

Outcome of single level intervertebral disc prolapse treated with interlaminar lumbar discectomy by fenestration

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Abstract: *Background:* Low back pain due to lumbar disc prolapse is the major cause of morbidity throughout the world affecting mainly young adults. Different surgical techniques for lumbar discectomy are in vogue with the aim of least possible damage to other structures while dealing with the prolapsed disc. This short term prospective study was done to assess the functional outcome interlaminar fenestration discectomy. *Materials and Methods:* Thirty six patients with clinical symptoms and signs of single level prolapsed lumbar intervertebral disc having radiological correlation by MRI study were subjected to disc excision by interlaminar fenestration. Outcomes were measured using the visual analogue scale (VAS) for back and leg pain, Roland-Morris score (RM) improvement and modified Macnab criteria at 3 months, 6 months and 2 years. All quantitative data were summarised using mean and standard deviation, and qualitative data using proportions. *Results:* Mean (SD) VAS for lower back ache and leg pain at 3 months, 6 months, and 2 years shows improvement in the overall low back pain and leg pain in patients studied. The maximum improvement in radicular pain is seen within six months after surgery and from then on not much improvement were noted. According to modified Macnab criteria outcome was good in 69.4%, fair in 22.2%, and poor in 8.3% of patients treated by fenestration surgery. *Conclusion:* Interlaminar lumbar discectomy by fenestration method without extensive laminectomy is effective and reliable surgical technique for treating properly selected patients with herniated lumbar disc at L4-L5 and L5-S1 levels. The results are comparable to microdiscectomy, and this may be due to the close similarity of the two procedures.

Keywords: Prolapsed intervertebral disc, Sciatica, Fenestration discectomy.

Introduction

Old books have little information about back ache. The best early description of sciatica comes from a monograph by Cotugno, written in 1764. About 90 years later pathologists found necropsy evidence of disc protrusion. Another 90 years passed before it was realized that there was any connection between these two observations. In 1911 Goldthwait, attributed, back pain to posterior displacement of the disc [1]. Conservative therapy including bed rest, and analgesic drugs and back care schools is generally accepted as adequate treatment in the beginning of an acute attack of sciatica. Traction therapy has been recommended and used for many years and favorable results were reported. Mixter and Barr's classical paper "Rupture of intervertebral disc with involvement of spinal canal" opened an era of systematic diagnosis and operative treatment of lumbar disc prolapse. Their operative approach was an extensive laminectomy. Shortly

afterwards hemilaminectomy became the favorite procedure in cases with unilateral symptoms. Love described extradural removal of herniated disc and devised interlaminar fenestration for treatment of lumbar disc prolapsed [2].

Refinement of fenestration technique was described by Williams who coined the term "Conservative surgical approach to the virgin herniated disc" which required the use of operating microscope to facilitate better visualization of dural sac, nerve roots and other interspinous structures including disc [3] and the advantage of fenestration and interlaminar approach has been demonstrated [4-6]. Mishra et al compared laminectomy and fenestration for disc excision and concluded the superiority of later approach in respect to early postoperative mobilization, early return to work and low incidence of postoperative backache as it is less extensive [7].

Frank U. Hermantin et al in a prospective randomized study compared efficacy of video-assisted arthroscopic microdiscectomy with those of conventional open laminotomy and discectomy and concluded that the rate of satisfactory outcome was approximately the same with both the procedures but the patients who had an arthroscopic microdiscectomy had a shorter duration of postoperative disability and used narcotics for a shorter period [8]. Interlaminar fenestration is a safe, effective and reliable surgical technique for treating properly selected patients with herniated lumbar disc. Standard fenestration discectomy does not destabilize the spine more than microdiscectomy [9-10].

Material and Methods

This is a prospective study of 36 patients undertaken in the Department of Orthopedics, Al Ameen Medical College Hospital Bijapur during June-2009 to November-2014. Study was approved by institutional ethics committee. A written informed consent was obtained from each patient. Patients with single-level lumbar disc herniations producing unilateral lumbar radiculopathy were selected for the study. Patients with stenosis, bilateral involvement, multiple disc herniations, revision surgeries, cauda equina syndrome and patients with disc prolapse other than L4-L5 and L5-S1 were excluded. All the study patients failed to respond to conservative method of treatment of minimum 6 weeks duration prospectively. All patients had undergone MRI scanning of the spine and diagnosed to have prolapsed L4-5 or L5-S1 disc.

