

Short term clinical and functional outcome after posterior lumbar inter body fusion in cases of lumbar canal stenosis by using RODI score assessment

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Abstract

Introduction: Lumbar canal stenosis remains one of the most frequently encountered clinically important degenerative spinal disorders requiring operative treatment in the aging population. The simplest procedure is arthrodesis without instrumentation, but this has been found to be associated with a high rate of non-union. To study the short term clinical and functional outcome after posterior lumbar inter body fusion in cases of lumbar canal stenosis assessed by RODI score.

Methods: This is a prospective study of 30 cases of lumbar canal stenosis, who were treated operatively with decompression and posterior lumbar inter body fusion, which was carried out over a period of 6 months in a tertiary care centre. 16 women and 14 men were included in the study. Clinical and Functional assessment using RODI score was done again immediate post-operatively and at 1st, 3rd and 6th month post-operatively.

Result : In our study it was noted that most patients were in the age group of 41-50 years (36.7%) followed by 51-60 years (33.3%), wherein males were 14(46.7%) and females were 16 (53.3%). In this study it was found that there is significant improvement in RODI score for back pain over the 6 month follow-up. There is significant difference between mean improvement in RODI score with respect to number of levels involved (p=0.02).

Conclusion: RODI showed Posterior Lumbar interbody Fusion with interbody cage and local graft with posterior instrumentation gave significantly improved clinical and functional outcome by causing significant reduction in pain and patient disability.

Keywords: Lumbar canal stenosis, RODI, Posterior lumbar interbody fusion, Time interval

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Introduction

Degenerative lumbosacral spine disorders are fairly common in middle aged and elderly population¹ and is one of the major cause for disability in adult working population². With the median age of population rising and more elderly people maintaining an active life style functional limitation due to symptomatic degenerative disease of spine is becoming more common. Lumbar canal stenosis remains one of the most frequently encountered clinically important degenerative spinal disorders requiring operative treatment in the aging population.^{3,4}

Lumbar canal stenosis is the terminology used to describe developmental or congenital narrowing of the spinal canal that produces compression of the neural elements before their exit from the neural foramen.⁵⁻⁸ The narrowing may be limited to a single motion segment or it may be more diffuse spanning two motion segments or more.

Treatment is aimed at not only obtaining immediate pain relief but also to prevent long term disabling sequel such as chronic backache and spinal

instability. With advances in our understanding of pathoanatomy and the clinicopathological correlation, the treatment has changed from various non-operative modalities to decompression and subsequently to decompression and fusion⁹⁻¹⁰ with or without instrumentation¹¹. The idea of lumbar or lumbosacral arthrodesis is to eliminate motion and thus to relieve pain.¹² The technique of interbody fusion is very important biomechanically, as it preserves the sagittal plane and gives the normal mechanical status of the whole spine, pelvis and lower limbs.¹³⁻¹⁴

Many surgical techniques are used in treating this problem, including posterior lumbar interbody fusion (PLIF), transforaminal lumbar interbody fusion (TLIF), and poster lateral fusion and posterior instrumentation (PLF). The simplest procedure is arthrodesis without instrumentation, but this has been found to be associated with a high rate of non-union. Addition of pedicle screw fixation provides direct stability to the spine and improves the fusion rate.¹⁵⁻¹⁹

PLIF was firstly described by Cloward in 1940 and modified which it became a common operation. PLIF has advantages disc height, disc stabilization, nerve root decompression and anterior spinal column, which is the weight-bearing axis.²⁰⁻²¹ by Lin, after for restoration of the reinforcement of the PLIF affords the opportunity to achieve a stable three-column fixation with anterior support and 360° fusion, and is done only posterior.²²⁻²³ Moreover, it decreases morbidity and has a lower cost compared to the anterior approach. PLIF is limited to

fusions of L3-S1 so as to avoid the risk of damage to the conus medullaris and cauda equina due to traction.²⁴

The present dissertation is a study of 30 cases of lumbar canal stenosis who were operatively treated by decompression and posterior lumbar interbody fusion with interbody cage and local graft with posterior instrumentation.

Aims and Objectives

To study the short term clinical and functional outcome after posterior lumbar inter body fusion in cases of lumbar canal stenosis by using RODI score.

Materials and Methods

This is a prospective study of 30 cases of lumbar canal stenosis, who were treated operatively with decompression and posterior lumbar inter body fusion, which was carried out over a period of 6 months in a tertiary care centre. 16 women and 14 men were included in the study. The ethics committee approved the study plan and informed consent was obtained from all patients before the operation.

