Single Level Lumbar Endoscopic Discectomy: Early Experience

H Elnoamany

Citation

H Elnoamany. *Single Level Lumbar Endoscopic Discectomy: Early Experience*. The Internet Journal of Neurosurgery. 2016 Volume 12 Number 1.

DOI: 10.5580/IJNS.33651

Abstract

Purpose: The purpose of this study was to evaluate technical problems, complications, and overall initial results of endoscopic discectomy in treatment of a single lumbar disc prolapse.

Overview of Literature: Since standard discectomy had been used to treat lumbar intervertebral disc prolapse, many modifications and new surgical techniques such as microdiscectomy, and transforaminal endoscopic discectomy have been used. Minimizing surgical trauma to posterior spinal tissues was achieved by posterior interlaminar endoscopic approach.

Materials and methods: Forty three patients with single level lumbar disc prolapse treated with endoscopic discectomy were included. METRx system (Medtronics) was used in all patients. Pain was evaluated one day, one month, 6 months and one year post procedure using 10-point Visual analogue Scale (VAS). Paired t test was used for parametric data. Wilcoxon signed rank tests were used for non-parametric data. Chi-Squared was used for qualitative variables. P value <0.05 is considered significant.

Results: The mean follow up was 29 months (range 12 months –48 months). Open surgical conversion was required in one patient with suspected large dural tear with root prolapsed before discectomy. Minor dural puncture occurred in another case in early practicing time. The average surgical time was 82 min. (range54-93 min.). Average blood loss was 20- 65 ml. The mean hospital stay in this series was 15 hours (range 8 hours- 24 hours). 93% of patients had good-to-excellent results.

Conclusions: Endoscopic discectomy using METRx system provides many benefits such as a small skin incision, reduced postoperative pain, shorter hospital stay, faster mobilization, shorter rehabilitation, reducing pain medication usage, quick recovery to daily life or work, as well as surgeon’s comfortability with the standard bimanual technique.

INTRODUCTION

Low back and sciatic pain has been one of the most common and disabling spinal disorders recorded in medical history [1,2]. First discectomy operation was done by Oppenhiem and Fedre Krause in 1906 [3]. Mixter and Barr are credited for establishing a clear causal connection between the herniated disc and sciatica, provided a detailed description of disc herniation and they were the first authors to do laminectomy and discectomy for surgical management of herniated lumbar discs [4]. In 1950, Hult advocated an anterior retroperitoneal annular fenestration for decompression of herniated lumbar discs [5] then surgical treatment for lumbar disc prolapsed became less invasive with the use of the microscope by Yasargil [6].

Percutaneous lumbar nucleotomy as a minimally invasive procedure for lumbar disc herniation was firstly reported in 1975 [7]. Afterwards, percutaneous lumbar disc surgery evolved including percutaneous nucleotomy using automated disc removal devices [8], spinal endoscopy [9], and the laser [10]. These procedures had many surgical limitations as it is not proper in treating patients with contained lumbar disc herniation and prove neither efficacy nor safety as standard open lumbar discectomy.

On the other hand, microendoscopic discectomy (MED), one of the minimally invasive spine surgery systems for lumbar disc herniation, was introduced by Smith and Foley in 1997 [11]. From 1998, this MED system allowed spinal surgeons to decompress a symptomatic lumbar nerve root by using an

endoscopic minimally invasive surgical approach. Also, it was applied not only in several types of lumbar disc surgery, but also in decompression surgery of spinal stenosis, cervical radiculopathy and cervical myelopathy.

The purpose of this prospective cohort study is to evaluate the clinical and radiological outcome in patients with single level lumbar disc prolapse treated with endoscopic discectomy using the METRx-MED system.

PATIENTS AND METHODS:

Forty three patients with manifestations of lumbar disc prolapse were included. All patients were operated for endoscopic discectomy by using METRx-MED system between Jan.2011 and Jun.2014.

This study was approved by the Institutional Review Board of Menoufia University. All patients provided written informed consent.

1. Inclusion criteria

Patients who presented with lumbar disc prolapse with failure of medical and physical treatment for at least 6 weeks were included in this study after fulfilling the following inclusion criteria: wide canal, single laterally projecting intracanalicular disc herniation, patient is only suffering from sciatica and patient's Body Mass Index (BMI) less than 40.