Fig-1: Pre op MRI of a patient showing L4-L5 IVDP



Preoperative visual analogue scale (VAS) scoring for lower back ache (LBA) and radicular leg pain were done in all patients. All patients were operated on prone position over Ralten-Hall frame under general anaesthesia. Spine was approached through a two to three inch midline incision depending on the levels. If needed, lower 3rd part of upper lamina or upper 3rd of lower lamina was cut to enlarge a fenestration for clear view. The sequestered and extruded loose disc fragments were removed, with the minimal removal of tissue fragments from the intervertebral space.

Fig-2: Sagittal section showing disc impinging on the left side

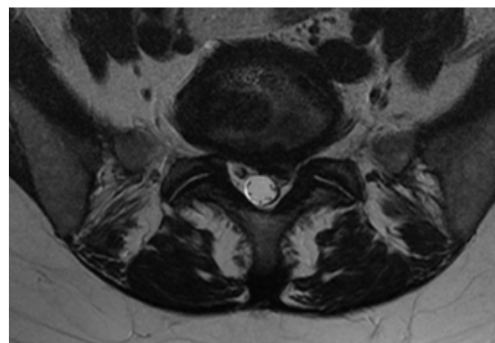
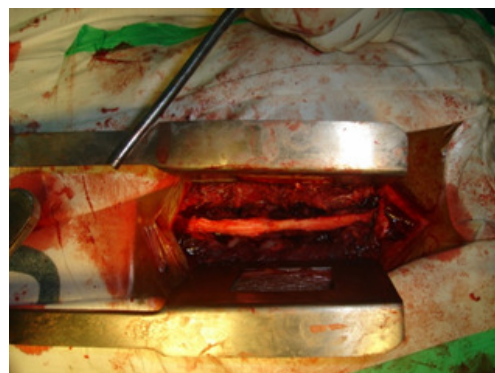


Fig-3: Intra operative photograph showing unilateral laminectomy



Postoperatively patients were allowed sit up on first postoperative day and gradual walking was encouraged. Lifting, bending and stooping prohibited for 6 weeks. The patients were followed up on an outpatient basis at 3 months and 6 months after surgery, and final assessment in November 2014. Data are presented as the mean and the standard deviations. For intergroup comparison of means we used the paired t-test. The level of significance was set up at $p < 0.05$.

Results

Of the 36 patients who were followed-up, there were 27 men and 9 women, with an average age of 34.3 years (27–54 years). 24 out of 36 patients (66.6%) were employed in heavy manual labor. Out of 36 patients studied 24 (66.7%) had disc herniation at L4-L5 level and remaining 12 had abnormality at L5-S1 level. Of this, 12 (33.3%) had protruded disc, 12 (33.3%) had extruded disc, 11 (30.5%) had sequestered disc and one (2.8%) had annular bulge (Table 1). The mean duration of follow-up was 2.6 years (range 2.0–4.3 years). The average duration of preoperative back pain was 18 months and that of preoperative leg pain was 8 months. The average duration of conservative management was 10 months.

	Count	Percentage
Bulge	1	02.8
Protrusion	12	33.3
Extrusion	12	33.3
Sequestration	11	30.5

In our study of 36 patients, the LBA preoperative mean±SD VAS score was 76.7±4.8 which improved to 28.8±9.0 postoperatively. This indicates 62.5% improvement in the overall low back pain in patients studied at three months. The two tailed “p” value was found to be less than 0.01 which is statistically significant.

The radicular pain had a mean±SD VAS score of 79.2±5.8 pre operatively which improved to a mean±SD VAS score of 25.0±9.3. This represents a 68.4% of improvement in the quality of radicular pain experienced by patient at three months. The maximum improvement in radicular pain is seen within three months after surgery. The two tailed “p” value was found to be less than 0.01 which is statistically significant (Table-2).

