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Evaluation of results of micro endoscopic discectomy

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Abstract
Introduction: Discectomy is a common procedure carried out for treatment of lumbar disc prolapse. In lumbar disc surgery pain is the most important indication, but neurologic symptoms and signs are also considered, although they are usually of far less functional consequence. Perhaps because they appear to be more objective than the pain related signs. We have evaluated the results of Micro-Endoscopic discectomy (MED) utilizing tubular retractors in terms of safety and efficacy of the technique. Micro-Endoscopic discectomy (MED) is term used interchangeably for describing the discectomy procedure utilizing tubular retractors either with an endoscope or a microscope and it directly deals with offending prolapsed or extruded disc fragment and decompresses the nerve root. In addition lateral and foraminal stenosis can also be tackled.
Methods and Materials: This study is a prospectively conducted study of 25 patients operated by a single surgeon with the METRx system (Medtronic, Sofamor-Danek, Memphis, TN) using 22mm port for lumbar disc herniation during the period between June 2015 and December 2016. Proforma was made in form of questionnaire and filled preoperatively or when they came for follow up while for others it was completed via telephonic conversation. The results were evaluated using ODI (Oswestry Disability Index) and VAS (Visual Analogue Scale 0-10) for back pain and leg pain.
Results: This study consists of 25 cases of lumbar disc prolapse treated by Micro-Endoscopic discectomy between the months of June 2015- December 2016. Average follow-up was 22.12±4.255 months (Range 13-29 months). 7 patients (28%) out of 25 patients turned out to be laborers. This bodes well with the incidence of lumbar disc prolapse in heavy weight lifters. Other occupations include housewife (16%), driver (12%), carpenter (8%), mason (4%) etc.
Discussion: MED introduced by Foley *et al*. [2]. combines standard lumbar microsurgical techniques with an endoscope, enabling surgeons to successfully address free-fragment disc pathologic factors and lateral recess stenosis. The endoscopic approach allows even smaller incision and less tissue trauma.
Conclusion: By limiting the tissue manipulation *via* small incisions and minimal muscle dissection, this technique has purported to have better perioperative outcomes, including shorter hospital stays, less blood loss, less pain medicine requirement, decreased surgical site infection (SSI) rate, and quicker return to activities, than conventional open approaches.

Keywords: Results, micro endoscopic discectomy

Introduction
Humans have been plagued by back and leg pain since the beginning of recorded history. Low back pain is thought to occur in almost 80% of adults in some points in their life. Among chronic conditions, back problems are the most frequent cause of limitations of activity in persons less than 45 years [1]. Intervertebral disc disease and disc herniation are most prominent in otherwise healthy people in the 3rd and 4th decades of life. It accounts for a majority of cases of low backache seen by an orthopaedician in clinical practice and is a major contributor of functional disability [1].
It is the responsibility of the orthopedic surgeon to diagnose and appropriately treat this ailment of which lumbar intervertebral disc prolapse is a very common cause.
Discectomy is a common procedure carried out for treatment of lumbar disc prolapse. In lumbar disc surgery pain is the most important indication, but neurologic symptoms and signs are also considered, although they are usually of far less functional consequence. Perhaps because they appear to be more objective than the pain related signs.
The basic tenet of any surgery is to effectively treat pathology with minimal disturbance of normal anatomy: leaving "the smallest footprint". MISS (Minimally Invasive Spine Surgery) is a similar advancement in the field of spine surgery that treats the pathology leaving behind

the smallest footprint. Ideally the goal of developing MISS is to get the same results obtained by using standard micro discectomy, providing effective treatment, targeted to the nerve decompression and not only focused on pain relief, like in nerve root/epidural injections, but at the same time avoiding discomfort related with open techniques. Discectomy performed open or with an operating microscope remains the standard surgical management. Tubular retractor system is being increasingly used. Potential benefits include less muscle and local damage, better cosmoses, decreased pain and operative time and faster recovery after surgery.

We have evaluated the results of Micro-Endoscopic discectomy (MED) utilizing tubular retractors in terms of safety and efficacy of the technique. Micro-Endoscopic discectomy (MED) is term used interchangeably for describing the discectomy procedure utilizing tubular retractors either with an endoscope or a microscope and it directly deals with offending prolapsed or extruded disc fragment and decompresses the nerve root. In addition lateral and foraminal stenosis can also be tackled [2].

