Outcomes Analysis of Anterior-Posterior Fusion for Low Grade Isthmic Spondylolisthesis

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Abstract

Background. Traditional surgical treatment of isthmic spondylolisthesis is posterior-lateral fusion, but the addition of anterior surgery has been explored. The purpose of this study was to evaluate the surgical and clinical outcomes of anterior-posterior surgical treatment for low-grade isthmic spondylolisthesis.

Methods. Retrospectively, we enrolled 23 consecutive patients (mean age of 50) who underwent surgical treatment for low grade isthmic spondylolisthesis. The mean follow-up was 10 months. Basic demographic and radiographic data was collected. Pre- and post-surgical clinical surveys (VAS, ODI, and SF-36) were collected.

Results. All 23 patients underwent anterior interbody fusion with a femoral ring allograft or ICBG in combination with posterior lumbar decompression and fusion with instrumentation. The average slip percentage decreased from 23.2% to 19.0% (p = 0.24) while slip angle increased from 9.8° to 17.9° (p < 0.001) and average disc height decreased from 1.9 cm to 0.80 cm (p < 0.001). VAS scores decreased from 7.1 to 2.4 (p < 0.001), ODI scores decreased from 52.5 to 28.1 (p < 0.001), and SF-36 scores increased in the Physical Component Scale (PCS) from 29.5 to 42.6 (p < 0.001).

Conclusion. In our study, patients demonstrated an improvement in the ODI as well the physical component scores of the SF-36, thus having a good clinical outcome.

When considering the operative treatment of low grade adult isthmic spondylolisthesis, it has been accepted that the main goal of surgical correction is to provide spinal stabilization, neural decompression, and deformity correction.¹

Several surgical techniques for spondylolisthesis have been implemented with different outcomes.² Historically, posterior-lateral fusion (PLF) has been the most commonly employed procedure. It allows for direct decompression of the neural elements if necessary, and results in good short-term outcomes in both adolescents and adults.³ Advances in spinal internal fixation have led to the widespread use of pedicle screws to stabilize PLF’s. Although instrumented posterior fusions provides motion segment stability in addition to neural decompression, it does not reconstruct the anterior column and may even exacerbate kyphosis.⁴

Alternatively, reconstruction of the anterior column through interbody fusion restores disc height, and it may also achieve neural decompression, although not directly. Interbody fusion can be achieved through a variety of approaches, such as posterior lumbar interbody fusion (PLIF), anterior lumbar interbody fusion (ALIF), and transforaminal interbody fusion (TLIF).

The use of both posterior stabilization and anterior column support utilizes the benefits of each procedure. Recently, a retrospective review of over 30 studies analyzing the surgical treatment for low grade isthmic spondylolisthesis concluded that a combined approach results in the most reliable clinical and surgical outcomes.²

Despite proven success in achieving surgical goals through a combined technique, there is still substantial controversy regarding methods to quantify the clinical improvement obtained in these patients. In the relevant literature, this is evidenced by the inconsistency in analysis of clinical outcomes. The use of standardized measures for both surgical and clinical outcomes is crucial because
these outcomes do not necessarily correlate.3,9 Considering that surgical treatment is dictated by patient symptomology and limitations on quality of life, it is imperative to analyze these clinical characteristics using validated, standardized questionnaires.

Several different clinical outcome questionnaires have been used without substantial evidence standardizing the results.2 This becomes problematic when comparing results from different studies. Recent literature has proven that the Visual Analog Survey (VAS), Oswestry Disability Index (ODI), and SF-36 are the best standardized questionnaires that focus on patient clinical outcomes.6,7

The purpose of this study was to evaluate the short-term surgical and clinical outcomes of anterior-posterior interbody fusion surgery for low-grade isthmic spondylolisthesis. We believe that patients will demonstrate a change in radiographic and clinical outcomes through the use of anterior-posterior surgery.

Materials and Methods

Before commencement, this study was approved by our Institutional Review Board. Patients were properly informed and consented using the IRB approved consent form. Retrospectively, we enrolled 23 consecutive patients that underwent surgical treatment for Isthmic Spondylolisthesis Grade 1 or 2 by 4 different orthopaedic spine surgeons (TE, JG, JS, JB) between 2001 and 2007. The average duration of symptoms prior to surgical intervention was 6.7 months. The average duration of follow-up for this study was 10 months.

The following inclusion criteria was used: patient underwent anterior-posterior spinal fusion for the treatment of low grade (grade 1 and 2) isthmic spondylolisthesis; patient was compliant with preoperative and postoperative data collection requirements; patient provided written consent for the study. The following exclusion criteria was used: patient was unable to complete the required SF-36, Oswestry Disability Index (ODI), or the Visual Analog Scale (VAS); patient did not mail the SF-36, ODI, or the VAS, which prevented inclusion of their results.

Once patients were properly screened, basic demographic data was collected. Radiographic data included Meyerding Scale, disc height, and slip angle. Disc height was determined by averaging the anterior and posterior disc height. All radiographs were accessed by independent observers not involved in the surgical procedure (JK and MQ). Additionally, pre- and post-surgical clinical surveys which included VAS, ODI, and SF-36 surveys were collected. Operative information included the specific surgical technique used as well as the surgical complications. Statistical analysis of radiological parameters and clinical outcomes was performed using Student’s t-test to verify significance using p < 0.05.

