

# A Non-randomized Controlled Clinical Trial to Evaluate the Outcome of Surgery in Degenerative Spondylolisthesis

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Received: 06-07-2021 / Revised: 19-08-2021 / Accepted: 28-10-2021

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Conflict of interest: Nil

## Abstract

**Aim:** The aim of this study to evaluate the surgery in degenerative spondylolisthesis.

**Methods:** This prospective non-randomized study conducted in the Department of Neurosurgery, IGIMS, Patna, Bihar, India, for 12 months. The patients were enrolled for surgery to be followed up postoperatively using self-administered questionnaire. Data from 50 patients were collected and analyzed over this period to compare the degree of pre-operative pain and functional disability with corresponding values at 6(six) months postoperatively.

**Results:** Out of the 50 patients, three patients (6%) had pseudo arthrosis and the rest (94%) had bony fusion. Patients in the bony fusion group had complications like infection (2 patient), deep vein thrombosis (2 patient) and cauda equina syndrome in another patient. The degree of spondylolisthesis was reduced post operatively (24% vs 16%;  $p < 0.001$ ). Pain on visual analogue scale was also reduced post operatively ( $7.12 \pm 0.58$  vs  $0.37 \pm 0.64$ ;  $p < 0.001$ ). Other disabilities including paresthesia (16% vs 2%), hypoesthesia (48% vs 32%), weakness (48% vs 28%), stiffness (6% vs 0), and urinary symptoms (12% vs 2%) were also significantly ( $p < 0.05$ ) reduced postoperatively.

**Conclusion:** Decompressive laminectomy with posterolateral instrumentation (pedicle screws and rods) and inter-transverse process arthrodesis with autologous bone graft is the surgical procedure of choice as it facilitates good bony fusion and relieves symptoms of radicular pain and claudication

**Key words:** spondylolisthesis, pseudo arthrosis a, visual analogue scale

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## Introduction

Lumbar spine stenosis is caused by a gradual narrowing of the spinal canal. Patients with lumbar spinal stenosis typically present with low back pain and leg pain, which occur especially when they are walking. This degenerative condition severely restricts function, walking ability, and quality of life. Lumbar spinal stenosis has become the most common indication for spinal surgery,[1,3] and studies have shown that surgical treatment in selected patients is more successful than

conservative alternatives.<sup>4</sup> As the use of surgery to treat lumbar spinal stenosis has increased during the past decades, so has the complexity of the surgical procedures.[2] Thus, decompression of the neural structures by means of laminectomy has increasingly been supplemented with lumbar fusion, with the intention of minimizing a potential risk of future instability and deformity. In recent years, approximately half the patients in the United States who have received surgical

treatment for lumbar spinal stenosis have undergone fusion surgery[4]. The surgical management of degenerative lumbar-spondylolisthesis associated with spinal canal stenosis has evolved throughout the past several decades. Early surgery of laminectomy (decompression) paid little importance to the instability related to the vertebral slippage. In patients who had decompressive laminectomy with preservation of a majority of facet joints, the outcome was dramatically better. The best outcome occurred in those patients who had undergone a decompressive laminectomy combined with a posterolateral intertransverse process arthrodesis.

### Material and methods

This prospective non-randomized study conducted in the Department of Neurosurgery, IGIMS, Patna, Bihar, India, for 12 months.

The patients were enrolled for surgery to be followed up postoperatively using self-administered questionnaire. Data from 50 patients were collected and analyzed over this period to compare the degree of pre-operative pain and functional disability with corresponding values at 6 months postoperatively.

### Methodology

Patients with degenerative spondylolisthesis and symptomatic spinal canal stenosis who had undergone non-operative treatment for at least 3(three) months before the surgery were included in the study. Patients who had a prior history of lumbar spine surgery, osteoporotic changes in the lumbosacral CT scan and back pain due to other pathologies were excluded from the study. The pre-operative and post-operative parameter was assessed by using a self-administered questionnaire, developed by Stucki et al.[5] Some modifications were made by rating the pain in the back and lower limbs/ buttock using visual analogue scale(VAS) ranging from 0 (no pain) to 10 (severe pain).[6] The percentage of

spondylolisthesis was assessed preoperatively by radiological method.[7] Slippage of spondylolisthesis (Percent) =  $b/100/a$  The degree of spondylolisthesis is classified depending on the displacement of the vertebral bodywidth[8] : Grade = 0 to 25%; Grade 2=25 to 50%; Grade 3= 50-75% and Grade 4 = 75 to 100%.

After obtaining written informed consent, the operation was performed using midline linear incision in the lower lumbar region to expose the posterior elements of the spine from one level above to one level below the proposed level of fusion. The surgical procedure included lumbar decompression (laminectomy) and transpedicular instrumentation by pedicle screws, rods and autologous iliac crest bone graft.

The pre-operative and postoperative (at 6 months) data(s) were followed up clinically and radiologically and analyzed using SPSS version 24.0. Student's t-test (two-tailed, dependent) was used and a 'p' value less than 0.05 were considered significant.

