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Functional Outcome After Posterior Lumbar Interbody Fusion With Cage in Patient With Lumbar Spinal Stenosis

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Lumbar spinal stenosis is common degenerative disease of the spine in the elderly population. Posterior Lumbar Interbody Fusion (PLIF) is increasingly used to achieve 360° fusion and allows for adequate intervertebral foraminal height restoration for neural decompression while maintaining posterior support structures. The study purpose is to know the functional outcome after posterior lumbar interbody fusion with cage in patient with lumbar spinal stenosis.

The study was performed by using retrospective longitudinal study design with 16 patients who had undergone posterior lumbar interbody fusion procedure with cage at Wahidin Sudirohusodo Hospital, Makassar, within period December 2015 to September 2017, with follow up time of 6 months and 12 months postoperatively.

All patients were evaluated for pain scale assessment and Oswestry Disability Index and were analyzed using the Wilcoxon Signed Rank Test test, and the Somer's Dtest Test, with p value <0.05.

From the analysis there are improvement of pain scale and functional outcome in patients before and after operation.

Keywords: Lumbar spinal stenosis, Posterior Lumbar Interbody Fusion (PLIF), cage, functional outcome

Background

Lumbar spinal stenosis is a condition of narrowing of the spinal canal or intervertebral foramen in the lumbar region accompanied by suppression of nerve roots coming out of the foramen. Lumbar spinal stenosis is one of the most common problems, which is a degenerative disease of the spine in the elderly population. The prevalence of this disorder is 5 out of 1000 people over the age of 50 in America. It is the most common disease that causes surgery on the spine at the age of more than 60 years. [1-3, 6, 7]

This disorder is generally slow. Generally exposed to L3-L4, and L4-L5 areas. Symptoms may include lower back pain, neurogenic claudication, pain radiating to the extremities, reduced travel distance on the road, and limited mobility. Conservative therapy may reduce symptoms, but underlying basic abnormalities remain and it is not possible to achieve excellent results with conservative therapy in a very long time.[4]

The goal of surgery is to get a complete decompression on the cauda equina and nerve root by minimizing damage to the spinal architecture. However, limited decompression is sometimes not enough, and re-stenosis may occur. On the other hand, extensive decompression may lead to instability after surgery, with architectural weakness in the vertebral structure. [2]

Operative procedures that can be performed include: decompressive laminotomy and partial fasetectomy, decompressive laminectomy and partial fasetectomy, micro decompression, decompression and fusion without instruments, decompression and fusion with instruments, decompression

and flexible stabilization, interspinous spacer device. [3]

The posterior Lumbar interbody fusion (PLIF) was first described by Cloward in 1940 and modified by Lin, after which it became one of the most common operations. PLIF can provide stable three-column fixation with anterior and 360° fusion support, and is performed only from the posterior. It also protects the instruments in the posterior part of the strain and failure in addition to restoring the height of the intervertebral discs, which can lead to nerve decompression. [5]

The aim of this study is to know the functional outcome of posterior lumbar interbody fusion with cage in patients with lumbar spinal stenosis.

Material and Methods

The study performed by using retrospective study design with 16 patients who had undergone posterior lumbar interbody fusion procedure with cage through a dorsal approach at Wahidin Sudirohusodo Hospital, Makassar, within period December 2015 to September 2017. Medical records of patients fulfilling inclusion and exclusion criteria were collected for height, body weight, Numeric Pain Rating Scale (NRS) and Oswestry Disability index (ODI) (In order to determine the effect of leg pain and low back pain on daily life activities) before surgery, and 6 months and 12 months postoperative.

The patient inclusion criteria were: (i) adult patients undergoing surgery for degenerative conditions of the lumbar spine, excluding tumour, trauma and infection, with a minimum follow-up of 1 year, (ii) age over 40 years , (iii) all operations are performed by the same surgeon.

All patients underwent a comprehensive neurologic examination. Pre-operative imaging included lumbosacral x-ray graphics (AP, Lateral), flexion-extension x-rays to demonstrate dynamic instability and MRI. Stenosis was not classified as foraminal and extraforaminal. All patients had posterior lumbar interbody fusion procedure with cage through a dorsal approach. All operations were performed by the same surgeon .

Wilcoxon Signed Rank test used to assess NRS and ODI comparison before operation, 6 months and 12 months postoperatively. The results of the comparison differed significantly if the p value <0.05. Somer's d test used to assess the ratio of preoperative disabilitance to 6 months and 12 months postoperatively. The results of the comparison differed significantly if the p value <0.05.