Results

All 23 patients underwent anterior interbody fusion with a femoral ring allograft or iliac crest bone graft in addition to posterior lumbar decompression and fusion with instrumentation. Demographic data and the breakdown of the spine levels involved can be found in Table 1. None of the patients had any surgical complications. Lastly, one patient had an isthmic spondylolisthesis due to an accident, and there were no Workers Compensation patients.

Radiographically, the average slip percentage decreased from 23.2% to 19.0% (p = 0.24) while slip angle increased from 9.8° to 17.9° (p < 0.001). Average disc height decreased from 1.9 cm to 0.80 cm (p < 0.001). VAS scores decreased

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Demographic Data and Levels Operated</th>
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<tbody>
<tr>
<td><strong>Demographics</strong></td>
<td></td>
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<tr>
<td>Number of Patients</td>
<td>23</td>
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<tr>
<td>Mean age</td>
<td>50 (range 33-77)</td>
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<tr>
<td>Males</td>
<td>10</td>
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<tr>
<td>Females</td>
<td>13</td>
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<tr>
<td>Smokers</td>
<td>3</td>
</tr>
<tr>
<td>Received an epidural prior to surgery</td>
<td>13</td>
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<tr>
<td><strong>Level Distribution</strong></td>
<td></td>
</tr>
<tr>
<td>L3-L4</td>
<td>1</td>
</tr>
<tr>
<td>L4-L5</td>
<td>6*</td>
</tr>
<tr>
<td>L5-S1</td>
<td>17*</td>
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</tbody>
</table>

*One patient had two isthmic spondylolithestes, one at L4-L5 and one at L5-S1.
Discussion
Surgical correction of isthmic spondylolisthesis has traditionally been corrected with a posterior-lateral fusion.\textsuperscript{3,10} The results have demonstrated modest improvement as compared to a traditional exercise program. In patients with isthmic spondylolisthesis, fusion without instrumentation can provide a superior outcome than instrumented fusions.\textsuperscript{4} Clearly, there is a wide range of approaches to the management of patients with isthmic spondylolisthesis.

Videbaek and colleagues\textsuperscript{11} followed patients that underwent posterior-lateral fusion or circumferential fusion for the treatment of low back pain, which included spondylolisthesis patients. In their study, patients that underwent circumferential fusion had a greater gain in clinical outcome as evidenced through ODI, SF-36, and Dallas Pain Questionnaire (DPQ). A follow-up study by Soegaard and associates\textsuperscript{12} demonstrated that patients that underwent circumferential fusion enjoyed a significant improvement in the quality of life at an increased savings to society.

The risks of anterior spine surgery has been well documented.\textsuperscript{3,13} Despite the detriments, the increased physical functioning of patients justifies this risk. The body of literature on circumferential fusion in patients with low grade isthmic spondylolisthesis has shown this technique to be superior to posterior-lateral fusion.\textsuperscript{2,14}

Previous studies concerning circumferential fusion for the treatment of low grade isthmic spondylolisthesis have demonstrated excellent results. With a small cohort, Spruit and coworkers\textsuperscript{15} demonstrated a radiographic benefit and excellent clinical outcome. In their study, radiographic assessment consisted of slip percentage, which decreased from 21% to 7%. Remes and colleagues\textsuperscript{16} found circumferential fusion was superior to strictly anterior or posterior-lateral fusion in patients with high grade isthmic spondylolisthesis. In the circumferential group, slip percentage decreased from 70.9% to 69.4% at follow-up. In a prospective controlled study, Swan and associates\textsuperscript{17} confirmed circumferential fusion was superior to posterior-lateral fusion in patients with low-grade isthmic spondylolisthesis. This study demonstrated their results by employing outcomes surveys as well as radiographic evidence of slip percentage, disc height, and slip angle.

In our study, we used VAS, ODI, and SF-36 surveys to quantify the clinical outcomes of our patients. Both the ODI and SF-36 have repeatedly been employed to survey the outcomes of spine patients.\textsuperscript{19,20} Our study demonstrated that patients with isthmic spondylolisthesis undergoing circumferential fusion can have a good clinical outcome. Most importantly, our patients showed an improvement in the ODI as well the physical component scores of the SF-36. Patients, therefore, had improvement in their functioning due to the surgery and not due to any psychological aspect of their condition. Radiographically, slip percentage decreased, slip angle increased, and average disc height decreased. Overall, we feel that there was slight reduction in the overall slip.

Our study was limited in the number of patients included; however, the study was large enough to detect significant differences in VAS, ODI, and SF-36 among our patient population. Our strengths include the use of three various clinical outcomes measures (VAS, ODI, and SF-36) in addition to radiographic data. We feel the data reported in this study is reproducible and in agreement with current trends for treatment of isthmic spondylolisthesis.

Disclosure Statement
None of the authors have a financial or proprietary interest in the subject matter or materials discussed, including, but not limited to, employment, consultancies, stock ownership, honoraria, and paid expert testimony.

References


