

Original Research Article

Transforaminal percutaneous endoscopic lumbar discectomy versus microdiscectomy: an Indian rural experience

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ABSTRACT

Background: The objective of the study was to compare surgical outcome of micro-discectomy with transforaminal percutaneous endoscopic lumbar discectomy for single level lumbar disc herniation in Indian rural population.

Methods: Retrospective comparative study was designed during the period of October 2012 to June 2015, patients in the age group of 22-75 years with unremitting sciatica with/without back pain, and/or a neurological deficit that correlated with appropriate level and side of neural compression as revealed on MRI, with single level lumbar disc herniation who underwent either microdiscectomy or TPELD were included in the study. Patients were assessed on visual analogue scale (VAS) for back and leg pain, modified macnabs criteria, the Oswestry Disability Index (ODI).

Results: Group I (MD) included 44 patients and Group II (TPELD) included 20 patients. Significant improvement was seen in claudication symptom post-operatively in both MD and TPELD. Mean operating time was significantly shorter in MD group (1.11 hrs vs. 1.32 hrs; $p < 0.01$). According to modified MacNab's criteria, outcome were excellent (81.8%), good (9.09%) and fair (9.09%) in MD. Similarly, in TPELD, 80%, 15% and 5% patients had excellent, good and fair outcome respectively. In both groups, no one had a poor outcome. Thus, overall success rate was 100% in the study.

Conclusions: TPELD and MD have comparable post-operative outcome in most of the efficacy parameters in Indian rural patients undergoing treatment of single level lumbar disc herniation. Additionally, TPELD offers distinct advantages such as performed under local anaesthesia, preservation of structure, lesser post-operative pain and early mobilization and discharge from hospital.

Keywords: Transforaminal percutaneous Endoscopic lumbar discectomy, Microdiscectomy

INTRODUCTION

Disc prolapse is common in general population with an incidence of 1 in 10,000 populations, requiring surgical intervention in 10% patients. Microdiscectomy (MD) remains the standard procedures for symptomatic lumbar disc prolapse for many decades.¹ The procedure is a minimally invasive that involves partial removal of the intervertebral disc compressing the nerve root or spinal cord with the aid of magnifying loupes. The potential benefits of the procedure includes lesser surgical trauma,

increased safety owing to good visualization of operative field, lesser postoperative morbidity, and shorter hospitalization.^{2,4} with most of patients leading a pain-free existence.⁵ Transforaminal Percutaneous endoscopic lumbar discectomy (TPELD) is a relatively new and advanced technique of minimal invasive surgery that involves use of an endoscope to visualize the disc removal through postero-lateral approach through the triangle of Kambin.^{6,7} The procedure does not require bone or facet resection thus preserving spinal stability.^{8,9} TPELD has several advantages; mainly minimal damage

to muscular and ligamentous structures, faster rehabilitation, minimal post-operative pain, shorter hospital stay and faster recovery of functions. However, the procedure is associated with few disadvantages and Complications such as spondylodiscitis. In addition, concerns are raised over translating good clinical outcomes into quality of life improvement and ability to return to work.^{10,11} With evolution of surgical technique, recent reports suggest that TPELD has become comparable to conventional procedures and is used worldwide for the treatment of lumbar disc herniation, offering many advantages over MD.¹² However, the direct comparison of these procedures, comparing peri-operative and surgical outcomes in Indian patients is largely not known. We presented here our experience with TPELD and MD in the treatment of single level lumbar disc herniation in Indian population.

METHODS

A retrospective comparative study was conducted in 64 patients who were operated during October 2012 to June 2015. Patients were in the age group of 22-75 years with unremitting sciatica with/without back pain, and/or a neurological deficit that correlated with appropriate level and side of neural compression as revealed on MRI, with single level lumbar disc herniation who underwent either MD or TPELD were included in the study. Patients with morbid obesity, having serious neurological deficit and/or spinal instability or with predominant back pain and other spinal degenerative conditions such as central stenosis, discogenic back pain and herniation at higher level of disc (L1-L2 level) were excluded from the study. The selected patients were divided into two groups according to the surgical methods. Group I included patients who underwent microdiscectomy (MD, n=44) and Group II included patients who underwent transforaminal PELD (TPELD, n=20). The patients with canal stenosis due to degenerated disc protrusion, facet hypertrophy and thickened Ligamentum flavum were operated with Microdiscectomy whereas acute, soft disc protrusion, unilateral symptoms, not responding to conservative line of treatment patients for at least 6 weeks were operated with TPELD. Patient's data were collected including demographic profile, symptoms on presentation (backache, leg pain, claudication, mild and major neurodeficit), operative time, length of hospitalization, postoperative complications and time to return to work. Pain was measured by the 10-point visual analogue scale (VAS) scoring before and after surgery. The score is measured as "no pain" (score of 0) and "pain as bad as it could be" or "worst imaginable pain" (score of 10). Functions were assessed by the Oswestry Disability Index or the Oswestry low back pain disability Questionnaire (ODI), the scale consists of 10 sections.¹³ For each section the total possible score is 5: if the first statement is marked the section score=0; if the last statement is marked, the score =5. When all 10 sections are completed the score is calculated as follows: 16 (total scored)/ 50 (total possible score) ×100=32%. Scores are

