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Microdiscectomy and Minimally Invasive Discectomy Using a Tubular Retractor System for Lumbar Disc Herniation: A Comparative Study

Lomber Disk Hernisinde Tübüler Retraktör Sistemi Kullanılarak Mikrodiskektomi ve Minimal İnvaziv Diskektomi: Karşılaştırmalı Bir Çalışma

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ABSTRACT

Objective: The findings of clinical research comparing microdiscectomy and a minimally invasive approach are ambiguous or inconsistent. Therefore, we compared the two interventions in terms of their clinical, radiological, and functional outcomes for lumbar disc herniation.

Methods: Seventy-eight patients who underwent microdiscectomy and minimally invasive discectomy (MID) using tubular retractors at a single level were prospectively followed up. The visual analogue scale (VAS) was used to assess the intensity of radicular pain. Clinical evaluation involved the straight leg raising test and the assessment of motor and sensory functions. We used the Oswestry Disability Index to assess functional outcomes. Instability was assessed by measuring the angular rotation and sagittal translation in dynamic lateral radiographs. The approaches were compared in terms of the length of incision, surgical duration, blood loss, length of hospitalization, and complications.

Results: The most commonly herniated disc was L4-L5. VAS significantly (p=0.0001) improved with MID using tubular retractors than with microdiscectomy in one month. The incision length required was significantly (p=0.05) smaller and the intraoperative blood loss was lesser for MID than for microdiscectomy. There was no spinal instability in either group at the end of the final follow-up. Although there was no significant difference in the clinical outcome, the functional outcome improved in both groups at the 1-year follow-up, and the incidence of postoperative complications was similar between the groups.

Conclusion: Microdiscectomy and MID are comparable procedures with comparable results, with a tendency for higher intraoperative complications in MID.

Keywords: Durotomy, lumbar disc herniation, microdiscectomy, minimally invasive discectomy, tubular retractors

ÖZ

Amaç: Mikrodiskektomi ile minimal invaziv yaklaşımı karşılaştıran klinik araştırmaların bulguları belirsiz veya tutarsızdır. Bu nedenle lomber disk hernisi için iki girişimi klinik, radyolojik ve fonksiyonel sonuçlar açısından karşılaştırdık.

Yöntemler: Tek düzeyde tübüler retraktörler kullanılarak mikrodiskektomi ve minimal invaziv diskektomi (MİD) uygulanan 78 hasta prospektif olarak takip edildi. Radiküler ağrının şiddetini değerlendirmek için görsel analog skala (VAS) kullanıldı. Klinik değerlendirme düz bacak kaldırma testini ve motor ve duyu fonksiyonlarının değerlendirilmesini içeriyordu. Fonksiyonel sonuçları değerlendirmek için Oswestry Engellilik İndeksini kullandık. İnstabilite, dinamik lateral radyografilerde açısal rotasyon ve sagittal translasyonun ölçülmesiyle değerlendirildi. Yaklaşımlar kesi uzunluğu, cerrahi süre, kan kaybı, hastanede kalış süresi ve komplikasyonlar açısından karşılaştırıldı.

Bulgular: En sık bel fıtığı L4-L5 idi. Bir ay içinde mikrodiskektomiye göre tübüler retraktörlerin kullanıldığı MID ile VAS anlamlı düzeyde (p=0,0001) düzeldi. Gerekli insizyon uzunluğu anlamlı derecede (p=0,05) daha kısaydı ve intraoperatif kan kaybı MİD için mikrodiskektomiye göre daha azdı. Son takibin sonunda her iki grupta da omurga instabilitesi görülmedi. Klinik sonuçlarda anlamlı bir fark olmamasına rağmen, 1 yıllık takipte her iki grupta da fonksiyonel sonuçlar iyileşti ve postoperatif komplikasyon görülme sıklığı gruplar arasında benzerdi.

Sonuç: Mikrodiskektomi ve MİD, MİD'de daha yüksek intraoperatif komplikasyon eğilimi gösteren, karşılaştırılabilir sonuçlara sahip karşılaştırılabilir prosedürlerdir.

