

Spondylolisthesis at L4/5 but Fixation of L4, L5 and S1 Reduces the Rate of Adjacent Segment Degeneration

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Abstract

Study background: Adjacent segment disease (ASD) is a common phenomenon seen in patients who have undergone prior lumbar fusion surgery is characterized by degeneration and/or stenosis. Treatment for ASD includes extension of the fusion with a posterior approach, with direct decompression of the neural elements when indicated.

Methods: 54 patients of spondylolisthesis involving L4/5 level were included in this study that were operated from January 2012 to December 2020 in Bangabandhu Sheikh Mujib Medical University and few private hospital in Dhaka who failed to respond in conservative treatment. 30 patients were male and 24 were female. patients were evaluated by clinical finding (low back pain, sensory, motor and jerks) VAS score, ODI score, JOA score, modified Macnab's criteria, claudication distance, X-ray lumbosacral spine AP and lateral view, MRI of lumbosacral spine, CT scan of lumbosacral spine. P value of less than 0.05 was level significance.

Results: Mean (\pm SD) age of the patients was 56.29 ± 8.13 with highest age being 68 years and lowest being 41 years. 40 were male and 24 were female. Preoperative VAS score (for both back pain and leg pain) was 6.86 ± 0.65 which significantly reduced to 1.04 ± 0.19 36 months after operation. Out of 64 patients, 62 patients showed interbody fusion with good trabecular marking. Postoperative MRI of lumbosacral spine at 36 months showed 48 patients out of 64 had no desiccation of L3/4 disc, 9 had mild disc desiccation and 7 developed desiccation of L3/4 disc. Final outcome was determined by Modified Macnab's criteria. Excellent result found in 39 patients, good result found in 22 patients and fair result found in 3 patients.

Conclusion: Fixation of L4, L5 along with S1 in single level PLIF or TLIF in L4/5 level significantly reduce the rate of disc degeneration at L5/S1 level with slight degeneration at L3/4 level.

Keywords: Spondylolisthesis • Adjacent segment degeneration • Motion segment • PLIF • TLIF

Introduction

Spondylolisthesis is a common degenerative spinal disease which includes degenerative spondylolisthesis (DS) and isthmic spondylolisthesis (IS), is described as a condition in which a vertebral body, compared to the vertebral body beneath it, shifts forward with an intact neural arch [1–3].

Spinal fusion has been the standard treatment for degenerative disc disease and other degenerative conditions of the spine after failure of non-operative regimens where interbody fusion is referred as gold standard. Successful instrumented fusions provide immediate stability and elimination of motion of the segment after decompression and long-term maintenance of correction after reconstruction. With rigid fusion of the lumbar spine motion segment, the immediate cephalad and caudal level undergoes increased loading stresses, an altered lordotic curve, and shifting of the instantaneous axis of rotation (IAR) posteriorly [4,5].

Adjacent segment disease (ASD) is a common phenomenon seen in patients who have undergone prior lumbar fusion surgery is characterized

by degeneration and/or stenosis. The rate of ASD has been estimated radiographically and clinically to be over 40% and over 30%, respectively, at 5-year interval [1]. This process may be resulted from increased biomechanical forces at the levels either above or below the fusion, or it might be influenced by natural history in a patient who has already demonstrated degenerative changes requiring the index operation. Patients may present with axial pain from disc or facet degeneration or with symptoms of neural compression such as neurogenic claudication, radiculopathy, or both. Treatment for ASD includes extension of the fusion with a posterior approach, with direct decompression of the neural elements when indicated [6].

Research Methodology

54 patients of spondylolisthesis involving L4/5 level were included in this study that were operated from January 2012 to December 2020 in Bangabandhu Sheikh Mujib Medical University and few private hospital in Dhaka who failed to respond in conservative treatment. 30 patients were male and 24 were female. After proper evaluation by history taking, clinical finding and radiological evaluation (X-ray, MRI and CT scan), patients were diagnosed as a case of spondylolisthesis (isthmic and degenerative) involving L4/5. Fixation done at level L4, L5 and S1 level with interbody fusion at L4/5 level with banana cage and bone graft. Patients were followed up for 36 months. Postoperatively, patients were evaluated by clinical finding (low back pain, sensory, motor and jerks) VAS score, ODI score, JOA score, modified Macnab's criteria, claudication distance, X-ray lumbosacral spine AP and lateral view, MRI of lumbosacral spine, CT scan of lumbosacral spine. P value of less than 0.05 was level significance [7-10].

