Decompression Only Versus Fusion Surgery for Lumbar Stenosis in Elderly Patients over 75 Years Old: Which is Reasonable?

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Abstract

As the population ages, more elderly patients suffer from spinal stenosis requiring lumbar fusion. However, there are few and conflicting results regarding the clinical outcome of lumbar fusion. The purpose of this study is to evaluate the safety and efficiency of posterior lumbar interbody fusion (PLIF) in over 75-year-old patients and analyze the relative effectiveness of lumbar spinal fusion surgery compared with decompression surgery for spinal stenosis. This retrospective review evaluated 25 patients aged 75 to 93 who were diagnosed with spinal stenosis and underwent PLIF for 24 months. The control group included 25 patients who were matched for age, gender, level, race, and severity of stenosis, and who underwent decompressive laminectomy and flavectomy without fusion (DLF). The fusion rate in the PLIF group was 32.0%, 84.0%, and 96.0% at 6, 12, and 24 months, respectively. During the follow-up period, 4 (16%) and 2 (8%) patients underwent revision surgery in the DLF and PLIF groups, respectively. The back pain in the DLF group decreased from 5.6 to 2.1 at 6 months and then substantially increased to 3.4 at 24 months. The decrease in back pain score after treatment was greater in the PLIF group compared to the DLF group (P < 0.01) with a statistically significant difference in the trend in the two groups over time (P < 0.01). Even in elderly patients, lumbar surgery appears to be a safe and justifiable treatment for spinal stenosis. Lumbar fusion surgery rather than decompressive surgery was recommended for those patients who mainly complained of back pain.

Key words: elder, lumbar, stenosis, fusion, surgery

Introduction

As the average age of the general population increases due to advances in medicine, the number of elderly patients presenting with a painful degenerative pathology of the lumbar spine is increasing.4) As the activities of daily living also increase, these patients are not satisfied with conservative management and want to be surgically treated. However, there has been a historic conflict concerning the safety and efficiency of spinal surgery in the elderly.4,5,9,13) In elderly patients diagnosed with symptomatic spinal stenosis without significant instability, both posterior lumbar interbody fusion (PLIF) and decompressive laminectomy with flavectomy without fusion (DLF) are surgical options. DLF is usually recommended in elderly patients because of the surgical risk, low fusion rate, and morbidity. However, some patients who underwent DLF complained of recurring pain soon after surgery and needed to later undergo fusion surgery at the level of DLF. Previously reported studies have analyzed the clinical outcomes after either decompressive surgery or fusion surgery for spinal stenosis in elderly patients. However, there is no comparative analysis of the clinical outcomes between decompression surgery and fusion surgery in elderly patients. The purpose of this study was to evaluate the safety and efficiency of PLIF in over 75-year-old patients and to analyze the relative effectiveness of lumbar spinal fusion surgery compared with decompression surgery for spinal stenosis.

Materials and Methods

1. Patient selection and surgical procedure
This study was approved by the Institutional
Research Board of our institute (B1210/176-103). We retrospectively reviewed the records of all elderly patients who were diagnosed with spinal stenosis and underwent PLIF at our institution between May 2003 and September 2010. The inclusion criteria were as follows: (1) patients older than 75 years, (2) moderate to severe central canal stenosis on magnetic resonance (MR) images, and (3) patients followed-up periodically for 24 months. The exclusion criteria were as follows: (1) patients showing significant instability (intervertebral translation ≥ 5 mm) or spondylolisthesis, (2) patients who underwent revision surgery or deformity correction, (3) patients who were not followed-up for 2 years after surgery, and (4) patients who were deceased at the time of the follow-up. The preoperative general status, underlying disease, functional outcome, fusion rate, and complications were evaluated. The comparative group, which included patients who underwent only DLF, was matched with the PLIF group with respect to age (± 3 years), gender, race, surgery date (± 1 year), surgery level, and the status of the spinal stenosis at the surgery segment. The indication for DLF is spinal stenosis without disc herniation. If the patients showed disc herniation and protrusion, PLIF with pedicle screws was performed.

The PLIF procedure was performed as follows: (1) midline skin incision and paraspinal muscle splitting, (2) bilateral partial hemilaminectomy and flavectomy, (3) discectomy, (4) cage packed with an autologous bone insertion, and (5) insertion and fixation of pedicle screws. The DLF procedure was the same as the PLIF until the flavectomy step. Midline structures, including the spinous process, were saved as much as possible.

II. Clinical and radiological evaluation

The preoperative general status was classified using the American Society of Anesthesiologists (ASA) patient classification status. This classification was also used in a previous investigation. Spinal stenosis of the central canal was determined by the dural sac cross-sectional area on the MR images (normal, > 100 mm²; moderate, 76–100 mm²; severe, < 75 mm²). The postoperative management included early mobilization with bracing for 16 weeks, starting on the first postoperative day. The radiological and clinical outcomes using the mean visual analogue scale (VAS) and Oswestry Disability Index (ODI) scores (the decrease from the baseline VAS and ODI scores) were evaluated at 1, 3, 6, 12, and 24 months after the surgery. Radiographs were examined at that time. Bone fusion was defined as bone bridge formation visualized by plain radiograph and no segmental motion on flexion-extension lateral radiographs.