Anahtar Sözcükler: Durotomi, lomber disk hernisi, mikrodiskektomi, minimal invazif diskektomi, tübüler retraktörler

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INTRODUCTION

Lumbar disc herniation (LDH) is defined as the localized displacement of disc material beyond the normal intervertebral disc space margins, resulting in lower back pain and radiculopathy (1,2). On extrusion, the disc material can compress and damage-sensitive nerve roots, resulting in paraesthesia and weakness of one or both legs.

The natural history of LDH is discerned by intermittent symptoms with improvement in most cases, which can make any intervention appear successful. Generally, patients with acute LDH are treated with bed rest and analgesics. If non-operative treatment fails, surgical management is considered. The surgical technique for LDH was first described in 1932, (3) and has greatly evolved since Yasargil et al. (4) first used a microscope to perform lumbar disc surgery in 1967. In 1997, Smith and Foley (5) developed a technique using tubular retractors. It involves inserting sequential dilators to split muscles and reach the disc, a so-called minimally invasive surgery.

Microdiscectomy and minimally invasive discectomy using a tubular retractor [minimally invasive discectomy (MID)] are two commonly used surgical techniques for the management of LDH. Microdiscectomy is still considered the gold standard method for treating LDH. Very few studies have compared microdiscectomy and MID in the Indian population. The study compared the clinical and functional outcomes between the two groups.

MATERIALS AND METHODS

We conducted a prospective study on all adult patients aged 18 to 60 years who presented to our hospital with lumbar radiculopathy with prolapse, extrusion, or sequestration of the intervertebral disc at any single level between L3-L4, L4-L5, or L5-S1 on MRI of the lumbosacral spine and who did not improve after 2 months of medical management. Patients with multiple-level intervertebral disc prolapse, prior spinal surgery, radiological instability at the same level, spinal canal stenosis, recurrent LDH, and cauda equina syndrome were excluded. Finally, 78 patients were included in the study, with a 1-year follow-up period. They were divided into two groups by convenience sampling. Both surgeries were performed by an experienced senior surgeon. Thirty-seven and 41 patients underwent microdiscectomy and MID, respectively, between 2018 and 2020.

The severity of radicular pain was measured using the visual analog scale (VAS), which ranged from 0 (no discomfort) to 10 (extreme pain; worst pain ever experienced). Straight leg raising test (SLRT), motor power, and sensory assessments were used in clinical evaluation. The Oswestry Disability Index (ODI) was used to assess functional outcomes. The gauze VAS was used to estimate blood loss by determining the percentage saturation of blood in the gauze. Anteroposterior and lateral lumbar spine radiographs (flexion and extension views) were used to assess spinal instability using the criteria of Dupuis et al. (6). Translation >4 mm of vertebral body width was defined as sagittal translatory instability, and angular rotation >10° was defined as sagittal angular instability.

The Kasturba Hospital Institutional Ethics Committee approved the study (approval number: IEC: 586/2018, date: 19.09.2018).

Surgical Techniques

Microdiscectomy Group (Group A)

The procedure was performed in the prone position under general anesthesia. The operative level was marked using a fluoroscope. The subcutaneous plane was infused with 1:1,00,000 adrenaline. At the affected level, a standard midline posterior approach was used. Subperiosteal dissection was performed on the side of the radiculopathy, and fenestration was performed. Using a nerve retractor, the lateral border of the traversing root was medially retracted. The herniated disc fragments were then identified and removed. Pituitary forceps were used to remove loose fragments from the disc space (Figure 1). Thorough saline irrigation was used to identify any retained disc fragments in the epidural space. Nerve roots were confirmed to be free. The wound was closed in layers over a drainage tube.

