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

Chang-Hyun Lee,1 Seung-Jae Hyun,1 Ki-Jeong Kim,1 Tae-Ahn Jahng,1 and Hyun-Jib Kim1

1Department of Neurosurgery, Spine Center, Seoul National University Bundang Hospital, Seoul National University College of Medicine, Seongnam, Gyeonggi-do, Republic of Korea

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.6) 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

I. Patient selection and surgical procedure

This study was approved by the Institutional

Received December 4, 2012; Accepted January 28, 2013
The Effectiveness of Fusion in Elderly Patient

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 were measured using the American Society of Anesthesiologists (ASA) patient classification status. Each time point (preoperative state, postoperative 1, 3, 6, 12, 24 months) was 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).

III. Statistical analysis

Each of the clinical outcomes was analyzed individually. Each time point (preoperative state, postoperative 1, 3, 6, 12, 24 months) was 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 451 ml.

Table 1 Patient demographics

| Variables         | PLIF       | DLF       |
|-------------------|------------|-----------|
| Number (male/female) | 25 (15/10) | 25 (15/10) |
| Mean age          | 79.7 (75–93) | 79.2 (75–90) |
| Median bone marrow densitometry | –2.05 | –2.10 |
| ASA               | Class I    | 11        | 7         |
| Classification    | Class II   | 10        | 13        |
|                   | Class III  | 4         | 5         |
| Heart             | IHD        | 2 (8%)    | 4 (16%)   |
|                   | Arrhythmia | 2 (8%)    | 0         |
| Lung              | COPD       | 1 (4%)    | 2 (8%)    |
| Hypertension      | 15 (60%)   | 17 (68%)  |
| Diabetes mellitus | 2 (8%)     | 9 (36%)   |

ASA: American Society of Anesthesiologists, COPD: chronic obstructive pulmonary disease, DLF: decompressive laminectomy and flavectomy, IHD: ischemic heart disease, PLIF: posterior lumbar interbody fusion.
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 laminctomy level and 1 patient underwent an additional laminctomy. 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 ($P = 0.25$).

| Table 2 Chronology of clinical outcomes |
|----------------------------------------|
|            | Preop | 1 mo | 3 mo | 6 mo | 12 mo | 24 mo |
| ODI        | PLIF  | 20.0 | 12.5 | 6.5  | 11.5  | 11.0  |
|            | DLF   | 24.4 | 15.6 | 11.0 | 12.7  | 15.1  |
| Back       | PLIF  | 7.4  | 3.0  | 2.7  | 3.0   | 2.6   | 2.8   |
| VAS        | DLF   | 5.6  | 3.1  | 2.3  | 2.1   | 2.6   | 3.4   |
| Leg        | PLIF  | 7.9  | 3.3  | 2.3  | 1.7   | 2.3   | 2.4   |
| VAS        | DLF   | 6.6  | 3.3  | 2.3  | 1.7   | 2.3   | 2.4   |

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.

Discussion

I. Safety and efficiency of lumbar fusion in elderly patients

In the literature review, there are various opinions about the safety and efficacy of lumbar fusion. On one hand, prior investigators reported that surgeons should be vigilant about perioperative complications in elderly patients (≥ 65 years) treated with instrumentation and suggested that elderly patients should be made aware that they are at increased risk for surgical complications because of their age. Other investigators reported that a negative effect of age on surgical morbidity and mortality had been established, but the effect of comorbidity has not been linked to the occurrence of major complications. On the other hand, Acosta et al. reported that there were no significant differences in the number of levels fused, operative time, mean length of the hospital stay, or perioperative complication rates in different patient groups (< 65 vs. ≥ 65 years). Okuda et al. reported that no obvious differences in the clinical results were observed between the age groups (< 70 vs. ≥ 70 years) based on the numbers available. Arinzon et al. reported that the overall postoperative complication rate was similar in different patient groups (65–75 years vs. ≥ 75 years). The authors insisted that age was not a contraindication for the surgical decompression of lumbar spinal stenosis.