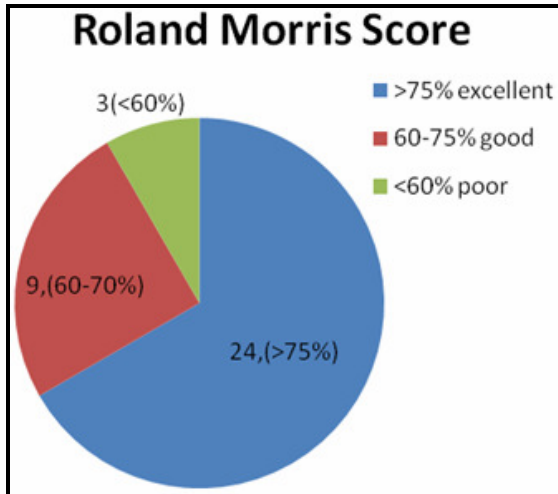
	Stage	Mean	SD	N	Group	mean % difference	paired 't'	p
LBA VAS score	Pre- op	76.7	4.8	36	Pre Vs 3 MTS	62.5	32.56	p<0.01
	3 MTS	28.8	9.0	36	Pre Vs 6 MTS	64.7	28.29	p<0.01
	6 MTS	27.1	9.5	36	3 MTS Vs 6 MTS	5.9	0.279	p>0.05
	1 year	26.4	8.2	36	6 MTS Vs 1 year	2.6	0.904	p>0.05
	2 year	25.7	8.1	36	1 year VS 2 years	2.7	0.468	p>0.05
Radicular pain VAS score	Pre- op	79.2	5.8	36	Pre Vs 3 MTS	68.4	25.04	p<0.01
	3 MTS	25.0	9.3	36	Pre Vs 6 MTS	70.0	25.55	p<0.01
	6 MTS	23.8	9.2	36	3 MTS Vs 6 MTS	5.0	1.81	p>0.05
	1 year	23.1	8.7	36	6 MTS Vs 1 year	2.9	0.902	p>0.05
	2 year	22.6	8.6	36	1 year VS 2 years	2.2	0.532	p>0.05

Roland Morris Score: 24 out of 36 patients (66.6%) had an overall improvement of greater than 75%. 9 patients (25%) had improved within the range of 60-75%. Three patients had dismal score. Three out of 36 patients failed to improve both subjective and objective criteria (Graph 1).

Subjective outcome assay: 17 out of 36 patients (47.2%) had subjective score of 1, which means

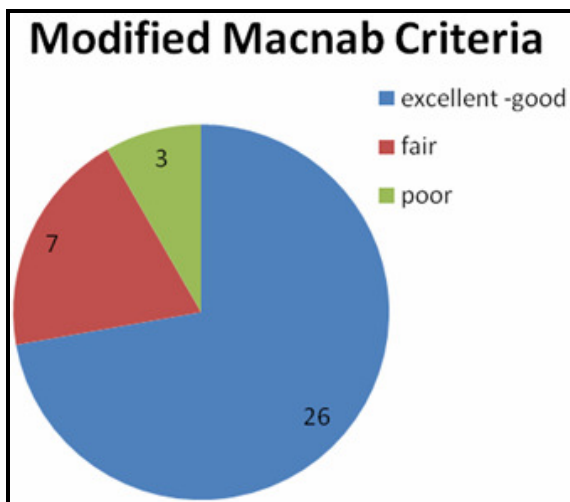
surgery met their expectations. 10 patients (27.7%) had score 2, means they would undergo the same surgery for the same outcome. 6 out of 36 patients (16.6%) said that although the surgery helped, they would not undergo the same surgery for similar outcome. 3 patients (8.3%) felt that, they were worse after surgery.

Graph-1: Results according to Roland Morris score



Objective criteria: Patients were assessed objectively using modified Macnab criteria for surgical outcome. According to these criteria, outcome was excellent to good in 26 (72.2%), fair in 7 (19.4%), and poor in 3 (8.3%) of patients treated by fenestration surgery (Graph 2). There was inadvertent dural tear in two patients. The dural rent repair was done under direct vision. No other major complications like DVT, pulmonary embolism, nerve root injury, retroperitoneal injury or wound infection occurred in our study.