Inclusion Criteria:

1. All patients who had low back pain / leg pain / neurogenic claudication/ neurological deficit and were diagnosed to have Lumbar canal stenosis in whom decompression and posterior lumbar inter body fusion with inter body cage and local graft with posterior instrumentation was done
2. All patients who have low back pain leg pain / neurogenic claudication/ neurological deficit and are diagnosed to have Lumbar canal stenosis in whom decompression and posterior lumbar inter body fusion with inter body cage and local graft with posterior instrumentation is planned.
3. Patients with MRI confirming diagnosis of Lumbar Canal Stenosis and have failed conservative line of management.
4. Patients having the willingness and ability to understand and provide consent to participate in the study and are able to communicate with the investigator and follow all directions until the stipulated period of study.

Exclusion Criteria:

Patients, otherwise meeting the inclusion criteria, were ineligible in case of any of the following criteria:

1. Patients with cauda equine syndrome who require urgent surgical intervention.
2. An earlier back operation for lumbosacral disease other than lumbar canal stenosis.
3. Another specific spinal disorder, e.g., ankylosing spondylitis, neoplasm or metabolic diseases.
4. Intermittent claudication due to atherosclerosis
5. Severe osteoarthritis or arthritis causing dysfunction of the lower limbs

6. Neurologic disease causing impaired function of the lower limbs, including diabetic neuropathy
7. Psychiatric disorders
8. Poor General Condition
9. Definitive diagnosis not established
10. Hemodynamically and medically unstable patients

Study Protocol:

Patient information sheet and Consent form were signed by all patients included in the study demographic data was collected from all patients included in the study.

RODI(Revised Oswestry Disability index) score was done based on the available records and patients history and data was collected for variable time intervals such as pre-operatively, immediate post-operatively, 1st, 3^d and 6th month post-operatively.

Pre-operative patients were subjected to Detailed History taking and general examination including neurological examination.

Pre-operative patients included in this study were operated by a senior spine surgeon for decompression and posterior lumbar inter body fusion with posterior instrumentation.

Clinical and Functional assessment using RODI score was done again immediate post-operatively and at 1st, 3^d and 6th month post-operatively.

Statistical analysis

Descriptive statistics such as mean, SD and percentage was used. Comparison between groups was done using appropriate tests and same was mentioned below the respective tables. A p-value less than 0.05 were considered as significant.

Results

In our study it was noted that most patients were in the age group of 41-50 years (36.7%) followed by 51-60 years (33.3%), wherein males were 14(46.7%) and females were 16 (53.3%). In our study all 30 patients had back pain, whereas leg pain present in 26 (86.7%) patients. In our study, 80% patients had only a single level involvement while 20% patients had multi-level involvement.

Table 1: Presence of signs in patients

Characteristics	No. of Patients	Percentage (%)
Neuroclaudication	24	80.00
Nerve Root tension signs	24	80.00
Neurological deficit	9	30.00

In our study, 24 (80%) had Neuroclaudication, 24(80%) had Nerve root tension sings and 9(30%) patients had Neurological deficit (Table 1).

Table 2: Distribution of cases on the basis of duration of symptoms

Duration of symptoms (in months)	No. of Patients	Percentage (%)
≤ 12	17	56.67
13-18	8	26.67
> 18	5	16.67
Total	30	100.00

In our study, 56.67% patients were symptomatic for less than 12 months, 26.67% patients for 13-18 months while only 16.67% patients for more than 12 months (Table 2).

Table 3: Comparison of RODI score at variable time intervals among the cases

	RODI Score			P-Value	Pairwise multiple comparison
	Mean	SD	Median		
Preoperative	63.93	13.82	63		Pre-op vs Imm. Post. Op., p< 0.001*
Immediate postoperative	39.13	14.83	36	< 0.001*	Pre-op vs 1 st month, p< 0.001* Pre-op vs 3 rd month, p< 0.001*
1 st month	28.80	15.56	24	< 0.001*	Pre-op vs 6 th month, p< 0.001*
3 rd month	21.13	12.34	18	< 0.001*	Immediate vs 1 st month, p< 0.001*
6 th month	19.40	12.42	16	< 0.001*	Immediate vs 3 rd month, p< 0.001* Immediate vs 6 th month, p< 0.001* 1 st month vs 3 rd month, p<0.001* 1 st month vs 6 th month, p<0.001* 3 rd month vs 6 th month, p= 0.002*

*Significant (P <0.05) Wilcoxon sign rank test used

In this study it was found that there is significant improvement in RODI score for back pain over the 6 month follow-up. There was maximal improvement immediate post operatively until the 3rd month follow-up. Relatively lesser improvement occurred till the final follow-up at 6th month (Table 3).