2. Exclusion criteria

Patients who had a recurrent lumbar disc prolapse, canal stenosis, and calcified disc were excluded. Patients with morbid obesity (BMI more than 40) and patients indicated for spinal fixation e.g.: isthmic spondylolisthesis were also excluded from the study.

3. Procedure details

We used the original technique described before [12]. We routinely permitted patients to ambulate after 5 hours postoperatively. We recommend wearing a commercially available soft corset for 3 weeks after surgery. All patients were followed up for at least one year postoperatively (Figures 1 and 2).

Figure 1

Shows tubular dilator under fluoroscopy in L5-S1 case operated in this study.

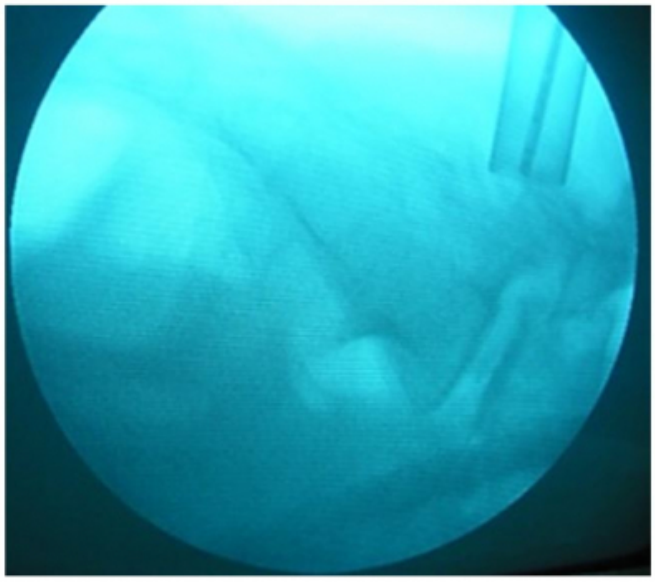
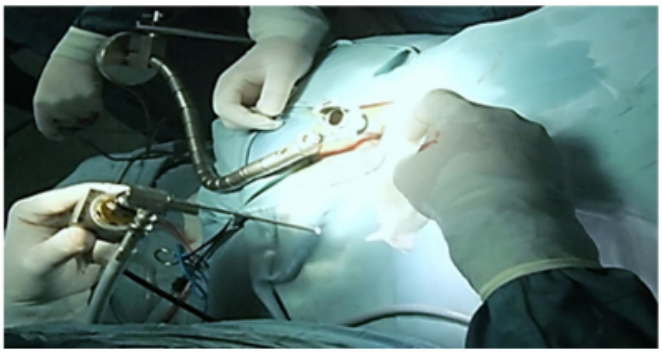


Figure 2

This photo shows tubular retractor in place while adjusting the focus by the black ring on the METRx MED system and doing white balance using white gauze at distance 1cm before using the endoscope.



OUTCOME EVALUATION

Pain was evaluated one day, one month, 6 months, and one year post procedure using 10 point Visual Analogue Scale (VAS), ranging from no pain (point 0) to worst pain imaginable (point 10). The overall outcome was evaluated postoperatively using Modified MacNab's criteria [13]. Also medication usage was evaluated as well.

STATISTICAL ANALYSIS

Results were statistically analyzed by SPSS version16 (SPSS Chicago.Inc). Paired t test was used for parametric data. Wilcoxon signed rank tests were used for non-parametric data. Chi-Squared was used for qualitative variables. P value

<0.05 is considered significant.

RESULTS

Forty three patients with lumbar disc prolapsed met the inclusion criteria of the study. The averaged of the patients was 41.75 years (range, 26-52 years), and 26 were men. Twenty three patients had L4-5 level disc prolapsed, sixteen patients with L5-S1disc prolapsed and four patients had L3-4 prolapsed disc. All patients suffered from unilateral sciatica, with 29 patients suffering from sciatica less than 6 month and the 14 patients suffered sciatica from 6-12 months.

There were no statistical differences between the outcome at one month and at one year regarding the duration of sciatica in this study (Table 1).