Graph-2: Assesement of objective criteria according to Macnab Criteria



Discussion

Low back pain due to lumbar disc prolapse is the major cause of morbidity throughout the world affecting mainly the young adults. Lifetime incidence of low back pain is 50-70%, with

incidence of sciatica more than 40%. However clinically significant sciatica due to lumbar disc prolapse occurs in 4-6% of the population. Most cases of sciatica due to Intervertebral disc lesions were in fact partial cauda equina lesions, mostly unilateral and characterized by muscular weakness, wasting, reflex abnormalities and sensory impairment referable to compression of one or more nerve roots. The standard surgical treatment of lumbar disc prolapse has been surgical excision of the disc, though the methods of discectomy vary.

The traditional view has been that wide laminectomy produces increased morbidity compared to less extensive procedures like interlaminar fenestration [11]. Love devised inter-laminar fenestration [2]. Refinement of fenestration technique was done by William who used an operating microscope to facilitate better visualization of structures including the prolapsed disc [3]. Fenestration surgery aims at removing the disc with minimal injury to the soft tissues. The approach herein differs from microdiscectomy only in extent of exposure. The disc removal per se in both is limited. Kelly et al. found that patients undergoing microdiscectomy had less tissue trauma when compared with those who underwent the classic technique; however, no difference could be noted in the clinical response [12].

Compared with the standard laminectomy, fenestration surgery has some advantages. Fenestration preserves the stability of the vertebral column, reduces incidence of failed back syndrome, allows rapid rehabilitation, requires decreased manipulation of the neural elements and subsequent perineural fibrosis and can be done without operating microscope.

A review of literature reveals success rates for lumbar disc surgery ranging from 46%-96%. We have noticed an overall good to excellent outcome in 69.4% of our patients (p<0.05). The improvement in radicular pain is much more predictable and constant. In the present study, interlaminar discectomy alone was adequate in 32 cases (88.8%). Remaining 4 patients (12.2) required superior laminotomy

and all of these patients had L4-L5 disc prolapses. L5-S1 disc can almost always be explored by ligamentum flavotomy alone. But L4-L5 disc may require additional superior laminotomy, the role of autogenous fat graft is still debated, we have not used in any of our patients. Excellent results have been obtained in our patients with regard to neurological improvement. 80% cases had motor improvement and 95% cases had sensory improvement.

People who involve in heavy manual labor have high incidence of symptomatic disc disease. This tends to occur in the third decade. These patients belong to the poorer section of society and respond less well compared to other population group [13]. We have not found a positive relationship towards early return to work as seen in many other studies. This may be due to the difference in the patient population and their occupational profile. However people employed in light work have experienced early return to work. Sangwan et al conclude that open interlaminar fenestration disc excision under direct vision offers the complete visualization of nerve root and complete removal of the offending disc along with loose fragments and it has yielded almost comparable results [14]. Kuldeep Nahar et al concluded that open interlaminar fenestration discectomy appeared to be safe, simple and economic operation in comparison to microdiscectomy and it offered equivalent results [15].

Henrikson et al. concluded that there is no significant advantage in postoperative outcomes and duration of hospital stay between

conventional fenestration discectomy and microlumbar discectomy [16]. Porchet et al. in an observational study have concluded that there is no difference between the two techniques when patient response outcomes were studied [17]. Tureyen compared the outcome of single sided, single-level, first-time lumbar disc herniation treated with and without the help of a microscope in 114 patients followed up for 1 year. They found that MLD had 90% success rate while conventional surgery had 89% success rate [18]. Majeed et al in their study concluded that, the minimally invasive lumbar discectomy scores were only slightly better than those of the conventional interlaminar fenestration discectomy in patient-rated outcomes [19].

Conclusion

We conclude that interlaminar lumbar discectomy by fenestration method without extensive laminectomy is effective and reliable surgical technique for treating properly selected patients with herniated lumbar disc at L4-L5 and L5-S1 levels. The results are comparable to microdiscectomy, and this may be due to close similarity of the two procedures. Our patients took a longer rehabilitation time because of fear of having undergone a back surgery. This is evidenced by the fact that they take longer time to return to work. This is in contrast to western studies where the duration of return to work has been much lesser. Fenestration surgery gives good to excellent reduction in radicular pain.

