

## Prognostic Factors of Surgical Treatment of Lumbar Spondylolisthesis

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### Abstract

Background Data: spondylolisthesis is the slippage of one vertebral body in respect to the adjacent vertebral body causing mechanical or radicular symptoms or pain. It can be due to congenital, acquired or idiopathic causes. Spondylolisthesis is graded based on the degree of slippage of one vertebral body on the adjacent vertebral body. It commonly occurs at the L4-5 level then at L5-S1 level.<sup>[1]</sup> Purpose: The aim of this work is to study the different prognostic factors of surgical treatment of spondylolisthesis. Study Design: This is a prospective & retrospective study. Patients and Methods: This is a retrospective and prospective study that includes 92 patients with lumbar spondylolisthesis that operated by transpedicular fixation at Neurosurgery department at Benha university hospitals from October 2018 to October 2020. All patients will be subjective to history taking regarding name, age, sex, address, occupation and smoking. All patients will be examined neurologically regarding general examination and local examination as motor power, sensation, reflexes, sphincters and will be investigated by x-ray dynamic views, CT, bone scan and MRI lumbosacral spine. The patients will be followed up immediately post operative by CT scan and clinically regarding symptoms that the patient was complaining of before operation. The patients will be followed up every 3 months clinically and by x-ray, CT and MRI if needed with follow up period 6-18 months. Results: we found multiple prognostic factors that affect surgical outcomes either succeeded or failed cases according to weight, level of lithesis, grade of lithesis, claudication distance, duration of operation, blood loss & hospital stay. Conclusion: multiple prognostic factors affect surgical outcomes either succeeded or failed cases

**Key words:** Lumbar spondylolisthesis, Pedicle screw fixation, prognostic factors, vas score.

### 1. Introduction

spondylolisthesis is the slippage of one vertebral body in respect to the adjacent vertebral body causing mechanical or radicular symptoms or pain. It can be due to congenital, acquired or idiopathic causes. Spondylolisthesis is graded based on the degree of slippage of one vertebral body on the adjacent vertebral body. It commonly occurs at the L4-5 level then at L5-S1 level. [1, 5, 6]

spondylolisthesis is commonly classified as one of six major etiologies: degenerative, isthmic, traumatic, dysplastic, pathologic or post surgical. [2, 3, 4]

The aim of this work is to study the different prognostic factors of surgical treatment of spondylolisthesis.

### 2. Patients and Methods

This retrospective and prospective study that include 92 patients with lumbar spondylolisthesis that operated by trans pedicular fixation at neurosurgery department at benha university hospitals from October 2018 to October 2020. All cases failed conservative measures for at least three months of active & passive physiotherapy program, non steroidal anti-inflammatory medications & lumbosacral brace before going to surgical treatment. All patients will be subjective to history taking regarding name, age, sex, address, occupation and smoking.

All patients will be examined neurologically regarding general examination and local examination as motor power, sensation, reflexes, sphincters and will be investigated by x-ray dynamic views, CT, bone scan and MRI lumbosacral spine.

The cases in our study are divided into to groups succeed & failed groups.

Succeeded group with the following criteria less claudication pain, no sphincteric affection, no motor deficit, no sensory affection, with improvement of vas score of pain post operative & fusion on X-ray after 6 months. [19, 20, 21].

Failed group with the following criteria: less claudication distance, bladder affection, motor deficit, decrease in improvement of vas score post operative, malposition of screws, fracture screws after 6 months, osteoporosis & adjacent level disc prolapse, fracture of fused vertebrae or instability [19, 20, 21].

#### 2.1. Post-operative follow-Up

Clinical follow-up: done immediately, at 3 and 6 months intervals. The evaluation included assessment of the rate of improvement of preoperative vas score of low back pain, sciatica, ability to walk, straight leg raising (SLR) test, sensory deficits and motor power. (Radiological follow-up: Immediate post operative and 6 months postoperative, including plain radiography (anteroposterior & standing lateral radiograph, dynamic flexion and extension).