Aims

- To study the extent of functional recovery and neurological recovery following MICRO-ENDOSCOPIC Discectomy in patients with lumbar intervertebral disc prolapse.
- To assess the complications following MICRO-Endoscopic Discectomy for lumbar intervertebral disc prolapse.
- Significance of age, sex, duration of symptoms and neurological signs as determinant of outcome of MICRO-Endoscopic Discectomy.

Methods and Materials

This study is a prospectively conducted study of 25 patients operated by a single surgeon with the METRx system (Medtronic, Sofamor-Danek, Memphis, TN) using 22mm port for lumbar disc herniation during the period between June 2015 and December 2016. Proforma was made in form of questionnaire and filled preoperatively or when they came for follow up while for others it was completed via telephonic conversation. The results were evaluated using ODI (Oswestry Disability Index) and VAS (Visual Analogue Scale 0-10) for back pain and leg pain. Patients were followed up at intervals of 1week, 2 weeks, 1 month, 6 months, 12 months and final follow-up. For comparison to preoperative score, the result of final follow up was taken into account.

Inclusion Criteria

1. Single level lumber disc prolapse.
2. Patients with back ache and/radicular pain with positive nerve root tension sign which showed no signs of improvement with conservative management of minimum of 6 weeks which consisted of rest, modification of activities, physiotherapy and analgesics and anti-inflammatory drugs
3. MRI proved significant disc herniation, extrusion or sequestration

Exclusion Criteria

1. Presence of other associated spine pathology like tumour and infection.
2. Presence of gross spinal deformity.
3. Previous history of spine surgery.
4. Presence of instability.

All the patients were assessed clinically. A detailed history was obtained and they were subjected to a thorough clinical examination. The findings were noted in the proforma. Radiological investigations like plain X-RAYS: Antero-Posterior and Lateral-flexion and extension views (to rule out instability) and MRI were carried out to confirm the diagnosis and know the level of the lesion. The patients were also assessed preoperatively and also postoperatively with the ODI and VAS score for back and leg pain. Routine blood investigations in the form of CBC/RFT/HIV/HBsAg were done. Routine preoperative medical fitness and written and informed Spine surgery consent was obtained.

All patients underwent Micro-Endoscopic discectomy (MED). The level and type of disc protrusion was observed intraoperatively. Postoperatively the patients were followed up in the immediate post-operative period and after 1 week, 2 weeks, 1 month, 6 months, 12 months and final follow up. Paired samples *t*-tests were used for comparisons of continuous variables like VAS and ODI. All statistical analyses were performed using IBM® SPSS® software version 20.0. A probability value of $P<0.05$ was considered statistically significant.

Operative Procedure

We have operated all patients with Micro-Endoscopic discectomy:

Preoperative preparations

Patient was kept nil orally since the night prior to the day of operation.

Entire back was prepared by shaving the part and thorough savlon wash was given.

Pre-operative antibiotic was given.

Anaesthesia

General anesthesia was used.

Position of the patient

The patient was positioned on a radiolucent table in prone position with bolsters below the chest and the iliac crest keeping the abdomen free and pressure points well-padded, so as to keep the respiration free and prevent engorgement of the epidural veins and thus reduce bleeding.

Approach

The surgeon stands on the side of the herniation. Using lateral fluoroscopy imaging on ipsilateral side, a long k wire was inserted at the level of the involved disc space parallel to center of disc space. The K-Wire was inserted 1-1.2 cm lateral to the midline. The K-Wire should be either targeted superiorly, at the disc level or inferiorly, depending upon the anatomy of the herniation or sequestration.

A 25 mm incision was then made centered over the K wire and was deepened till the fascia. The final tubular retractor, which was 22 mm in diameter, was then docked with the rigid flex arm as the final working channel. In cases of extra-foraminal disc herniations the incision was taken just lateral to the facet joint under fluoroscopic guidance and the tube was docked just lateral to the facet joint directly over the fragment. The soft tissue was separated using a long cautery tip till the lamina could be visualized. Then, laminotomy was done using a kerrision rongeur. An inferiorly migrated disc was generally in the axilla of the nerve root. In case of a shoulder disc the nerve root once identified, can be retracted medially using a nerve root retractor.

