but reported to be between 1.2 and 5.6%. Multiple spondylolyses may appear either in sequence or may be separated by more than one vertebrae.

Wiltse investigated the prevalence of spondylolysis and reported that it becomes more common at the age of seven years [2]. The incidence increases to age 22 and then remains constant.8 Slippage has been reported in approximately 50% of cases [2]. The vast majority of slips are low-grade [3]. Osterman reviewed 71 patients with spondylolisthesis and reported the following grade distribution: 79% grade I, 20% grade II, 1% grade III [4].

Accentuation of lumbar lordosis with activities is a predisposing cause of stress fractures in the pars that are responsible for the development of spondylolysis. Children and adolescents who engage in hyperextension-biased activities are known to have a higher incidence of spondylolysis [5]. Familial occurrence of spondylolisthesis has been described [6]. The frequency of the isthmic defect in the Caucasion population is approximately six percent [7]. It increases up to 35% in families where one member has been diagnosed with and isthmic defect [8,9]. Although spondylolisthesis is more common in males than females, progression is more likely in females than males. Certain populations demonstrate a higher incidence of spondylolysis. Forty percent of Alaskans may have the pars defect by adulthood [10]. In Eskimos, 13 percent of adolescents have

spondylolysis, and the percentage increases to 54 percent in adults [11].

Piwnica has demonstrated on plastic models under differering loads that the stress in the vertebral arch reaches its maximum at the isthmus. It has been suggested by several authors that spondylolisthesis is not present at birth and appears usually as the child begins to stand and walk. Lumbar hyperlordosis has been associated with increased incidence of isthmic lesions.

Bilateral pars interarticularis defects can usually be seen on both oblique radiographs of the lumbar spine and on the lateral radiograph. If it is unilateral, as it is in 25% of patients, it can be a subtle finding that is best viewed on oblique radiographs. The diagnosis of spondylolysis may be missed in 20% of symptomatic young patients if obique x-rays are not obtained [12]. While there is a plethora of published literature on single level spondylolyses there are only a few documented cases of multiple spondylolyses that have been treated surgically. Additionally, the surgical treatment of multiple levels of spondylolysis with spondylisthesis has not been described. The purpose of this report is to describe the management of an active patient with multiple lumbar spondylolysis. To our knowledge this is the first reported case of a patient with back pain and four contiguous lumbar levels of spondylolyses in addition to a single level with Myerding Grade II spondylolisthesis.

Case Report

A 32 year-old active duty soldier developed low back pain during routine training exercises. Initial radiographs of the lumbar spine showed multiple contiguous pars defects extending from the second to fifth lumbar vertebra with a Meyerding Grade I isthmic spondylilisthesis at L4-5 (Figure 1 a,b) Flexion and extension radiographs demonstrated instability with increased disk angulation at L4-5 (Figure 2 a,b).

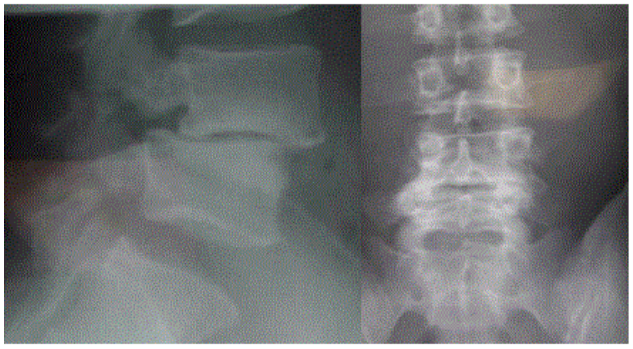

Figure 1: a. Lateral radiograph showing Myerding Grade 2 isthmic spondylolisthesis at L4-5, b. AP radiograph showing disc narrowing and collapse at L4-5.

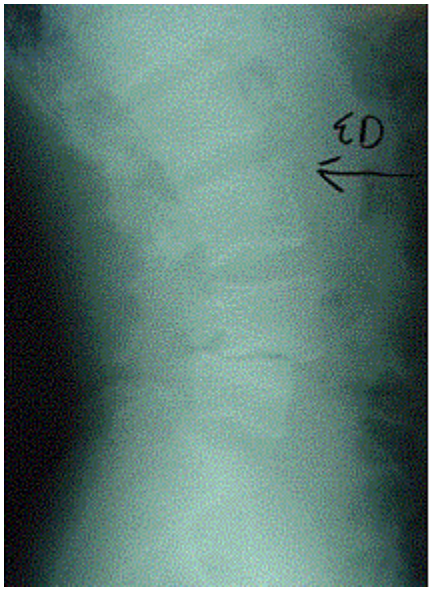

Figure 2: Extension (a) and Flexion (b) radiographs showing increased angulation and instability at L4-5.

