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A Comparison of Tubular Minimal Invasive Surgery and Conventional Surgery in The Treatment of Patients Suffering from Single Level Lumber Disc Herniation (Short Term Follow Up)

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Abstract

Background :
Lumbar disc herniation is frequently-occurring and the most common spine-related disease in orthopedic surgery. However, nearly more than 50% of affected persons usually respond to conservative treatment. Furthermore, there is another group of patients who are suffering from incapacitating low back pain and sciatica although they have been treated for more than 6 weeks or who are suffering from early or progressive neurological impairment that required another approach far from the conservative treatments**.**

Aim of the Study
The present study is designed to unveil the most reliable procedure which should be most adopted for single level lumbar disc herniation in Iraqi patients **.**

Patients and Methods
A total of 40 patients who were suffering from back pain radiated to the lower limb were included in the present investigation. Out of them, 20 patients underwent open discectomy and the other 20 patients underwent tubular discectomy **.**

Results:
1**-**At the 10th day of postoperatively assessment, an obvious statistically significant decrease in the mean total Oswestry low back pain disability score was recorded in micro-tubular discectomy compared with the open discectomy (P<0.001)**.**
2**-**At the 6th month of postoperatively, the mean total Oswestry low back pain disability score was increased in both groups; nonetheless, there has still been a decrease in the micro-tubular discectomy group in comparison with that of open discectomy group (P<0.001).

Keyword: lumber disc herniation, micro-tubular discectomy, Open disctomy

Introduction:

The herniated disc occurs when the gel-like center of person's disc ruptures out through a tear in the tough disc wall. The gel material is irritating to the patient's spinal nerve, causing like a chemical irritation. Patients usually suffer from a pain as a result of the spinal nerve inflammation and swelling caused by the pressure of the herniated disc, which usually tends to decrease over time; patients then experience partial or complete pain relief. On the other hand, it was established that to deal with lumbar disc herniation, the open microdiscectomy was most reliable surgical treatment [1].

However, such an approach has now been replaced by the most recent one which is what was called minimally invasive procedures [2,3]. The main reasons behind the new trend is that while the open microdiscectomy is conducted by mobilizing the muscles laterally off the spinous process and lamina using a unilateral retractor, the new minimally invasive procedures relay on dilating the paraspinous muscles and using tubular retractors without stripping the muscles off the spinous process[4,5,6]. Obviously, such a new approach is now being recommended by many orthopedic surgeons because they thought that dilating the muscles rather than stripping them decreases the surgical morbidity [7,8,9]. Furthermore, it was established that the minimally invasive approach will have a great impact on the patients themselves. The patients with this approach will recover more quickly because of less tissue trauma [10], less postopertive pain, and finally lower blood loss.

Patients and Methods

Patient Selection

A total of 40 patients who were suffering from back pain that radiated to the lower limb were clinically diagnosed by a consultant physician according to standard patient's criteria and confirmed by MRI examination were included in the present study. All patients had a single level lumber disc with posterolateral herniation. Out of the 40 patients, 20 underwent open discectomy and the other 20 patients underwent tubular discectomy. The two groups were randomly selected with regard to the type of surgical operation, open discectomy or tubular discectomy, to avoid any bias in the selection that could affect the statistical outcome.

The present study was approved by the local Institutional Review Board of the University of Kufa, Faculty of Medicine in accordance with the 1964 Helsinki declaration and the revised form of 2015 and its later amendments. All the patients were informed of the aim of the present work and the possibility of publication of the results of the outcome of the surgery; all the patients willingly agreed to participate and a signed a written consent to indicate their willing to participate.

This prospective cohort study has been conducted during the period between February 2020 till June 2021. During that time, a follow up post-operation , on day 1, day 10, 6th week and 6th month, has been recorded with a special attention to the patients' pain and their return to work simultaneously.

All the surgical operations and the subsequent follow up were conducted by the same team which consist of two orthopedic surgeons and all surgeries in both approach were done by that team.

Criteria of Patients Selection

1- Patient with clinical examination signs of nerve root compression proved by MRI study.
2- Patient who do not respond to conservative treatment until 6 weeks.
3- Patient between 20 – 60 years old.

4- Patient with a single level lumbar disc herniation.

