Results of Conservative Treatment versus Surgical Repair in Treatment of Spondylolysis in Adolescents and Young Adults

A Systematic Review of Literature

Submitted for Fulfillment of Master Degree in Orthopedic Surgery

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2017

سورة البقرة الآية: ٣٢

Acknowledgment

First and foremost, I feel always indebted to ALLAH, *the Most Kind and Most Merciful.*

I'd like to express my respectful thanks and profound gratitude to **Dr. Ahmed Mohamed El-Badrawi,** *Assistant Professor of Orthopedic Surgery - Faculty of Medicine- Ain Shams University for his keen guidance, kind supervision, valuable advice and continuous encouragement, which made possible the completion of this work.*

I am also delighted to express my deepest gratitude and thanks to **Dr. Ahmad Mohamad Morsi,** *Assistant Professor of Orthopedic Surgery, Faculty of Medicine, Ain Shams University, for his kind care, continuous supervision, valuable instructions, constant help and great assistance throughout this work.*

I would like to express my hearty thanks to all my family for their support till this work was completed.

Mohamed Labib Amin Abdel Fattah Saloum

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List of Abbreviations

Abb.	Full term

CT ..... Computed tomography

DR..... Direct repair

N/A..... Not available

NR..... Not recorded

ODI ..... Oswestry Disability Index

RTP..... Return to play

SF-36 ..... Short Form 36

Abstract

Background: Spondylolysis is a common cause of low back pain in athletes. The advancement of spine imaging has shown that unilateral spondylolysis is highly prevalent. It is unclear whether athletes with unilateral spondylolysis who undergo surgical repair are able to return to sports as effectively or faster than if they were treated conservatively.

Objectives: To determine whether it is effective to do surgical fixation after a period of conservative management, compared to the effectiveness of conservative treatment alone for unilateral spondylolysis in athletes

Design: This is a comprehensive literature review. A thorough PubMed search in the papers till 2016 with the keywords: Spondylolysis, Conservative Management, Pars interarticularis repair, Pars interarticularis defect, Pars interarticularis fracture

Results: A total of 254 articles were initially enrolled from the search, and 28 case series and reviews were finally included because they referred to incidence, diagnosis, treatment and return to play and overall function in fine athletes with symptomatic spondylolysis. There were 14 studies reporting surgical treatment (194 patients of average age 19 years) and 14 studies with conservative treatment (589 patients of average age 15.7). The percentage of athletes who were successfully treated with conservative or operative treatment was 85 and 87.8 %, respectively.

Conclusion: The limited evidence on the effectiveness of surgical treatment versus conservative treatment for unilateral spondylolysis in athletes does not allow any conclusions to be drawn about the relative effectiveness of surgery versus conservative treatment for facilitating rapid return to sport or a high level of post injury sporting level/performance. It does suggest, however, that for adult athletes for whom conservative treatment has not been successful, surgery is likely to enable return to sport, reduce pain and promote overall function.

Keywords: Spondylolysis, Conservative Management, Pars interarticularis repair, Pars interarticularis defect, Pars interarticularis fracture, Lytic Spondylolythesis, athletes, Return to play.

INTRODUCTION

Spondylolysis is a unilateral or bilateral defect in the pars interarticularis, which results from acute trauma or repetitive microtrauma. It is a common cause of lower back pain in young adults and adolescents, especially in those participating in sporting activities. It was found that 47% of patients below the age of 18 presenting to a sports medicine clinic with back pain had spondylolysis compared to 5% of adults above the age of 21 presenting with similar lower back pain symptoms.[1] Most commonly, Spondylolysis happens at the pars interarticularis of L5, representing 85% to 95% of cases; L4 represents 5% to 15% of cases. It is estimated that the prevalence of spondylolysis in the general population is between 3% and 6%[2-3].

The typical presentation is lower back pain or pain radiating to the butt and/or posterior thigh. Physical examination demonstrates pain that is increased by extension of the lumbar spine and hamstring tightness and patients often describe it as diffuse and dull. [5] Diagnosis of spondylolysis begins with a series of plain anteroposterior, lateral, and oblique lumbar radiographs. When plain radiographs are normal and the patient history and physical examination are suggestive of the diagnosis, single photon emission computed

tomography (CT) may be the most effective method of detecting spondylolysis.[6,7] Additional imaging modalities may include a bone scan, CT scan, or magnetic resonance imaging.