The patient has oblique radiographs that demonstrated 4-level bilateral pars defect sponylolysis (Figure 3 a,b). His MRI showed single level advanced degenerative disc condition with collapse at L4-5 (Figure 4). The remaining lumbar discs appeared normal on the MRI imaging study. The soldier was initially treated with nonoperative modalities including nonnarcotic analgesics, temporary bracing, and general conditioning exercise programs. He remained active with physical training and he required several temporary duty restriction profiles during the next five years. Several years later, his symptoms became disabling and he was referred to a military spinal surgery clinic for evaluation. He had chronic back pain with associated L4 pain and sensory symptoms in both legs. His pain was exacerbated by lumbar spinal flexion maneuvers. Repeat radiographs and an MRI study revealed in addition to the pars defects he had a grade I spondylolisthesis at L4-L5 with posterior disc protrusion and moderate stenosis. A techniciam bone scan showed increased activity consistent with degenerative changes in the region of the L4-5 disc space and no increased uptake in any of the 4 paired posteriorlumbar pars defects. Additionally, the patient underwent pars injections at each lumbar level and did not have any clinical lessening of his degree of back pain.

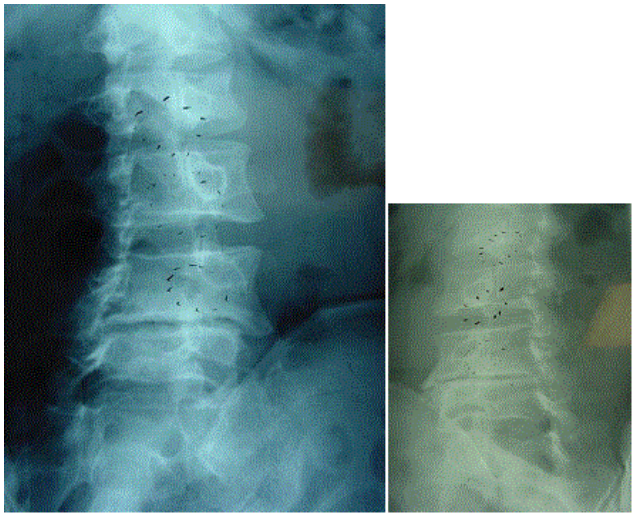

Figure 3: Right Oblique (a) and left oblique (b) radiograph showing 4 separate levels of bilateral pars defect spondylolysis.

The patient was treated with elective L4-5 decompression and instrumented posterior lumbar interbody fusion using titanium mesh cages and autologous iliac crest bone graft (Figure 5).

Figure 4: MRI showing single-level advanced lumbar degenerative disc condition at L4-5.

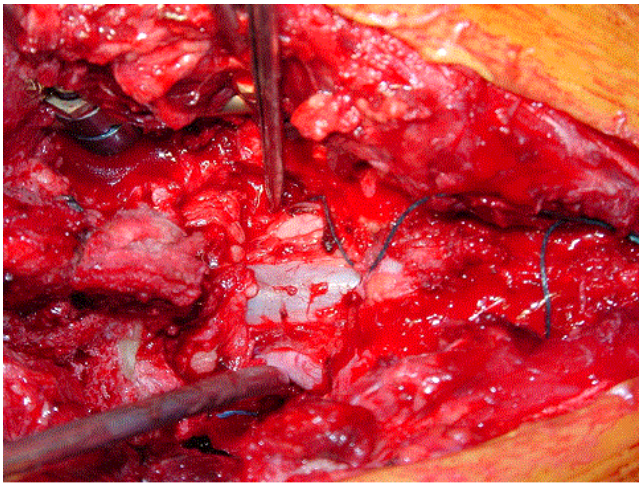

Figure 5: Intraop image showing Gill Laminectomy decompression with wide decompression of thecal sac and bilateral L5 nerve roots.