Minimally Invasive Discectomy Using a Tubular Retractor Group (Group B)

The patient was positioned as described above. A paramedian incision lateral to the midline was made over the affected side using a transmuscular approach. Serial dilators were then inserted and docked on the lower border of the lamina. A flexible arm was used to insert and secure a 22-mm tubular retractor to the operating table. Fluoroscopic images were obtained to confirm the extent of surgery. The remaining muscle fibers in the surgical field were cleared using electrocautery. A laminotomy was performed using a high-speed burr. The lateral border of the traversing nerve root was also identified. Wanding was performed as required to decompress various areas at the level of surgery. Using a Penfield, the dural sheath and nerve root were retracted medially. Disc forceps were

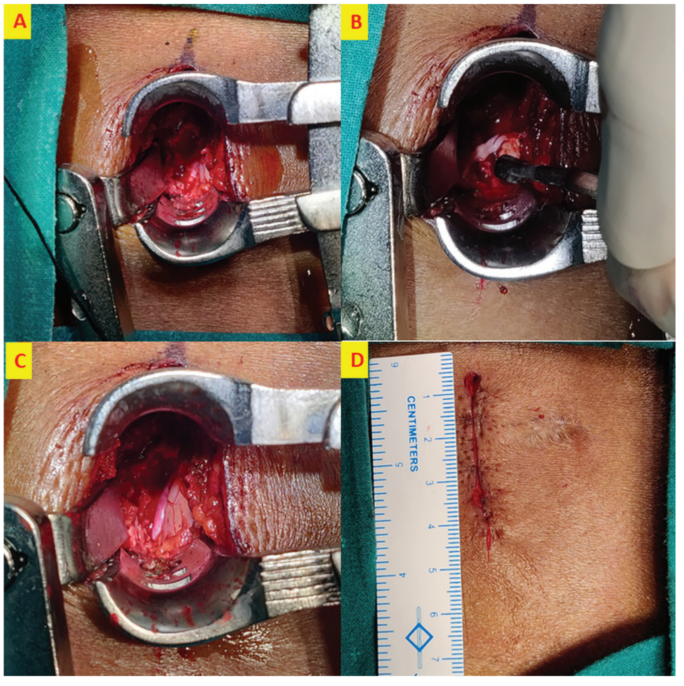

Figure 1. Steps of microdiscectomy (A) Lamina exposed, (B) Extruded disc beneath the root, (C) Free nerve root after discectomy, (D) Incision measured before closure.

used to remove the herniated disc material and loose fragments (Figure 2). The wound was closed in layers over a surgical drain.

The duration of surgery, incision length, blood loss, intraoperative complications such as nerve root injury, conversion to open procedure, and dural tear if any were noted.

Patients were followed up at one month, six months, and one year after surgery. At each visit, the intensity of pain was assessed using VAS. The SLR test, motor power, and sensory assessments were performed. Functional outcome was evaluated using the ODI score. Radiological assessment was performed at the end of one year to assess spinal instability.

Statistical Analysis

The efficacy of microdiscectomy and MID in single-level LDH was compared using the SPSS software (Released 2006, Version 15.0. Chicago, SPSS Inc.). The VAS score and motor weakness were compared using the Mann-Whitney U test. The VAS score, motor weakness, and sensory impairment were compared preoperatively and postoperatively using the Wilcoxon signed-rank test. The ODI and SLRT scores were compared between the two groups using the t-test. ODI and SLRT were compared preoperatively and postoperatively using Bonferroni post-hoc analysis. A t-test was used to compare Lasegue's test results, length of hospital stay, and average time to return to work. Differences were considered statistically significant at $p<0.05$. Mean values are presented as mean ± standard deviation.

RESULTS

Seventy-eight patients diagnosed with LDH who underwent either microdiscectomy or MID during the study period were analyzed. We prospectively studied all 78 patients and compared both groups: 37 patients underwent microdiscectomy and 41 underwent MID (Table 1).

The mean age of patients in the microdiscectomy group was 41±10.03 years and 41.78±11.29 years in the MID group. However, this was not significantly different between the two groups ($p=0.749$). Among affected patients, the most common disc involved in herniation was L4-L5. Only one patient had L3-L4 disc prolapse (Table 1).