Exclusion Criteria

1- Patient with back pain but without radiculopathic symptom
2- Pregnant female patients
3- Patient with spinal stenosis
4- Patients whose dynamic x- ray and clinical examination show unstable symptom.
5- Multi-level disc herniation on MRI
6- Central disc herniation (cauda equina syndrome)

Surgical Procedure

1- Tubular Discectomy

All cases were performed under general anesthesia with endotracheal tube and in prone position. Before turning the patient to the prone position, the anesthesiologist shouldensure that intravenous line and endotracheal tube are secure and that appropriate personnel are available to prevent injury during the turn. A pad of cotton was placed on the patient face to avoid any injury to the face especially eyes in prone position. The head is positioned in horseshoe headrest, Complications of the prone position to which there must be constant attention are retinal ischemia and blindness from orbital compression. The abdomen of the patient was free to decrease the intra-abdominal pressure and decrease bleeding during laminotomy. After that, flexion to lumbar spine is done to make the discectomy easier by opening the disc space to allow pituitary forceps to get in easily in the disc space and start draping.

Then under fluoroscope determines the level of the prolapse disc by a lateral view and using a k- wire as a guide. After determining the required level, an anteroposterior view is taken by fluoroscope to ensure whether the exact site was right or left according to the spinous process.

One finger-breadth (1.5 c m) lateral to the midline on the symptomatic side of the patient at the appropriate disc level. All of the patients receive an antibiotic of a third generation cephalosporin one hour before skin incision as prophylactic dose. Typically, the surgeon stands on the side of prolapsed disc and fluoroscopic screen is located contralateral to the surgeon. An assistant is also standing on the contralateral side.

Then, the lamina appear then fenestration is done by starting with the inferior edge of the superior lamina of the surgical level, at the insertion of the ligamentum flavum, and continue laminotomy medially and laterally and cranially according to the surgical target, until complete visualization of the ligament. Then, flavectomy is done and the lateral part of the root will be in the field. Then we use root retractor to protect the root and insure that we are in the wanted disc space by aid of fluoroscope. Then discectomy done with pituitary rongeurs

After completing the decompression, the surgical field is washed with saline solution, and with garamycin amp 80mg in the disc space, to rule out any bleeding points. Hemostasis can be achieved with bipolar coagulation and the use of hemostatic agents, such as bone wax and gel foam. Complete hemostasis before closing is important as hematoma can cause compression of the neural elements, muscular pain, fibrosis and infection. Usually no drain is placed in lumbar tubular decompressive surgeries. Then, suturing is done layer by layer (fascia, subcutaneous and skin).

2- Open Discectomy

At the same position of tubular microdiscectomy, the level is determined by the aid of fluoroscope, 5-6 cm skin

incision is made mid-line, the fascia is opened, then the paraspinal muscle is stripped from spinous process, and then, according to clinical and MRI finding, we go direct to the site of pain without removing the spinous process. Then, a fenestration is done in the lamina and laminotomy is done to one side and then the flavectomy and the discectomy are done. Besides, the surgical site was irrigated with normal saline and the disc space was injected with 80 mg ampule of gentamycin. After that, a fat pad is taken from the subcutaneous layer and placed over the dura to decrease adhesion.

Both groups, open and tubular, received the same treatment to avoid any bias regarding VAS score which are:

1- Antibiotics (3rd generation cephalosporin) for 5 days .

2- Analgesia **a**- Paracetamol vial 1gm 8 hrs; **b**- Narcotics in form of TRAMADOL amp single dose day zero post op

3- fluid (Glucose Saline 1 pint 8 hrs.)

Results:

General characteristic of the studied groups:

As a baseline characteristic of the studied groups, eight persons, 21-30 years old, underwent a micro-tubular discectomy accounting to 40.0%; seven cases underwent an open discectomy representing 35.0% of the total cases. Furthermore, seven cases, aged 31-40 years, were subjected to a micro-tubular discectomy (35.0%) while six cases were subjected to an open discectomy representing 30% of the total cases. Again, three patients, 41-50 years old, experienced a micro-tubular discectomy and four persons experienced an open discectomy accounting 15.0% and 20.0% respectively. Finally, only five patients who were more than 50 years old were involved in the present investigation; two of them underwent an open-tubular discectomy while the other three underwent an open discectomy representing 10.0% and 15.0% respectively. In all of the compared cases above, no significant differences were observed (P = 0.922).

