A comparison of instrumented posterolateral fusion versus percutaneous pedicle screw fixation combined with anterior lumbar interbody fusion in elderly patients with L5-S1 isthmic spondylolisthesis and foraminal stenosis

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Objectives

To compare the clinical and radiological outcomes of treating L5-S1 isthmic spondylolisthesis and foraminal stenosis in elderly patients by

- instrumented posterolateral fusion (PLF)
  vs.
- percutaneous pedicle screw fixation (PPF)

combined with anterior lumbar interbody fusion (ALIF)
METHODS

Patient population

- Between November 2002 to June 2008
- 56 consecutive elderly patients (> 65 yrs) in whom Grade I or II L5-S1 isthmic spondylolithesis with symptomatic foraminal stenosis was diagnosed underwent ALIF.
- These patients had preoperative, postoperative, and follow-up evaluations and protocols established as routine in our institute.
- November 2002 ~ December 2002
  → ALIF with instrumented PLF
- January 2006 ~ June 2008
  → ALIF with PPF
- Retrospective review of the office charts, hospital charts, and radiologic studies to assess preoperative symptomatology, findings on clinical examinations, and radiologic characteristics.
- Among 56 consecutive patients, 7 were excluded for the several reasons.
- The remaining 49 patients comprised the study cohort.
- ALIF with instrumented PLF (group A) - 23 patients
  ALIF with PPF (group B) - 26 patients
INCLUSION CRITERIA

- Chronic and persistent L5 radiculopathy
- Progressive neurological deficits (weakness etc.),
- Persistent and unremitting LBP
- NIC
- No response to conservative treatment
- Class I or II based on the ASA classification
- T-scores of BMD > -3.0
- F/U for more than 2 years

EXCLUSION CRITERIA

- Symptomatic central stenosis at the same level and required decompression
- Previous spine surgery
- Concomitant scoliosis of >15°
- Compression fracture or instability at the adjacent segment
- The need for simultaneous decompression at the adjacent level
Outcome Assessment
(preop. and postop. 3mo/6mo/1yr/every yr)

1. Clinical
   - Visual Analog pain Scale (VAS) and modified MacNab criteria
   - Hospital day, operation time, Estimated Blood Loss (EBL), and complication

2. Radiologic
   - F/U: Dynamic plain film & CT
   - (including reconstructed sagittal images)
     → determine fusion state

<table>
<thead>
<tr>
<th>Fusion</th>
<th>Nonunion</th>
</tr>
</thead>
<tbody>
<tr>
<td>bony trabecular continuity</td>
<td>the presence of a visible gap graft collapse</td>
</tr>
<tr>
<td>between the vertebral bodies</td>
<td>motion greater than 4° in the motion study</td>
</tr>
<tr>
<td>paravertebral bone bridge</td>
<td></td>
</tr>
<tr>
<td>between transverse processes</td>
<td></td>
</tr>
<tr>
<td>and lateral facet</td>
<td></td>
</tr>
<tr>
<td>less than 4° mobility in flexion</td>
<td></td>
</tr>
<tr>
<td>and extension radiographs</td>
<td></td>
</tr>
</tbody>
</table>

* Statistical Analysis

   - SPSS (version 10.0)
   - Unpaired t-test and Chi-square test
   - P<0.05 : significant (+)
Surgical Techniques

ALIF

- Fidji (PEEK) cage

→ Filled with allograft bone chip

with instrumented PLF (group A)

- Pedicle screws and rods (GSS)
- Cancellous bone chips that were harvested from the posterior iliac crest were placed on the decorticated lateral side.

with PPF (group B)

- Pedicle screws and rods (Sextant)
# Result

## Demographics

<table>
<thead>
<tr>
<th></th>
<th>Group A (ALIF + PLF)</th>
<th>Group B (ALIF + PPF)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Male</strong></td>
<td>9</td>
<td>11</td>
<td>0.104</td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td>14</td>
<td>15</td>
<td>0.106</td>
</tr>
<tr>
<td><strong>ASA Grade I</strong></td>
<td>4</td>
<td>5</td>
<td>0.492</td>
</tr>
<tr>
<td><strong>ASA Grade II</strong></td>
<td>19</td>
<td>21</td>
<td>0.492</td>
</tr>
<tr>
<td><strong>Age in years</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mean</td>
<td>68±2.49</td>
<td>68.7±2.56</td>
<td>0.343</td>
</tr>
<tr>
<td>range</td>
<td>65-73</td>
<td>66-75</td>
<td></td>
</tr>
<tr>
<td><strong>T-score of BMD</strong></td>
<td>-2.96±0.11</td>
<td>-2.97±0.10</td>
<td>0.803</td>
</tr>
</tbody>
</table>
Modified MacNab criteria

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of Patients(%)</th>
<th>6month</th>
<th>P value</th>
<th>2yr</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group A</td>
<td>Group B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent</td>
<td>15(65.2)</td>
<td>9(34.6)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>6(26.1)</td>
<td>9(34.6)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fair</td>
<td>2(8.7)</td>
<td>7(26.9)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>poor</td>
<td>0(0)</td>
<td>1(3.9)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E+G total</td>
<td>21(91.3)</td>
<td>18(69.2)</td>
<td>0.010</td>
<td></td>
<td>0.203</td>
</tr>
</tbody>
</table>

VAS scores for LBP and Leg Pain:

- **LBP**:
  - Group A: *p<0.001
  - Group B: *p=0.003

- **Leg Pain**:
  - Group A: *p<0.001
  - Group B: *p=0.003
# Perioperative parameters

<table>
<thead>
<tr>
<th></th>
<th>Group A (ALIF + PLF)</th>
<th>Group B (ALIF + PPF)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital stay (day, mean)</td>
<td>10.3±0.49</td>
<td>7.2±0.29</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>OP time (min, mean)</td>
<td>136.8±4.69</td>
<td>82.5±3.69</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Blood loss (ml, mean)</td>
<td>305.1±10.03</td>
<td>162.7±3.62</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Transfusion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of patients (%)</td>
<td>8(34.7)</td>
<td>3(11.5)</td>
<td>0.030</td>
</tr>
<tr>
<td>Complication</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of patients (%)</td>
<td>1(4.3)</td>
<td>1(3.8)</td>
<td>0.691</td>
</tr>
</tbody>
</table>

**Fusion rate**

![Graph showing fusion rate](image-url)
75/M
ALIF
with instrumented PLF

Preop

POD # 6 mon
65/M
ALIF with PPF

73/M
ALIF with PPF

Preop

POD # 1 yr

POD # 1 yr

POD # 2 yrs
Conclusion

• A relatively longer time and lower rate for fusion in the patients treated with ALIF and PPF were noted, which may be correlated with a relatively lower rate of patients with excellent or good outcomes.

• These results seem to favor ALIF with instrumented PLF rather than ALIF with PPF in the treatment of elderly patients with L5-S1 isthmic spondylolisthesis and foraminal stenosis.

• However, additional long-term follow-up, a larger number of patients, and well-designed studies are necessary for a more rigorous evaluation of the outcome of these surgical techniques.

Disclosure declaration

None of the authors has any potential conflict of interest.