

## ORIGINAL ARTICLE

# SURGICAL OUTCOME OF LUMBAR DEGENERATIVE SPONDYLOLISTHESIS WITH REDUCTION VERSUS FUSION IN SITU.

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### ABSTRACT

**Background:** Surgical approaches used in the treatment of patients with severe lumbar spondylolisthesis (Grade II and Grade III) are usually associated with a great deal of controversies. The objective of the study was to assess the surgical outcomes of severe Lumbar spondylolisthesis treated with either pedicle screw fixation, reduction and fusion or instrumented Fusion in-situ.

**Methods:** We retrospectively studied 32 patients (20 females and 12 males), who had severe lumbar spondylolisthesis. All patients were divided in two groups (group A reduction and fusion and group B fusion in-situ). The mean follow-up period was 6 months. Radiological and clinical outcomes were measured by slip percentage, slip angle correction rate, Oswestry Disability index (ODI), visual analogue scale (VAS). Data was analyzed by SPSS version 22.0

**Results:** The analysis of the preoperative visits and final follow-up of all patients indicated that vertebral reduction and fusion could slightly enhance the surgical outcome in comparison to instrumented fusion in situ. Preoperative and Postoperative data was collected in all patients and found VAS from 7.76 to 2.08 in group-A and VAS from 8.5 preoperative to 2.4 postoperative in group-B and ODI from 69.42% to 20.06% in group-A and 70.9% to 22% in group-B and mean slip correction rate was 59.8%. There was no single case of loss of reduction.

**Conclusion:** The reduction, fusion and spinal decompression enhances surgical outcome and it can be concluded that such procedure is slightly superior over fusion in situ. Excellent and good levels of satisfaction were observed in all group-A patients, although surgical time was slightly more than fusion in-situ group.

**KEYWORDS:** lumbar vertebrae, Instrumentation, Spinal Fusion

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### INTRODUCTION

Lumbar degenerative spondylolisthesis slippage of one lumbar vertebra on the lower one as the result of degenerative changes in spine<sup>1</sup>. Symptomatic patients respond well to non-surgical treatments such as lifestyle modification, NSAIDs, physical therapy, epidural injection<sup>2,3</sup>. Surgical indications include refractory cases with unbearable symptoms, unresponsive to a conservative treatment more than 3 months, rest pain, progressive radicular symptoms and high grade spondylolisthesis and –

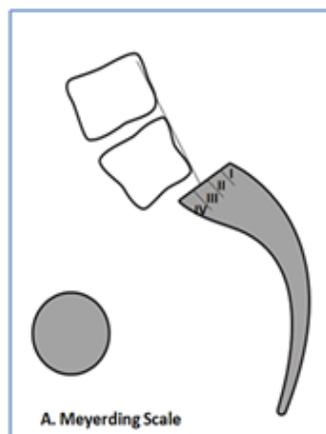
sagittal imbalance.

A range of surgical techniques has been used for surgical treatment of lumbar degenerative spondylolisthesis. These include in-situ posterolateral fusion, in situ transsacral fusion, vertebral reduction and fusion via two separate anterior and posterior approaches or a single stage posterior approach are the commonly performed techniques. In operative management of high grade spondylolisthesis, the risk of neurologic complications and pseudoarthrosis usually high. It would be ideal to find a

simple method that can restore normal spinal alignment without causing any iatrogenic complications and can provide satisfactory clinical outcomes. In this study, we aim to evaluate the surgical outcomes of high grade spondylolisthesis treated with either intraoperative distraction rod, vertebral reduction, fusion and instrumentation through the isolated posterior approach or in-situ fusion without reduction.

## METHODS

We retrospectively studied the patients with high grade (>50% slippage) lumbar spondylolisthesis that was treated surgically at orthopedic department Dr Ziauddin university hospital Clifton Karachi. The selected patients were operated from sept:2015 to sept:2016 with average age  $59.53 \text{ years} \pm 7.87$ . Those Patients who were unresponsive >3 months to conservative management, with progressive low back pain and radicular symptoms in legs with neurological deficit, radiographically confirmed diagnosis were included in this study and Patients with revision lumbar spine surgery and infection, malignancy, lumbar congenital deformity and follow up period of less than 6 months were excluded from the study. Magnetic resonance imaging scans, antero-posterior and lateral radiographs in standing were taken for all of our patients preoperatively. We measured slip angle formed by the L5 inferior endplate and the line perpendicular to the posterior aspect of S1 using Meyerding angle as seen in fig.17 and calculated slip percentage of anterior displacement of the upper vertebra on the top of the lower vertebra.<sup>8</sup> After explaining the surgical procedure in local language and English, all patients signed informed consent. All the surgical procedures were performed by a single surgical team and in the same manner. There was not complication seen in all operated patients.