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.
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 that 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

1) Acosta FL, Cloyd JM, Aryan HE, Ames CP: Perioperative complications and clinical outcomes of multilevel circumferential lumbar spinal fusion in the elderly. J Clin Neurosci 16: 69–73, 2009
2) American Society of Anesthesiologists ASA Physical Status Classification System. Available at http://www. asahq.org/Home/For-Members/Clinical-Information/ ASA-Physical-Status-Classification-System. 2011. Accessed 25 September 2012
3) Arinzon ZH, Fredman B, Zohar E, Shabat S, Feldman JS, Jedeikin R, Gepstein RJ: Surgical management of spinal stenosis: a comparison of immediate and long term outcome in two geriatric patient populations. Arch Gerontol Geriatr 36: 273–279, 2003
4) Becker P, Bretschneider W, Tuschel A, Ogon M: Life quality after instrumented lumbar fusion in the elderly. Spine 35: 1478–1481, 2010
5) Carreon LY, Punco RM, Dimar JR, Glassman SD, Johnson JR: Perioperative complications of posterior lumbar decompression and arthrodesis in older adults. J Bone Joint Surg Am 85-A: 2089–2092, 2003
6) Deyo RA, Ciol MA, Cherkin DC, Loeser JD, Bigos SJ: Lumbar spinal fusion. A cohort study of complications, reoperations, and resource use in the Medicare population. Spine 18: 1463–1470, 1993
7) Endres S: Instrumented posterolateral fusion—clinical and functional outcome in elderly patients. Ger Med Sci 9: Doc09, 2011
8) Grob D, Humke T, Dvorak J: Degenerative lumbar spinal stenosis. Decompression with and without arthrodesis. J Bone Joint Surg Am 77: 1036–1041, 1995
9) Kilincer C, Steinmetz MP, Sohn MJ, Benzel EC, Bingeman W: Effects of age on the perioperative characteristics and short-term outcome of posterior lumbar fusion surgery. J Neurosurg Spine 3: 34–39, 2005
10) Lee GY, Guen YL, Lee JW, Joon WL, Choi HS, Hee SC, Oh KJ, Kyoung-Jin O, Kang HS, Heung SK: A new grading system of lumbar central canal stenosis on MRI: an easy and reliable method. Skeletal Radiol 40: 1033–1039, 2011
11) North American Spine Society Evidence-Based Clinical Guidelines for Multidisciplinary Spine Care. Available at http://www.spine.org/Documents/ Lumbar Stenosis11.pdf pp 63–64 2011. Accessed 25 September 2012
12) Okuda S, Oda T, Miyauchi A, Haku T, Yamamoto T, Iwasaki M: Surgical outcomes of posterior lumbar interbody fusion in elderly patients. Surgical technique. J Bone Joint Surg Am 89(Suppl 2 Pt.2): 310–320, 2007
13) Raffo CS, Lauerman WC: Predicting morbidity and mortality of lumbar spine arthrodesis in patients in their ninth decade. Spine 31: 99–103, 2006
14) Yone K, Sakou T: Usefulness of Posner’s definition of spinal instability for selection of surgical treatment for lumbar spinal stenosis. J Spinal Disorder 12: 40–44, 1999
15) Zhou ZJ, Zhao FD, Fang XQ, Zhao X, Fan SW: Meta-analysis of instrumented posterior interbody fusion versus instrumented posterolateral fusion in the lumbar spine. J Neurosurg Spine 15: 295–310, 2011

Address reprint requests to: Ki-Jeong Kim, MD, PhD, Department of Neurosurgery, Spine Center, Seoul National University Bundang Hospital, Seoul National University College of Medicine, 300 Gumi-dong, Bundang-gu, Seongnam-si, Gyeonggi-do 463-707, Republic of Korea.

e-mail: kiujeong@snu.ac.kr

Neurol Med Chir (Tokyo) 53, December, 2013