III. Statistical analysis

Each of the clinical outcomes was analyzed individually. Each time point (preoperative state, postoperative 1, 3, 6, 12, 24 months) were recorded for patients completing the treatment course. Categorical variables were compared using the Chi-square test. A linear mixed model was used to test the differences between each time point and clinical outcome score such as VAS and ODI. Statistical significance was defined as a P value of less than 0.05. The statistical analyses were performed using SPSS 18.0 statistical software (SPSS Inc., Chicago, Illinois, USA).

IV. Results

A total of 25 patients underwent PLIF. The matched control group (25 patients) was compared with the PLIF group. The patient’s characteristics are summarized in Table 1. Each group was composed of 15 males and 10 females with the mean follow-up at 3.9 ± 1.6 years (range 22.0–102 months). The mean age of the PLIF group at the operation was 79.7 years (range 75–93 years). The median bone densitometry in the PLIF group was –2.05. The fusion rate in the PLIF group was 32.0%, 84.0%, and 96.0% at 6, 12, and 24 months, respectively. There were no cases of mortality and morbidity related to the spinal surgeries. Two patients suffered from pneumonia but recovered completely. Three patients had urinary tract infections that were cured after medical treatment. The mean blood loss during the PLIF and DLF was

<table>
<thead>
<tr>
<th>Variables</th>
<th>PLIF</th>
<th>DLF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number (male/female)</td>
<td>25 (15/10)</td>
<td>25 (15/10)</td>
</tr>
<tr>
<td>Mean age</td>
<td>79.7 (75–93)</td>
<td>79.2 (75–90)</td>
</tr>
<tr>
<td>Median bone marrow densitometry</td>
<td>−2.05</td>
<td>−2.10</td>
</tr>
<tr>
<td>ASA Classification</td>
<td>Class I</td>
<td>11</td>
</tr>
<tr>
<td>Classification Class II</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>Classification Class III</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Heart</td>
<td>IHD</td>
<td>2 (8%)</td>
</tr>
<tr>
<td>Arrhythmia</td>
<td>2 (8%)</td>
<td>0</td>
</tr>
<tr>
<td>Lung</td>
<td>COPD</td>
<td>1 (4%)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>15 (60%)</td>
<td>17 (68%)</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>2 (8%)</td>
<td>9 (36%)</td>
</tr>
</tbody>
</table>

357.8 cc and 75.4 cc, respectively ($P < 0.01$). The mean surgical time during PLIF and DLF was 183.6 minutes and 78.2 minutes, respectively ($P < 0.01$). During the follow-up period, 4 (16%) and 2 (8%) patients underwent revision surgery in the DLF and PLIF groups, respectively. In the DLF group, 3 patients underwent PLIF at the laminectomy level and 1 patient underwent an additional laminectomy. In the PLIF group, 2 patients underwent additional level fusion.

V. Clinical outcome

The back pain VAS scores for the PLIF group improved from 7.4 to 2.7 over the first 6 months and reached a plateau of 2.8 over 24 months (Fig. 1, Table 2). However, the back pain VAS scores for the DLF group were 5.6 preoperatively, improved to 2.1 at 6 months and were aggravated to 3.4 at 24 months. The decrease in back pain score after treatment was greater in the PLIF group compared to the DLF group ($P < 0.01$) with a statistically significant difference in the trend in the two groups over time ($P < 0.01$). The leg pain VAS scores were initially 7.9 in the PLIF group and 6.6 in the DLF group (Fig. 2, Table 2). The leg pain of the PLIF and DLF groups were 2.0 and 1.7, respectively, at 6 months after surgery and 2.0 and 2.4, respectively, at 24 months after surgery. As time progressed, the leg pain of the 2 study groups improved significantly ($P < 0.01$), but this improvement was not significantly different between the two groups ($P = 0.06$). The ODI score for the PLIF group decreased from 20.0 to 6.5 at 6 months and increased to 11.0 at 24 months (Fig. 3, Table 2). The ODI score for the DLF group followed a similar trend (25.4 → 11.0 → 15.1). The decrement of ODI over time was significant ($P < 0.01$). However, there was no significant difference between the ODI scores of the two study groups ($P = 0.25$).