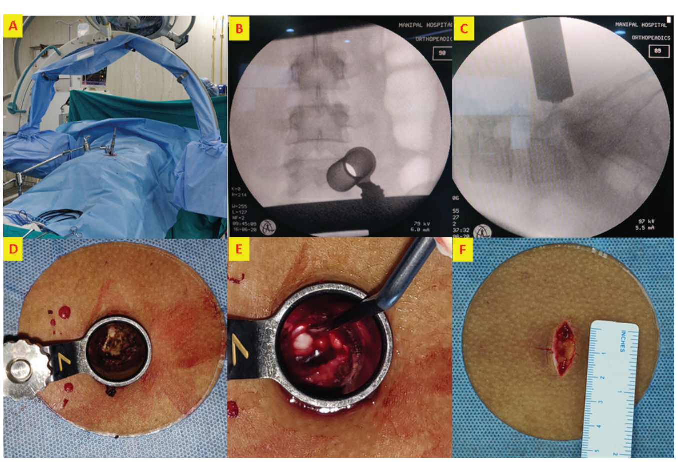

Figure 2. Steps of MIS with tubular retractor (A) image intensifier to identify level, (B, C) fluoroscopy images confirming the docked level, (D) dura retracted, (E) retraction of traversing root exposing the herniated disc, (F) Incision size.

MIS: Minimally invasive surgery.

The mean VAS score improved significantly in the MID group at immediate postoperative and 1-month follow-up (2.68±1,753) compared with the microdiscectomy group (3.38±1,361) ($p<0.05$). Furthermore, at the end of one year, VAS score improvement was similar in both groups, and the VAS score improved significantly from preoperative to postoperative follow-up in both groups ($p<0.01$) (Figure 3).

The mean preoperative ODI score was 48.95±11.79 in the microdiscectomy group, whereas it was 51.95±13.52 in the MID group, depicting severe disability in both groups. A significant improvement was noted within both groups when the pre-operative and postoperative follow-up ODI scores were compared ($p<0.01$). However, there was no difference in the mean ODI scores at postoperative follow-up between both groups ($p=0.80$) (Figure 4).

Significant improvements in SLRT and Lasegue's sign ($p<0.01$) were noted from the pre-operative period to postoperative follow-up. No difference in SLRT was noted at the end of one year in either group ($p=0.919$) (Table 2).

At the end of one-year, both groups showed comparable sensory and motor power improvements (MRC grading) ($p<0.01$) (Table 3, 4). There was no disability due to motor and sensory deficits among the operated patients in either of the groups.

The surgical incision length was measured using a measuring scale. The mean surgical incision length in the microdiscectomy group

Table 1. Baseline demographics of patients who underwent surgery in groups A and B

Characteristics	Parameter	Group A (n=37) (%)	Group B (n=41) (%)
Sex	Male (n=54)	32 (86.49%)	22 (53.66%)
	Female (n=24)	05 (13.51%)	19 (46.34%)
Level	L3-L4	1 (2.7%)	0 (0%)
	L4-L5	23 (62.2%)	18 (43.9%)
	L5-S1	13 (35.1%)	23 (56.1%)
Radiculopathy	Right	12 (32.4)	24 (58.5%)
	Left	25 (67.6)	17 (41.5)

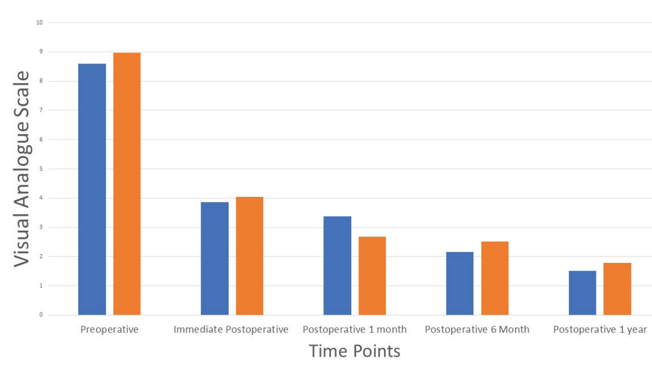

Figure 3. Visual analog scale depicting the severity of pain between the microdiscectomy and MID groups.

