International Journal of Research in Orthopaedics
Murthy H et al. Int J Res Orthop. 2016 Sep;2(3):164-169
http://www.ijoro.org

Research Article

DOI: http://dx.doi.org/10.18203/issn.2455-4510.IntJResOrthop20163124

VAS score assessment for outcome of posterior lumbar inter body fusion in cases of lumbar canal stenosis

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Received: 25 July 2016
Accepted: 13 August 2016

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ABSTRACT

Background: One of the major causes for disability in adult working population is degenerative lumbosacral spine disorders are fairly common in middle aged and elderly population. Lumbar canal stenosis remains one of the most frequently encountered clinically important degenerative spinal disorders requiring operative treatment in the aging population. The objective of the present study is to assess the outcome of posterior lumbar inter body fusion in cases of lumbar canal stenosis
Methods: The present study, 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 center were included. 16 women and 14 men were included in the study.
Results: Most patients were in the age group of 41-50 years (36.7%) followed by 51-60 years (33.3%). In this study it was found that there was significant improvement in VAS score for back pain and leg pain over the 6 month follow-up. There is significant difference between mean improvement in VAS score with respect to number of levels involved for leg pain (p =0.01). There is no statistical significance difference between number of levels involved and improvement in back pain (p =0.66).
Conclusions: VAS score 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, VAS, Posterior lumbar interbody fusion, Time interval

INTRODUCTION

Degenerative lumbosacral spine disorders are fairly common in middle aged and elderly population and is one of the major cause for disability in adult working population.[1,2] 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 squeal 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 fusion with or without instrumentation.[9-11] 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-Sl so as to avoid the risk of damage to the conus medullaris and cauda equina due to traction.[24]

The primary objective is to study the outcome of posterior lumbar inter body fusion in cases of lumbar canal stenosis by using VAS score.

METHODS

This is a prospective cum retrospective 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 comprised of 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, patients with MRI confirming diagnosis of lumbar canal Stenosis and have failed conservative line of management and 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 (6 months).

Exclusion criteria were patients with cauda equina syndrome who required urgent surgical intervention, an earlier back operation for lumbosacral disease other than lumbar canal stenosis, specific spinal disorder, e.g., ankylosing spondylitis, neoplasm or metabolic diseases, intermittent claudication due to atherosclerosis, severe osteoarthritis or arthritis causing dysfunction of the lower limbs, neurologic disease causing impaired function of the lower limbs, including diabetic neuropathy, psychiatric disorders, poor general condition, definitive diagnosis not established and hemodynamically and medically unstable patients

Study protocol

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

Previously operated patients clinical and functional assessment using VAS(Visual Analogue Scale) score for back pain and leg pain 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, 3rd 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 VAS score for back pain and leg pain was done again immediate post-operatively and at 1st, 3rd 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, 24 (80%) had neuroclaudication, 24 (80%) had nerve root

tension signs and 9 (30%) patients had neurological deficit as shown in Table 1.

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, 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 as in Table 2.

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

Table 3: Comparison of back pain VAS score at variable time intervals among the cases.

	Back Pain VAS Score			P-value	Pairwise multiple comparison	
	Mean	SD	Median			
Preoperative	7.47	1.73	8		Pre-op vs. imm. Post-op	p< 0.001*
Immediate postoperative	4.20	2.09	4	< 0.001*	Pre-op vs. 1st month	p< 0.001*
					Pre-op vs. 3rd month	p< 0.001*
1st month	3.00	1.66	3	< 0.001*	Pre-op vs. 6th month	p< 0.001*
3rd month	2.07	1.39	2	< 0.001*	Immediate vs. 1st month	p< 0.001*
6th month	1.80	1.30	2	< 0.001*	Immediate vs. 3rd month	p< 0.001*
					Immediate vs. 6th month	p< 0.001*
					3rd month vs. 6th month	p= 0.011*

Table 4: Comparison leg pain VAS score at variable time intervals among the cases.