interpreted as follows 0% to 20%: minimal disability, 21%-40%: moderate disability, 41%-60%: severe disability, 61%-80%: crippled, 81%-100%: either bed-bound or exaggerating their symptoms. The patient satisfaction was assessed by the modified Macnab's criteria.¹⁴ The score were graded as excellent (no pain; no restriction of mobility return to normal work & level of activity), good (occasional non-radicular pain relief of presenting symptoms; return to modified work), fair (some improved functional capacity still handicapped and unemployed) and poor (continued objective symptoms of root involvement; additional operative intervention needed at the index level irrespective of length of postoperative follow-up) to mark his satisfaction level. Complications were categorized as major (re-surgery, dural tear) and minor (back pain, leg pain, dysethesias).



Figure 1: Skin marking over the lumbar spine for TPELD.



Figure 2: MRI Lumbosacral spine, sagittal section showing left sided neural foraminal obstruction L4-L5.

Case 1

22 years male came to out patients department with complain of pain in back and left leg since 2 month. Pain was sudden in onset and severe in intensity. Pain was radiating to left lower limb over the posterior aspect of thigh and leg till toe, he also gave history of tingling sensation. Patient has history of lifting heavy weight 2 days back, since then patient was unable to walk for 5 feet and sit for more than 5 minutes. On examination:

Tenderness was present at L4-L5, Straight leg raising test was 30 degree left and 70 degree right, cross straight leg raising test was absent. Sensory hypoesthesia was present on left side over L4 region. No motor deficit. Pt was managed conservatively for 6 weeks with rest and analgesics. MRI was done suggestive of Left sided extra foraminal nerve root compression due to disc fragment. (Figure 2-4). TPELD was performed. 8 cm long left sided extraforaminal disc fragment was removed (Figure 5). Patient became a symptomatic post operatively.



Figure 3: Axial T1 weighted image of L4-L5 disc space showing hyperintense large left sided lateral recess and foraminal disc fragment which is isointense with intervertebral disc.

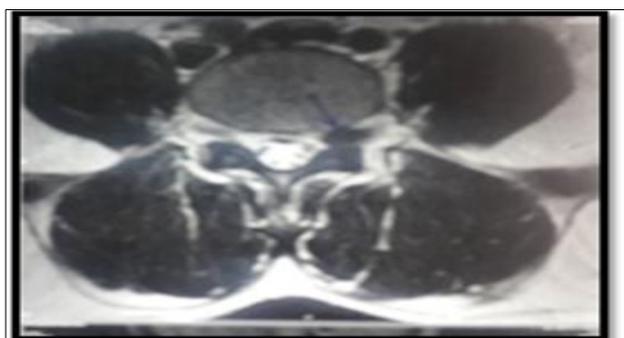


Figure 4: Axial T2 weighted image of L4-L5 disc space showing hypointense large left sided lateral recess and foraminal disc fragment which is isointense with intervertebral disc.



Figure 5: Disc fragment after removal.

Statistical analysis

The formal sample size was not calculated for the study. Statistical analyses were performed using SPSS statistic software. Paired sample t-test and Wilcoxon signed rank test were used to compare the differences of pre- and postoperative parameters for clinical parameters. Independent t-test, Mann-Whitney U test, Chi-square test, and Fisher's exact test were used to compare the differences of clinical and peri-operative outcomes between the two groups. P value of less than 0.05 was considered significant.

