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Outcome of Posterior Lumbar Interbody Fusion (PLIF) with Cage and Bone Graft in The Treatment of Degenerative Lumbar Spinal Canal Stenosis

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Abstract

Introduction: *Posterior lumbar interbody fusion (PLIF) is a reliable treatment option for patients with Lumbar canal stenosis & spondylolisthesis; providing spinal stabilization in a balanced alignment with the disc space height restored and with the neural elements being decompressed mechanically. The titanium cages provided immediate stability to spinal levels, restoration of the disc space and neuro-foraminal area, and an increased surface area leading to successful fusion.* ***Materials and Methods:*** *This prospective study was carried out at the Department of Orthopedic Surgery at DMCH, Dhaka within the defined period. All the data were compiled and sorted properly and the quantitative data was analyzed statistically by using Statistical Package for Social Science. The results were expressed as percentage and mean ± SD and p<0.05 was considered as the level of significant.* ***Result:*** *Mean age of the study population was 51.32±8.29 with a female: male ratio 1.6 :1 where maximum patient was housewife (57.14%). 60.72% patients had only single level involvement while 39.28% patients had multi-level involvement. Mean VAS score reduced significantly at final follow-up (6.55±0.66 to 2.29±0.46 for back pain and 6.59±0.65 to 1.21±0.42 for leg pain. Mean ODI score decreased significantly from 56.71±3.09 to 15.82±3.46 at final follow-up. Radiologically Grade-I fusion achieved in 89.28% cases. Overall functional outcome was excellent (89.29%) & good (7.14%) according to Modified Macnab criteria.* ***Conclusion:*** *Posterior lumbar interbody fusion (PLIF) with cage and bone graft in the treatment of degenerative lumbar spinal canal stenosis provides excellent neurological and functional outcome and fusion rate at final follow-up.*

Keywords: *Lumbar canal stenosis, PLIF, Cage, Interbody fusion.*

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Introduction:

Chronic LBP (CLBP) is a syndrome in which there is pain in lower back region, which lasts minimum 12 weeks. Degenerative lumbar spine disorders comprise the major proportion of etiology of chronic low back pain in adult population, which often leads to serious disability to carry out daily routine activities. These conditions are often managed initially using conservative treatment like NSAIDs, rest, muscle strengthening exercises, lumbosacral brace[1]. The management options for patients with degenerative lumbar disease have evolved over the decades with variable results of the different options published globally[2]. There are various surgical modalities which have been offered for these conditions like decompression alone, decompression along with posterolateral fusion, and latest technique is decompression with interbody fusion. The current choice for treating lumbar degenerative disease is interbody fusion surgery[1]. The idea of lumbar or lumbosacral

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arthrodesis is to eliminate motion and thus to relieve pain. Addition of pedicle screw fixation provides direct stability to the spine and improves the fusion rate[3]. Posterior lumbar interbody fusion (PLIF) is a reliable treatment option for patients with LCS & spondylolisthesis; providing spinal stabilization in a balanced alignment with the disc space height restored and with the neural elements being decompressed mechanically. The titanium cages provided immediate stability to spinal levels, restoration of the disc space and neuroforaminal area, and an increased surface area leading to successful fusion. Additional use of cage in PLIF would provide better biomechanical advantages, including restoration of disc space height, better sagittal alignment, good initial anterior column weight bearing and better fusion rates. Posterior Lumbar Interbody fusion is biomechanically sound as it ablates the degenerated disc, restores the normal intervertebral height and dynamically decompressing foraminal stenosis and positions the bone graft along the weight bearing axis[4]. This technique of 360˚ fusion is meant to achieve primary stability and prevent segmental movement until bony fusion[5]. Spinal arthrodesis implies fusion of joints around the vertebral disc unit involving articular facets or vertebral interbody region[6]. The objective of spinal fusion surgery is to achieve a solid arthrodesis of spinal segments while restoring disk height, immobilizing the unstable segment and restoring load bearing to anterior structures. Nowadays, both posterior lumbar interbody fusion (PLIF) and transforaminal lumbar interbody fusion (TLIF) have been widely and successfully used in the management of lumbar degenerative diseases[7]. The interbody cage evolved fast in the years that followed, with several variation kinds including titanium cages, and the use of cages in conjunction with locally morcellized bone graft rather than tricortical iliac bone graft became the norm of contemporary treatment[8].

Materials & Methods:

This Prospective Interventional Study study was carried out among 28 patients attending at the department of Orthopaedic Surgery at Dhaka Medical College Hospital, Bangladesh Spine & Orthopaedic Hospital (BSOH), Al-Manar Hospital Ltd, Dhaka for the treatment of lumbar spinal canal stenosis within the defined period from January 2022 to December 2022. Ethical clearance was obtained from the Institutional Review Board (IRB) of DMCH. Purposive sampling was done according to availability of the patients. The collected data were entered into the computer and analyzed by using SPSS (version 20.1) to assess the epidemiology, clinical feature, diagnosis and treatment of the lumbar spinal stenosis patients.

Results:

Mean age of the patients was 51.32±8.29 years and the ranges were 40-70 years where maximum belonged to 40-49 years of age (42.86%) (Table I).

Table I: Distribution of the study patients (n=28)

Age (years)	Number	Percentage
40-49	12	42.86%
50-59	9	32.14%
≥60	7	25%
Total	28	100%

Greater part of the patients was female 60.71% with a female: male ratio 1.6 :1 (Table II).

Table II: Gender distribution of the study population (n=28)

Gender	Number	Percentage
Female	17	60.71%
Male	11	39.29%
Total	28	100%

Average postoperative hospital stay was 5.43 ± 0.79 days which was ranged 5-7 days (Table III).