Table 1

Correlation between duration of sciatica preoperatively and the outcome in all studied patients.

	Duration of Sciatica				χ^2 Test	P value
	≤6 months (n=29)		>6 months (n=14)			
	no	%	no	%		
Outcome after one month						
E	15	51.7	3	21.4		
G	10	34.5	7	50.0	3.75	0.135
F	4	13.8	4	28.6		
P	0	0.0	0	0.0		
Outcome after one year						
E	23	79.3	8	57.1		
G	6	20.7	5	35.7	3.55	0.169
F	0	0.0	1	7.1		
P	0	0.0	0	0.0		

(χ^2) Chi-Squared test

The operative times ranged from 54- 93 minutes with average time of 82 minutes and the average blood loss in this series was 45 ml. (ranged from 20- 65 ml.). All patients had a post-procedure overnight hospital stay.

According to modified MacNab's criteria, 27 patients (62.8%) had an excellent outcome, 13 patients (30.2%) had a good outcome, only three patients (7%) had a fair outcome, and no patient (0%) in this study had a poor outcome. 93% of our patients were satisfied from the surgical procedure and only one patient was not satisfied after surgery.

The preoperative mean VAS of leg pain was 8.09 ± 0.78 (ranging from 6–9), which highly significantly decreased to 1.02± 0.70 (ranging from 0–5) at the end follow-up (P < 0.001) (Table 2).

Table 2

Shows distribution of the studied patients in the current study regarding VAS of leg pain at different time follow up.

	VAS Preoperative	VAS One day	VAS One month	VAS 6 months	VAS One year
Mean ±SD	8.09± 0.78 R = 6-9	3.60± 0.92 R= 2-7	2.62± 0.78 R= 2-6	1.79± 0.70 R= 1-5	1.02± 0.70 R= 0-5
Paired t test	-	26.26	36.40	*5.77	*5.84
P value	-	< 0.001	< 0.001	< 0.001	< 0.001

**Wilcoxon test*

R: range

The average return to work period was 14 days (range1–48 days). During the follow-up period, there were no recurrent disc herniations.

Two patients in this study had a dural tear, in one of them; the tear was very small and it happened after disc removal. In this patient, the dural tear repaired intra-operative using subcutaneous free fat graft with gel foam and muscle tissue to stop the leak and the patient was instructed postoperatively to lie down in prone position for three days. The other patient had a large dural tear which happened before disc removal and this case was turned to an open disc surgery.

CASE PRESENTATION

Male patient 45y old, complaining of right sided leg pain not responding to medical treatment. Motor power of the patient is intact, intact sensation, and the patient is continent. MR images of lumbosacral spine revealed RT. L5-S1 disc prolapsed closing the RT. S1 nerve root foramen. Patient underwent endoscopic discectomy of the prolapsed disc using METRx tubular retractors. Patient recovered very well after surgery and he returned to previous work after four weeks from surgery. MRI post procedure by sex months revealed total removal of the offending disc material and totally opened foramen (figure 3).

Figure 3a

Preoperative T2 weighted MR axial image showing right L5-S1 disc prolapsed severely compressing the RT. S1 nerve root and totally occlude the nerve root foramen.

Figure 3b

Preoperative T1 weighted MR sagittal image showing large prolapsed L5-S1 disc

Figure 3c

Intraoperative endoscopic view shows the disc punch while removing disc material.