The disc was then identified. The bulge in a contained disc can be well appreciated under the microscope. The disc was then probed using a nerve hook and the herniated fragment was delivered out of the annulus. The fragment was then removed with a disc forceps. Multiple attempts were made to seek hidden disc fragments with a nerve hook till adequate nerve root decompression was performed. A pulsatile central dural sac and nerve root that was mobile was considered an adequate decompression surgery. The epidural bleeding was controlled using a combination of bipolar cautery, bone wax and Gelfoam®. The thoracolumbar fascia and subcutaneous tissue were closed using 2-0 Vicryl (Ethicon, Johnson and Johnson). The skin was closed using 2-0 Ethilon (Johnson and Johnson Int.).

A single dose of intravenous antibiotic was given on the same night as a standard protocol. Postoperatively, all patients were mobilized as soon as the pain subsides and were discharged within 24-48 hours post-surgery. Patients were encouraged walking till pain tolerance for 3 weeks. They were allowed all activities except bending forward, lifting weight and sitting for more than 30 min. Bending forward and lifting weight were restricted till 3 months postoperative. A gradual back-strengthening program was started after 6 weeks.

The patients were followed up at intervals of 1 week, 2 weeks, 1 month, 6 months and 12 months and at final followup and were evaluated by VAS (Visual Analogue Scale) for back and leg pain and ODI questionnaire (Oswestry Disability Index).

Observations

This study consists of 25 cases of lumbar disc prolapse treated by Micro-Endoscopic discectomy between the months of June 2015- December 2016.

Average follow-up was 22.12±4.255 months (Range 13-29 months)

Age

Table 1

Age	Cases	%
21-30	6	24%
31-40	8	32%
41-50	8	32%
51-60	3	12%

Sex

Table 2

Sex	Cases	Per%
Male	12	48%
Female	13	52%
Total	25	100

- **Precipitating Factors**

Events which precipitated the onset of pain were analyzed. History of lifting heavy weights was present in 9 cases (36%) and insidious onset was present in 14 (56%) and trauma in 2(8%) cases.

- **Occupation**

7 patients (28%) out of 25 patients turned out to be laborers. This bodes well with the incidence of lumbar disc prolapse in heavy weight lifters. Other occupations include housewife (16%), driver (12%), carpenter (8%), mason (4%) etc.

- **Co Morbidity And Habits**

Table 3

Habits and co-morbidity	Cases	Per%
Smoking	9	36%
Obesity	6	24%
DM	3	12%
HTN	2	8%

- **Distribution Of Symptoms**

Table 4

Symptoms	Preop Cases	Preop (%)	Postop Cases	Postop (%)
Radicular Pain	25	100%	6	24%
Low Backache	25	100%	7	32%
Paraesthesia	8	32%	3	12%
C/O motor weakness	7	28%	1	4%
Bowel/Bladder	0	0%	0	0%

- **Distribution Of Signs**

Table 5

Signs	Preop Cases	Preop %	PostOP Cases	PostOP %
SLRT	25	100%	2	8%
Para-spinal muscle Spasm	19	76%	2	8%
Restricted movement	18	72%	1	4%
Sensory deficits	14	56%	2	8%
Motor deficits	8	32%	1	4%
Absent knee jerk	0	0%	0	0%
Absent ankle jerk	2	8%	0	0%
B/B involvement	0	0%	0	0%

Most common sign observed in all patients is positive SLR, paraspinal muscle spasm, restricted forward bending respectively. In 14 patients, 11 patients were having paresthesia over L4-L5 dermatomal region and 3 patients were having L5-S1 dermatomal paresthesia. 32% patients having motor weakness in terms of weak ankle dorsiflexion and weak toes extension. Postoperatively all but 2 patients could perform SLR without any pain or restriction in the normal range of motion. Incidence of muscle spasm also showed a significant reduction. Overall, there was improvement across all signs seen in patients on final follow up.

- **Disc Level**

Table 6

Disc level	Cases	Per%
L_3-L4	1	4%
L_4-L_5	17	68%
L5-S1	7	28%

- **Symptom Onset-Operation Interval**

Average duration of onset of symptoms to time of surgery was 6 months (Range 2months-1year).

- **Forward Bending In Post-Operative Period**

Table 7

Forward bending	Cases	Per%
Up to thigh	1	4%
Up to knee	2	8%
Up to toes	22	88%

- **Complications**

Table 8

Complication	Cases	Per%
Superficial wound infection	1	4%
Discitis	1	4%
Recurrence of radiculopathy	1	4%

One patient who developed superficial infection was having uncontrolled diabetes. She was managed conservatively with regular dressings and antibiotics with control of diabetes. Her wound was healed in 3 weeks without any further sequelae. Another patient who developed discitis was also managed with one week of intravenous antibiotics and 3 weeks of oral antibiotics. Patient with recurrent disc herniation was explained for revision operation; however, she refused for surgery and managed conservatively with NSAIDS and pregabalin. Her pain was improved over a period of three months with physiotherapy and medications.

