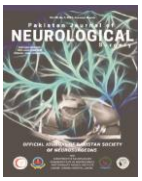

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Original Article

Micro-Endoscopic Discectomy versus Open Discectomy: A Struggle for Better Clinical Outcomes

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ABSTRACT

Objective: The objective of the current study was to compare the clinical outcomes of a micro-endoscopic discectomy with an open discectomy.

Materials & Methods: This Quasi-experimental study was conducted in the Department of Neurosurgery, Alrazi Healthcare, Lahore, and Ammar Medical Complex, Lahore. The sample consisted of 40 patients with lower back pain with radiation to the lower limbs. A lumbar disc single-segment hernia was diagnosed based on magnetic resonance imaging (MRI) findings. Independent sample t-test was used to explore the difference in outcomes and level of pain between group A and group B. Chi-square test was used to compare the recovery rate of patients in both groups.

Results: A significant difference between the two groups in terms of surgery duration (t = 15.977, P = .000), blood loss during surgery (t = -10.256, P = .000), length of incision (t = -58.355, P = .000), and hospital stay after surgery (t = -4.687, P = .000) was found. The overall recovery rate for the micro-endoscopic Discectomy group was 95% whereas, in the open discectomy group, it was 90%.

Conclusion: Micro-endoscopic discectomy is superior to open discectomy in terms of lesser surgical trauma, lesser blood loss, lesser hospital stay, earlier return to work, and higher pain resolution.

Keywords: Lumbar Disc Herniation, Open Discectomy, Micro-Endoscopic Discectomy, Minimally Invasive Spine Surgery.

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INTRODUCTION

The most common neurosurgical disease in the lumbar region is a herniated lumbar disc which is

primarily caused by external pressures and age-related wear and tear. The patients usually present with backache and radiation in the lower legs with or without neurological defects.[1] This can be treated with conservative as well as surgical methods. It is important to have surgical treatment if no response to conservative treatment is seen in 3 months.[2] Surgical treatment is also required for the treatment of a hernia in the lumbar disc along with severe pain, cauda equina syndrome, or lumbar spinal stenosis.[2,3] The surgical treatment success rate among patients with a hernia at a single segment in the lumbar disc is about 80 percent as per Echt et al.[4] The most commonly used surgical treatment is open discectomy with decompression of nerve roots.[4] But after the open surgical treatment, complications such as lumbar instability might occur in some of the patients.[5]

The advancement in spine surgery and the introduction of endoscopy as well as the minimally invasive techniques has improved the outcomes, and also minimized the complications like blood loss, instability, and prolonged hospital stay. Micro-endoscopic discectomy is the technique used to treat lumbar disc herniation using a tubular retractor and endoscopes. The micro-endoscopic discectomy relieves the pain as well as lessens the surgical incisions that lead to trauma avoidance with rapid recovery.[6] This procedure can be done with a high-definition endoscope and microscopes to obtain a clearer surgical field of view and to ensure surgical accuracy. This is a minimally invasive technique and can completely relieve nerve-root compression while reducing the surgical insult to the patient and ensuring faster recovery.[7]

To the best of our knowledge, no local study is available that compares the clinical outcomes of micro-endoscopic discectomy and open discectomy in terms of pain reduction, early mobilization, and return to work in our local population, so we conducted this study.

MATERIALS AND METHODS

Study Design and Setting

This quasi-experimental study was conducted in the Department of Neurosurgery, Alrazi Healthcare, Lahore, and Ammar Medical Complex, Lahore from June 2021 to June 2022. The sample size was calculated using a 2-proportion formula with a 90% confidence interval and 80% power.

Inclusion Criteria

Forty patients, belonging to both genders, between 16 – 60 years of age with lower back pain with radiation to the lower limb and single segment disc herniation (protrusion and extrusion) at L4-L5 or L5-S1 on MRI were included.

Exclusion Criteria

Patients with multi-level disc disease, spinal stenosis, cauda equina syndrome, facet joint arthritis, and unfit for surgery were excluded from the study.

Randomization & Data Collection

Patients were divided into two groups using a lottery method under random sampling. Each group contained 20 patients. Group A received an open discectomy procedure whereas group B received a micro-endoscopic discectomy with tubular retractors. Informed consent was signed by the patient to participate in the study. The level of pain was measured by a Visual Analog scale rated between 0 to 10, where 0 meant No pain and 10 meant severe pain.