Surgical Technique

Preoperative antibiotic prophylaxis was done by intravenous cefazolin 1 g one hour before surgery. The patient underwent a generalized endotracheal anesthetic procedure and positioned prone on the operating table or a framework to lower the pressure in the abdomen. Approach posterior routine through the midline incision 10 cm, so it looks lumbar vertebra. Then performed the decompression procedure by means of total facetectomy, laminectomy, resection of the flavum ligament in the affected segment. After the disectomy, the end plate of the vertebral body is cleansed. Proper cage installation is performed. In all cases, an autogenous local bone graft from bone originated from the previous decompression procedure to achieve fusion. The bone used is cleaned from the connective tissue, then the cancellous bone is placed in the cage. Then performed spondilolistesis correction using two rods according to standard operating protocol. The remaining bone is then used as an autogen corticocancellous graft placed posterolaterally (Fig. 1).

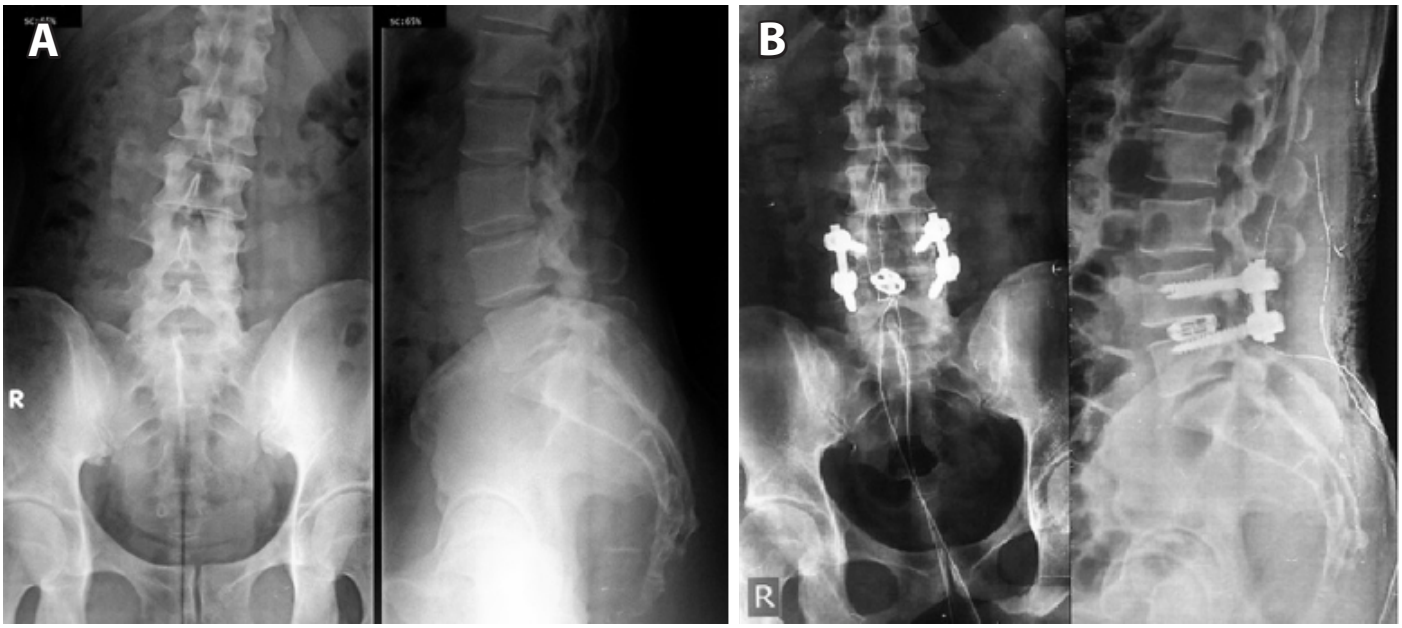

Figure 1.
Radiological features before (A) and after (B) PLIF with cage procedure.

Results

The study included 16 patients, mostly male (62.5%). The age of the study subjects was between 44-78 years with mean (mean) of 57 years. Majority of patients including overweight, with BMI between 20.3-28.3 and 24.5. The location of the operation was mostly carried out on L4-L5 (68.8%) (Tab 1).

The 6-month postoperative NRS was significantly lower than the preoperative NRS score of 6.00 down to 3.56, or a decrease of 40.7% (p <0.001). This suggests a significant reduction of pain after 6 months postoperatively. The 12-month postoperative NRS was significantly lower than the pre-operative NRS score of 6.00 down to 0.81, or a decrease of 86.5% (p <0.001). This suggests a significant reduction of pain after 12 months postoperatively. The 12-month postoperative NRS was significantly lower than the 6-month postoperative NRS score of 3.56 down to 0.81, or a decrease of 77.2% (p <0.001). This suggests a significant reduction of pain after 12 months postoperatively compared to 6 months postoperatively.