#### 2.2. Statistical analysis

Analysis of data will be by the aid of software package of (SPSS) using suitable statistical tests.

Quantitative data will be summarized as mean and SD while qualitative data as frequency and percentage.

The collected data will be presented as suitable tables and figures

#### 2.3. Ethical approval

This study will take ethical approval from ethical committee. Informed written consent will be taken from patients or their relatives.

### 3. Results

This is a retrospective and prospective study that includes 92 patients with lumbar spondylolisthesis in that The mean age is 49.35 years with standard deviation 7.10 .Regarding gender, there is a female predominance; about two thirds are females 67 of 92 (72.8%) and 25 of studied group one third are males (27.2) .

In table (1) ,there is female predominance 59 of succeeded cases (75.6%) . The Mean weight  $\pm$ SD of succeeded is  $48.87\pm 7.02$  but the Mean weight  $\pm$ SD of failed cases is  $88.07 \pm 3.29$  which statistically significant .

38 of succeeded cases are house wife (48.7%) & 23 are heavy workers (29.5%) but 11 of failed cases are house wife (78.6%) which is statistically non significant . 68 of succeeded cases are not smoking (87.2%) & in failed cases 78.6 which is statistically non significant .

40 of succeeded cases had bilateral sciatica (51.3%) , while 8 of failed cases had unilateral sciatica (57.1%) which is statistically non significant . 24 of succeeded cases had claudication at 40 -50 meters (30.8%) , while 6 of failed cases had claudication at 10 meters which is statistically significant . 50 of succeeded cases had intact sphincters (64.1%) , 28 had urgency (35.9%) , while 8 of failed cases had urgency (57.1%) which is statistically highly significant . all succeeded cases had intact sensation while 8 of failed cases had decreased sensation (57.1%) which is statistically highly significant .71 of succeeded cases had positive SLRT(91%) while 12 of failed cases had positive SLRT (85.7%) . 68 of succeeded cases have full motor power (87.2%) & 10 have weakness , while 10 of failed cases have weakness (71.4%) which is statistically non significant. The mean of vas score of succeeded cases preoperative was 8.73 with standard

deviation 0.55 . while vas score of failed cases was 8.79 with standard deviation 0.43 .

In Table (2) , the most frequent level of succeeded cases was L4-5 (62.8%) according to pre operative X-ray finding which was statistically significant .while the most frequent level of failed cases was L5-S1 (42.9%) which is statistically significant .

The most frequent grade of spondylolisthesis of succeeded cases was GI & GII (33.3% & 44.9 %) respectively but the grade of failed cases was GIV & GV (35.7%) which was statistically highly significant .

The number of level fixed in succeeded cases was single level in (85.9%) & multiple in (14.1%) but in failed cases was (57.1% & 42.9 %) respectively for single & multiple levels which was statistically significant .

In table (3) shows that 78 of succeeded cases had fusion on X-ray after 6 months (100%) & 8 of failed cases had fracture screws on X-ray after 6 months which was statistically highly significant .

In figure (1) ,The median of T score of dexa scan of succeeded cases was (-1.1) while IQR was (-1.9)-(-0.88) but the median of T score of dexa scan of failed cases was (-1.7) & IQR was (-2.05)-(-1.3) which is statistically non significant .

In table (4) , the mean of vas score of succeeded cases pre operative was 8.73 with standard deviation 0.55 , while post operative was 1.01 with standard deviation 1.53 which was statistically highly significant .while of failed cases preoperative was 8.79 with standard deviation 0.43 & post operative is 8.07 with standard deviation 1.21 which was statistically non significant with median in succeeded group was 9 & 0 pre & post operative respectively which was statistically highly significant