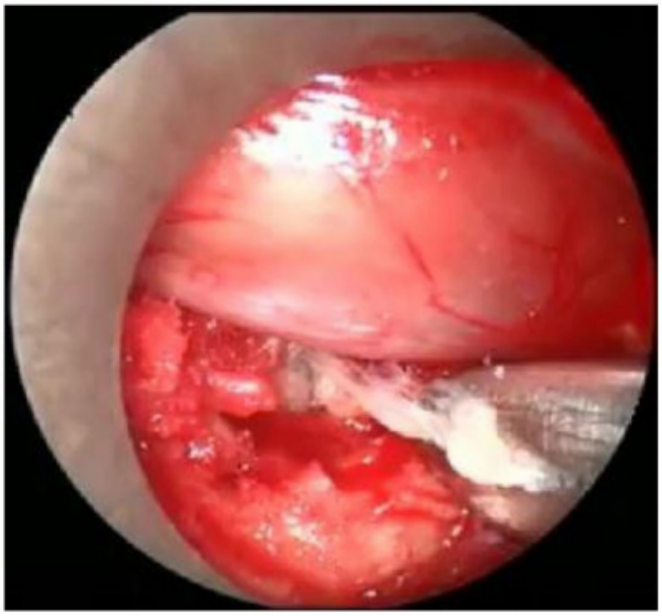


Figure 3d

Postoperative T2 weighted MR axial image showing totally removed disc material and totally free RT. S1 nerve root

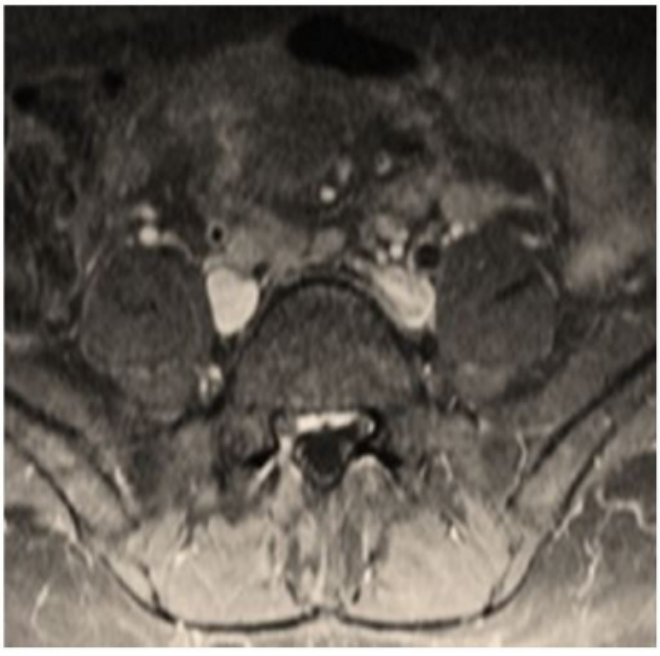


Figure 3e

Postoperative T2 weighted MR sagittal image showing totally removed prolapsed disc material and the dura and nerve roots are not compressed any more.

Figure 3f

Anteroposterior lumbosacral X-ray showing a very small laminotomy done in RT. L5 lamina.

DISCUSSION

Open hemilaminectomy to treat symptomatic intervertebral disc herniation, was first described by Mixter and Barr in 1934, which set the standard for subsequent surgical techniques [4]. The trend since has been to develop less invasive surgical procedures for the treatment of radiculopathy secondary to herniated disc. The concept of minimally invasive spine surgery is to provide surgical options that optimally address the disc pathology without producing the types of morbidity commonly associated with open surgical procedures (e.g. morbidity associated with incision of the paraspinal muscle in traditional open techniques). Minimally invasive techniques are not, however, a perfect procedure for all lumbar disc pathology. These techniques are designed to treat nerve root compression alone as the source of radiculopathy in patients with acute primary disc herniations.

The goal of minimally invasive techniques is either disc debulking or selective fragment removal subsequently relief nerve root compression. Selective fragmentectomy may remove an obstructive disc herniation mechanically. However, intradiscal depressurization and lavage with saline also may improve symptoms without significant change in neural anatomy. Good results have been achieved without significant change in neural anatomy following the procedure. The governing factor in considering a minimally invasive procedure is patient selection [14].

Depending on the previous statements we chose our inclusion criteria for this study.

The overall results of standard discectomy range from 68% to 95% in different series [15-19]. Jhala and Mistry [20] in their report stated that “Since microdiscectomy introduced by Caspar and Yasargil, it is considered the gold standard procedure in single lumbar disc prolapsed patients. Its results also range from 88% to 98.5%. The two procedures were tested over many decades and resulted in good outcome”. In their report comparing between standard discectomy and microdiscectomy, Katayama concluded that microdiscectomy gave better lighting, magnification and subsequently decreased the length of incision and posterior spinal tissue trauma [21].