### Results

This study was conducted in 50 patients of degenerative spondylolisthesis requiring surgery to compare the preoperative and postoperative pain and disability. The demographic profile of the patients is shown in Table 1. All the patients turned up for postoperative assessment at 6 months. Out of the 50 patients, three patients (6%) had pseudoarthrosis and the rest (94%) had bony fusion. Patients in the bony fusion group had complications like infection (2 patient), deep vein thrombosis (2 patient) and cauda equina syndrome in another patient (Table 3). The degree of spondylolisthesis was reduced post operatively (24% vs 16%;  $p < 0.001$ ). Pain on visual analogue scale was also reduced post operatively ( $7.12 \pm 0.58$  vs  $0.37 \pm 0.64$ ;  $p < 0.001$ ). Other disabilities including paresthesia(16% vs 2%), hypoesthesia (48% vs 32%), weakness (48% vs 28%), stiffness(6% vs 0), and urinary symptoms (12% vs 2%) were also significantly ( $p < 0.05$ ) reduced postoperatively.

**Table 1: Demographic profile and Co-morbidity status**

Age (In years)	51.38±10.82	
M/F ratio	18/32	
Diabetes mellitus	6	12
Hypertension	10	20
Coronary artery disease	2	4
Bronchial asthma	2	4
Hyperthyroidism	1	2
Duration of symptoms		
Upto 12 months	26	52
12-36 months	17	34
>36 months	7	14
Level		
L3-4	3	6
L4-5	31	62
L5-S1	13	26
L3-4/L4-5	1	2
L4-5/L5-S1	2	4

**Table 2: Shows the percentage of spondylolisthesis, VAS and degree of disability pre-operative and post-operative**

Parameters	Pre- operative	Post- operative	p- value
%age Spondylolisthesis	24%	16%	<0.001
VAS	7.12 ±0.58	0.37 ±0.64	<0.001
Paresthesia	8 (16 %)	1 (2%)	<0.001
Hypoesthesia	24 (48 %)	16 (32 %)	0.07
Weakness	24 (48%)	14 (28 %)	0.04
Stiffness	3 (6 %)	0	0.03
Urinary Symptoms	5 (12%)	1 (2 %)	0.03
Bowel Symptoms	0	1 (2%)	0.17

**Table 3: Post-operative complications**

Parameters	Nos.	Percentage (%)
Infection	2	4
Deep vein thrombosis (DVT)	2	4
Cauda equina syndrome	2	4

## Discussion

The results of our study have shown that the degree of spondylolisthesis, pain and disability are markedly reduced postoperatively with minimal complications. There was no incidence of implant failure through 3 patients (6%) developed pseudoarthrosis without bony fusion. Some early studies[9,10] have indicated that fusion status does not affect early clinical outcome. A fibrous union appears to provide sufficient stabilization

and pain relief of the back and lower extremities. In a prospective randomized study comparing decompressive laminectomy and arthrodesis with and without spinal instrumentation, Fischgrund et al[11] noted that pseudoarthrosis developed in 55% of the non-instrumental group, but the clinical outcome was still good or excellent in 83% of the patients. However, instrumentation has been recommended to increase the fusion rate, decrease the rehabilitation time and

improve patient outcome.[12,15]In the current study, the fusion mass was evaluated using plain radiograph. The overall results of bony fusion and pseudoarthrosis (94% and 6%) in our study seem better than that of Mardjetko et al[16] (86% and 14%) and Booth et al (85% and 15%).[17] However, our sample size is too small to claim any superiority, and one[16] of them involves a meta-analysis.

In this study, all patients had significant post-operative pain relief compared to the preoperative period. The classic presentation of lumbar spondylolisthesis with canal stenosis is that of bilateral neurogenic claudication as well as intermittent pain radiating to the thigh or leg, or both which is worse with prolonged standing, activity or lumbar extension, and this pain is relieved by sitting, lying down, or lumbar flexion[18]. In patients with spondylolisthesis and canal stenosis of the L4-L5 segment, the L5 nerve root is usually affected. In case of severe stenosis, the L4 root may also be affected. L4 radiculopathy usually causes pain that radiates in the lateral thigh across the tibial tubercle area and extends down the medial portion of the leg. An L5 radiculopathy usually causes pain and numbness that radiates from the posterolateral thigh to the lateral portion of the leg and onto the dorsum of the foot. The maximum number of patients in this study involved L4-5 and L5-S1 levels.

The degree of disabilities was also significantly reduced postoperatively. Though statistically significant improvement can be shown, our results fall short of others[13] who had followed up the patients for 3 years and could demonstrate the ability to walk in 83% patients who had an instrumental fusion.

### Conclusion

Decompressive laminectomy with posterolateral instrumentation (pedicle screws and rods) and inter-transverse process arthrodesis with autologous bone graft is the surgical procedure of choice as it facilitates good bony fusion and relieves

symptoms of radicular pain and claudication.

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