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Operative Procedure

Patients were kept prone in knee chest position, with having two bolster to keep abdomen free from any external pressure. Hypotensive anaesthesia maintained. Posterior midline incision made for desired level. Dissection has been done subperiosteally with monopolar diathermy up to the laminae and laterally up to lateral part of the facet joint. Decompression of the L4/5 level have been done posteriorly or transforaminally and PLIF or TLIF with banana cage and bone graft done. Pedicle screw inserted in L4, L5 and S1 vertebra pedicle after confirming the position with image intensifier. Rod applied maintaining appropriate lordosis. Haemostasis secured by gel foam. Drain tube kept in the wound and wound closed in layer by layer. Sterile bandage applied.

Results

The results of current study demonstrate that mean (\pm SD) age of the patients was 56.29 ± 8.13 with highest age being 68 years and lowest being 41 years. 40 were male and 24 were female. One patient had dual tear and one patient had nerve root injury during operation. Postoperative hospital stay was 5.57 ± 0.63 .

Preoperative VAS score (for both back pain and leg pain) was 6.86 ± 0.65 which significantly reduced to 1.04 ± 0.19 36 months after operation. JOA score pre-operatively was 10.68 ± 1.061 which significantly increased to 27.57 ± 0.63 36 months after operation. ODI score pre-operatively was 34.43 ± 2.99 which significantly reduced to 8.39 ± 1.59 36 months of operation.

Out of 64 patients, 62 patients showed interbody fusion with good trabecular marking. 2 patients showed pseudarthroses but there was good posterolateral fusion seen on postoperative X-ray and CT scan. Postoperative MRI of lumbosacral spine at 36 months showed 48 patients out of 64 had no desiccation of L3/4 disc, 9 had mild disc desiccation and 7 developed desiccation of L3/4 disc. 4 patients had developed disc prolapse at L3/4 level. 2 patients develop signs and symptoms of L4 nerve entrapment. No patient develops signs and symptoms of S1 nerve root entrapment.

Final outcome was determined by Modified Macnab's criteria. Excellent result found in 39 patients, good result found in 22 patients and fair result found in 3 patients.

Discussion

The results of current study demonstrate that mean (\pm SD) age of the patients was 56.29 ± 8.13 with highest age being 68 years and lowest being 41 years and few other authors also found same result [1,5,11] 40 were male and 24 were female also found same result found female predominance [2,3,5]

One patient had dural tear and one patient had nerve root injury during operation. Postoperative hospital stay was 5.57 ± 0.63 . Preoperative VAS score (for both back pain and leg pain) was 6.86 ± 0.65 which significantly reduced to 1.04 ± 0.19 36 months after operation. JOA score pre-operatively was 10.68 ± 1.061 which significantly increased to 27.57 ± 0.63 36 months after operation. ODI score pre-operatively was 34.43 ± 2.99 which significantly reduced to 8.39 ± 1.59 36 months of operation (Tables 1, 2 and 3).

Out of 64 patients, 62 patients showed interbody fusion with good trabecular marking. 2 patients showed pseudarthroses but there was good posterolateral fusion seen on post-operative x-ray (Figure 1).

Postoperative MRI (Figure 2) of lumbosacral spine at 36 months showed 48 patients out of 64 had no desiccation of L3/4 disc, 9 had mild disc desiccation and 7 developed desiccation of L3/4 disc. Miakoshi et al. found almost similar result in a study with 45 patients [10]

Disc height was maintained after 36 months at L5/S1 level, Slight reduction in average disc height at L3/4 level after 36 months. Almost similar result found by some other authors who found maintenance of Disc height almost same as preoperative (Figure 3) at L5/S1 level, Slight reduction at L3/4 level when

Table 1. VAS score of the study population (N=64).