MID: Minimally invasive discectomy.

was 4.42±1.25 cm compared with that in the MID group, which was 2.45±0.41 cm (Table 5). The MID group had a significantly smaller incision than the microdiscectomy group (p<0.01). The difference in the mean intraoperative blood loss between the microdiscectomy and MID groups was significant (79.38±24.30 mL vs. 59.02±19.31 mL, p=0.005) (Table 5). Salient differences in the average duration of surgery were not observed among the microdiscectomy group (75±16.46 min) or the MID group (75.85±21.82 min) (p=0.847). No significant difference was observed in the length of hospital stay between the microdiscectomy and MID groups (2.92±1.06 days vs. 3.59±3.58 days, p=0.279). The average time to return to work was calculated for both groups. The difference in the average time to return to work between the microdiscectomy and MID groups was not significant (1.27±1.31 months vs. 1.29±1.69 months, p=0.948). One patient with root injury was noted to have foot drop in the MID group; however, the patient recovered at the 6-month follow-up. Three (3.85%) and eight (10.25%) patients in the microdiscectomy and MID groups, respectively, underwent incidental durotomies

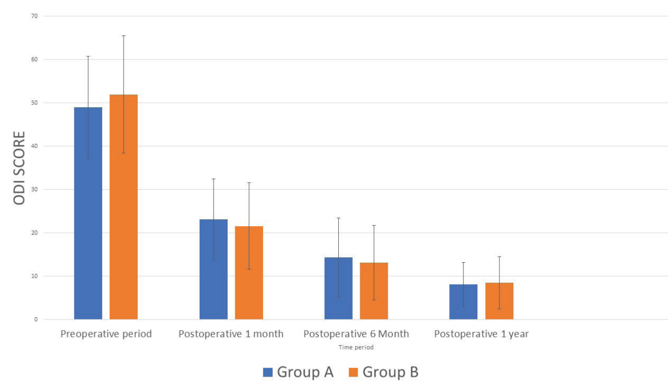

Figure 4. Bar diagram showing the functional ODI score between the microdiscectomy and MID groups.

MID: Minimally invasive discectomy, ODI: Oswestry Disability Index.

Table 2. Comparison of the straight leg raising test between groups A and B

		SLRT in degrees (mean ± SD)	
		Group A	**Group B**
Pre-operative		37.03±9.68	42.44±10.44
Post-operative	1 month	77.84±6.72	74.39±11.63
	6 months	82.7±6.52	80.24±14.58
	1 year	86.67±4.82	86.52±4.87

SD: Standard deviation, SLRT: Straight leg raising test.

during surgery. However, dural repair was not attempted because the tears were minor. No complications associated with dural tears were noted in these patients. One patient (1.28%) in the MID group had a postoperative surgical site infection that was managed by regular wound dressings and oral antibiotics; the infection resolved within 2 weeks. In one patient in the microdiscectomy group, we noted complex regional pain syndrome-like features immediately in the postoperative period, which were managed with gabapentin and NSAIDS; the patient improved within 6 weeks (Table 6). Both groups had no radiological instability at the end of follow-up. Overall, both interobserver and intraobserver agreement for the parameters used to perform the radiological assessment for instability was high (p<0.01) (Figure 5).

DISCUSSION

Microdiscectomy and MID are two different surgical techniques for treating LDH; the former is currently the gold standard for management. Laminectomy were modified into microdiscectomies with the advent of magnification devices such as microscopes and loupes. MID has emerged as an alternative technique for the surgical management of LDH. It is said to have produced equal or better results than microdiscectomy, although there is insufficient evidence to support this claim. The principle behind the tubular retractor system is to replace muscle dissection with the muscle-splitting transmuscular approach, which is less traumatic to soft tissues and has a faster recovery rate. A review of related literature has shown ambiguous outcomes (7,8). Current studies on surgical approaches for LDH are suffused with obscurity, making it difficult for surgeons to accept MID as the standard approach. We attempted to determine whether either approach has a significant advantage over the other. In our prospective comparative non-randomized observational study, we assessed the efficacy of surgery in single-level LDH.

Clark et al. (7) and Rasouli et al. (8), observed that the MID group had a higher VAS score for leg pain after one year. At one month after surgery, the alleviation of pain was more significant in the MID group than in the microdiscectomy group. However, these appreciable differences were not observed at the end of one year. The alleviation of pain following surgery was significant in both groups, as reported previously (7,9,10).