Foley and Smith in 1997 [11] introduced the microendoscopic approach, which allows even smaller incisions and less tissue trauma, compared with standard open microdiscectomy. The MED potentially provides additional long-term outcomes over other open procedures because it significantly induces less iatrogenic injury to the

posterior spinal muscles.

Kamper and colleges in their systematic review revised twenty-nine reports, 16 of them were randomised controlled trials (RCTs) and 13 non-randomised studies (n = 4,472 patients). They stated that, clinical outcomes were not different between the surgery types (conventional microdiscectomy, MED, transforaminal endoscopic discectomy). They concluded that there is moderate to low quality evidence of no differences in clinical outcomes between MED surgery and conventional microdiscectomy for patients with sciatica due to lumbar disc herniation [22].

Also, Kulkarni and colleges studied 188 consecutive patients who underwent surgery for herniated disc using the tubular retractors between April 2007 and April 2012. They stated that, MED for herniated discs effectively achieves the goals of surgery with minimal access [23]. On the other hand; Evaniew and colleges studied 10 trials in the lumbar discectomy group of a total 1159 patients. They found that minimally invasive surgery did not improve long-term function [24].

According to modified MacNab's criteria, 42 patients (93%); in our study; had a good to excellent result postoperatively, and only three patients (7%) had a fair outcome. More than 90% of our patients were satisfied postprocedure from the surgical results.

Nygaard and colleges [25] in year 2000 found a strong correlation between the duration of preoperative leg pain and postoperative outcome in patients with lumbar disc herniation. Leg pain lasting more than 6-8 months correlates with an unfavorable outcome. In the current report, the excellent and good outcomes were different and better in group of patients with history of sciatic leg pain ≤ 6 months duration more than in patients with history of sciatic leg pain 6 months duration both at one month and one year follow up periods. Despite that, this difference was statistically insignificant. We choose one month period of follow up because most of the patients returned to their previous work by this time postoperatively. Additionally, this study results came along with the results of Baldwin [26] and Khoo et al., 2002, who found that the duration of radicular symptoms is important in the patient selection criteria [27]. Despite its insignificancy, our patients with sciatic leg pain for more than 6 months tend to have poor outcomes.

The advantages of endoscopic discectomy; using METRx tubular tertractors; over open discectomy (OD) include small incision, better cosmesis, early ambulation, less postoperative pain, less blood loss, short hospital stay, less analgesics, short time to return to work and thus less cost of treatment [23,28-31]. It also gives the surgeon the comfort he needs due to bimanual surgical technique. In our study skin incision was 1.8-2 cm in length initially which after healing became shorter leading to better cosmesis.

Katayama et al. compared microdiscectomy against macrodiscectomy and concluded that; both the procedures have the same overall outcome, then the procedure with lesser tissue invasion, lesser length of incision, lesser use of postoperative analgesics with an early return to work becomes the procedure of choice [21].

Bookwalter and colleges reported that 40% of their patients returned to work in fewer than 5 weeks proving its cost-effectiveness [32]. Caspar et al. reported a mean return-to-work time of 18.6 weeks [33] and Foley and Smith reported a mean return-to-work time of 17.6 days [11]. In this study, 35 patients (81.4%) returned to their previous work after 4 weeks following surgery.

In their preliminary series, the developers of this technique reported a complication rate of one patient in 41 (3%), with all patients reporting a good to excellent results in follow-up based on modified MacNab criteria [11]. As this is our preliminary experience with this technique, we excluded patients with recurrent disc and only operated virgin lumbar intracanlicular discs. We had only one patient with large dural tear that happened before disc excision and the procedure was apandant and discectomy was performed by open technique to carefully deal with dural tear. Another case which had a small dural tear after discectomy which repaired intraoperatively very successfully, this makes our complications rate 4.6% in this study.

In 2014, Evaniew and colleges [24] mentioned that; the evidence suggested overall higher rates of nerve-root injury, incidental durotomy and reoperation with minimally invasive surgery than with open surgery. But they said that infections were more common with open surgery than with minimally invasive surgery. In our series, we encountered neither disc recurrence cases throughout the whole period of follow up nor postoperative wound infection.

In a study published in 2014, authors concluded that; there is low quality evidence that MED takes 11 min longer than conventional microdiscectomy, results in 52 ml less blood loss and reduces mean length of hospital stay by 1.5 days.

