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POSTERIOR LUMBAR INTERBODY FUSION: ASSESMENT OF COMPLICATIONS

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ABSTRACT

Objective: The aim of study is to investigate the complications of surgeries which were operated with instrumentation and posterior lumbar interbody fusion with the diagnosis of spinal stenosis.

Materials and Method: Sixty patients who were diagnosed as lumbar stenosis were investigated for the study. The patients that operated with instrumentation and posterior lumbar interbody fusion technique was selected. All patients were investigated from the files and radiology archive retrospectively. Vertebrae fractures, spondylolisthesis and neoplastic operations excluded from the study.

Results: A total of 60 patients were included in this study. Mean age of the patients was 54.3 ± 11.1 years. Forty-four patients (73.3 %) were females and 16 were males (26.7 %). All patients had spinal stenosis. Most frequent operation applied to patients was L3-4-5 Instrumentation and PLIF in 32 patients (53.3 %), followed by L2-3-4-5 Instrumentation and PLIF in 14 patients (23.3 %). Forty-three patients had no complication after the procedure (71.7 %), 6 patients had bilateral numbness (10 %), 4 patients had tural tear (6.7 %), 3 patients had bilateral radicular pain (5 %), 2 patients had dislocation (3.3 %) and 2 patiens had infection(3.3 %). When the complication rates were assessed respective to each other, proportion of bilateral numbness was the highest as 35.3 %, and proportions of infection and PLIF dislocation were the lowest as 11.7 % for each. The age distribution between genders was statistically similar (p=0.34). Likewise, the distributions of operation types (p=0.55) and complications (p=0.64) were also similar between female and male patients.

Conclusions: PLIF allows for adequate interbody height restoration and allows for neural decompression. Neurological and paraspinal muscle injury complications due to risk of retraction on thecal sac with nerve roots and paraspinal muscles must be remembered.

Key Words: Posterior lumbar interbody fusion, spinal stenosis, complications of fusion

Level of Evidence: Retrospective clinical study, Level III.

INTRODUCTION

Several surgical techniques are available and debate remains whether additional instrumentation and fusion is required [7]. Transpedicular screw fixation and interbody cages are mostly chosen for instrumentation. Spinal stenosis, degenerative disc diseases, trauma, infection and neoplasms are main diagnosis for using lumbar interbody fusion (LIF) [9]. LIF involves placement of an implant material such as cage or structural graft within the intervertebral disc space after discectomy and endplate preparation.

There are 5 main approaches which are posterior lumbar interbody fusion (PLIF), transforaminal lumbar interbody fusion (TLIF or MI-TLIF), anterior lumbar interbody fusion (ALIF), oblique lumbar interbody fusion/anterior to psoas (OLIF/ATP) and lateral lumbar interbody fusion (LLIF) that mostly used for performing LIF. In case of spinal interbody fusion in addition to decompression and pedicle screw fixation, two widely used techniques for spinal fusion are posterior lumbar interbody fusion (PLIF) and transforaminal lumbar interbody fusion (TLIF). The PLIF technique for

instrumented spinal fusion was introduced more than a half century ago in 1952 by Cloward [2].

The posterior approach may be suitable for degenerative indications requiring a fusion procedure, segmental instability, recurrent disc herniation, symptomatic spinal stenosis and pseudoarthrosis may also benefit from a PLIF procedure. Contraindications for posterior fusion surgery include extensive epidural scarring, arachnoiditis, and active infection. The aim of study is to investigate the complications of posterior lumbar interbody fusion surgeries with the diagnosis of spinal stenosis.

MATERIALS AND METHOD

Sixty patients who were diagnosed as lumbar stenosis were investigated for the study. The patients that operated with instrumentation and posterior lumbar interbody fusion technique was selected (Figure-1).

All patients were investigated from the files and radiology archieve retrospectively. Vertebrae fractures, spondylolisthesis and neoplastic operations excluded from the study.

Figure-1. Early postoperative and follow up sagittal computed tomography image of PLIF dislocated patient.

Statistical Analyses

The numerical variables were presented as mean and standard deviation, and categorical data were presented as frequency and percent. The comparisons between independent groups were performed using Mann-Whitney U test for numerical data, and Chi-square test for categorical data. A p value lower than 0.05 was considered as a statistically significant result for that analysis. SPSS 25 (IBM Inc., Armonk, NY, USA) was used for the statistical analyses of the study.

RESULTS

A total of 60 patients were included in this study. Mean age of the patients was 54.3 ± 11.1 years. Forty-four patients (73.3 %) were females and 16 were males (26.7 %) (Table-1).

All patients had spinal stenosis. Most frequent operation applied to patients was L3-4-5 Instrumentation and PLIF in 32 patients (53.3 %), followed by L2-3-4-5 Instrumentation and PLIF in 14 patients (23.3 %) (Table-2).

Forty-three patients had no complication after the procedure (71.7 %), 6 patients had bilateral numbness (10 %), 4 patients had tural tear (6.7 %), 3 patients had bilateral radicular pain (5 %), 2 patients had dislocation (3.3 %) and 2 patients had infection (3.3 %). When the complication rates were assessed respective to each other, proportion of bilateral numbness was the highest as 35.3 %, and proportions of infection and PLIF dislocation were the lowest as 11.7 % for each (Tasble-3).