**Figure 1: For each one quarter that upper vertebrae is displaced forward on vertebra below**

Grade I – (1-25%)

Grade II – (25-50%)

Grade III – (50-75%)

Grade IV – (more than 75%)

After the general anesthesia, the patient was placed in prone position. With midline posterior spinal incision, we performed Transforaminal to achieve 360 degree fusion and after that pedicle screw fixation and rod insertion followed by Decompression and at the time of screw head insertion, depending on the amount of replacement needed, the proximal screwhead placed ahead of the distal screws. Therefore, with tightening of the proximal screws, the slipped vertebra will come back to the original place. To do this, we first tightened both distal screws to the longitudinal rods. Then, we applied mild distracting force between proximal and distal screws to facilitate the reduction maneuver and later we tightened the proximal screws to draw back the slipped vertebra and finally auto genous bone graft was used to achieve fusion and in other group of patient we performed decompression and instrumented in-situ fusion without reduction. Interbody cage was used in all patients.

The patients' pain and disability were assessed by visual analogue scale (VAS) and Oswestry disability index (ODI) questionnaire<sup>9,10</sup>. These forms are completed by the patients themselves. Meyerding angle was measured pre and postoperatively on xrays and last follow up visit at 6 months. Correction rate was calculated as Slip Correction Rate (%) =  $(\text{Preoperative} - \text{Postoperative slip \%}) / \text{preoperative slip \%} \times 100$

## Statistical Analysis

A descriptive analysis was done for demographic and clinical features and results were presented as mean  $\pm$  standard deviation for quantitative variables like, age, Oswestry Disability Index (ODI) and Visual Analogue Scale (VAS). For qualitative variables frequencies and percentages were presented like gender, diagnosis grade and surgical procedures. To determine the association between Diagnosis grade and surgical procedure, Chi-square / Fisher's exact test was applied. Just to find out the difference between pre and post-operative VAS and ODI, Paired sample t-test was applied. Statistical analyses were conducted by using the Statistical package for social science SPSS version 22 and all p-values were two sided and considered as statistically significant if  $< 0.05$

## RESULTS

Out of 32 patients (table 1) evaluated in this study, 20 (62.5%) were women and 12 (37.5%) were men with mean age of  $59.53 \pm 7.87$  at surgery. They were followed up for 6 months. All patients are divided in two groups according to surgical procedure (reduction group A and fusion in-situ group B

)Patients with lumbar degenerative spondylolisthesis grade II and grade III were selected (Table 2) for study that included 6 (18.8 %) patients with L4 /L5 grade II spondylolisthesis and 18 (56.3 %) with L5/S1 grade II, while 5 (15.6%) patients with L4/ L5 grade III and 3 (9.4 %) patients with L5/ S1 grade III spondylolisthesis, Pre and postoperatively VAS and ODI score was compared in both groups i-e VAS from 7.76 to 2.08 in group A and VAS from 8.5 to 2.4 in group B and ODI from 69.42% to 20.06 % in

group-A and 70.9% to 22% in group-B (Table 3). Intra-operatively no complication occurred and similarly post-operatively there was no worsening of neurological symptoms, instead all patients had significant postoperative resolution of symptoms.

