Transforaminal Endoscopic Discectomy for Lumbar Disc Prolapse

Babu B Hundekar¹

ABSTRACT

Introduction: Open surgery for lumbar disc is associated with significant iatrogenic morbidity. Percutaneous endoscopic disc surgery performed in the awake state offers a new paradigm for the treatment of lumbar disc prolapse. As the procedure requires a skin incision of only 8mm, it is the least invasive disc surgery procedure at present. So the present study was done to evaluate the efficacy of percutaneous endoscopic lumbar discectomy for lumbar disc prolapse and report the results on the basis of modified MacNab criteria.

Material and Methods: A prospective study of 22 cases of percutaneous endoscopic lumbar discectomy using transforaminal approach for symptomatic lumbar disc prolapsed was done. 22 patients with contained disc prolapse were subjected to percutaneous endoscopic lumbar discectomy under local anaesthesia, using transforaminal approach during the period 2013-14. The results were analysed using Visual Analogue Score for pain and Modified MacNab criteria for outcome measure.

Results: The mean duration of follow-up was 24 weeks. Out Of 22 patients there were 12male and 10 female patients. 15 patients had prolapsed disc at L4/5 level, 4 at L5/S1 level, 3 at L 3/4 level. Mean pre-op VAS score was 7.3 (range 6--10) and immediate post-op VAS score was 3.1(range 0--4). VAS score at one month was 2.4 (range 0-4). VAS score at six months was 2.3 (range 0-4). The modified MacNab score at one month post-op was excellent in 4, good in 15, fair in 2, poor in 2 cases. Excellent or good outcome was obtained in 19 out of 22 cases (86.3%). There was no incidence of infection, dural leak, nerve injury or vascular complications.

Conclusion: PELD is a minimally invasive procedure for discectomy with early encouraging results. The results of the procedure are acceptable and the procedure is safe and effective. Careful selection of the patients is essential to ensure favorable outcome with minimal morbidity.

Keywords: Low backache, Percutaneous endoscopic lumbar discectomy, Lumbar disc prolapse, Transforaminal approach.

INTRODUCTION

Low backache is the most common problem in the general population. It is second only to the headache. 8 out of 10 people will have an episode of backache during one's lifetime.¹ Discogenic pain is the major cause of backache. Sedentary lifestyle, lack of exercises and long hours of travel are the major contributors for disc prolapse.

Although majority of patients get relief with conservative treatment, about 10 % of patients who don't achieve satisfactory recovery with conservative treatment require surgery.

Surgery for lumbar disc prolapse can be classified into two broad categories. Open versus minimally invasive. First open laminectomy and discectomy was done by Oppenheim and Fedre Krause in 1906², though the first publication was done by Mixter and Brar in 1934.^{2,3} Since then laminectomy, hemilaminectomy and fenestration were introduced and are still being practiced all over the world. Open surgical procedures are associated with iatrogenic morbidity such as dural tear, destabilization of spine due to resection of posterior elements, epidural fibrosis and it takes time to recover from surgical trauma to paraspinal structures.⁴ It therefore became more common for spine surgeon to consider minimally invasive procedures for these patients.⁵ With the introduction of microscope, Casper and Yasergill refined the open laminectomy into open microdiscectomy. Currently open microdiscectomy is the most widely performed procedure for disc prolapse and is considered gold standard.

The concept of minimally invasive surgery for lumbar disc herniation is to provide surgical options that optimally address the disc pathology without producing the iatrogenic morbidity associated with the open surgical procedures. Percutaneous endoscopic surgery has several advantages over open surgery, including clear visualization and targeted fragmentectomy.⁶ There is less damage to paraspinal muscles and the procedure can be performed under local anaesthesia with ongoing patient feedback. Thus there is reduced risk of major nerve root injury. Patients will be able to return work earlier after minimally invasive procedures as compared to more traditional methods.⁷ The aim of present study was to investigate the early experience using percutaneous endoscopic lumbar discectomy for surgical treatment for symptomatic lumbar disc prolapse from 2013 to 2014.

MATERIAL AND METHODS

This was the prospective study of 22 cases of PELD performed using transforaminal approach during the period 2013-2014. Patients were selected based on the inclusion exclusion criteria. Ethical clearance for the study was taken from the institutional ethical board and informed consent was taken from the patients before the start of the study.

Inclusion criteria: Patients with following criteria were included in the study.