References

1. Kirkaldy, Willis WH. The relation of structural pathology to the nerve root. *Spine*, 1984; 9(49):1084.
2. Love JG. Root pain resulting from intraspinal protrusion of vertebral discs: diagnosis and treatment. *J Bone Joint Surg* 1939; 19:776-80.
3. Williams RW. Micro lumbar discectomy; a conservative surgical approach to the virgin herniated lumbar disc. *Spine*, 1978; 3:17582.
4. Nagi ON, Sethi A, Gill SS. Early results of discectomy by fenestration technique in lumbar disc prolapse. *Ind J Orthop*. 1985; 19(1):15-9.
5. Casper W, Campbell B, Barbier DD et al. The Casper microsurgical discectomy and comparison with a conventional standard lumbar disc procedure. *Neurosurgery*. 1991; 28:78-87.
6. Mishra SK, Mohapatra NC, Pradhan NK, Mohapatra MK. Lumbar disc excision. Comparative study of laminectomy and interlaminar fenestration. *Ind J Orthop*. 1998; 33(3):153-55.
7. Mishra SK, Mohapatra NC, Pradhan NK, Mohapatra MK. Lumbar disc excision: comparative study of laminectomy and interlaminar fenestration. *Indian Journal of Orthopaedics*. 1998; 32(3):153-5.
8. Frank UH, Todd Peters, Louis Quartararo, Parviz Kambin. A Prospective, Randomized Study Comparing the Results of Open Discectomy with Those of Video-Assisted Arthroscopic Microdiscectomy, *J Bone Joint Surg Am*, 1999; 81(7):958-65.

9. Garg M, Kumar S. Interlaminar discectomy and selective foraminotomy in lumbar disc herniation. *J Orthop Surg (HongKong)*. 2001; 9(2):15-18.
10. Mascarenhas AA, Thomas I, Sharma G and Cherian JJ. Clinical and radiological instability following standard fenestration discectomy. *Indian J Orthop*. 2009; 43(4):347-351.
11. O'Connell JEA. Protrusions of the lumbar intervertebral discs. *J Bone Joint Surg (Br)*. 1951; 33:8-30.
12. Kelly RE, Dinner MH, Lavynne MH, Andrews DW. The effect of lumbar disc surgery on postoperative pulmonary function and temperature. *Spine*, 1993; 18(2):287-290.
13. Barior C, Arrotegui J et al. Clinical factors predict my outcome often surgery for herniated lumbar disc. An epidemiological multivariable analysis. *J Spine Disorl* 1990; 3:205-209.
14. Sangwan SS, Kundu ZS, Singh R, Kamboj P, Siwach RC, Aggarwal P. Lumbar disc excision through fenestration. *Indian journal of orthopaedics*, 2006; 40(2):86-89.
15. Nahar K, Shrivastava RK, Vader A. Prospective Study of Prolapsed Lumbar Intervertebral Disc Treatment by Fenestration. *Int J Res Med*. 2013; 2(2):170-173.
16. Henriksen L, Schmidt K, Eskesen V, Jantzen E. A controlled study of microsurgical versus standard lumbar discectomy. *Br J Neurosurg* 1996; 10(3):289-294.
17. Porchet F, Bartanusz V, Kleinstueck FS, Lattig F, Jeszenszky D, Grob D, Mannion AF. Microdiscectomy compared with standard discectomy: an old problem revisited with new outcome measures within the framework of a spine surgical registry. *Eur Spine J* 2009; 18(Suppl 3):360-366.
18. Tureyen K. One-level one-sided lumbar disc surgery with and without microscopic assistance: 1-year outcome in 114 consecutive patients. *JNS Spine*, 2003; 99(3):247-250.
19. Majeed et al. Comparison of outcomes between conventional lumbar fenestration discectomy and minimally invasive lumbar discectomy: an observational study with a minimum 2-year follow-up. *Journal of Orthopaedic Surgery and Research*, 2013; 8:34.

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