Table 4: Comparison of improvement in RODI score with respect of duration of symptoms

Duration of Symptoms (in Month)	No. of Patients	Improvement RODI Score		P-Value
		Mean	SD	
≤ 12	17	75.76	6.01	0.001
13-18	8	77.44	5.07	
> 18	5	43.45	10.34	

By using ANOVA test, there is significant difference between mean improvements with respect to duration of symptoms for RODI score (p=0.001). The improvement in RODI score was significantly better in patients with lesser duration of symptoms (Table 4).

Table 5: Comparison of improvement in RODI score with respect to number of levels involved

	No of patients	Improvement RODI score		P-Value
		Mean	SD	
Single	24	68.97	14.97	0.020
Multiple	6	78.22	5.12	

By using 2 independent sample t-test, there is significant difference between mean improvement in RODI score with respect to number of levels involved (p=0.02). The patients with multiple level involvement had significant improvement in RODI score than those with single level involvement (Table 5).

Discussion

In our study, 26 patients(86.7%) had Leg Pain. This is similar to study by Rajendra et al²⁵ where 87.5% patients had leg pain. In our study, 24 patients(80%) had Neuroclaudication. In study by Rajendra et al²⁵ and Audat et al.²⁶ 100% patients had neuroclaudication. In our study, 11 patients(36.7%) had Nerve Root tension signs. In study by Rajendra et al²⁵ where 93% patients had nerve root tension signs. In our study, 9 patients(30%) had Neurological deficit. In study by

Rajendra et al²⁵ where 62.5% patients and Audat et al.²⁶ where 55.6% had.

In our study, 56.67% patients were symptomatic for less than 12 months, 26.67% patients for 13-18 months while only 16.67% patients for more than 12 months.

In our study, 80% patients had only a single level involvement while 20% patients had multi-level involvement.

In this study, the mean RODI score has significantly improved from 63.93 pre-operatively to 19.40 at 6 months post-operatively. In the study by Dong-Hee Kim et al. similar improvement of RODI score from 70.0 preoperatively to 37.9 post-operatively at last follow up is seen.²⁷ In the study by Kok et al similar improvement of RODI score from 40.0 preoperatively to 17.7 post-operatively at 24 months is seen.²⁸

In this study it was found that there is significant improvement in RODI score over the 6 month follow-up. Significant improvement was noted to occur all through the 6 month follow-up. But there was maximal improvement immediate post operatively until the 3'd month follow-up. After which relatively lesser improvement occurred till the final follow-up at 6th month. This correlates with a similar finding noted by Atlas et al.²⁹ in The Maine lumbar spine study, where the maximal benefit of surgery was observed by the time of the first follow-up evaluation, which was at 3 months.

In this study, it was found that the improvement RODI score was significantly better in patients with lesser duration of symptoms than in patients symptomatic for more than 18 months (p-value <0.05). This correlates with the similar findings noted by Ng et al³⁰ where the patients with sciatica for more than 12 months have a less favorable outcome (p-value 0.039).

In this study, it was found that the patients with multi-level involvement had significant improvement in RODI score than those with single level involvement (p =0.02). We failed to find a similar correlation mentioned in other similar studies published in the literature.

Summary and Conclusion

Lumbar Canal stenosis is a progressive degenerative disorder of the spine most frequently causing morbidity in middle aged and elderly. The diagnosis is essentially clinical and only supported by radiological investigations.

Non-operative line of treatment is effective for relief of symptoms in most patients in whom inflammatory edema of nerve roots cause compromised canal diameter in a relatively narrow canal. But the pain relief and recovery of sensation and weakness is not as good as in those subjected to surgery especially when radiological evidences of irreversible bony and soft tissue changes are already present.

Surgery for lumbar canal stenosis is performed only when patient has reached the state of disability i.e. patient is unable to carry out his day-to-day activities due to pain. Limited operative decompression with retention of stabilizing elements may decrease short term morbidity but lead to long term failure due to recurrent stenosis or development of stenosis at an adjacent level. Decompression of the stenotic lumbar canal along with fusion is definitely better than

decompression alone, specially so in patients having degenerative lumbar spinal stenosis with Spondylolisthesis or Degenerative scoliosis. Pedicle instrumentation after laminectomy provides segmental fixation, improves the rate of fusion and avoids the need to extend fusion to adjacent normal levels.

Surgery is aimed only at providing relief of symptoms and not for achieving improvements in neurological status. If any neurological improvement occurs it is to be regarded as an additional bonus benefit of the surgery.

Results evaluated according to RODI showed Posterior Lumbar interbody Fusion with interbody cage and local graft with posterior instrumentation gave significantly improved clinical and functional outcome by causing significant reduction in pain and patient disability.

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Conflict of Interest: The authors declare that they have no conflict of interest

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