Duration	VAS (n=64)	p-value
Pre-operative	6.86 ± 0.65	0.549
After 12 months of operation	1.95 ± 0.54	0.002
After 24 months of operation	1.07 ± 0.26	0.001
After 36 months of operation	1.04 ± 0.19	0.004

Table 2. JOA score of the study population (N=64).

Duration	JOA (n=64)	p-value
Preoperative	10.68 ± 1.06	0.724
After 12 months of operation	23.54 ± 0.75	0.001
After 24 months of operation	24.64 ± 0.87	<0.001
After 36 months of operation	27.57 ± 0.63	<0.001

Table 3. ODI score of the study population (N=64).

Duration	ODI (n=64)	p-value
Preoperative	34.43 ± 2.99	0.488
After 12 months of operation	10.15 ± 2.12	0.012
After 24 months of operation	8.93 ± 1.88	0.012
After 36 months of operation	8.39 ± 1.59	0.009

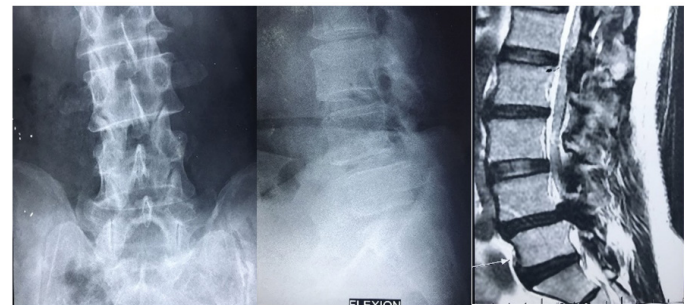


Figure 1. X-ray lumbosacral spine AP and Lateral view.

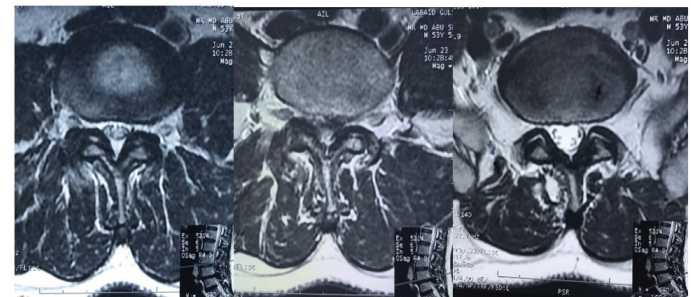


Figure 2. MRI of lumbosacral spine sagittal section.

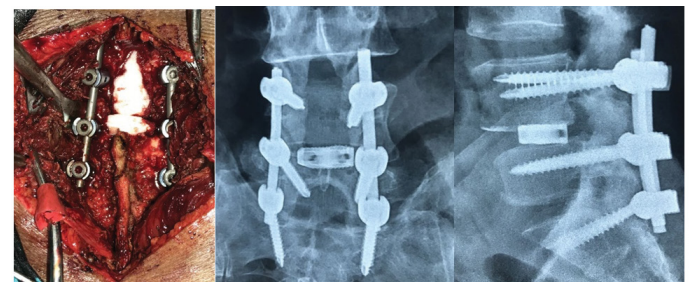


Figure 3. Perioperative image of fixation, AP and lateral radiograph of lumbosacral spine showing construct.

Fixation done at L4, L5 and S1 level. But more disc space reduction found at L5/S1 level when fixation done only at L4 and L5 level [6,9,11,12]. Four patients had developed disc prolapse at L3/4 level. 2 patients develop signs and symptoms of L4 nerve entrapment. Hikono et al. found same result [9].

Table 4. Outcome of the study population according to Modified Macnab's criteria (N=64).

Criteria	Outcome (n=64)	p-value
Excellent	39	0.004
Good	22	
Fair	3	

No patient develops signs and symptoms of S1 nerve root entrapment. Similar result found by some other author [7,8]. Final outcome was determined by Modified Macnab's criteria. Excellent result found in 39 patients, good result found in 22 patients and fair result found in 3 patients (Table 4).

Conclusion

It can be concluded that fixation of L4, L5 along with S1 in single level PLIF or TLIF in L4/5 level significantly reduce the rate of disc degeneration at L5/S1 level as there is no single space left unfixed. There is slight degeneration at L3/4 level as there is multiple levels to maintain the lumbar motion.

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