Concerning treatment options, low back pain associated with Spondylolysis could be treated conservatively or through various surgical modalities. Initial management of Spondylolysis is conservative, Most of skeletally immature athletes suffering from spondylolysis may respond to conservative management with activity restriction for pain control followed by 3–6 months of thoracolumbar bracing followed by a physical therapy program. Despite changes in their daily activities and cessation from all strenuous sports, some individuals will continue to have severe symptoms, requiring surgical intervention. It is less likely for Patients who are skeletally mature to achieve bony union with bracing and activity modification and they are more likely to require surgical intervention. [4-5]

On the other hand, surgical management is indicated in cases in which low back pain has not resolved after at least 6 months of conservative management. Other indications of surgical treatment are worsening neurological symptoms, increasing pain or progressive lythesis or multi-level lesions. Several surgical repair procedures are used for repair of the

defect, including interfragmentary or pedicular screws, pedicle screw-rod constructs, and pedicle screw-rod-hook constructs. Fusion surgeries are also described for helping in relieving pain. However, Fusion surgery prevents the affected segment from performing its natural motion that aggravates degeneration of the adjacent segment and causes clinical manifestations whereas DR surgery preserves the motion in affected segment and avoids problems in adjacent segment. In addition, clinical studies have demonstrated that DR for lumbar spondylolysis can produce great outcomes regarding pain relief, functional improvement, and radiological outcomes such as fusion rate. [7-13]

Common types of surgical intervention:

Basic Surgical Technique. lumbar spine midline approach is performed with care taken preserving the multifidi attachment to the lateral capsules of the L4–5 and L5–S1 facet joints (unless pedicular screws are to be used) and to keep the supraspinous and interspinous ligaments intact. The defect is exposed and fibrous tissue is removed. It is not necessary to directly expose the pars defect if the lytic defect is in the coronal plane. Internal fixation is applied next. Through a 3-cm window over the posterior inferior iliac spine, a small amount of cancellous bone can be harvested from the iliac crest. Some

have reported harvesting cancellous bone from the ala of the sacrum, whereas others use cancellous allograft or off-label rhBMP-2. The graft is placed as an onlay at the pars defect with care taken not to place the graft ventral to the defect, a location which could compromise the exiting nerve root. Resection of the caudal 3–5 mm of the inferior facet joints of the cephalad vertebra is recommended no matter what internal fixation is selected. Theoretically, this resection reduces the possibility of the inferior facets impinging into the pars region when the patient stands or loads the spine, particularly during hyperextension.[35,45]

Single Lag Screw Fixation (Buck, 1970). After exposing the pars defect and lamina bilaterally, a bur is used to square off the inferior edge of the lamina. A drill is introduced at this edge and is directed upward, forward, and slightly outward to pass through the pars and across the pars defect. Direct visualization should confirm the passing of the drill through the pars defect, and the drill trajectory should remain wholly within bone. A screw of appropriate length is placed through this path, and again the screw must be seen to pass through the pars defect. The screws are partially withdrawn, and an autologous bone graft from the iliac crest is placed in the pars defect. The screws are readvanced forward through the pars defect, securing the bone grafts in place and stabilizing the

construct (Fig. 1). A less invasive modification of the Buck method involves stereotactic navigation using the O-arm. After exposing the spinous process, a trajectory across the pars defect is determined via navigation. A Kirschner wire is passed through this trajectory, and a cannulated screw is placed over the wire across the defect.[9,46]

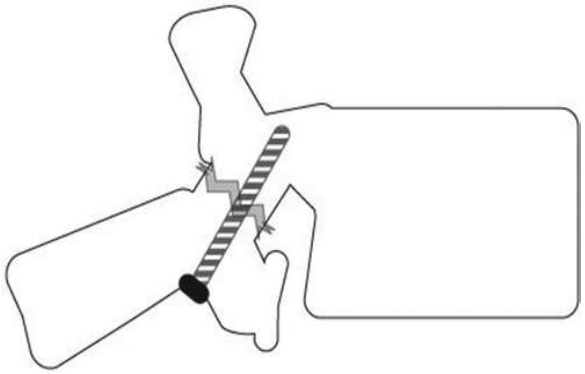

Fig. (1): Drawing showing single lag screw fixation as described by Buck, 1970

Hook Screw Fixation (Morscher, 1984). Autologous cancellous bone grafts from the iliac crest are first placed into the pars defects. Then, 2.5-mm holes are drilled at the bases of the superior articular processes bilaterally. Special screws whose tips consist of a cancellous thread and whose bases consist of a machine thread are used. The screw head is designed to allow attachment to a hook that hooks over the lamina. The screws are inclined so that they form a 40° angle with the superior vertebral endplate. The screws are also placed approximately 20° divergent from each other. The hooks are

attached to the screw heads and fastened via a lock nut. The distal end of the hook is hooked underneath the lamina. The lock nut is tightened to achieve appropriate compression over the defect (Fig. 2). [47]