The 6-month postoperative ODI was significantly lower than the pre-operative ODI value of 58.38, down to 32.87, or a decrease of 43.7% (p <0.001). This indicates a significant functional improvement after 6 months postoperatively. The 12-month postoperative ODI rate was significantly lower than the pre-operative ODI value of 58.38 dropping to 8.38 or a decrease of 85.6% (p <0.001). This indicates a significant functional improvement after 12 months postoperatively. The 12-month postoperative ODI was significantly lower than the 6-month postoperative ODI rate from 32.87 to 8.38 or a decrease of 74.5% (p <0.001). This indicates a significant functional improvement after 12 months postoperatively compared to 6 months postoperatively.

There were significant functional improvements after 6 months and 12 months postoperative than before surgery (p <0.001) .Table above shows before the operation there were 7 subjects (43.8%) who were paralyzed and 9 subjects (56.3%) who severe disability, whereas in 6 months postoperatively no more paralyzed subjects and the remaining 2 subjects with severe diability. At 12 months postoperative follow-up, all subjects (100%) had minimal disability. (Tab 2)

Table 1. Distribution characteristics of study subjects.

Variable	N (%)	Range	Mean ± SD
Male	10 (62,5%)	–	–
Female	37 (37,5%)	–	–
L3 - L4 location	5 (31,3%)	–	–
L4 - L5 location	11 (68,8%)	–	–
Age (year)	–	44 – 78	57 ± 8,0
BMI (kg/m^2)	–	20,3 – 28,3	24,5 ± 2,2

Discussion

Studies of these 16 patients showed significant pain reduction in patients with a period of 12 months postoperatively compared with 6 months postoperatively performed by the same surgeon. And in addition to the disability measurements with the Oswestry Disability Index also showed significant changes with the initial disability of 58.38% (severe disability) to 32.87% (moderate disability) after 6 months and 8.38% (minimal disability) after 12 months post operation.

Previous study by Trouillier et al., reported that the average ODI rate for the entire group was 58% before surgery, 26% after 12 months, and 30% after 42 months. Pain scores also decreased from pre-operative values of 80%, to 30% after one year, and 45% after 3.5 years. [4]

Lin, et al., reported a satisfactory clinical outcome of 74% and a 93% fusion rate in 71 patients with spinal stenosis undergoing PLIF procedures. Hutter studied 142 patients with spinal stenosis treated with PLIF and obtained good results at 78% as well as 91% fusion. [6]

Based on the results of the Ramani study, elderly patients with Lumbar spinal stenosis with instability were suitable patients for the PLIF procedure. The patients would have improved clinical symptoms, function, and actual patient satisfaction (91%), at least at short time follow-up (1 year). [7]

Atlas S.J., et al, reported that among patients with lumbar spinal stenosis completing 8- to 10-year follow-up, low back pain relief, predominant symptom improvement, and satisfaction with the current state were similar in patients initially treated surgically or nonsurgically. However, leg pain relief and greater back-related functional status continued to favor those initially receiving surgical treatment. [8]

In the patients who primarily complain of radiculopathy with an underlying biomechanically stable spine, a decompression surgery alone using a less invasive technique may be sufficient. Preoperatively, with the presence of indicators such as failed back surgery syndrome (revision surgery), degenerative instability,

Table 2. Comparison of disabilities before surgery, 6 months and 12 months postoperatively.

Disability		Time		
		Before surgery	6 months post operatively	12 months post operatively
Minimal	N	0	0	16
	%	0,0%	0,0%	100,0%
Moderate	N	0	14	0
	%	0,0%	87,5%	0,0%
Severe	N	9	2	0
	%	56,3%	12,5%	0,0%
Crippled	N	7	0	0
	%	43,8%	0,0%	0,0%

considerable essential deformity, symp-tomatic spondylolysis, refractory degenerative disc disease, and adjacent segment disease, lumbar fusion is probably recommended. Intraoperatively, in cases with extensive decompression associated with a wide disc space or insufficient bone stock, fusion is pre-ferred. [9]

Okuda S., et al, reported high satisfaction rate to PLIF and significan correlation between patient and surgeon-based surgical outcomes were detected. Postoperative permanent motor loss and multiple revision surgery were the major factors related to a negative response. [10]

This is in line with the aim of this study that PLIF procedures with cage can improve the functional outcome of patients with lumbar spinal stenosis, characterized by reduced pain and reduced functional disability daily. The PLIF procedure with cage allows restoration of altitudes between the vertebral bodies is sufficient, allowing for nerve decompression while maintaining the posterior structure, and also allowing 360 degree fusion through a single incision. [4, 11].

Conclusion

There is improvement of functional outcome after the posterior Lumbar Interbody Fusion procedure with cage in patients with lumbar spinal stenosis. PLIF with cage can be used as one of the treatment options for treating patients with lumbar spinal stenosis, but advanced research is needed to assess radiological fusion and to compare PLIF procedures with cage with other surgical procedures.

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