Demographic and clinical characteristics between females and males were compered. Accordingly, mean ages of the female and male patients were 55.4 ± 11.7 years and 51.3 ± 9.4 years, respectively. The age distribution between genders was statistically similar (p=0.34). Likewise, the distributions of operation types (p=0.55) and complications (p=0.64) were also similar between female and male patients (Table-4).

Table-1. General demographic characteristics of patients

	Mean	**SD**
Age (years)	54.3	11.1
	n	**%**
Gender		
Female	44	73.3
Male	16	26.7

Table-2. General clinical characteristics of patients

	n	**%**
Disease		
Spinal stenosis	60	100
Operation		
L2-3-4-5 Instrumentation and PLIF	14	23.3
L3-4-5 Instrumentation and PLIF	32	53.3
L3-4-5-S1 Instrumentation and PLIF	4	6.7
L4-5 Instrumentation and PLIF	6	10
L4-5-S1 Instrumentation and PLI	4	6.7

Table-3. Complication rates

Complication	n	%
None	43	71.7
Bilateral numbness	6	10
Dural tear	4	6.7
Bilateral radicular pain	3	5
PLIF dislocation	2	3.3
Infection	2	3.3

Table 4. Comparisons of demographic and clinical characteristics between genders

	Female		Male		p
	Mean	SD	Mean	SD	
Age (years)	55.4	11.7	51.3	9.4	0.34
	n	%	n	%	p
Operation					0.55
L2-3-4-5 Instrumentation and PLIF	8	18.2	6	37.5	
L3-4-5 Instrumentation and PLIF	24	54.5	8	50.0	
L3-4-5-S1 Instrumentation and PLIF	2	4.5	2	12.5	
L4-5 Instrumentation and PLIF	6	13.6	-	-	
L4-5-S1 Instrumentation and PLI	4	9.1	-	-	

DISCUSSION

The main advantage associated with PLIF surgery is that this approach is a traditional lumbar approach that all spinal surgeons are well trained and comfortable in performing. A posterior exposure allows excellent visualization of the nerve roots without compromising blood supply to the graft. PLIF allows for adequate interbody height restoration, allows for neural decompression whilst maintaining posterior support structures [8]. There are disadvantages that a surgeon should be wary of when performing PLIF like paraspinal iatrogenic injury associated with prolonged muscle retraction and this could delay recovery and mobilization due to approach-related muscle trauma[3,5]. It may be difficult to correct coronal imbalance and restore lordosis with this approach. Endplate preparation may be difficult compared to anterior fusion approaches and other potential risks include retraction injury of nerve roots causing fibrosis and chronic radiculopathy [6,13,16].

There is no clear definitive evidence for one approach being superior to another in terms of fusion or clinical outcomes [14]. These operations can also be performed using mini-open or minimally invasive approaches [10]. Interbody fusion is preferable to postero-lateral on-lay fusion techniques due to lower rates of postoperative complications and pseudoarthrosis [4].

Kunder et al investigated 990 patients who were operated with using PLIF and TLIF and they found that the complication rate of TLIF was fifty percent lower compared to PLIF [7]. This significant difference was not only the case for surgery related complications as infections, nerve root damage and dural tears, but also for hardware problems and other complications. Severe complications as iatrogenic nerve root dysfunction were more often described for PLIF. They concluded with that the significant difference in complication rate can be explained by the higher a priori chance due to a bilateral instead of unilateral approach, though in case of TLIF the resection of bony structures is more extensive compared to PLIF. Due to less extensive resection of bony structures, there is possibly a larger chance on traction on the nerve root when inserting the cages for PLIF compared to TLIF [11].

Alobaidaan et al evaluated a total of 8609 patients underwent PLIF procedure with or without Human Bone Morphogenic Protein-2 (rhBMP2) for fusion [1]. They found that complication rates for infection, cardiac, pulmonary, lumbosacral neuritis, wound, and urinary tract were significantly lower in the rhBMP2 group. There was no difference in the rates of central nervous system complications or radiculitis between the 2 groups. They concluded with that the data showed that the patients who received rhBMP2 had lower complication rates compared to the nonrhBMP2 group, however use of rhBMP2 was associated with a higher rate of pseudoarthrosis.

Okuda et al evaluated a total of 1000 patients who underwent PLIF for degenerative lumbar disorders for adjacent segment disease (ASD) [12]. The overall ASD rate was 9.0 %, and the average ASD period was 4.7 years after primary surgery. With respect to clinical features of ASD, degenerative spondylolisthesis at the cranial fusion segment was the most frequent. In terms of repeat ASD, second and third ASD incidences were 1.1 % and 0.4 %, respectively. They summarized that as for ASD by fusion length, age, and preoperative pathologies, ASD incidence was increased by fusion length, while the time period to ASD was significantly shorter in elderly patients and those with degenerative lumbar scoliosis.

Teng et al investigated 26 studies which compares complication rates of LIF procedures and reported that there were no statistically significant differences between ALIF, PLIF and TLIF regarding reoperation rates, rates of neurological deficits, rates of infections or rates of venous thromboembolism [15].

We have a complication rate of 29.3 % including bilateral numbness, dural tear, bilateral radicular pain, PLIF dislocation and infection. When the complication rates were assessed respective to each other, proportion of bilateral numbness was the highest as 35.3 %, and proportions of infection and PLIF dislocation were the lowest as 11.7 % for each.

Conclusion

PLIF allows for adequate interbody height restoration and allows for neural decompression. Neurological and paraspinal muscle injury complications due to risk of retraction on thecal sac with nerve roots and paraspinal muscles must be remembered.

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