- Radiating leg pain that was more severe than axial back pain.
- Positive straight leg raising test.
- Pain not relieved after conservative (non-surgical) treatment for minimum of 8 weeks.
- MRI scan of L-s spine confirming contained disc prolapsed.

Exclusion criteria: Patients with following criteria were not included in the study.

¹Associate Professor, Department of Orthopaedics, Hind Institute of Medical Sciences, Safedabad, Barabanki Road, Lucknow-225003, Uttar Pradesh, India

Corresponding author: Dr. Babu B Hundekar, M. S (ortho), Associate Professor, Department of orthopaedics, Hind Institute of Medical Sciences, Safedabad, Barabanki Road, Lucknow-225003, Uttar Pradesh, India

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- Spinal canal stenosis or foraminal stenosis.
- Multiple level disc protrusion.
- Significant motor deficit.
- Spondylolisthesis.
- Disc herniation with migration into spinal canal.
- Infection, tumour or fracture associated with disc prolapsed.
- Calcified disc.

Surgical procedure

All cases except two patients, were performed under local anaesthesia with conscious sedation. In two patients who were very apprehensive, general anaesthesia was used. Patient was positioned prone on a radiolucent table. The entry point was 10-11 cm lateral from the midline. A metal rod or 18 no. spinal needle was placed over the back in AP view in c-arm to locate the respective disc space. Then the metal rod was placed transversely across the centre of the target disc in lateral view.

Once the entry point was determined, the skin window was infiltrated with 1% plain lidocaine. A 6 inch long 18 gauge needle was inserted from the skin window at 60-65* angle to the parasagittal plane, anteromedially towards the anatomic disc centre. The subcutaneous tissue and trajectory was infiltrated with lidocaine as the needle is advanced. Than the c-arm was moved to lateral projection and position of needle tip in annular window in foramen was confirmed. The annulus was infiltrated

with lidocaine.

The stylet was removed and 1mm guide wire was inserted through the spinal needle. An incision about 5mm was made around the spinal needle at the entry point. The guide wire was advanced about 1-2cm into the disc and the spinal needle was removed. Now sequentially dilators were inserted over the guide wire. The scope sheath was inserted over the last dilator. Once its position was confirmed in c-arm in both AP and Lateral view, the obturator (dilator) was removed and the scope was inserted. Continuous saline irrigation was done.

If there was bleeding, cautery was used. The prolapsed disc material was removed using 3mm forceps and grasper was inserted through the working channel of the endoscope, under direct endoscopic visualisation (Figures 1-6).

Communication with the patient was maintained throughout the procedure to ensure nerve root safety and to confirm relief of radicular pain. The wound was closed with a single stich and dressing is applied.

ANALYSIS OF RESULTS:

Patients were evaluated using visual analogue score for pain and the modified MacNab score for outcome measure (Table 1). They were assessed pre-operatively, at one month and at six months after the procedure.

RESULTS



Figure-1: Xylocaine infiltration



Figure-3: Discectomy in progress



Figure-2: Needle insertion



Figure-4: Cauterisation

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Figure-5: Discectomy- endoscopic view



Figure-6: Disc material removed

There were 12 male and 10 female patients. The average age was 39.1 years, ranging from 22 years to 65 years. 15 patients had prolapsed disc at L4/5 level, 4 at L5/S1 level, 3 at L 3/4 level (Table 2).

Mean pre-op VAS score was 7.3 (range 6--10) and immediate post-op VAS score was 3.1(range 0--4). VAs score at one month was 2.4 (range 0-4). VAs score at six months was 2.3 (range 0-4). The modified MacNab score at one month postop was excellent in 4, good in 15, fair in 2, poor in 2 cases. Considering the number of subjects with excellent or good score as favourable outcome, i.e.; 19 out of 22 cases (86.3%) in the present study had a favourable outcome. All except one patient were discharged within 48 hours.

Surgery was not abandoned before completion in any of the subjects. 4 patients complained of severe pain during the procedure, but afterwards they didn't had pain.

There was no case of neurological deficit following the procedure. 2 patients with L5/S1 disc didn't have complete relief as sufficient disc material could not be removed and opted for open surgery. There was no incidence of infection, dural leak, nerve injury or vascular complications (Table 3).

The mean duration of follow-up was 24 weeks. 19 out of 22 patients (92%) regarded the procedure as tolerable and were willing to undergo the same procedure again, should the need arise.