**Table (1)** Comparison between success outcomes according to personal data.

	Success out comes		No (14)	%	Statistical test	P value
	Succeed	Failed				
	No (78)	%				
<b>Sex</b>						
<b>Male</b>	19	24.4	6	42.9	FET= 1.22	0.19
<b>Female</b>	59	75.6	8	57.1		
<b>Age</b>	48.87 $\pm$ 7.02		52.0 $\pm$ 7.28		St t= 1.53	0.13
<b>Mean <math>\pm</math>SD</b>	84.17 $\pm$ 6.37		88.07 $\pm$ 3.29		St t= 2.23	0.028*
<b>Mean <math>\pm</math>SD</b>						
<b>Occupation</b>						
<b>Housewife</b>	38	48.7	11	78.6	FET= 4.24	0.14
<b>Heavy worker</b>	23	29.5	1	7.1		
<b>Light worker</b>	17	21.8	2	14.3		
<b>Smoking</b>						
<b>Yes</b>	10	12.8	3	21.4	FET= 0.19	0.41
<b>No</b>	68	87.2	11	78.6		

**Table (2)** Comparison between success outcomes according to pre operative X ray findings.

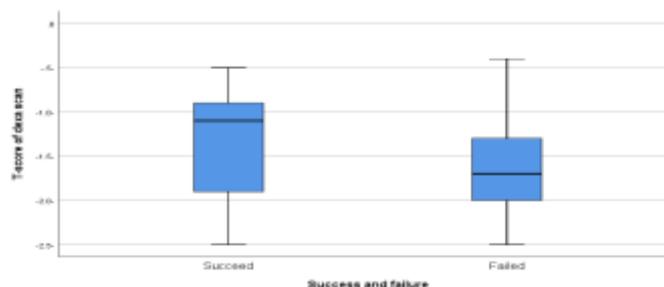
	Success		Failed		Statistical test	P value
	Succeed No (78)	%	No (14)	%		
<b>Lithesis level</b>						
<b>L4-5</b>	49	62.8	4	28.6	FET= 10.21	0.022*
<b>L5-S1</b>	17	21.8	6	42.9		
<b>L2-3</b>	4	5.1	2	14.3		
<b>L3-4</b>	6	7.7	0	0.0		
<b>2 Levels</b>	2	2.6	2	14.3		
<b>Grades of lithesis</b>						
<b>GI</b>	26	33.3	1	7.1	FET= 40.12	<0.001* *
<b>GII</b>	35	44.9	0	0.0		
<b>GIII</b>	15	19.2	3	21.4		
<b>GIV</b>	2	2.6	5	35.7		
<b>GV</b>	0	0.0	5	35.7		
<b>X Ray finding</b>						
<b>Decrease disc space</b>	7	9.0	2	14.3	X2= 2.32	0.31
<b>2 factors</b>	45	57.7	5	35.7		
<b>3 factors</b>	26	33.3	7	50.0		
<b>Number of level fixed</b>	67	85.9	8	57.1	FET= 4.75	0.02*
<b>Single</b>	11	14.1	6	42.9		
<b>Multiple</b>						

**Table (3)** Comparison between success outcomes according to post-op clinical and radiological findings.

	Success		Failed		Statistical test	P value
	Succeed No (78)	%	No (14)	%		
<b>X ray 6m</b>						
<b>Fused</b>	78	100	1	7.1	FET= 62.29	<0.001* *
<b>Malposition of screw</b>	0	0.0	5	35.7		
<b>Fracture screws</b>	0	0.0	8	57.1		

**Table (4)** Comparison between VAS score pre and post-op among different success outcomes.

	Success	
	Succeed(78)	Failed(14)
<b>VAS score pre</b>		
<b>Mean ±SD</b>	8.73±0.55	8.79±0.43
<b>Median, IQR</b>	9.0,9.0-9.0	9.0 , 8.75-9.0
<b>VAS score post</b>		
<b>Mean ±SD</b>	1.01±1.53	8.07±1.21
<b>Median, IQR</b>	0.0,0.0-1.0	9.0, 7.0-9.0
<b>Wilcoxon test</b>	7.77	1.90
<b>P value</b>	<0.001**	0.057