Data Analysis

Data was analyzed in SPSS version 25.0. Mean and standard deviation was calculated for age whereas frequencies and percentages were calculated for gender. Independent sample t-test was used to explore the difference in surgery

duration, blood loss, length of Incision, the time required for returning to work, hospital stay, and level of pain between group A and group B. Chi-square test was used to compare the recovery rate of patients in both groups.

Surgical Procedure

a) **Open Discectomy:** After anesthesia, the patient was put prone on Wilson's frame. After the paint drape, the site was marked with fluoroscopy. The incision was given. Paravertebral dissection was done and laminectomy was done. The ligamentum flavum was opened, and the nerve root was identified and retracted. Analotomy was done and the disc was removed with biopsy forceps from the symptomatic side. Foraminotomy was done. Pyodine was injected into the disc space and the wound was washed. After securing hemostasis, muscles were closed with interrupted sutures, and facia with continuous water-tight sutures. Subcutaneous closure and skin were done in an interrupted fashion.

b) **Micendoscopic Discectomy:** After anesthesia, the patient was put prone on Wilson's frame. After the paint drape, the site was marked with fluoroscopy. A small skin incision (0.5 cm) was made and a pin was inserted to finalize the marking. A tubular micro-endoscopic retractor system was used. The site was dilated with dilators, and once dilated to maximum, an endoscope holder was placed. The endoscope was fixed and the microscope was also adjusted and optimized. Lamina and medial facet joints were identified and drilled. The ligamentum flavum was opened, and the thecal sac was retracted. Analotomy was done and the disc was removed with biopsy forceps from the symptomatic side. Microscope and endoscope were utilized simultaneously. The wound was thoroughly washed and subcutaneous tissue and skin were closed after removing the instruments.

Both surgical procedures were performed by the same surgical team

RESULTS

Demographics

In group A, males were 40% and females were 60%. In group B, males were 35% and females were 65% (Table 1).

Table 1: Gender-wise data distribution.

Group	Male	Female
A	n = 8 (40%)	n = 12 (60%)
B	n = 7 (35%)	n = 13 (65%)

Outcomes

The results of an independent sample t-test revealed a significant difference between the two groups in terms of surgery duration (t = 15.977, P = .000). The mean time taken to perform micro-endoscopic discectomy was 70.56 ± 5.93 which was greater than the mean time taken to perform open discectomy was 49.68 ± 3.97. A significant difference between the two groups in terms of blood loss during surgery (t = -10.256, P = .000). The average blood loss during micro-endoscopic discectomy was 33.54 ± 7.14 ml which was less than the average blood loss during open discectomy was 58.34 ± 10.13 ml. The length of the incision was also significantly different in both groups (t = -58.355, P = .000). The mean incisional length in the micro-endoscopic discectomy group was 2.37 ± 0.45 cm which was smaller than the incisional length in open discectomy 6.78 ± 0.34 cm. The mean duration of back to work in the micro-endoscopic discectomy group was 3.47 ± 2.20 days which was less than in the open discectomy group, i.e., 4.98 ± 1.95 days. This difference was found statistically significant (t = -3.564, P = .000). A significant difference was

Table 2: Comparison of outcomes of using both surgical techniques.

Variable	Groups	n	Mean ± Std. Deviation	t	Sig
Surgery Duration (minutes)	Micro-endoscopic Discectomy	20	70.56 ± 5.93	15.977	0.000*
	Open Discectomy	20	49.68 ± 3.97		
Blood-Loss (mL)	Micro-endoscopic Discectomy	20	33.54 ± 7.14	-10.256	0.000*
	Open Discectomy	20	58.34 ± 10.13		
Length of Incision (mm)	Micro-endoscopic Discectomy	20	2.37 ± 0.45	-58.355	0.000*
	Open Discectomy	20	6.78 ± 0.34		
Back to work	Micro-endoscopic Discectomy	20	3.47 ± 2.20	-3.564	0.001*
	Open Discectomy	20	4.98 ± 1.95		
Hospital stay (day)	Micro-endoscopic Discectomy	20	1.54 ± 0.75	-3.47	0.000*
	Open Discectomy	20	4.01 ± 3.65		

*significant result

Table 3: Comparison of rate of recovery among both groups.