There were no significant increases in the complication and mortality rates following surgery in this patient population compared with younger patients

**TABLE 1: FREQUENCY OF FRACTURE SITE IN BOTH STUDY GROUPS**

Characteristics	n
Age in years	59.53 ± 7.87
Preoperative VAS (group A)	7.76 ± 0.58
Postoperative VAS	2.08 ± 0.32
Preoperative ODI (group A)	69.42 ± 3.64
Postoperative ODI	20.06 ± 1.07
<b>Gender</b>	
Male	12 (37.5 %)
Female	20 (62.5%)
<b>Diagnosis</b>	
L4/L5 Spondylolisthesis Grade II	6 (18.8%)
L5/S1 Spondylolisthesis Grade II	18 (56.3%)
L4/L5 Spondylolisthesis Grade III	5 (15.6%)
L5/S1 Spondylolisthesis Grade III	3 (9.4%)
<b>Procedure</b>	
Reduction	17 (53.1%)
Fusion in Situ	15 (46.9%)

**TABLE 2: REDUCTION AND FUSION IN-SITU PROCEDURES IN DIFFERENT DIAGNOSIS**

Parameter	Diagnosis				p-value
	L4/L5 Spondylolisthesis Grade II	L5/S1 Spondylolisthesis Grade II	L4/L5 Spondylolisthesis Grade III	L5/S1 Spondylolisthesis Grade III	
<b>Procedure</b>					
Reduction	2 (33.3%)	14 (77.8%)	0 (0%)	1 (33.3%)	0.009
Fusion in-Situ	4 (66.7%)	4 (22.2%)	5 (100%)	2 (66.7%)	
<b>Gender</b>					
Male	4 (66.7%)	6 (33.3%)	1 (20.1%)	1 (33.3%)	0.394
Female	2 (33.3%)	12 (66.7%)	4 (79.9%)	2 (66.7%)	

**TABLE 3: A COMPARISON OF PREOPERATIVE AND POSTOPERATIVE VAS AND ODI SCORE IN REDUCTION AND FUSION IN SITU GROUPS**

<b>Group A</b>			
<b>Parameters</b>	<b>Preoperative</b>	<b>Postoperative</b>	<b>p - value</b>
VAS	7.76 ± 0.58	2.08 ± 0.32	< 0.001
ODI	69.42 % ± 3.64	20.06 % ± 1.07	< 0.001
<b>Group B</b>			
<b>Parameters</b>	<b>Preoperative</b>	<b>Postoperative</b>	<b>p - value</b>
VAS	8.5 ± 0.72	2.4 ± 0.2	< 0.002
ODI	70.9% ± 2.21	22 % ± 2.1	< 0.002

**DISCUSSION**

For High grade spondylolisthesis, various approaches (posterior only, staged or simultaneous anterior and posterior approaches) have been reported in the literature, but it would be ideal to identify a posterior spinal approach that can achieve all our surgical aims and provide appropriate long-term results<sup>11,12</sup>. In High grade (II and III) spondylolisthesis, there is controversy about vertebral reduction or in-situ fusion among spine surgeons. It seems that due to the availability of more powerful and smaller implants that are more likely to achieve a successful fusion and provide better clinical satisfaction, hence, reduction seems to be more popular<sup>13</sup>. Therefore, a variety of reduction techniques have been invented by numerous authors. Many of them have raised the issue of gradual reduction of the slipped vertebra<sup>14,15</sup>. Karampalisetal (14) used Magerl's external fixator for this purpose and performed circumferential fusion in 9 patients with high grade spondylolisthesis and measured both clinical and radiological outcomes after about 11 years. The improvement in slip magnitude (Meyerding classification), slip angle, lumbosacral angle, sacral rotation, and sacral inclination were 2.9 grades, 66%, 47%, 51%, and 47%, respectively. Solid fusion was achieved in 88.9% of the patients. Mean postoperative ODI and low back outcome scores were 8%

and 56.6%, respectively. The author finally recommended this technique as a powerful and safe technique without any neurologic complications that may be associated with other procedures. In comparison, the number of patients in this study was more than twice and none of the patient had any surgical complications. Postoperative ODI in our study was 20.06 % in reduction group and 22% in fusion in-situ group.

this study was a retrospective which inevitably has some inherent limitations. The number of patients was not significantly large, and no CT scan was done for accurate assessment of fusion. In future, a larger prospective studies ARE required using similar technique to confirm the results of this study.

**CONCLUSION**

In surgical treatment of severe lumbar spondylolisthesis, the use of a distraction rod and pedicle screws to reduce the slipped vertebra in combination with spinal decompression, posterolateral fusion is associated with satisfactory clinical and radiological outcomes which is slightly better than fusion in-situ and this method can be the method of choice in grade II and grade III lumbar spondylolisthesis

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