A significant improvement in ODI scores was noted in both groups during follow-up. However, we did not find any significant difference between the groups in the post-operative ODI scores or improvement in the scores in our study. In studies by Lau et al. (11), Harrington and French (12), Ryang et al. (9), and Teli et al (10), there was a significant

Table 3. Comparison of sensory deficits in groups A and B

		Number of patients (%)			
		Group B		**Group B**	
Sensory grading		**Grade 1**	**Grade 2**	**Grade 1**	**Grade 2**
Pre-operative		22 (59.5%)	15 (40.5%)	24 (58.5%)	17 (41.5%)
Post-operative	Immediate	23 (62.2%)	14 (37.8%)	23 (56.1%)	18 (43.9%)
	1 month	23 (62.2%)	14 (37.8%)	23 (56.1%)	18 (43.9%)
	6 months	8 (21.6%)	29 (78.4%)	11 (26.8%)	30 (73.2%)
	1 year	3 (8.1%)	21 (56.8%)	4 (9.8%)	19 (46.3%)

Table 4. Comparison of motor deficits in groups A and B

Category	MRC grading	Time points				
		Pre-operative, n (%)	Immediate post-operative, n (%)	Post-operative at 1 month, n (%)	Post-operative at 6 months, n (%)	Post-operative at 1 year, n (%)
Group A	Grade 0	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	Grade 1	1 (2.7%)	2 (5.4%)	2 (5.4%)	1 (2.7%)	1 (2.7%)
	Grade 2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	Grade 3	2 (5.4%)	2 (5.4%)	2 (5.4%)	1 (2.7%)	1 (2.7%)
	Grade 4	5 (13.5%)	4 (10.8%)	4 (10.8%)	5 (13.5%)	5 (13.5%)
	Grade 5	29 (78.4%)	29 (78.4%)	29 (78.4%)	30 (81.1%)	30 (81.1%)
Group B	Grade 0	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	Grade 1	1 (2.4%)	1 (2.4%)	1 (2.4%)	0 (0%)	0 (0%)
	Grade 2	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	Grade 3	4 (9.8%)	4 (9.8%)	4 (9.8%)	4 (9.8%)	4 (9.8%)
	Grade 4	9 (22%)	9 (22%)	9 (22%)	5 (12.2%)	5 (12.2%)
	Grade 5	27 (65.9%)	27 (65.9%)	27 (65.9%)	32 (78%)	32 (78%)

MRC: Medical Research Council.

Table 5. Primary outcome parameters and significance

Parameter		Group A	Group B	p-value
Incision length (cm)	Mean ± SD	4.42±1.25	2.45±0.41	0.0001**
	Minimum	4	2.32	
	Maximum	4.84	2.58	
Intraoperative blood loss (mL)	Mean ± SD	79.38±24.30	59.02±19.31	0.05*
	Minimum	65.28	52.93	
	Maximum	81.48	65.12	
Duration of surgery (minutes)	Mean ± SD	75.00±16.46	75.85±21.82	0.847
	Minimum	69.51	68.97	
	Maximum	80.49	82.74	
Hospital stay (days)	Mean ± SD	2.92±1.06	3.59±3.58	0.279
	Minimum	2.56	2.46	
	Maximum	3.27	4.71	
Return to work (months)	Mean ± SD	1.27±1.31	1.29±1.69	0.948
	Minimum	3.84	3.76	
	Maximum	4.71	4.83	

*Significant, **Highly significant, SD: Standard deviation.

Table 6. Various complications in groups A and B

	Number of patients (%)	
Complications	**Group A**	**Group B**
Nerve root injury	1 (2.7%)	0 (0%)
Dural tear	3 (8.1%)	8 (19.5%)
Surgical site infection	0 (0%)	1 (2.4%)
Other patient-related impairments	**Group A**	**Group B**
Complex regional pain syndrome	1 (2.7%)	0 (0%)
Postoperative sciatic scoliosis	1 (2.7%)	0 (0%)
Hamstring tightness	9 (24.32%)	5 (12.19%)

difference in ODI scores during postoperative follow-up when compared between the groups. Moreover, no marked difference was noticed in terms of return to work between the two groups in our study, as highlighted in similar studies (13,14).