A concommittent posterolateral fusion was performed. No attempt was made to address his other contiguous lumbar pars defects intraoperatively. Postoperatively, the soldier was not braced and he received physical therapy consisiting of lumbar isometric exercises and range of motion therapy for 8 weeks. At 12 weeks postoperatively, he returned to full-duty and was able to successfully complete the army physical fitness test with a maximum score of 300 points. At two years postop, he completed a functional outcomes questionnaire consisting of combined questions from the AAOS modems and SRS outcomes instruments which indicated a high level of function with a very low level of residual back pain (1/10 analog pain score). He remained on active duty as a soldier without physical restriction or limitation of function at 2 year follow-up. His 2-year follow-up radiographs showed solid union with no evidence of increased slippage (Figure 6 a,b).

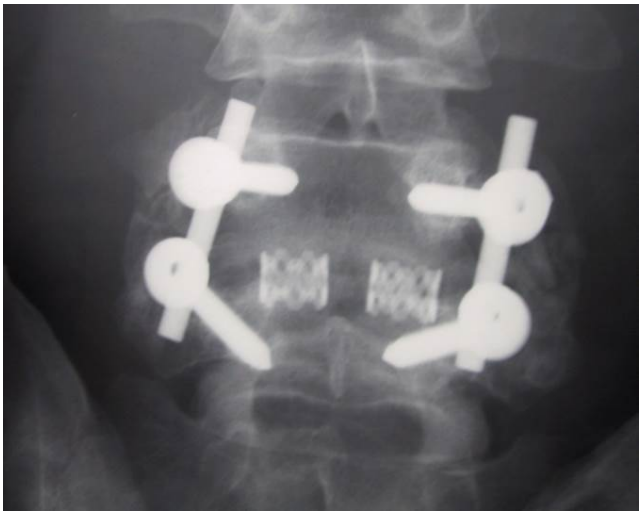

Figure 6: 2 year follow-up lateral (a) and AP (b) radiographs showing solid fusion without progression of slippage at any level.

Discussion

There are a myriad of treatment options for patients with spondylolysis and spondylolisthesis. The treatment options are as follows: no treatment, observation, activity restriction, exercises, antilordotic bracing, casting, pars repair, fusion with and without decompression, and complete and partial reduction of the slippage with fusion. Patient symptoms, age, physical findings, slip grade and slip angle are important factors to consider when deciding on treatment options. The vast majority of patients with low-grade spondylolisthesis can be treated without surgery.

In patients who have repetitive trauma such as gymnasts and football players, restriction of the aggravating activity or bed rest often relieves the symptoms related to spondylolysis or spondylolithesis. Bracing to reduce lumbar lordosis renders good to excellent results in up to 80% of patients with grade I or less spondylolisthesis. Brace wear is recommended for three to six months full time, with gradual weaning as symptoms permit. Occassionally, brace wear permits healing of the stress fracture in younger patients, particularly with more acute clinical presentations. Physical therapy should emphasize stretching of the lumbodorsal fascia and abdominal strengthening.

Conservative management of spondylolisthesis includes antilordotic bracing and physiotherapy. Good results have been reported with the use of a brace, exercise programs, and mixed conservative treatments. For the most part, these studies have been retrospective reviews with mixed materials. Blanda et al. [13] described nonoperative treatment protocol for athletes with spondylolysis or isthmic spondylolisthesis. All of the athletes in this study reported experiencing pain with activities involving repetitive hyperextension and extension rotation of the lumbar spine. The non-operative treatment protocol included restriction of activity, lumbar bracing, and physical therapy, and the patients were followed for an average of 4.2 years. Twenty patients in this study had isthmic spondylolisthesis: 12 were Grade I, six were Grade II, and two were Grade III. Twelve (60%) of the athletes with isthmic spondylolisthesis required surgery and 8 (40%) had successful nonoperative treatment. Of the 62 athletes with spondylolysis, the majority had excellent results with nonoperative therapy, and only 9 (14.5%) required posterolateral fusion.

Patients with complete pars defects have a higher incidence of spondylolisthesis and degenerative disc disease at the involved motion segment. Most commonly this occurs at the L5-S1 intervertbral disc with L5 pars defects. Some authors have reported that intervertebral disc damage may occur at the upper adjacent segment to the pars defects and give rise to symptoms. Biomechanical studies have shown that bilateral pars defects increased intervertebral mobility, not only at the involved level but also at the upper adjacent level to the lysis. Biochemical and biomechanical changes that occur as a disc degenerates can lead to instability and progression because the intervertebral disc is the main structure that opposes the anteriorly directed shear forces.

