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

Harish Murthy[1,*], TVS Reddy[2]

[1]Associate Professor, [2]Dept. of Orthopaedics, Raichur Institute of Medical Sciences, Raichur, 2Surxa Hospital, Kurnool

***Corresponding Author:**
Email: drharishmurthy@yahoo.co.in

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 1't, 3'd 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

Access this article online

Website:
www.innovativepublication.com

DOI:
10.5958/2395-1362.2016.00051.7

Introduction

Degenerative lumbosacral spine disorders are fairly common in middle aged and elderly population[1] and is one of the major cause for disability in adult working population[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[9-10] with or without instrumentation[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 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 / neuroqenic 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 / neuroqenic 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. lntermittent 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, 1"1, 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 1't, 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 1st month, p< 0.001* Pre-op 3rd month, p< 0.001*
1st month	28.80	15.56	24	< 0.001*	Pre-op vs 6th month, p< 0.001*
3rd month	21.13	12.34	18	< 0.001*	Immediate vs 1st month, p< 0.001*
6th month	19.40	12.42	16	< 0.001*	Immediate vs 3rd month, p< 0.001* Immediate vs 6th month, p< 0.001* 1st month vs 3rd month, p<0.001* 1st month vs 6th month, p<0.001* 3rd month vs 6th 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 al[25] where 87.5% patients had leg pain. In our study, 24 patients(80%) had Neuroclaudication. ln study by Rajendra et al[25] 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 al[25] where 93% patients had nerve root tension signs. In our study, 9 patients(30%) had Neurological deficit. In study by Rajendra et al[25] 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 al[30] 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.

Acknowledgement: Nil

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

Reference

1. Katz JN, Harris MB, Clinical practice: lumbar spinal stenosis. 2008. N Engl J Med:358(8):818-8 25.
2. Sairyo K, Katoh S, Sasa T, Goel VK, Vadapalli S, Masuda A, Biyani A, Ebraheim N: Athletes with unilateral spondylolysis are at risk of stress fracture at the contralateral pedicle and pars interarticularis: A clinical and biomechanical study. American Journal of Sports Medicine, in press.
3. Lee CH, Hyun SJ, Kim KJ. 2013. Decompression Only Versus Fusion Surgery for Lumbar Stenosis in Elderly Patients over 75 Years Old: Which is Reasonable? Neurol Med Chir (Tokyo):5a(3):194-200.
4. Truszczynska A, Rqpala K, Truszczynski O et al. 2013. Return to work after spinal stenosis surgery and patients' quality of life. Int J Occup Med Environ Health:26(3):1-7.
5. Postacchini F. 1985. The diagnosis of lumbar spinal stenosis: analysis of clinical and radiographic findings in 43 cases. Ital J Orlhop Traumatol:1 1.5-21.
6. Tan SB. 2003 Spinal canal stenosis. Singapore Med Journal:44:168-9.
7. Epstein NE, Maldonado VC, Cusick JF. 1998. Symptomatic lumbar spinal stenosis, Surg Neurol:50:3–10.
8. Alvarez JA, Hardy RH Jr. 1998. Lumbar spine stenosis: a common cause of back and leg pain. Am Fam Physician: 57:1825–40.
9. Krag MH, Beynnon BD, Pope MH, et al. 1986. An internal fixator for posterior application to short segments of the thoracic, lumbar, or lumbosacral spine: design and testing. Clin Orthop Relat Res:(203):75-98.
10. Roy-Camille R, Saillant G, Mazel C. 1986. Internal fixation of the lumbar spine with pedicle screw plating. Clin Orthop Relat Res:(203):7-17.
11. Hur JW, Kim SH, Lee JW, Lee HK.2007. Clinical analysis of postoperative outcome in elderly patients with lumbar spinal stenosis. J Korean Neurosurg Soc:41:157-160.