There were no differences in complications or reoperations [22]. In this study, the operative time was nearly one and half hour in cases operated earlier and became near to 50 min after good learning curve. The amount of blood loss ranged from 20- 65 ml. in our cases with no case of massive blood loss.

CONCLUSIONS

Endoscopic lumbar discectomy using METRx tubular tertractors is an excellent technique which could replace a conventional open procedure if the learning curve could be overcome. Endoscopic discectomy provides many benefits such as a small skin incision, reduced postoperative pain, shorter hospital stay, faster mobilization, shorter rehabilitation, reducing pain and medication usage, quick recovery to daily life or work, as well as surgeon's comfortability with the standard bimanual technique. Moreover, the endoscope allows the surgeon to obtain more wide visualization through the oblique lens, so it can be possible to operate in the field beyond the confines of the tubular retractor.

ACKNOWLEDGMENT

Thanks to Dr. Zeinab Abdel Aziz Kasemy, Lecturer of public Health and Community Medicine, Menoufiya University for doing statistics in this study.

References

1. Kaushal M and Sen R, Posterior endoscopic discectomy: Results in 300 patients, lndian J Orthop. 2012 Jan-Feb; 46(1): 81–85.
2. Saal E and Saal M, Intradiscal electrothermy, managining lumbar disc herniation.Spine,17:1239, 1992.
3. Jhala A and Mistry M. Endoscopic lumbar discectomy: Experience of first 100 cases. Indian J Orthoo.2010; 44(2): 184-190.
4. MIXTER W.J. and BARR J.S.Rupture of the Intervertebral Disc with Involvement of the Spinal Canal N Engl J Med 1934; 211:210-215
5. Kambin P. History of Surgical Management of Herniated Lumbar Discs From Cauterization to Arthroscopic and Endoscopic Spinal Surgery, Arthroscopic and Endoscopic Spinal Surgery, history of lumbar disc surgery,Text and Atlas, Second Edition, Humana Press Inc. ,Totowa, NJ, pp. 1-28; 2005.
6. Williams RW and Yasergil . Micro lumbar discectomy: A conservative surgical approach to the vergin herniated lumbar disc. Spine 3:175-182, 1999.
7. Hijikata s, Yamagishi M, Nakayama T, Oomori K. Percutaneous nucleotomy : a new treatment method for lumbar disc herniation. J Toden Hosp 1975; 5: 5-13.
8. Onik G, Helms CA, Ginsberg L, Hoaglund FT, Morris J. Percutaneous lumbar discectomy using a newa aspiration probe. porcine and cadaver model. AJR 1985, 144: 1137-40.
9. Schreiber A, Suezawa Y. Trans discoscopic percutaneous nucleotomy in disk herniation. Orthop Rev 1986; 15: 35-8.
10. Choy DS, Case RB, Fielding W, , Hughes J, Liebler W, Ascher P. Percutaneous laser nucleolysis of lumbar disks. N Eng J Med. 1987, 317; 771-2.
11. Foley KT, Smith MM. Microendoscopic discectomy. Tech Neurosurg; 1997;3:301-307.
12. Nakagawa Y, Yoshida M, Maia K. Microendoscopic Discectomy (MED) For Surgical Management of Lumbar Disc Disease: Technical Note. The Internet Journal of Spine Surgery. 2005, Volume 2 Number 2.
13. Macnab I. "negative disc exploration: an analysis of the cause of nerve root involvement in sixty-eight patients." J Bone Joint Surg (Am) 1971;53:891-903
14. Andreshak TG, An HS, Hall J, Stein B: Lumbar spine surgery in the obese patient. J Spinal Disord 1997;10:376-379.
15. Yorimitsu E, Chiba K, Toyama Y, Hirabayashi K. Long-term outcomes of standard discectomy for lumbar disc herniation: A follow-up study of more than 10 years. Spine. 2001;26:652–7.
16. Loupasis GA, Stamos K, Katonis PG, Sapkas G, Korres DS, Hartofilakidis G. Seven-to 20-year outcome of lumbar discectomy. Spine. 1999;24:2313.
17. Gibson JN, Waddell G. Surgical interventions for lumbar disc prolapse updated cochrane review. Spine. 2007;32:1735–47.
18. Mariconda M, Galasso, Beneduce T, Volpicelli R, Della Rotonda G, Secondulfo V. Minimum 25 yr. outcome of standard discectomy for lumbar disc herniation. J Bone Joint Surg Br. 2006;88:152–3. Suppl.
19. Toyone T, Tanaka T, Kato D, Kaneyama R. Low-back pain following surgery for lumbar disc herniation: A prospective study. J Bone Joint Surg Am. 2004;86:893–6.
20. Jhala A, Mistry M. Endoscopic lumbar discectomy: Experience of first 100 cases. Indian J Orthop 2010;44:184-90
21. Katayama Y, Matsuyama Y, Yoshihara H, Sakai Y, Nakamura H, Nakashima S, et al. Comparison of surgical outcomes between macro discectomy and micro discectomy for lumbar disc herniation: A prospective randomized study with surgery performed by the same spine surgeon. J Spinal Disord Tech. 2006;19:344–7.
22. Kamper SJ, Ostelo RW, Rubinstein SM, Nellensteijn JM, Peul WC, Arts MP, et al. Minimally invasive surgery for lumbar disc herniation: a systematic review and meta-analysis Eur Spine J. 2014 May;23(5):1021-43
23. Kulkarni AG, Bassi A, Dhruv A. Microendoscopic lumbar discectomy: Technique and results of 188 cases .Indian J Orthop. 2014 Jan-Feb; 48(1): 81–87
24. Evaniew N, Khan M, Drew B, Kwok D, Bhandari M, Ghert M. Minimally invasive versus open surgery for cervical and lumbar discectomy: a systematic review and meta-analysis CMAJ Open. 2014 Oct-Dec; 2(4): E295–E305.
25. Nygaard OK, Kloster R, Solberg T. Duration of leg pain as a predictor of outcome after surgery for lumbar disc herniation. A prospective cohort study with one year follow-up. J. Neurosurgery (Spine 2), 92: 131-134; 2000.
26. Baldwin NG. Lumbar Disc Disease: The Natural History. Neurosurgical Focus, American Association of Neurological Surgeons, 13(2) ; 2002.
27. Khoo LT, Khoo KM, Isaacs RE and Fessler RG.Endoscopic lumbar laminotomy for stenosis, in Perez-Cruet MJ, Fesseler RG (eds) : Outpatient spinal surgery.St.Louis, Quality Medical Publishing, Inc 2002,pp197-215.
28. Kotil K, Tunckale T, Tatar Z, Koldas M, Kural A, Bilge T. Serum creatine phosphokinase activity and histological changes in the multifidus muscle: A prospective randomized