RESULTS

Patient's characteristics

Group I (MD) included 44 patients and Group II (TPELD) included 20 patients. Mean age at the time of operation was significantly lower in TPELD patients as compare to MD patients (37.7 years vs. 44.65 years; $p < 0.04$). Male were significantly higher in TPELD group (75%) as compare to MD group (45%) ($p < 0.02$). The mean follow-up for TPELD and MD was 22.6 months. Follow up at the time of writing paper was almost 3 years. Results of 3 year follow up were not analysed statistically. But no one presented with any significant complain (Table 1). In MD group, symptoms of backache, leg pain and claudication were present in all patients. In TPELD group, leg pain and claudication were present in all patients while 18 patients (90%) had symptom of backache. Mild neurodeficit was present in 89% MD patients and in 85% TPELD patients (Figure 6). Major neuro-deficit was present in 2% MD patients (Table 1). Mean operating time was significantly shorter in MD group (1.11 hrs vs. 1.32 hrs; $p < 0.01$). No significant difference in mean hospital stay between MD and TPELD group (3.86 days vs. 2.10 days; $p > 0.05$). Significant improvement was seen in claudication symptom post-operatively in both MD and TPELD [MD: 138.86 feet (pre) to 1.5 km (post) operatively; $p < 0.01$) and TPELD: 147.5 feet (pre) to 2.5 km (post); $p < 0.01$]. This improvement was significantly higher with TPELD as compared to MD ($p < 0.01$) (Table 2). In MD, the baseline VAS score for back pain was improved substantially post-surgery [(6.70±0.82 (Pre) vs. 0.84±0.54 (post); $p < 0.01$)]. Similarly, baseline scores for leg pain was improved substantially post-surgery [(7.52±0.82 (pre) vs. 0.59±0.62; $p < 0.01$)]. Similar improvement was seen in TPELD for back pain [6.79 ± 2.70 (pre) vs. 0.39 ± 0.50 (post); $p = 0.01$] and leg pain [7.85±1.35 (pre) vs. 0.55±0.89; $p < 0.01$]. Improvements in back pain and leg pain were comparable between TPELD and MD group and found no significant difference ($p > 0.05$) (Figure 7 and 8). Significant improvement was seen in ODI scores post-operatively in both MD and TPELD groups. [MD; 67.68% (pre) vs. 4.63% (post); $p < 0.01$) and TPELD; 66.8% (pre) vs. 4.5% (post); $p < 0.01$] but no significant improvement was found between TPELD and MD ($p > 0.05$). (Figure 9) According to modified MacNab's

criteria, outcome were excellent (81.8%), good (9.09%) and fair (9.09%) in MD. Similarly, in TPELD, 80%, 15% and 5% patients had excellent, good and fair outcome respectively. In both groups, no one had a poor outcome. Thus, overall success rate was 100% in the study (Figure 10). Complications are minimal in both procedures. There were total three major complications in the study: dural tear was reported in one MD patient who was successfully managed with primary suture; and reoperation has to be performed in two TPELD patients. One patient had inadequate disc removal & due to persistent pain underwent microdiscectomy on same day. Second patient after two weeks developed pain and underwent laminotomy there was no disc but lot of root oedema which was responsible for pain, subsequently required transforaminal root block. Minor complications were present in seven MD patients: backache 4 (9.75%) and leg pain 3 (7.31%) which was relieved with short course of analgesics and physiotherapy. In TPELD, dysesthesia was reported post-operatively in 4 (20%) patients and was relieved in 10-14 days (Table 3). On post-operative day 2nd, MD patients were mobilised and were back to office in six weeks and to heavy work within 3 months whereas TPELD patients were mobilised on same day and were back to office in 4 weeks and to normal work within 2 months.

Table 1: Comparison of clinical data.

Parameters	MD	TPELD
Demographics		
No of patients (N)	44	20
Age (years)	44.65 (22-75)	37.7 (28 -55)
Males/Female (N)	20/24	15/5
Signs/ symptoms		
Backache (n/%)	44 (100 %)	18 (90%)
Leg Pains (n/%)	44 (100 %)	20 (100%)
Claudication (n/%)	44 (100 %)	20 (100%)
Mild Neurodeficit (n/%)	39 (89%)	17 (85%)
Major Neurodeficit (n/%)	1 (2%)	0
No Neurodeficit (n/%)	4 (9%)	3 (15%)

p<0.05 is significant.

Table 2: Comparison of operative time, hospital stay and post op recovery parameters.

Parameters	MD	TPELD	P value
OT time (hrs)	1.11 (0.7-1.5)	1.32 (1-2)	0.003
Hospital stay (days)	3.86 (1-8)	2.10 (1-4)	0.74
Post-op recovery			
Mobilisation	2 nd day	Same day	-
Back to office work	6 weeks	4 weeks	-
Back to normal Work	3 months	2 Month	-

Table 3: Comparison of major and minor complications.