Grade **Description of criteria** Excellent Free of pain, no mobility restriction, able to return to work Good Occasional non-radicular pain, relief of presenting symptoms, able to return to modified work Fair Some improved functional capacity, still handicapped or unemployed Poor Continued objective symptoms of root involvement, additional operative intervention needed at index level Table-1: Modified MacNab criteria for characterizing outcome after spinal surgery

Data	No. of patients	Percent	
Sex	12	54.5	
Male	10	45.5	
Female			
Age (year)			
20-40	13	59	
41–65	9	41	
Duration of symptoms (months)			
6–12	7	32	
>12	15	68	
Spinal level involved			
L3–L4	3	14	
L4–L5	15	68	
L5-S1	4	18	
Table-2: Demographic Characteristics of 22 Patients			

Complication	No. of patients	Percent	
Deep infection	0	0	
Thrombophlebitis	0	0	
Dysesthesia	4	18	
Dural tear	0	0	
Intraoperative vascular injury	0	0	
Death	0	0	
Table-3: Complications			

In the evolution of spine surgery, the endeavour has always been to develop surgical techniques that would provide maximum benefit with minimal damage to the surrounding neural and musculoskeletal structures. Open lumbar microdiscectomy is considered gold standard for treatment of disc prolapse with a reported success rate of 80-96%.^{8,9} Employment of endoscopic technique through a percutaneous approach can further cut down on the surgical morbidity while achieving similar or better outcomes. The recent development in optics and allied tools like laser and flexible radiofrequency probes has further made it possible to use percutaneous techniques for the treatment of spinal disorders.^{6,10,11}

The surgical goal for both the procedures is the same, i.e.; to decompress the nerve root by removing the offending prolapsed disc fragments. Despite the fact that the present study is initial series taking into account the surgeon's learning curve, the success rate was 86.3%. This is comparable to the result of gold standard open micro discectomy and also other studies published in literature.

Many reports are presented which prove the efficacy of PELD with overall comparable results.¹²⁻¹⁴ Our study had an overall result of 86.3%. We compared our results with the series of

DISCUSSION

Wen-Ching Tzan et al (2007) where the average patient age was 38years, Level of Disc- L4/5 in 65% cases, and L5/S1 in 23% cases. Complication rate was 6 with an overall result of 89%.¹² Similar results are reported by C C Wang et al. In their series of 23 cases, the average patient age was 44years, Level of Disc-L4/5 in 56% cases, and L5/S1 in 43% cases. Mean pre-op VAS score was 7.3 which became 2.1 post operatively. Complication rate was 6 with an overall result of 82.6% outcome which included excellent and good results.¹³

In the study of Hermatin et al, the average patient age was 39years.Pre-op VAS score was 6.6 and post-op score was 1.9. 73% of patients were satisfied with results.¹⁴

With the patient in awake state of anaesthesia, continuous verbal communication with the operating surgeon was possible. This increases the safety of the procedure. If the patient experiences pain or increased numbress or heaviness of the leg, he can immediately tell the surgeon. Also patient can tell about the relief of pain after sufficient decompression of the root/ cord.

The endoscopic approach allows very small incision and less tissue trauma compared with standard open microdiscectomy. As PELD causes significantly less iatrogenic injury to paraspinal muscles, it may potentially provide additional long term benefits over more aggressive open procedures.

We treated relatively young population. 13 out of 22 patients' age was below 40 years. Selection criteria of the patients play a significant role for surgical success in disease like lumbar disc herniation. Most of the patients had protrusion at L4/5 level. Four patients had protrusion at L5/s1 level and 3 at L 3/4 level. PELD has got very good results in posterolateral protrusions but relatively poor results in central disc prolapse. It is not indicated in sequestrated discs, as it is very difficult to extract the sequestrated fragments from canal. Disc decompression is the main goal of PELD. Also level is very important. It is difficult to decompress completely at L5/s1 level due to difficulty in reaching the disc due to iliac bone wings. Also chances of injury to the nerve root at L5/s1 level is more.

The average surgical time was 1 hour, average hospital stay was 2 days and reoperation rate was 5%. Overall success rate was 92% which is comparable to results of micro-discectomy.

From these data it can be concluded that PELD is safe and effective in selected cases of contained posterolateral protrusions of disc. With small skin incision, less use of analgesics and early return to work, it can be considered as gold standard for surgery in contained lumbar disc prolapse.

CONCLUSION

PELD is a minimally invasive procedure for discectomy with early encouraging results. It has learning curve initially, but once experience is acquired, the results of the procedure are acceptable and the procedure is safe and effective. Careful selection of the patients is essential to ensure favourable outcome with minimal morbidity.

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