12. Hanley EN Jr. 1995. The indications for lumbar spinal fusion with and without instrumentation. Spine:20:1435-53.
13. Kwon BK, Berta S, Daffner SD, et al. 2003. Radiographic analysis of transforaminal lumbar interbody fusion for treatment of adult isthmic spondylolisthesis. J Spinal Disord Tech:16:469-76.
14. Lowe TG, Tahernia AD. 2002. Unilateral transforaminal posterior lumbar interbody fusion. Clin Orthop:394:64-72.
15. Whitecloud TS 3rd, Roesch \41y', Ricciardi JE. 2001. Transforaminal interbody fusion versus anterior-posterior interbody fusion of the lumbar spine: a financial analysis. J Spinal Disord:14:100-3.
16. France JC, Yaszemski MJ, Lauerman WC, et al. 1999. A randomized prospective study of posterolateral lumbar fusion: outcomes with and without pedicle screw instrumentation. Spine (Phila Pa 1976):24:553-60.
17. Mdller H, Hedlund R. 2000. Surgery versus conservative management in adult isthmic spondylolisthesis-a prospective randomized study: part 1. Spine (Phila Pa 1976):25:1711-5.
18. Fritzell P, Hdgg O, Wessberg P, et al. 2001. Volvo award winner in clinical studies: Lumbar fusion versus nonsurgical treatment for chronic low back pain: a multicentre randomized controlled trial from the Swedish Lumbar Spine Study group. Spine (Phila Pa 1976):26:2521-34.
19. Hallett A, Huntley JS, Gibson JN. 2007. Foraminal stenosis and single-level degenerative disc disease: a randomized controlled trial comparing decompression with decompression and instrumented fusion. Spine (Phila Pa 1976):32:1375-80.
20. Lin PM. 1977. A technical modification of Cloward's posterior lumbar interbody fusion. Neurosurgery:1.1 18-24.
21. Diedrich O, Luring C, Pennekamp PH, Perlick L, Wallny T, Kraft CN. 2003. Effect of posterior lumbar interbody fusion on the lumbar sagittal spinal profile. Z Orthop lhre G renzgeb.:141(4):425-32.
22. Cunningham BW, Polly DW Jr. 2002. The use of interbody cage devices for spinal deformity: a biomechanical perspective. Clin Orthop Relat Res:394:73-83.
23. Madan S, Boeree NR. 2002. Outcome of posterior lumbar interbody fusion versus posterolateral fusion for spondylolytic spondylolisthesis. Spine (Phila Pa 1976):27:1526-42.
24. Hacker RJ. 1997. Comparison of interbody fusion approaches for disabling low back pain. Spine (Phila Pa 1976):22:660-5.
25. Rajendra Nath, Sanjay Middha, Anil Kumar Gupta, and Rohit Nath. 2012. Functional outcome of surgical management of degenerative lumbar canal stenosis. Indian J Orthop.:46(3):285-290.
26. Audat Z, Moutasem, Yousef K, Mohammad. 2012. Comparison of clinical and radiological results of posterolateral fusion, posterior lumbar interbody fusion and transforaminal lumbar interbody fusion techniques in the treatment of degenerative lumbar spine. Singapore M original Article ed J:53(3):183-63.
27. Dong-Hee Kim, MD, soon-Taek Jeong, MD, sang-Soo Lee, MD. 2009. Posterior Lumbar lnterbody Fusion using a Unilateral single cage and a Local Morselized Bone Graft in the Degenerative Lumbar Spine. Clinics in Orthopedic Surgery:1:214-221.
28. D. Kok, M. Grevitt, F.H. Wapstra and A.G. Veldhuizen. 2012. The Memory Metal spinal system in a Posterior Lumbar Interbody Fusion (PLIF) Procedure: A Prospective, Non-comparative study to evaluate the safety and performance. The open orthopaedics Journal:6:220-22s.
29. Atlas sJ, Deyo RA, Keller RB, chapin AM, patrick DL, Long JM, et al.1996. The Maine Lumbar spine study, part lll. 1-year outcomes of surgical and nonsurgical management of lumbar spinal stenosis. spine (phila pa 1976):21(15):1787-94.
30. Ng LC, Sell P. 2004. Predictive value of the duration of sciatica for lumbar discectomy. A prospective cohort study. J Bone Joint Surg Br.:86(4):546-9.