![Fig. 1 Visual analogue scale ratings for back pain.](image1)

![Fig. 2 Visual analogue scale ratings for leg pain.](image2)

Table 2 Chronology of clinical outcomes

<table>
<thead>
<tr>
<th></th>
<th>Preop</th>
<th>1 mo</th>
<th>3 mo</th>
<th>6 mo</th>
<th>12 mo</th>
<th>24 mo</th>
</tr>
</thead>
<tbody>
<tr>
<td>ODI</td>
<td>PLIF</td>
<td>20.0</td>
<td>12.5</td>
<td>6.5</td>
<td>11.5</td>
<td>11.0</td>
</tr>
<tr>
<td></td>
<td>DLF</td>
<td>24.4</td>
<td>15.6</td>
<td>11.0</td>
<td>12.7</td>
<td>15.1</td>
</tr>
<tr>
<td>Back</td>
<td>PLIF</td>
<td>7.4</td>
<td>3.0</td>
<td>2.7</td>
<td>3.0</td>
<td>2.6</td>
</tr>
<tr>
<td>VAS</td>
<td>DLF</td>
<td>5.6</td>
<td>3.1</td>
<td>2.3</td>
<td>2.1</td>
<td>2.6</td>
</tr>
<tr>
<td>Leg</td>
<td>PLIF</td>
<td>7.9</td>
<td>2.6</td>
<td>2.6</td>
<td>2.0</td>
<td>2.2</td>
</tr>
<tr>
<td>VAS</td>
<td>DLF</td>
<td>6.6</td>
<td>3.3</td>
<td>2.3</td>
<td>1.7</td>
<td>2.3</td>
</tr>
</tbody>
</table>

DL: decompressive laminectomy and flavectomy without fusion, ODI: Oswestry disability index, PLIF: posterior lumbar interbody fusion; Preop: Preoperative state, mo: months after surgery, VAS: visual analog scale.
The Effectiveness of Fusion in Elderly Patients

In this study, the PLIF group showed a fusion rate of 84.0% at 12 months and 96.0% at 24 months. Another investigation of lumbar fusion in elderly patients (≥ 75 years) revealed that the fusion rate was 92.9%. Therefore, the fusion rate in elderly patients does not appear to be inferior to that in the general population which has a fusion rate of 95.1% (range 92.6–100%). Minor complications did occur with complete recovery observed in all cases. Only 2 patients in the PLIF group underwent additional surgery because of adjacent segment degeneration. Because the fusion surgery was performed only at the most severe segments, adjacent segment fusion may be a natural course. The functional and clinical outcomes were significantly improved. The clinical outcomes improved until 6 months after surgery and were maintained for 24 months after surgery. Therefore, PLIF for spinal stenosis appears to be a justifiable procedure, even in elderly patients.

II. Comparative analysis between the PLIF and DLF groups

Grob et al. conducted a trial of symptomatic lumbar stenosis with less than 5 mm of intervertebral translation in patients who were randomly assigned to three groups: (1) decompression with laminotomy and medial facetectomy, (2) decompression with arthrodesis of the most stenotic segment, and (3) decompression with arthrodesis of all the affected segments. At 28 months after surgery, all groups showed an increase in walking ability and a decrease in pain. No difference among the groups was noted. Yone and Sakou reported that 80% of the patients experienced good outcomes among those patients who underwent instrumented fusion. Only 43% of the patients in the group with instability and decompression without fusion experienced good outcomes. Previous investigations suggested that decompression alone is suggested only for patients with leg-predominant symptoms and without instability.

In this study, the back pain in the PLIF group decreased significantly at 1 month after surgery and persisted at a similar intensity. However, the back pain in the DLF group decreased at 6 months after surgery and then increased over 24 months, which has a statistical significance compared to that in the PLIF group. Aggravated back pain appears to be caused by postoperative instability rather than the progression of degeneration. The leg pain in the DLF group did not follow this trend. The changes in leg pain in both groups had similar patterns. The ODI in both groups also showed similar results. In this study, PLIF resulted in a functional outcome and improvement in leg pain similar to those observed after DLF.
With respect to the improvement in back pain, PLIF can have more favorable outcomes than DLF.

This study has some limitations. First, it is retrospective with a small sample size. The selection of surgical method and the use of postoperative pain relievers were not controlled. However, the number studied, 50 patients, accounts for all patients who underwent the surgery and regularly visited the out-patient department for minimum of 2 years (mean 3.5 years) at our institute. Second, study groups enrolled only relatively stable spine. Elderly patients who showed severe instability and poor bone quality were excluded in order to match group homogeneity. Therefore, the result of this study group was not applied with general elderly patients. Another limitation of this study is out of consideration about kyphosis and scoliosis. Fusion segment of the PLIF group is 1 or 2 level. Degenerative lumbar kyphosis was showed in almost all patients. However, there is no evaluating tool between kyphosis and back pain. As a result, surgeries of deformity correction were excluded. Therefore, further studies are necessary to analyze long-term result of DLF versus PLIF. Regardless of the risk-effectiveness, this study shows that lumbar spinal surgery improves life quality in the elderly.

Conclusion

Even in elderly patients, lumbar surgery appears to be a safe and justifiable treatment for spinal stenosis. Both PLIF and DLF are effective for improving leg and back pain. The spine surgeon needs to consider lumbar fusion with instrumentation rather than decompression only in patients who complained mainly of back pain.

Conflicts of Interest Disclosure

None of the authors has any financial interest in the subject under discussion in this paper.

References


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