Vas Score for Back Pain

Table 9

Preop Vas Score			Postop Vas Score	
VAS SCORE	No. of Cases	Per%	No. of Cases	Per%
0-3	1	4%	21	84%
4-6	4	16%	4	16%
7-10	20	80%	0	0%

From the table, the VAS score improved significantly in majority of the cases, where the preoperative mean VAS score of 80% patients was 7 or more, but in the postoperative period 84% of the patients had mean VAS score of 3 or less.

The mean preoperative VAS score for back pain was 7.44 ±1.35 while the mean postoperative VAS score was 2.28±1.02 on mean follow-up of 22.12±4.255 months.

- **Vas Score For Leg Pain(Radiculopathy)**

Table 10: Vas Scale For Leg Pain

Preop Vas Score			Postop Vas Score	
VAS Score	No. of cases	Per%	NO. of Cases	Per%
0-3	2	8%	22	88%
4-6	18	72%	2	8%
7-10	5	20%	1	4%

The mean VAS score for leg pain also showed significant improvement with more than 90% patients having a score of 4 or above, before surgery. In post-operative period almost 90% patients having a mean VAS score of 3 or less.
The mean preoperative VAS score for radiculopathy was 4.86±1.38 while the mean postoperative VAS score was 1.84±1.06 on mean follow-up of 22.12±4.255 months.

- **ODI Index**

Table 11: ODI Score

Preop ODI Score			Postop ODI Score	
ODI Score	No. of cases	Per%	No. of Cases	Per%
0-10	0	0%	11	44%
11-20	0	0%	12	48%
21-30	6	24%	2	8%
31-40	9	36%	0	0%
41-50	10	40%	0	0%

Initially, of the patients admitted 40% had an ODI score of more than 40, with another 36% having ODI between 31-40. After surgery none of the patients admitted had an ODI of above 30, with the vast majority having the score below 20.
The mean preoperative ODI score was 37.96±7.17 while the mean postoperative ODI score was 11.08 ±5.71 on mean follow-up of 22.12±4.255months.

Discussion

Low back disorders have become the most common musculo-skeletal Disorder, with a major impact on the costs of health care and are a major source of disability [3].
One must recognize that low back pain is a symptom that has many causes, the commonest being a protruded disc. The origins of disc related sciatica with its clear morphologic and clinical neurologic findings were not recognized until the 20th century. After Mixter and Barr in 1934 described disc protrusions and showed the effectiveness of surgery in its management, there has been an increasing enthusiasm to solve sciatica problems surgically by disc excision.
Better investigative modalities (myelography/CT/MRI) have led to more accurate diagnosis of disc lesions. They have revolutionized the diagnosis of spinal disease by the accurate visualization of all structures within the neural canal. In addition, it offers the opportunity to outline the neural foramina and extra foraminal areas and thus guides the surgeon in planning a precise surgical correction, preventing unnecessary exploration of uninvolved levels [4]. Results of lumbar disc surgery are excellent when there is agreement between clinical presentation and imaging studies.
A proper surgical technique should lead to satisfactory outcomes, minimal morbidity and good cosmesis. It should be cost effective, able to adjust to patient factors like obesity, ethnicity, etc. The percutaneous systems such as chemonucleolysis [5], percutaneous lumbar discectomy (manual and automated), nucleoplasty and percutaneous laser-assisted discectomy[6] cannot deal with disc fragment extrusions and associated bony and ligamentous compression. The results of these procedures have been very variable and speculative ranging from 29% to 92% success rates [7].
Open discectomy (OD) and microdiscectomy remain the current gold standard of surgical treatment [8-10]. The overall results of standard discectomy range from 68% to 95% in different series. Though the results of standard discectomy are equally good, microdiscectomy introduced by Yarsargil and Caspar (1997) is considered gold standard. The results of microdiscectomy also range from 88% to 98.5% [11-13]. Both the procedures are time tested procedures giving a good surgical result in patients having disc prolapse. Katayama *et al.* [9] compared the results of macrodiscectomy versus microdiscectomy. They concluded that there was no difference between the surgical outcomes of both of them but microdiscectomy gave better vision, magnification

and therefore decreased length of incision and tissue invasion. They also found that microdiscectomy allowed patients to return early to work with lesser use of postoperative narcotic analgesics. It is but natural that if both procedures have overall same outcome than the procedure with lesser tissue invasion, lesser length of incision, lesser use of postoperative analgesics with an early return to work is the procedure of choice.