On the other hand, the mean age standard deviation (±SD) were (35.6 ± 9.2) for the micro-tubular discectomy and (36.4 ± 10.4) for the open discectomy, with no significant difference being found (P= 0.800).

Table 1 shows the demographic characterization of the patients in the present investigation: 14 males patients underwent micro-tubular discectomy and 12 males underwent open discectomy accounting to 70.0% and 60.0% of the total cases respectively. However, this study involved only 14 female patients: six cases underwent micro-tubular discectomy (30.0%) while 8 underwent open discectomy accounting to 40.0%. No significant difference was recorded with regard to gender (P=0.507).

As Table 1 shows, 18 married male patients underwent micro-tubular discectomy (90.0%) while 17 married male patients underwent open discectomy (85.0%). Yet, only two unmarried patients were subjected to micro-tubular surgery (10.0%) and three unmarried underwent open discectomy (15.0%). Again, no significant difference was recorded (P=0.723).

Finally, as for the occupation of the patients, five employed patients were exposed to micro-tubular discectomy and six employed ones were exposed to open discectomy representing 25.0% and 30.0% respectively. On the other hand, 15 unemployed persons underwent micro-tubular discectomy (75.0%) and 14 unemployed (70.0%) were subjected to open discectomy. No significant difference was observed with regard to the

occupation of the patients (P=0,723) (Table 1).

Table 1: Baseline characteristics of the studied groups

Variable		Tubular discectomy		Open Discectomy		P. value*
		No.	%	No.	%	
Age (year)	21 - 30	8	40.0	7	35.0	
	31 - 40	7	35.0	6	30.0	0.922
	41 - 50	3	15.0	4	20.0	
	> 50	2	10.0	3	15.0	
	Mean age ± SD	35.6 ± 9.2		36.4 ± 10.4		0.800
Gender	Male	14	70.0	12	60.0	0.507
	Female	6	30.0	8	40.0	
Marital status	Married	18	90.0	17	85.0	0.723
	Unmarried	2	10.0	3	15.0	
Occupation	Employed	5	25.0	6	30.0	
	Unemployed	15	75.0	14	70.0	

SD: standard deviation

*In all comparisons P. value is not significant

Site and level of the disc prolapse of the study groups

The total number of patients who had a left site disc prolapse surgical intervention were 20 cases; 11 were exposed to micro-tubular discectomy, accounting for 55.0%, and nine patients underwent open discectomy, representing 45.0% of the total cases. Likewise, the total number of cases who required right site surgical intervention were 20 cases as well. However, nine patients were exposed to micro-tubular discectomy and 11 cases went through open discectomy, accounting for 45.0% and 55.0% respectively. As indicated in Table 2, no significant difference was observed (P=0.527).

Out of the 20 cases exposed to micro-tubular discectomies, 11 patients underwent surgery at vertebral level of L5-S1 (55.0%), 8 had surgery at L4-L5 (40.0%), one experienced surgery at L3-4 (5.0%), none at L2 – 3 to an open discectomy. Out of the other 20 patients, 9 had surgery at L5-S1 (45.0%), ten had a surgery at L4-5 (50.0%), none at L3-4, and one at L2-3 (5.0%). A statistical analysis was conducted to see whether there was a significant difference between the two groups; in fact, no significant difference in the number of surgeries was observed (P=0.490) (Table 2).

Comparison of mean total Oswestry low back pain disability score of the study groups at different assessment points

The result of a comparison of mean total Oswestry low back pain disability scores of the studied group at different assessment points was grouped in Table 3. The mean total of Oswestry Low Back Pain Disability score for the 10 sections of the

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questionnaire was not significantly different in both groups pre-operatively as the mean was 35.05 ± 6.28 in micro-tubular and 33.20 ± 7.27 in open discectomy group,

Table 2: Site and level of disc prolapse characteristics of the studied groups

Variable		Tubular discectomy		Open discectomy		P. value
		No.	%	No.	%	
Site	Left	11	55.0	9	45.0	0.527
	Right	9	45.0	11	55.0	
disc prolapse level	L2-3	0	0.0	1	5.0	0.490
	L3-4	1	5.0	0	0.0	
	L4-5	8	40.0	10	50.0	
	L5-S1	11	55.0	9	45.0	

*In both comparison P. value is not significant

(P. value >0.05). At the 10th day assessment, a significantly lower total scores were reported in micro-tubular than open discectomy group, (P. value < 0.001). At the postoperative 6th week, a significant reduction was reported in both groups; however, the total mean score in micro-tubular discectomy group was significantly lower than that in the open discectomy group, (P value=0.003). At the postoperative 6th month, the total score increased in both groups; nonetheless, it is still lower in micro-tubular than open discectomy group, (P value<0.001) (Table 3).