The incision length, smaller was smaller in the MID group than in the microdiscectomy group; hence, intraoperative blood loss was much lesser in the former. Moliterno et al. (15) and Lau et al. (11), found similar results. A smaller incision in MID patients compared with microdiscectomy patients significantly reduced intraoperative blood loss. However, studies by Harrington and French (12), Ryang et al. (9), and Arts et al. (14), showed no difference between both groups in terms of operative blood loss.

When comparing the surgical time, Lee et al. (13), and Arts et al. (14) reported that MID had significantly shorter operative times than microdiscectomies. However, we found no significant difference in operation times between patients who underwent MID and microdiscectomy, indicating that both approaches took similar time. Lau et al. (11), Harrington and French (12), and Ryang et al. (9), found results similar to ours.

In terms of hospital stay, Lee et al. (13) and German et al. (16) reported that patients undergoing MID had a significantly shorter hospital stay than those undergoing microdiscectomy. The duration of stay in our study did not significantly differ between the two groups. However, one patient in the MID group stayed for 25 days in the hospital because of surgical site infection.

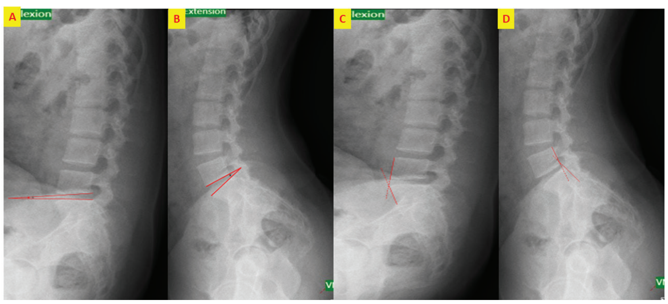

Figure 5. (A, B) Evaluation of anterior and posterior angular rotation and (C, D) evaluation of sagittal translation in flexion and extension views

When comparing the groups, Lau et al. (11), Lee et al. (13), and Bhatia et al. (17) discovered that there was no difference in neurologic improvement in terms of sensory and motor power. In our study, all individuals with neurological deficits in terms of sensory and motor power improved dramatically over the course of a year. However, there were no significant differences between both groups. Intraoperative nerve root injury is a possible complication of discectomy. Overdevest et al. (18) found three cases of nerve root injury in each group. Bhatia et al. (17) observed one patient with nerve root injury in the MID group who had great toe paresis and eventually recovered within 2 months. In our study, one patient (2.7%) in the microdiscectomy group had a nerve injury, and paresis occurred in the ankle during the postoperative period. He was observed with ankle foot orthosis and physiotherapy; at the end of 6 months, motor power had improved. However, there was no such complication in the MID group.

Wrong-level surgery is a known complication during discectomy; the incidence is higher in MID surgery because there can be errors during tubular retractor placement at the intended site of surgery. In Irace and Corona (19), no patient demonstrated an incorrect level or side clinically or radiologically in microdiscectomy. Kulkarni et al. (20) identified one (0.5%) wrong level among 188 cases of tubular discectomy, which was later corrected in revision surgery. Overdevest et al. (18) found that five patients who underwent microdiscectomy and one patient who underwent tubular discectomy had wrong-

Table 7. Literature review of related studies

Study	Study type	Study	Eligible (n)	VAS at the final follow-up	ODI at final follow-up (%)	Total complications (n)	Conclusion
Arts et al. (14)	RCT	Tubular discectomy v/s microdiscectomy	328	14.1 v/s 18.3 mm		19 v/s 14	Tubular discectomy resulted in less favorable results for leg pain, back pain, and recovery.
Bhatia et al. (17)	Retrospective	Microdiscectomy v/s tubular discectomy	148	1.82 v/s 1.28	14 v/s 14	6 v/s 16	The rate of recovery was significantly faster for TD than for MD.
Lau et al. (11)	Retrospective	MIS v/s microdiscectomy	45			4 (20%) v/s 6 (24%)	No significant difference between the two groups
Asati et al. (25)	Retrospective	Tubular discectomy v/s microdiscectomy	414	1.68 v/s 1.70	14 v/s 13	24 v/s 50	Both were found to have similar outcomes.
Teli et al. (10)	RCT	Minimally invasive microdiscectomy v/s open microdiscectomy	142	2 v/s 2 (Same)	14 v/s 16	18 v/s 10	Outcome measures were equivalent in both groups
Brock et al. (26)	RCT	Subperiosteal v/s transmuscular approach	141	91.5% (n=54) v/s 97% (n=64)	20% v/s 25.7% Improvement		The early postoperative outcome was equivalent in both groups