Table III: Duration of pre-operative &postoperative hospital stays (n=28)

Hospital stay	Mean ±SD	Range (min-max)
Pre-operative hospital stay (In days)	6.36±6.91	2-20
post-operative hospital stay (in days)	5.43±0.79	5-7

Pre-operatively, mean VAS score (Back pain) of all patients was 6.55±0.66 (6-8) whereas post-operatively VAS score was decreased significantly at final follow up (2.29±0.46) compared to pre-operative status (p value <0.001). Paired t-test was performed comparing preoperative vs final follow-up at 06 months (Table IV).

Table IV: Mean VAS score (Back pain) in study population at (n=28)

Time point	Mean ±SD	Range (min-max) days
Pre-operative	6.55±0.66	6-8 days
post-operative	2.29±0.46	2-3 days

*** p value <0.001**

Pre-operatively, mean VAS score (Leg pain) of all patients was 6.59±0.65 (6-8) whereas post-operatively VAS score was decreased significantly at final follow up (1.21±0.42) compared to pre-operative status (p value <0.001). Paired t-test was performed comparing preoperative vs final follow-up at 06 months (Table V)

Table V: Mean VAS score (Leg pain) in study population at (n=28

Time point	Mean ±SD	Range (min-max) days
Pre-operative	6.59±0.65	6-8 days
post-operative	1.21±0.42	1-2 days

*** p value <0.001**

Pre-operatively, mean ODI score of all patients was 56.71±3.09 (52-62) whereas post-operatively ODI score was decreased significantly at final follow up (15.82±3.46) compared to pre-operative status (p value <0.001). Student t-test was performed comparing preoperative vs final follow-up at 6 months (Table VI).

Table VI: Oswestry Disability Index (ODI) in study population at (n=28)

Time point	Mean ±SD	Range (min-max) days
Pre-operative	56.71±3.09	52-62
post-operative	15.82±3.46	12-25

*** p value <0.001**

Radiological outcome was assessed post-operatively by Bridwell grading system. Radiological fusion with remodeling and trabeculae was found in majority patients after 6months of follow up (89.28%). No patient had experienced non-union (grade IV) during all of the post-operative follow up (Table VII).

Table VII: Assessment according to Bridwell fusion criteria (n=28)

Bridwell grade	After 6 months (n)	Percentage
Grade I	25	89.28
Grade II	3	10.72
Grade III	0	0
Grade IV	0	0

Table VIII shows comprehensive post operative outcome. Most of the cases 25 (89.29%) had excellent outcome, 2(7.14%) case had good and 1 (3.57 %) case had fair outcome.

Table VIII: Distribution of study population according to post operative clinical outcome (n=28)

According to Modified Macnab criteria (Macnab et al., 1971)

Comprehensive outcome	Frequency (n)	Percentage
Excellent	25	89.29
Good	2	7.14
Fair	1	3.57
Poor	00	00

Discussion:

In our study mean age of the patients was 51.32±8.29 years and the range were 40-70 where maximum belonged to 40-49 years of age (42.86%). Similar result was found by Murthy & Reddy (2016) where maximum patients were in the age group of 41-50 years (36.7%) followed by 51-60 years (33.3%)3. In our study greater part of the patients were female 60.71% with a female: male ratio 1.6 :1. Murthy & Reddy (2016) found male 46.7% and female 53.3% which is almost similar to our study3. In our study, pre-operatively, mean VAS score for back pain of all patients was 6.55±0.66 (6-8) whereas post-operatively VAS score was decreased significantly at final follow up (2.29±0.46) compared to pre-operative status (p value <0.001). Etemadifar et al. (2016) also found similar result where VAS score of back pain improved significantly (p=0.37). Pre-operatively, mean VAS score for leg pain of all patients was 6.59±0.65 (6-8) whereas post-operatively VAS score was decreased significantly at final follow up (1.21±0.42) compared to pre-operative status (p value <0.001) and it is also similar to Etemadifar et al. (2016)[9]. In our study, average postoperative hospital stay was 5.43±0.79 days which was ranged 5-7 days. Similar result was observed by Xu et al. (2020) in which mean duration of hospital stay after operation was 6.9±1.8 days[10]. Regarding ODI score (Oswestry Disability Index), in our study pre-operative mean ODI score of all patients was 56.71±3.09 (52-62) whereas post-operatively ODI score was decreased significantly at final follow up (15.82±3.46) compared to pre-operative status (p value <0.001) which is significant. Etemadifar et al. (2016) found almost similar result where ODI score decreased significantly (p=0.53) from 68±12[9]. Radiological outcome was assessed post-operatively by Bridwell grading system. Radiological fusion with remodeling and trabeculae was found in majority patients after six months of follow up (89.28%). No patient had experienced non-union (grade IV) during all of the post-operative follow up. Etemadifar et al. (2016) in their study found 68% (PLIF) grade I fusion[9]. In our study, according to Modified Macnab criteria 89.29% patients had excellent clinical outcome. Aziz & Aziz (2022) in their study found almost similar result (84.61%) excellent & good outcome according to Modified Macnab's criteria)[11]. Hossain et al. (2021) in their study found 90% excellent & good result with only 5% non-satisfactory outcome[4].

Conclusion:

Posterior lumbar interbody fusion (PLIF) with cage and bone graft in the treatment of degenerative lumbar spinal canal stenosis provides excellent neurological and functional outcome and fusion rate at final follow-up.

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Conflict of Interest: None.

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