Levels of disability in both study groups pre- and postoperatively:

Table 4 shows the levels of disability reported in both study groups pre- and postoperatively. It was obvious, that the level of disability (minimal, moderate and severe) which has been assessed revealed that in preoperative stage, the number of patients who were suffering from minimal disability and underwent micro-tubular discectomy was only one patient out of 20 cases accounting to 5.0%. However, the same number of cases (one patients) underwent open discectomy (5.0%). Out of the 20 cases, 15 persons were of moderately disability exposed to minimal micro-tubular discectomy (75.0%) while 17 moderately disable patients went through open discectomy representing 85.0% of the total cases. As for severe disability, 4 subjects were exposed to micro-tubular surgery and only 2 persons underwent open discectomy accounting to 20.0% and 10.0% respectively (Table 4). The results here show no significant difference between both groups at baseline level (P = 0.763).

Table 4 also reveals the assessment points of the level of disability after 10 days postoperatively; none of the patients still have sever disability in both groups, but those who became with minimal disability were more frequent in micro-tubular than open discectomy group, (P<0.001). Nonetheless, at the 6th week and 6th month post operatively, all patients became with minimal disability, (Table 4).

Table 3: Comparison of mean total Oswestry Low Back Pain Disability score of the study groups at different assessment points (Pre and postoperatively)

	Tubular discectomy		Open discectomy		P. value between groups (unpaired test)
	Mean	SD	Mean	SD	
Preoperative	35.05	6.28	33.20	7.27	0.394
Postoperative 10 days	20.30	2.45	30.70	2.58	<0.001 sig
Postoperative 6 weeks	1.05	0.94	2.40	1.60	0.003 sig
Postoperative 6 months	3.80	1.32	7.60	1.93	<0.001 sig
Percentage of reduction	89.2%	6.2%	77.1%	7.3%	0.032
P. value with group (paired t test)	< 0.001 sig		< 0.001 sig		

Table 4. Levels of disability reported in both studied groups pre and postoperatively

Assessment point	Disability level	Tubular discectomy		Open discectomy		P. value* between groups
		No.	%	No.	%	
Preoperative	Minimal	1	5.0	1	5.0	0.673 ns
	Moderate	15	75.0	17	85.0	
	Severe	4	20.0	2	10.0	
Postoperative 10 days	Minimal	12	60.0	0	0.0	**< 0.001 sig**
	Moderate	8	40.0	20	100.0	
Postoperative 6th week	Minimal	20	100.0	20	100.0	-
Postoperative 6th month	Minimal	20	100.0	20	100.0	-
P. value* within group	**<0.001 sig**			**<0.001 sig**		

sig: significant, ns: not significant
Chi square test used in comparisons between and within groups

Discussion

The present study is supported by the work of Kulkarni et al [11] who published his prospective study in 2014 using 188 consecutive patients exposed to tubular retractors for the treatment of herniated disc. All his patients were discharged within 24 to 48 hours' post-surgery. He concluded further after 1 week, 6 weeks, 3 months, 6 months, 12 months and 2 years by using VAS scale for leg pain which showed improving from 4.14 – 0.76 and also the mean VAS scale for back pain which showed improvement from 4.1 to 0.9. Furthermore, he reported that Oswestry disability index (ODI) changed from 59.5 to 22.6, that the microscopic-endoscopic discectomy (MED) is highly effective in the treatment of herniated discs with the advantage of minimal

postoperative morbidity and early postoperative recovery:

On the other hand, the present investigation is in disagreement with most recent work (Yadav et al. Medicine (2019) 98:50) who used VAS and ODI scores for clinical effectiveness assessment after the use of micro discectomy and open-lumber discectomy. They found a significant difference clinically and statistically between the VAS and ODI scores of the 2 groups after the first day postoperatively. After six weeks and six months follow up of both groups, the results were of a clinical improvement significant in each group but statistically not significant. Their work suggested an improvement in ODI in both groups. Further work has been published in 2016 by He J et all. 2016 [(12)], using meta-analysis protocol involving 501 patients and concluded that there were no any significant differences in the ODI and VAS between the micro-endoscopic and the open discectomy though the micro-endoscopic discectomy was associated with much less blood loss comparing with the open discectomy.