VAS: Visual analogue scale, ODI: Oswestry Disability Index, TD: Tubular discectomy, MD: Microdiscectomy, MIS: Minimally invasive surgery, RCT: Randomized controlled trial.

level surgery. In our series, in one patient undergoing MID, the operating surgeon performed fenestration at a lower level instead of the pathological level. The status was confirmed by fluoroscopy. The correct level was then identified, and fenestration and discectomy were performed. Radiological localization and confirmation of the level of retractor placement are of paramount importance to avoid these errors.

According to Overdevest et al. (18), Bhatia et al. (17), and Dasenbrock et al. (21), incidental durotomies occur significantly more frequently during MID than during microdiscectomy. There was no statistical difference in the incidence of dural tears between the microdiscectomy and MID groups, according to Lee et al. (13) and Rasouli et al. (8). Due to the limited surgical field for dural repair in MID, it may sometimes be necessary to convert to an open microdiscectomy for wider access as it will be difficult to perform dural repairs through the tubular retractors. Although incidental autotomies were identified in both groups in our study, they were slightly more frequent in patients with MID (Table 6), but there was no significant difference between both groups. Because the tears were minor, no dural repair was attempted.

In their study, Overdevest et al. (18) found no postoperative wound complications in either of the procedures. Bhatia et al. (17) observed one patient in each group with a surgical site infection. Teli et al. (10) reported similar results, with no differences between the two groups. One patient in the MID group (2.4%) had postoperative surgical site infection and underwent wound exploration on postoperative day 2. Although there was no growth on culture, the histopathology report was conclusive for discitis and abscess.

Spinal instability is a common cause of poor outcomes following lumbar disc surgery (22). Bhat et al. (23) noted spinal instability in two patients within the first 12 months after microdiscectomy, both of which required fusion at the level of instability, and Lee et al. (24) noted one patient with instability following microdiscectomy. At the end of the 1-year follow-up, we discovered no spinal instability in either group (Figure 5).

According to current evidence, both microdiscectomy and MID result in significant and comparable long-term improvements in outcomes such as pain. Because there was no statistically significant difference between the two methods in our study, we believe that both methods can be used in lumbar discectomy. Several previous studies have also concluded that there was no significant difference between MID and microdiscectomy in terms of clinical outcomes (10,11,14,17,25,26) (Table 7).

Our study had a few limitations. Although our study was a prospective comparative study, the selection of surgical technique was not randomized and may have led to some bias in the study. The sample size in both groups was small and unequal. A larger study group with a longer follow-up period is needed to truly assess the potential benefits and complications such as recurrence and spinal instability in patients.

Study Limitations

The limitation of our study was the smaller sample size available during the study period. Also, this was not a randomized trial. The study's confounding factor is surgeon bias in selecting a particular method for a particular patient. However, the pre-operative scoring used was obscured by the surgeons.

CONCLUSION

Patients undergoing microdiscectomy and MID with tubular retractors had similar outcomes. Patients in both groups had comparable pain scores and ODI scores at the end of the 1-year follow-up. Intraoperative complications are slightly higher in MID patients. Intraoperative blood loss, immediate post-operative pain and length of surgical scar were significantly less in the MID group.

Ethics

Ethics Committee Approval: The Kasturba Hospital Institutional Ethics Committee approved the study (approval number: IEC: 586/2018, date: 19.09.2018).

Informed Consent: Prospective study.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Concept: S.N.B., Design: S.N.B., Analysis or Interpretation: K.R.N., S.N.B., N.A., Literature Search: K.R.N., R.K.K., Writing: S.N.B., N.A., R.K.K.

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