	Leg Pain VAS Score			P-value	Pairwise multiple comparison	
	Mean	SD	Median			
Preoperative	7.60	1.85	8		Pre-op vs. imm. post. op	p< 0.001*
Immediate postoperative	3.03	1.79	3	< 0.001*	Pre-op vs. 1st month	p< 0.001*
					Pre-op vs. 3rd month	p< 0.001*
1st month	1.47	1.33	2	< 0.001*	Pre-op vs. 6th month	p< 0.001*
3rd month	1.07	1.26	1	< 0.001*	Immediate vs. 1st month	p< 0.001*
6th month	0.83	1.23	0	< 0.001*	Immediate vs. 3rd month	p< 0.001*
					Immediate vs. 6th month	p< 0.001*
					1st month vs. 3rd month	p=0.007*
					1st month vs. 6th month	p=0.002*
					3rd month vs. 6th month	p= 0.02*

Table 5: Comparison of improvement in VAS score for back pain and leg pain with respect to duration of symptoms.

Pain	Duration of symptoms (in months)						P-Value
	≤ 12		13 – 18		> 18		
	Mean	SD	Mean	SD	Mean	SD	
Back pain	83.44	16.60	72.71	7.27	51.11	9.18	< 0.001
Leg pain	93.89	8.84	91.15	70.83	24.49	24.49	0.005

In this study it was found that there was significant improvement in VAS 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 as given in Table 3. In this study it was found that there is significant improvement in VAS score for leg 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 as given in Table 4.

By using ANOVA test, there was significant difference between mean improvement in VAS score with respect to duration of symptoms for back pain and leg pain. The improvement in VAS of back pain and leg pain was significantly better in patients with lesser duration of symptoms as presented in Table 5.

By using 2 independent sample t-test, there was significant difference between mean improvement in VAS score with respect to number of levels involved for leg pain (p=0.01). The patients with multiple level involvements have significant improvement in VAS score than those with single level involvement for leg pain. There was no statistical significance difference between number of levels involved and improvement in back pain (p=0.66) as given in Table 6.

Improvement in VAS score	Single (n=24)		Multiple (n=6)		P value
	Mean	SD	Mean	SD	
Back Pain	75.97	17.81	72.06	19.22	0.665
Leg Pain	87.16	15.91	97.92	5.10	0.01

DISCUSSION

In our study, 26 patients (86.7%) had leg pain, which was similar to study done by Rajendra et al where 87.5% patients had leg pain.[25] In our study, 24 patients (80%) had neuroclaudication as compared to study done by Rajendra et al and Audat et al.[25,26] 100% patients had neuroclaudication. In our study, 24 patients (80%) had nerve root tension signs whereas in study by Rajendra et al where 93% patients had nerve root tension signs.[25] In our study, neurological deficit had 9 patients (30%) less as compared to study by Rajendra et al (62.5%) and Audat et al (55.6%).[25,26]

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 multilevel involvement.

In this study the mean VAS score for back pain and leg pain have significantly improved from 7.47 and 7.6 preoperatively to 1.8 and 0.83 at 6 months post operatively and p value was (<0.001) for both. The study by Zhao et al showed similar improved pain scores with p-value (<0.01).[27] In the study by Kim et al similar improvement was observed in VAS score for back pain and leg pain from 6.5 and 6.1 preoperatively to 1.8 and 1.8 at last follow up was seen.[28] In the study by Kok et al. similar improvement in VAS scores from 5.7 pre-operatively to 2.1 at 24 months was seen.[29] In this study it was found that there was significant improvement in VAS score for back pain and leg pain 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 3rd 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.[30] 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 our study, average leg pain improvement was of 89.31% and average back pain improvement of 75.19%. Similar findings were observed in the study of Herron et al with average leg pain improvement of 82% and average back pain improvement of 71%.[31]

In this study, it was found that the improvement in VAS score of back pain and leg pain 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 al where the patients with sciatica for more than 12 months have a less favourable outcome (p= 0.039).[32]

In this study, it was found that the patients with multilevel involvement had significant improvement in VAS score for leg pain score than those with single level involvement (p-value 0.01 and 0.02). We failed to find a similar correlation mentioned in other similar studies published in the literature.

In present study, it was found that the patients without neurological deficit showed more improvement in VAS score for back pain and leg pain than those with neurological deficit. However this correlation was statistically insignificant. We failed to find a similar correlation mentioned in other similar studies published in the literature.

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 was 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 revealed according to the VAS showed that 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.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the institutional ethics committee

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Cite this article as: Murthy H, Reddy TVS. VAS score assessment for outcome of posterior lumbar inter body fusion in cases of lumbar canal stenosis. Int J Res Orthop 2016;2:164-9.