Indeed, as stated earlier our results showed equivocally, though ODI was not significant between both groups pre-operatively, at the 10th day assessment a significantly lower total score reported in micro-tubular than open discectomy group, (P. value < 0.001); at 6th week postoperatively, a significant reduction reported in both groups. However, the mean total score in micro-tubular discectomy group was significantly lower than open discectomy group, (P. value = 0.003). At the 6th month postoperatively, the total score increased in both groups; nonetheless, it is still lower in micro-tubular than open discectomy group, (P. value < 0.001), (Table 3 and Figure1). On the other hand, the current results also showed, beyond doubt, that a significant reduction was reported in VAS score in both groups with the time postoperatively, but the reduction in VAS score was more obvious in micro tubular group (P<0.001). Suggesting that the present work prefers the use of micro-tubular approach due to the differences in ODI scores between them in favor of the micro-tubular discectomy. Figures 1, and 2 demonstrate the change in mean total Oswestry low back pain disability and VAS score of the studied groups pre and postoperatively showing the change in mean total of ODI and VAS of patients who underwent micro-tubular approach in contrast with those patients who underwent open discectomy.

Conclusions and Recommendations:

The present study demonstrated an advantage in favor of minimal invasive tubular discectomy over the open discectomy techniques. Furthermore, much evidence and intensive research is highly recommended and powered by random and large clinical samples before any final conclusion could be reached to use this approach as standard treatment strategy for the lumber disc herniation.

Conflict of interests:

The authors declare that they have no conflict of interests.

References

1- Österman H, Seitsalo S, Karppinen J, Malmivaara A. Effectiveness of microdiscectomy for lumbar disc herniation: a randomized controlled trial with 2 years of follow-up. Spine. 2006 Oct 1;31(21):2409-14.

2. Mayer HM. A history of endoscopic lumbar spine surgery: what have we learnt?. BioMed Research International. 2019 Apr 3;2019.

3. Gibson JN, Subramanian AS, Scott CE. A randomised controlled trial of transforaminal endoscopic discectomy vs microdiscectomy. European spine journal. 2017 Mar;26(3):847-56.

4. Foley KT. Advances in minimally invasive spine surgery. Clin Neurosurg. 2002;49:499-517..

5. Inada T, Nishida S, Kawaoka T, Takahashi T, Hanakita J. Analysis of revision surgery of

microsurgical lumbar discectomy. Asian Spine Journal. 2018 Feb;12(1):140.
6. Palmer S. Use of a tubular retractor system in microscopic lumbar discectomy: 1 year prospective results in 135 patients. Neurosurgical focus. 2002 Aug 1;13(2):1-4..
7. German JW, Adamo MA, Hoppenot RG, Blossom JH, Nagle HA. Perioperative results following lumbar discectomy: comparison of minimally invasive discectomy and standard microdiscectomy. Neurosurgical focus. 2008 Aug 1;25(2):E20..
8. Kapetanakis S, Gkantsinikoudis N, Charitoudis G. The role of full-endoscopic lumbar discectomy in surgical treatment of recurrent lumbar disc herniation: a health-related quality of life approach. Neurospine. 2019 Mar;16(1):96..
9- Chi JH, Dhall SS, Kanter AS, Mummaneni PV. The Mini-Open transpedicular thoracic discectomy: surgical technique and assessment. Neurosurgical Focus. 2008 Aug 1;25(2):E5..
10. Righesso O, Falavigna A, Avanzi O. Comparison of open discectomy with microendoscopic discectomy in lumbar disc herniations: results of a randomized controlled trial. Neurosurgery. 2007 Sep 1;61(3):545-9..
11. Kulkarni AG, Bassi A, Dhruv A. Microendoscopic lumbar discectomy: Technique and results of 188 cases. Indian Journal of Orthopaedics. 2014 Feb;48(1):81-7..
12-He J, Xiao S, Wu Z, Yuan Z. Microendoscopic discectomy versus open discectomy for lumbar disc herniation: a meta-analysis. European Spine Journal. 2016 May;25(5):1373-81.