Group	Number of Cases	Excellent	Good	Fair	Excellent Rate	χ^2	Sig
Micro-endoscopic Discectomy	20	16 (80%)	3 (15%)	1 (5%)	19 (95%)	0.178	0.709
Open Discectomy	20	14 (70%)	4 (20%)	2 (10%)	18 (90%)		

found between the two groups in terms of hospital stay after surgery (t = -3.564, P = .000). The average hospital stay of the micro-endoscopic discectomy group was 1.54 ± 0.75 days which was less than the average hospital stay of the open discectomy group was 4.01 ± 3.65 days (Table 2).

Recovery Rate

There was no difference found in the recovery rate of patients of both groups (X^2 = 0.178, P = .709). However, in the Micro-endoscopic Discectomy group, the overall recovery rate was 95% whereas, in the open discectomy group, it was 90% (Table 3).

Pain

The level of pain was high in both groups before surgery, that's why no difference in the level of pain was found among both groups (t = .537, P = .704). One day after surgery, the micro-endoscopic discectomy group showed less pain (2.86 ± 1.34) as compared to open discectomy (3.56 ± 1.65) which was significant (t = -1.985, P = .047). On 3rd day after surgery, the reported level of pain was less among patients of the micro-endoscopic discectomy group (2.71 ± 1.35) as compared to the open discectomy group (3.06 ± 1.57) which was significant (t = -1.961, P = .038). One month after surgery, the reported level of pain was reduced among patients of the micro-endoscopic discectomy group (2.57 ± 1.45) as compared to the open discectomy group (2.98 ± 1.56) which was significant (t = -1.057, P = .045). Six months after surgery, the reported level of pain was less among patients of the micro-endoscopic discectomy group (1.45 ± 1.15) as compared to the open discectomy group (2.24 ± 1.63) which was significant (t = -2.015, P = .035).

Before surgery, the level of pain among both groups was almost the same which was, later on, found low among patients who were treated with the Micro-endoscopic Discectomy as compared to the level of pain among patients treated with the open Discectomy (Table 4).

Table 4: Level of Back Pain among patients of both groups.

Variables	Groups	n	Mean ± Std. Deviation	t	Sig.
Before surgery	Micro-endoscopic Discectomy	20	7.00 ± 1.75	0.537	0.704
	Open Discectomy	20	6.98 ± 1.89		
1 day after surgery	Micro-endoscopic Discectomy	20	2.86 ± 1.34	-1.985	0.047
	Open Discectomy	20	3.56 ± 1.65		
3 days after surgery	Micro-endoscopic Discectomy	20	2.71 ± 1.35	-1.961	0.038
	Open Discectomy	20	3.06 ± 1.57		
1 month after surgery	Micro-endoscopic Discectomy	20	2.57 ± 1.45	-1.057	0.045
	Open Discectomy	20	2.98 ± 1.56		
6 months after surgery	Micro-endoscopic Discectomy	20	1.45 ± 1.15	-2.015	0.035
	Open Discectomy	20	2.24 ± 1.63		

DISCUSSION

The prevalence of hernia of the lumbar disc is about 20% with the symptoms of pain in the lower back radiating towards lower limbs,[1] which is due to the degenerative changes in the tissues of intervertebral disc bones as an outcome of more physical work.[4] Obesity is also a very important factor in causing lumbar disc herniation.[5] It is very important to have surgical treatment of lumbar disc herniation because the tissue of the intervertebral disc has a little chance of repair as well as blood supply is restricted due to which disability could be an outcome otherwise.[3]

It is evident from the literature that rehabilitation of single-segment hernia of the lumbar disc could be obtained by medication, physiotherapy, and acupuncture techniques which relieve the pain and is cost-effective.[6-9] But in case of severe conditions which could not be improved by any conservation method, surgical treatment is needed. This treatment is required in 10 to 20 percent of patients.[1]

The focus of surgical treatment is on stability as well as reliability with fewer complications after spinal surgery. Thus, upgradation in the surgical method is continuous and the introduction of a camera and endoscope has been done in surgical treatment with the help of which surgical area visualization has become so easy to treat. It helps to visualize the anatomy of tissue while avoiding any damage to the nerve root during a surgical procedure.[4]

Current study findings revealed a recovery rate of 95% with micro-endoscopic discectomy and 90% with open discectomy with no significant difference between both groups which is in line with the findings of a similar study in which the recovery rate for micro-endoscopic discectomy was 93.75% and open discectomy was 91.67%.[9] The reason for not having any difference in recovery rate could be the complete decompression of the nerve root in both surgical procedures.