Parameters	MD	TPELD
Major complications		
Dural tear n (%)	1 (2.43)	0
Reoperation n (%)	0	2 (10)
Minor complications		
Backache n (%)	4 (9.75)	0
Leg pains n (%)	3 (7.31)	0
Dysesthesias n (%)	0	4 (20)

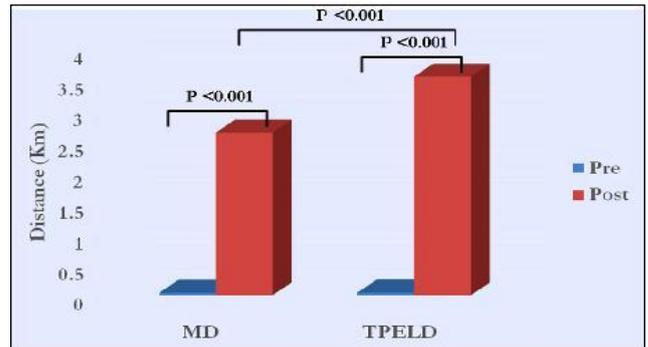


Figure 6: Comparison of claudication symptoms between MD and PELD.

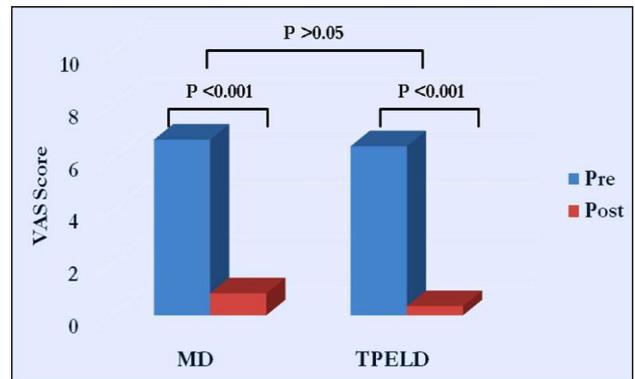


Figure 7: Comparison of VAS score for back pain in MD and PELD.

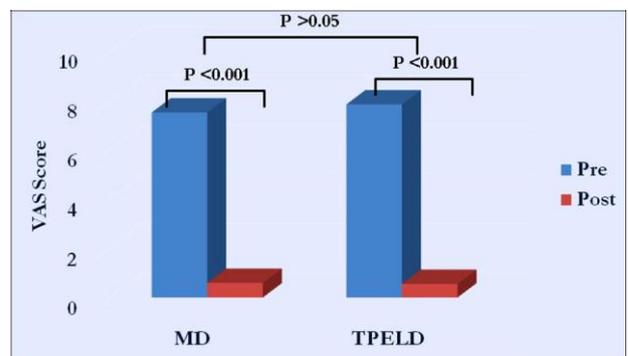


Figure 8: Comparison of VAS score for leg pain in between MD and PELD.

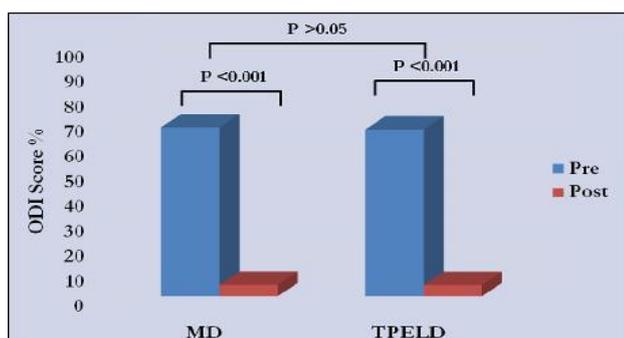


Figure 9: Comparison of ODI score in MD and PELD.

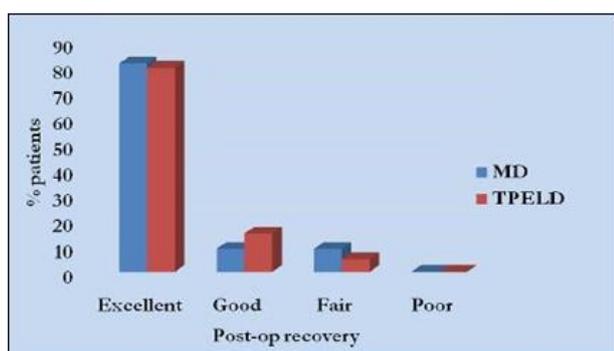


Figure 10: Comparison of post-operative recovery as per modified Macnab's criteria in between MD and PELD.