**Fig. (1)** Box plot shows differences between succeed and failed groups according to T score of dixa scan.

#### 4. Discussion

In our study as regard the age of the patients: The age range was from 35 to 66 years old. Kalichman et al., 2009 found that the age range was 32 to 79 yrs [14]

batric et al., 2010 found that the age range was 68 to 82 yrs [15]

In our study as regard the gender of the patients: We noted that the female cases are 67 cases and the male cases are 25 cases. Jacobsen et al, 2007 agreed with us as female cases were 48 & male cases were 42 & the need of fixation with instrumentation is higher in females as a result of generalized joint laxity due to hormonal factor, weak back muscles and obesity may be risk factors. [12]

Kalichman et al., 2009 found that female cases were 84 & male cases were 104 cases [12]

In our study 52 % were house wives & 48 % were workers while Ewis et al., found that 80 % were house wives & 20 % were workers. [17]

In our study as regard clinical presentation: back pain, claudicating pain and sciatica were reported in 100 % of cases with different degrees & distribution. 24 of succeeded cases (78) had claudication at 40-50 meters & 23 have claudication at 20 meters, while 6 of failed cases (14) had claudication at 10 meters. 28 of succeeded cases (78) had urgency (35.9%) & 8 of failed cases 14 (57.1%). marou et al., 2015 found that 10 of good group 39 had urinary dysfunction (26%) & 4 of poor group 13 have urinary dysfunction (31%) [16]

In our study, 6 of failed cases had decrease in sensation. 10 of succeeded cases have weakness (12.8%) & of failed cases (28.2%).

kalichman & hunter 2008 found that 42-82 % of cases have claudication & sciatica. [4]

while marou et al., 2015 found that 5 of succeeded cases 39 (13%) have weakness & 2 of failed cases 13 have weakness (15%). [16]

In our study Mean of vas score pre operative of succeeded cases was  $8.73 \pm 0.55$  & of failed cases was  $8.79 \pm 0.43$ , while post operative of succeeded cases was  $1.01 \pm 1.53$  & of failed cases was  $8.07 \pm 1.21$ .

Zhng et al., 2017 found that mean of vas score pre operative was  $8.88 \pm 1.36$ , while it was  $2.25 \pm 1.26$  postoperatively. [11]

Kashani et al., 2010 who reported predominance of severe back pain 84% of his studied cases and sciatica in 60% of cases [10]

In our study as regard level of spondylolithesis: The most common affected level is L4-5 in (62.8% of succeeded cases 28.6% of failed cases) followed by L5-S1 level followed by L3-4. Miao et al., 2013 & Zhng S et al., 2017 found that the most affected level was L4-5 95 % of cases. (61) While in Ewais et al., 2020, the most affected level is L5-S1 followed by L4-5. [13, 17, 22]

In our study, 45 % of cases was GII followed by GI while said et al., 2020 found that it was GI in 59 % followed by GII. [20]

In our study, 81% of cases was fixed at single level & 19 % fixed at multiple levels while said et al., 2020 found that 55 % was multiple level. [20]

In our study, the Mean of vas score pre operative of succeeded cases was  $8.73 \pm 0.55$  & of failed cases was  $8.79 \pm 0.43$ , while post operative of succeeded cases was  $1.01 \pm 1.53$  & of failed cases was  $8.07 \pm 1.21$ .

Zhng S et al., 2017 found that the mean of vas score pre operative was  $8.88 \pm 1.36$ , while it was  $2.25 \pm 1.26$  postoperatively. [11]

Post operative follow up after 6 month, 100 % of succeeded cases have fused & 57 % of failed cases have fracture screws, while in Zhong et al., 2020 was 17%. [19]

In our study, the median of T score of dexa scan succeeded cases & failed cases were -1.1 & -1.7 respectively, while

Ponnusamy et al., 2011 found that it was -1.8 [18]

In our study, screw mal position was 35 % of failed cases while in Zhong et al., 2020 was 29%. [19]

#### 5. Conclusion

Different prognostic factors affect surgical outcomes of lumbar spondylolithesis & need for more research for insure & detect other prognostic factors

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