Operative treatment of symptomatic spondylolysis is rare. A variety of surgeries have been described. In general, reported operative success rates are high. However, in none of the studies reported to date is the combination of multilevel lyses with a concomitant lysthesis detailed. In this case we demonstrate the feasibility of fusing a symptomatic segment within a multisegmental defect. Our results were satisfying. And despite the theoretical biochemical and biomechanical disadvantages, our fusion has continued to provide relief to someone who had run out of options. We have demonstrated that within a multilevel defect, satisfactory surgical results can be obtained.

Moller and Hedlund [14] performed a prospective randomized study to determine whether posterolateral fusion in patients with adult isthmic spondylolisthesis results in an improved outcome compared with an exercise program. The study included 111 adult patients who had lumbar isthmic spondylolisthesis of any grade and at least one year of back pain and severely restricted functional ability. Thirty-four patients were randomly allocated to an exercise program and 77 patients were randomly selected to have posterolateral fusion with or without transpedicular fixation. Ninety-three percent of the patients were available for both one and two-year follow-up. The functional outcome, as assessed by the Disability Rating Index and the amount of pain reduction, was better in the surgically treated group than in the exercise group at both the one and two-year follow-up assessments. In the exercise group, the disability rating index did not change at all, and the pain scores decreased slightly. The authors concluded that the surgical management of isthmic spondylolisthesis improves function and relieves pain more efficiently than an exercise program.

Molinari and Gerlinger [15] reported the functional outcomes of 29 U.S. Army soldiers with single level disc degeneration and chronic low back pain who were treated with physical therapy or instrumented posterior lumbar fusion. A small subset of nine soldiers in this study were identified as having isthmic spondylolisthesis. Four of the soldiers had physical therapy and and five were treated surgically. Eight of the nine soldiers successfully returned to military duty after treatment. One of the four soldiers who was treated with physical therapy continued to experience chronic back pain and required disability discharge from the military. No conclusions were made from this small subset of patients.

Vidhadhara recently described the treatment of a 48 year old female who had 4 levels of lumbar spondylolysis [16]. The patient was treated with multiple level lumbar surgery. Two levels were treated with intervertebral fusions, 1 level with pars repair, and conservative treatment of the last level. Multiple level surgery yielded a good clinicoradiological outcome in this patient. The author concluded that the success of management of multiple lyses depends on the choice of appropriate treatment for each level separately. Pars block is a good invasive investigation to detect the symptomatic levels in a complex situation. The difference between the management of this patient and the patient reported in our manuscript is the fact that our patient had a more limited surgery with only had a single-level lumbar fusion with a good clinical outcome. Pars injections in our patient did not produce pain relief preoperatively, and therefore, multiple level fusion or pars repair was not clinically indicated.

Liu et al. recently described the treatment of double-level lumbar spondylolysis. Most multiplelevel lumbar spondylolysis occurred at 2 or 3 spinal levels and was associated with sports, trauma, or heavy labor. Multiplelevel lumbar spondylolysis occurred mostly at L3-5; associated spondylolisthesis usually occurred at L-4 and L-5, mostly at L-4. The treatment principle was the same as that for single-level spondylolisthesis. The authors reported good relief of pain in 13 patients with no evidence of significant complications. However, none of the patients in their series had more than 3 levels of spondylolysis [17].

This manuscript describes the successful treatment of a patient who had multiple levels of spondlylolysis with single-level spondylolistheses. The patient had single level fusion surgery and

returned to a high degree of function with significant improvement in his chronic back pain symptoms. Successful treatment of back pain in patients with multiple levels of lumbar pars defects may be achieved with single-level fusion procedures as demonstrated in this case report with 2- year follow-up. We have reported the successful surgical management of a patient with chronic back pain and spondylolisthesis with associated multiple levels of isthmic defects with single level fusion surgery.

Conclusion

We report the successful operative management of a soldier who had four-level lumbar spondylolysis with associated spondylolisthesis at L4-5 and chronic back pain. The patient was treated with single-level L4-5 fusion and was able to return to full duty in the armed forces. Single-level fusion surgery maybe an appropriate treatement strategy in patients with chronic back pain and single-level lumbar instability and multiple levels of spondylolysis. Further study is encouraged.

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