Selective Transforaminal Lumbar Interbody Fusion for Degenerative Adult Scoliosis Correction

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INTRODUCTION

Adult scoliosis is a multifaceted disease associated with multiple symptoms including spinal rigidity, stiffness, severe and progressive back pain, neurogenic claudication, and degeneration. It is defined as any curvature of the spine of more than 10 degrees in a skeletally mature individual without previous scoliosis. The prevalence of degenerative scoliosis is estimated from 2.5 to 15%.

The correction of the deformity could be performed either using the combined Anterior/Posterior (AP) or Transforaminal Lumbar Interbody Fusion (TLIF) approach. The TLIF approach theoretically minimizes risk to the patient typically associated with an anterior procedure, has the advantage of anterior strut grafting, and increased fusion rates.

METHODS

This retrospective study analyzed the safety and feasibility of the TLIF approach for the patients with degenerative adult scoliosis. Twenty-one consecutive patients who underwent TLIF between February of 2001 and November of 2006 were included in the study. All patients had central canal stenosis and/or lateral recess stenosis, some of them had spondylolisthesis and disc herniation. There were no surgeries performed to correct the deformity only. Patient demographics, levels of operation, length of follow-up, and pre/postoperative Cobb angle measurements are summarized in Table 1. Radiographic analysis included Cobb angle measurement on pre- and postoperative posteroanterior standing radiographs (mean follow-up time of 36 months). Clinical outcome measures: patient's perceived overall treatment effect, patient satisfaction, and additional surgical procedures performed.

OPERATIVE PROCEDURE

The average number of levels fused was 2 (range, 1-3 levels). Selective interbody fusion (TLIF) were performed from T12 to S1. In addition, posterior lateral fusion with instrumentation was performed: the average of 4.4 levels per patient. The extent of fusion was determined according to the coronal and sagittal deformations and the extent of disc degeneration. The upper instrumented vertebra was T9 or T10 in 1 patient, T11 in 3 patients, T12 in 14 patients, and L1 in 2 patients. The lower instrumented vertebra was L1 in 1 patient, L5 in 4 patients, and sacrum in 16 patients.

The mean operative time was 388 minutes (range, 275 - 501 minutes).

RESULTS

The mean preoperative Cobb angle was 25.2 degrees (range, 9 - 32 degrees) compared to the mean of 10.1 degrees (range, 1 - 35 degrees) postoperatively, which indicates a 65% correction of the deformity in the coronal plane (Figure 1). The clinical outcomes defined as patients' perceived overall treatment effect was excellent/good in 19 patients (91%) and patient satisfaction was 77%.

The incidence of complications was 47.6%: 4 cerebrospinal fluid leaks, 2 sacral screw malposition, 1 deep venous thrombosis, 1 pulmonary embolism, and 1 hematoma. Although, bone morphogenetic protein (BMP-2) was used for all patients, two patients had pseudoarthrosis. Additional surgical procedures were performed in three patients: one patient was operated for failed fusion, another for adjacent level disease, and one patient had hardware removal surgery because of radiculopathy.

DISCUSSION

There is probably no issue in degenerative scoliosis management that would not be controversial; starting from conservative versus surgical treatment, surprisingly, the upper instrumented vertebra, and the extent of fusion. Pain is thought to be the main indication for surgical treatment, however, in a study that analyzed factors playing role in the decision making process - pain was not considered the main determinant factor, rather it was the functional status and inability to walk (Pekmezci et al). Nevertheless, surgery should be considered after a thorough discussion with a patient regarding the likely outcomes following the procedure, natural history of the disease, and especially acknowledging the high risk of complications and morbidity.

Posterior vs. A/P Approach

A retrospective study was performed by Pateder et al. (Spine, 2007), which compared radiographic lumbar curve correction between the posterior only (n = 45) and combined anterior/posterior (A/P) approach (n = 35 patients) in degenerative scoliosis patients. Some authors believe that the A/P approach achieves better correction of the deformity and helps to decrease the number of fusion levels. This study established that there was no statistically significant difference in the amount of scoliosis correction, number of levels fused, complication or pseudoarthrosis rate between the two different approaches (Table 2).

TABLE 2. Comparison of the Posterior Only and A/P Approach

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<thead>
<tr>
<th></th>
<th>Posterior</th>
<th>A/P</th>
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<tbody>
<tr>
<td>Level fusion</td>
<td>45</td>
<td>35</td>
</tr>
<tr>
<td>FU</td>
<td>min - 28 mos</td>
<td>mean - 53 mos</td>
</tr>
<tr>
<td>Cobb Angle (pre)</td>
<td>48.7°</td>
<td>51°</td>
</tr>
<tr>
<td>Cobb Angle (post)</td>
<td>24.8°</td>
<td>23.3°</td>
</tr>
<tr>
<td>Levels</td>
<td>11.3 (7-14.3)</td>
<td>10.7 (6.1-13.7)</td>
</tr>
<tr>
<td>Pseudarthrosis</td>
<td>13%</td>
<td>12%</td>
</tr>
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Surgical data (EBL) and the complication rate reported in this study may seem a little high, but these numbers are even lower or consistent (Table 3) with the previously reported studies. The incidence of complications was reported to be high in most series, ranging from 20 - 80%. Reoperation rates ranged from 14 to 58%. Cho et al. (Spine, 2007) reviewed 42 patients with degenerative lumbar scoliosis that underwent posterior fusion with instrumentation and reported 68% complication rate. Statistical analysis performed indicated that a blood loss of more than 2000 mL increased postoperative complications.


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<thead>
<tr>
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<th>Posterior</th>
<th>A/P</th>
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<tr>
<td>OR Time</td>
<td>188 min (275 - 501)</td>
<td>197 min (110 - 340)</td>
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<tr>
<td>EBL</td>
<td>1142 mL (250 - 2500)</td>
<td>2106 mL (600 - 6000)</td>
</tr>
<tr>
<td>LOS</td>
<td>7.3 days (3 - 16)</td>
<td>20.7 ± 9.6 days</td>
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<tr>
<td>Complications</td>
<td>47.6%</td>
<td>68%</td>
</tr>
<tr>
<td>Reoperation</td>
<td>14.3%</td>
<td>14%</td>
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TABLE 3. Surgical Data Comparison

CONCLUSIONS

This study suggests that the TLIF approach in selected levels is a feasible and an alternative to anterior/posterior reconstructive surgery in adult patients with degenerative scoliosis and spinal stenosis. Surgery in this patient population is associated with a high risk of complications.

FIGURE 1. Pre/Postoperative Radiographic Studies and Graphs: Illustration of the Deformity Correction

Selectivity vs. the Deformity Correction

Cobb Angle Pre-operative vs. Cobb Angle Post-operative

N = 21

Age: 64 (45 - 77)
F/M Ratio: 13 / 17
Previous Surgeries: 15 (58%)
Follow up: 16 mos (12 - 47)
TLIF Levels: 3 (2 - 5)
Segments: T12 - S1
Institutional: 6.4 (4 - 11)
Cobb Angle (pre-op): 25.2 (9 - 52)
Cobb Angle (post-op): 10.1 (3 - 35)

TABLE 1. Selected Demographic Criteria and Surgical Data