DISCUSSION

Our study demonstrate that both TPELD and MD have comparable post-operative outcome in most of the efficacy parameters that includes improvement in back pain, leg pain, ODI scores and modified MacNab's criteria. In both the procedures, as compared to baseline all these parameters show substantial post-surgery improvement. No one had a poor outcome in both procedures; with overall success rate of 100%. This suggests that TPELD, though relatively newer technique, offers efficacy benefits in line with standard MD with additional benefit of improvement in claudication symptoms. Similar findings were observed in other published studies. In a study by Hoogland et al VAS score for leg pain and back pain improved significantly, and the results of surgeries were rated as excellent or good in 85.71% of the patients at 2-year follow-up.¹⁵ In another retrospective study by Ahn et al the mean VAS score decreased significantly from pre-operative to post-operative, and based on the Macnab criteria, 81.4% of the patients met excellent or good outcomes at a mean follow-up duration of 31 months.¹⁶ Lee et al and Lau et al also reported similar findings in their studies.^{17,18} In the present study, dural tear reported in one patient in MD group who was successfully managed with primary suturing. Epidural adhesion and scar tissue often seen with repeated surgery increase the risk of intraoperative incidental dural tear. In one study, dural tear reported in two patients in MD group, whereas there was no dural

tear in TPELD group.¹⁸ Other authors in their studies reported no case of dural tear after TPELD surgery. There are numerous reports on recurrence of disc herniation followed by re-operation. In this study re-operation has to be performed in two patients of TPELD group, first TPELD case reoperated on same day as there was inadequate disc material removal. Second case operated after 3 weeks as he had neuralgic type pains on operated side limb. But intra-op there was no disc; it was root oedema and congestion, relieved with local steroids.

In other studies mainly reoperation is for recurrence, recurrence rate of 4.6% and 4% was reported respectively in TPELD group followed by re-operation.^{15,18} Back ache and leg pain as seen in seven patients of MD group can occur because of muscle dissection and removal of posterior structures, such as lamina.^{16,19} Similarly chronic low back pain was reported in 32% patients in postsurgical group who underwent lumbar laminectomy.²⁰

Dysesthesias as a complication appeared in four patients in TPELD group. This finding is similar to findings by Ahn et al and Hoogland et al where one patient (2.3%) with transient dysesthesia and three patients (1.1%) with nerve root irritation were reported respectively. Lee DY et al also reported one (3.4%) patient with persistent voiding disturbance along with dysesthesia in TPELD group.¹⁸ Mean operating time in MD was significantly shorter compared to patients in TPELD group. However studies conducted by Ryang et al and Lau et al reported comparable operating times with either minimally invasive or microdiscectomies.^{17,21} On a contrary to literature, length of hospital stay was relatively long (approximately three days) and comparable for both the groups in our study.¹⁷ Unlike this German et al showed that patients who underwent minimally invasive microdiscectomies had about half the length of stay compared to patients who underwent conventional microdiscectomies (0.84 days vs. 1.43 days).²² One main reason for this is that in rural India, many patients travel a long distance to have surgery, and many other were emergent transfers from other community hospitals. Such patients insist on staying longer before going back home. The patient's ability to return to the previous employment is a measure of success of the surgical procedure. Palmer reported a mean return-to-work time of 4.4 weeks following MD while Perez-Cruet et al reported a mean return-to-work time of 2.3 weeks following MD.^{23,24} In our study patients were mobilized on same day and were back to office in four weeks with TPELD, almost two weeks earlier than MD, demonstrating early recovery with procedure. The problem associated with endoscopic surgeries is the steep learning curve of exacting a new procedure. The specific skills required include visual-spatial orientation, handling of endoscopic equipment and working through a small field of view. As the surgeon becomes familiar with the system, three dimensional images can be conceptualized. McLoughlin and Fourney analyzed the depth of the learning curve involved in

minimally invasive lumbar MD and found that it took about 15 cases for spine surgeons to be comfortable with, and proficient at, the technique.²⁵ Also a recent study assessing the learning curve for minimally invasive lumbar MD by a single surgeon, states that approximately thirty cases are required to overcome the learning curve difficulties.²⁶ Overall experience from this single centre study showed that learning curve was not an issue as both TPELD and MD were handled proficiently by experienced operating surgeon. The study has few limitations. The retrospective study design and relatively small number of patients are considered when interpreting the results. Long term follow up of patients needed to understand the difference in efficacy outcome between these procedures.

CONCLUSION

TPELD and MD have comparable post-operative outcome in most of the efficacy parameters in Indian rural patients undergoing treatment of single level lumbar disc herniation. Additionally, TPELD offers distinct advantages such as performed under local anaesthesia, preservation of structure, lesser post-operative pain and early mobilization. But the TPELD has a steep learning curve over the MD.

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