Furthermore, the findings of the current study showed less hospital stay, minimum loss of blood during surgery, low level of pain as well as less bed-rest duration in the group that had micro-endoscopic discectomy as compared to open discectomy but the duration of operation was less in open discectomy as compared to micro-endoscopic discectomy which is following the findings of a similar study.[10]

According to Teli et al[11] and Martin-Laez et al,[12] the mean duration of surgery for the microendoscopic discectomy group was 56 ± 12, and 65.45 ± 18.6 minutes respectively which were slightly less than the findings of the current study which revealed 70.56 ± 5.93 minutes. Contrary to this, the findings of Garg et al[13] and Hussein et al,[14] reported the mean duration of surgery for the microendoscopic discectomy group was 84 ±

36 and 98.9 ± 26.9 which were higher than the findings of the present study. The mean difference in terms of surgery duration in the current study was 20.88 ± 1.96 minutes which was more time duration than findings reported by Martin-Laez et al, i.e. -7.47 ± 0.64.[12] Majority of studies reported more surgical duration taken for microendoscopic discectomy as compared to open discectomy 10,[13,14] which is also aligned with the findings of the current study.

Less hospital stay among patients who undergoes microendoscopic discectomy than open discectomy was reported in several studies with the mean hospital stay in days, i.e. 2.25 ± 0.5 days,[10] 3 ± 1 days,[12] 0.44 ± 0.15 days[14] and 3.57 ± 0.98 days.[15] These findings are in line with the findings of the current study, i.e. 7.54 ± 3.75.

The findings of the current study revealed a minimum amount of blood loss during surgery among patients who had micro-endoscopic discectomy, i.e. 33.54 ± 7.14 mL versus open discectomy 58.34 ± 10.13 mL which following the findings of Garg et al,[12] (41 ± 12 mL), Hussein et al[14] (41.6 ± 13.1 mL) and Haung et al,[15] (87.5 ± 69.4 mL) as compared to open discectomy, Garg et al,[12] (306 ± 120 mL), Hussein et al[14] (124.22 ± 24.5 mL) and Haung et al,[15] (190 ± 115 mL).

According to Teli et al[10] and Huang et al,[14] no significant relief in pain perception was achieved while comparing both groups which is contrary to the findings of the current study. The mean difference in the level of pain among both groups reported by Teli et a,l[11] was 0.1 ± 0.1 which is a minute difference but the current study revealed a significant level of pain relief among patients who have micro-endoscopic discectomy as compared to open discectomy group (MD = -0.7 ± 0.31).

Although, micro-endoscopic discectomy is not a simple procedure as it requires a lot of expertise because of the difficulty in dissection of paravertebral muscles and pavement of surgical channel.[16,17] But it provides an enlarged vision of local tissue which enhance the surgical accuracy while reducing the amount of impairment of paravertebral muscles. This leads to an improved state of recovery with lesser pain and patients can start the physiotherapy earlier which reduces the lumbar instability and resulted in a shorter stay in the hospital.[18,19]

Limitations

This study is limited due to the small sample size, and small follow-up duration. The study was carried out in Lahore, Pakistan, and can't be representative of regional, provincial or national trends.

Recommendations

Further studies with larger sample sizes are recommended. Longer follow-up studies are recommended to see the long-term outcomes of MED in terms of pain relief, recurrence, and stability.

CONCLUSION

In conclusion, the clinical outcomes are similar for a micro-endoscopic discectomy and open discectomy to treat single-segment hernia of the lumbar disc but surgical trauma and blood loss are less in micro-endoscopic discectomy. Micro-endoscopic discectomy is superior to open discectomy in terms of lesser surgical trauma, lesser blood loss, lesser hospital stay, earlier return to work, and higher pain resolution.

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Additional Information

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Human Subjects: Consent was obtained by all patients/participants in this study.
Conflicts of Interest:
In compliance with the ICMJE uniform disclosure form, all authors declare the following:
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AUTHORS CONTRIBUTIONS

Sr.#	Author's Full Name	Intellectual Contribution to Paper in Terms of:
1.	Ammar Anwer and Ijaz Hussain Wadd	Study design and methodology, paper writing, analysis of data and interpretation of results, literature review and referencing, editing, and quality insurer.
3.	Abdul Ghafoor	Data collection and calculations.
4.	Javaria Siddiq	Data collection and calculations, Literature review, and referencing.
5.	Malik Muhammad Yasin and Jamshaid Farooq	Data collection and calculations, analysis of data, and interpretation of results.