MED introduced by Foley *et al*. [2]. combines standard lumbar microsurgical techniques with an endoscope, enabling surgeons to successfully address free-fragment disc pathologic factors and lateral recess stenosis. The endoscopic approach allows even smaller incision and less tissue trauma.

We compared our results with Kulkarni *et al*. [14], Jhala *et al*. [15] Kulkarni *et al*. Their study shows the mean age of patients was 46 years (range 16-78 years) and the sex ratio was 1.5 males to 1 female. The mean follow up was 27 months (range 8-69 months). The mean VAS scale for leg pain improved from 4.14 to 0.76 (P<0.05) and the mean VAS scale for back pain improved from 4.1 to 0.9 (P<0.05). The mean ODI changed from 59.5 to 22.6 (P<0.05). The mean operative time per level was about 50 minutes (range 20-90 minutes). Dural punctures occurred in 11 (5%) cases. An 18 mm tube was used in 160 (85%) patients and 16 mm tube was used in 28 (15%) patients. Out of 198 total levels operated, L4-5 (n = 111, 56%) and L5-S1 (n = 69, 35%) were the most commonly involved. The mean operative time was 50 minutes.

In Our study mean age of the patients was 39.88 years. Sex ratio was 1.083. Mean follow up was 22.12±4.25 months. The mean VAS scale improved from 7.44 to 2.28 for back pain (P<0.05). The mean VAS score improved from 4.86 to 1.84 for leg pain (P<0.05).Pre-op mean ODI score was 37.96 while the postop mean was 11.08 after follow up (P<0.05). Dural puncture was not seen in any of our cases operated for MED. Mean back to work time was 26.6 days. Mean time in which the patient was discharged from the hospital after surgery was 1.12 days. We used a standard 22mm tube in all the patients. Of the 25 total no. of patients operated L4-5 (n=17, 68%) and L5-S1 (n=7, 28%) were the most commonly involved. The mean operative time was almost similar at 56 minutes. Jhala *et al*. Jhala *et al*. [15] in their series of 100 cases average surgical time was 70 min. Complication rate was 5% with open surgery conversion in one patient and recurrence in two patients. Return to work 21 days. The mean follow up was 12 months (range 3 months – 4 years). Open conversion was required in one patient with suspected root damage. Minor dural punctures occurred in seven cases and root damage to L5 root in one case that had paresthesia in L5 region even on 4 years of follow-up. Hospital stay was of 1-2 days. Technical difficulties encountered in initial 25 cases were insertion of guide pin, image orientation, perioperative dissection and bleeding problems, and reaching wrong levels suggestive of a definitive learning curve.

In our study the average surgical time per level was 56 minutes, mean hospital stay was 1.12 days, and mean follow up was 22.12months (13-29 months) Return to work 26.6 days. There were three patients with complications (12%) there was superficial wound infection in one patient at a rate of 4%.Infection was treated with antibiotics and daily dressings. Discitis in one patient at a rate of 4% which was treated with antibiotics and bed rest. One patient had recurrence of Radiculopathy. Recurrence occurred within 2 months of primary surgery. Patient had an initial symptom-free period after surgery but developed recurrence of symptoms later on. Repeat MRI showed residual disc at the same level. Patient refused a second surgery but had fair results on the last follow-up and managed anyhow with conservative treatment in form of medicines and physiotherapy.

Conclusion

This is a single center study from a tertiary care Center at Ahmedabad. Due to reduced operative time and less hospital stay and less complication patient can be discharged early and in such a huge workload at a tertiary care teaching institute, it results in overall reduced expense to the healthcare system. By limiting the tissue manipulation *via* small incisions and minimal muscle dissection, this technique has purported to have better perioperative outcomes, including shorter hospital stays, less blood loss, less pain medicine requirement, decreased surgical site infection (SSI) rate, and quicker return to activities, than conventional open approaches. The sample size of this study is small and more patients in future could be included for better comparison. There is a learning curve associated with the procedure to reach an adequate level of expertise. Adequate training of surgeons and effective utilization of the technique can harness the benefits of this procedure and make it a gold standard in management of prolapsed lumbar discs.

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