controlled comparative study of discectomy with or without retraction. J Neurosurg Spine. 2007;6:121–5.
29. Tullberg T, Isacson J, Weidenhielm L. Does microscopic removal of lumbar disc herniation lead to better results than the standard procedure? Result of a one-year randomized study. Spine (Phila Pa 1976) 1993;18:24–7.
30. Perez-Cruet MJ, Foley KT, Isaacs RE, Rice-Wyllie L, Wellington R, Smith MM, et al. Microendoscopic Lumbar Discectomy: Technical Note. Neurosurgery. 2002;51:S129–36.
31. Nakagawa H, Kamimura M, Uchiyama S, Takahara K, Itsubo T, Miyasaka T. Microendoscopic discectomy (MED) for lumbar disc prolapse. J Clin Neurosci. 2003;10:231–5.
32. Bookwalter JW 3rd, Busch MD, Nicely D. Ambulatory surgery is safe and effective in radicular disc disease. Spine 1994;19:526-30.
33. Caspar W, Campbell B, Barbier DD, Kretschmmer R, Gotfried Y. The Caspar microsurgical discectomy and comparison with a conventional standard lumbar disc procedure. Neurosurgery. 1991;28:78–87.

Author Information

Hossam Elnoamany, MD, PhD, JBNS
Neurosurgical Department, Menoufia University Hospital, Faculty of Medicine, Menoufia University
Menoufia, Egypt
Hae1967@gmail.com