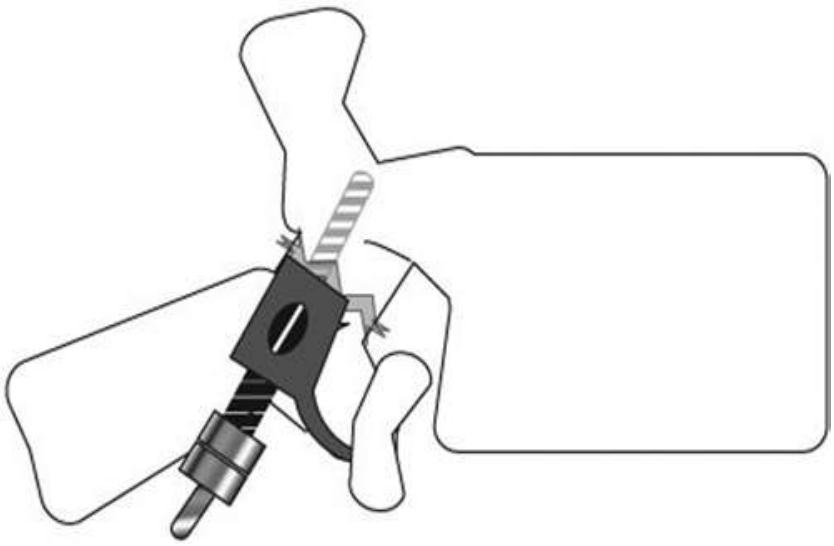

Fig. (2): Drawing showing hook screw fixation as described by ***Morscher et al. (1984)***.

Cerclage Wire Fixation (Scott, 1987). The pars defects, laminae, and transverse processes are exposed. The soft tissues on the anterior edge of the transverse processes are freed from the transverse processes. The sclerotic margins of the pars defects are drilled down to expose healthy bone, and the transverse process, superior facet, and lamina are decorticated. A 2-mm hole is drilled in the base of each transverse process, and a 4-mm hole is drilled in the base of the spinous process. A wire is passed through the hole in the transverse process and

draped superiorly over the top of the transverse process. The other end of the wire is passed through the hole of the spinous process and draped inferiorly around the bottom of the spinous process. The same procedure is performed on the contralateral side. Autologous cancellous bone from the iliac crest is used to fill the pars defect, and strips of corticocancellous bone from the iliac crest are laid over the pars defect beneath the wires, extending from the base of the transverse process to the lamina. The wires are tightened, providing compression and stabilization across the pars defects [9] (Fig. 3).

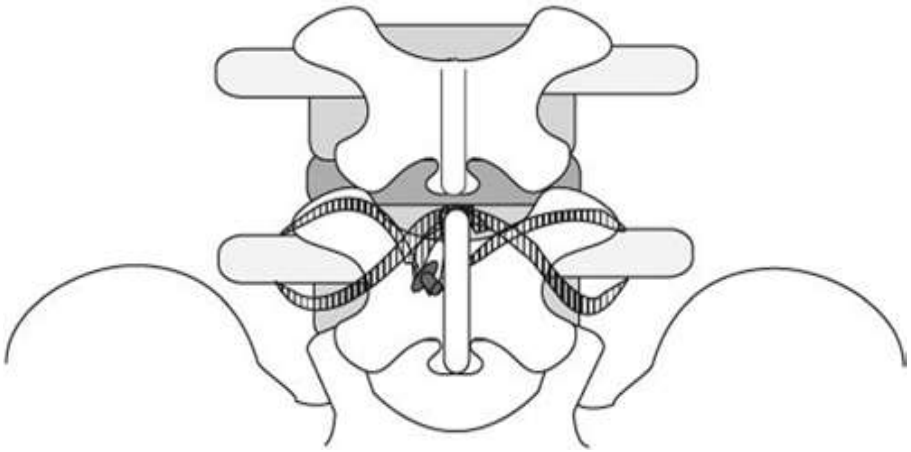

Fig. (3): Drawing depicting wire fixation as described by ***Scott (1987)***.

Pedicle Screw Cable Fixation (Songer, 1998). The bone graft is inserted into the pars defect between the pedicle above and the lamina below. Pedicle screws are placed with the entry point just below the facet joint. A cable is passed underneath the left laminae, threaded through the right pedicle screw head,