ORIGINAL ARTICLE

Microdiscectomy in Relieving Neurological Symptoms in Patients with Lumbar Disc Herniation

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Abstract

Introduction: *Minimally invasive spine surgical approaches such as microdiscectomy have gained attention in recent years due to less tissue damage, speedy and acceptable neurological improvement with less complication.*

Objective: *To assess efficacy of microdiscectomy in improving neurological status in patients with lumbar disc herniation.*

Material and Methods: *A Quasi experimental study comprising 70 consecutive cases though non-probability purposive sampling technique of both the sexes admitted in Neurosurgery department, Mayo Hospital operated for the 1st time for any disc pathology with no other spinal lesions giving consent themselves or though legal guardians was conducted. Pain for leg and back was measured pre and post-operatively was done by VAS which had 42 days of follow up. Standard Neurological examinations were conducted pertaining to muscle power (by MRC), sensory status and SLR test pre and post-operatively. Variables according to their nature were expressed in the form of Mean ± SD, Median (Range) and Frequency (percentage). Mc Neumer's chi square test and paired t test were used to see association between pre-operative and post-operative Neurological status (MRC grade, sensory status, SLR) depending on their nature viz: qualitative or quantitative respectively in SPSS version 15 and hence efficacy of microdiscectomy was assessed.*

Results: *Out of 70 patients 74% were male and 26% were females. Mean ± SD of patients was 37.6 ± 13.0 years. Majority were Laborers after housewives. Illiterates, Poor lifting techniques were the most common characteristics in the respective headings of education and employment. Most common level of disc herniation was L4-L5, L5-S1 level (96%) where Prolapse and extrusion were most common MRI findings. As compared to pre-operative (3.4) muscle power 1st and 42nd day power were respectively 4.0 and 4.7 (p = 0.001). Pre-operatively only 32 (45.7%) had normal sensation which improved to 38 (54.3%) and 51 (72.9%) respectively in 1st and 42nd day of surgery (p = 0.001). Pre-operative mean SLR improved to 98.6 degrees in 1st POD and continued to be the same till 42nd day (p = 0.001). All the MRC findings, sensory status and SLR values in each post-operative days were statistically significant with the baseline by paired t test (p = 0.001).*

Conclusion: *Microdiscectomy is one of the effective procedures which can be adopted for symptomatic unilateral lumber disc herniation with significant improvement in Neurological statuses.*

Key Words: *lumbar disc herniation, microdiscectomy, efficacy, MRC, sensation, SLR.*

INTRODUCTION

The standard surgical treatment of lumbar disc herniation has been open discectomy,[1] but there has been a trend towards minimally invasive procedures. The open discectomy is traditionally done by mobilizing the muscles laterally off the spinous process and lamina using a unilateral retractor. A minimally invasive microdiscectomy involves dilating the paraspinous muscles and using tubular retractors without stripping the muscles off the spinous processes.[2] It is

thought that dilating the muscles rather than stripping the muscles decreases surgical morbidity.[3,4] The purported benefit of the minimally invasive approach is that it would allow patients to recover more quickly because of less tissue trauma.[5]

While a minimally invasive approach may seem ideal, there is a learning curve associated with execution of the procedure, patient safety, and outcome.[6] Although minimally invasive microdiscectomies are appealing to many patients, its superiority over standard open discectomy has not been conclusively demonstrated. Wu et al. concluded in their restrospective study that minimally invasive microdiscectomy affords optimal post-operative outcomes and is superior when compared to open discectomy.[7]

Harrington and French found that perioperative parameters were similar. In their study, the minimally invasive group had less narcotic usage and shorter length of stay, but they did not conclude that one technique was better than the other.[8] Cole and Jackson showed that obese individuals undergoing minimally invasive microdiscectomies had decreased incision lengths and may have a reduced infection rates.[9] However, German et al.[3] and Porchet et al.[6] show that there is no significant difference. Ryang et al. found, similar to our results, that operating times with either minimally invasive or open discectomies were not significantly different.[10] German et al. showed that patients who underwent minimally invasive microdiscectomies had about half the length of stay compared to patients who underwent open discectomies (0.84 days vs. 1.43 days).[3] Although shorter hospital stays may lead to lower medical costs,[11] McLoughlin and Fourney analyzed the depth of the learning curve involved in minimally invasive lumbar microdiscectomies and found that it took about 15 cases for spine surgeons to be comfortable with, and proficient at, the technique. Operative times and complications for minimally invasive microdiscectomy were reduced as the surgeon became more experienced with the technique.[12] An advantage that minimally invasive surgery may offer is the psychological effect that newer and more advanced technology is being used.[3] This may allow patients to believe that minimally invasive microdiscectomy is superior. Many patients specifically request and want only minimally invasive surgery. German et al. found that minimal and open discectomy had similar perioperative results; the difference was significant although of modest clinical significance; but in this study comparison was made between two modalities of microdiscectomy and not with standard discectomy.[13] One study showed there is significant perioperative bleeding opting for microdiscectomy. The same study emphasized it is superior in teaching younger colleagues; the tool might facilitate a more rapid acquisition of higher surgical knowledge.[14] Although there is no conclusive evidence that minimally invasive microdiscectomy is superior to open discectomy, the perception of superiority may be so powerful that it motivates the patient to request only minimally invasive microdiscectomy.[15]

This newer minimal invasive technique have mixed and inconsistent results. Some studies showed microdiscectomy is superior to open discectomy[3,8,9,11,12] whereas some studies showed the results are similar to open discectomy.[6,10,13,14] Overall the comparison of the procedures were done on the basis of neurological outcomes, pain relief, hospital stay, operative time, hospital costs, and post-operative complications.

Rational

The literature review shows inconsistent results in comparing open discectomy and microdiscectomy. It further gives grounds for suspicious; does the procedure has different outcomes from country to country, hospital to hospital, surgeon to surgeon? This is a newer technique for our setting. It is a timely study to see what the scenario in Pakistan is. This study is necessary to be conducted in government hospital setup where good logistics lack, where there are high rates of infection and where nursing care is poor. In statistical point of view to rationalize the procedure conducted in other places, external validation is required; therefore this study is relevant to conduct. It is feasible, cost effective, time bound to be conducted by a post graduate trainee.

Objective

To assess efficacy of microdiscectomy in improving neurological status in patients with lumbar disc herniation.

MATERIAL AND METHOD

A Quasi experimental study was done in patients admitted in Neurosurgery department of Mayo Hospital through OPD Mayo Hospital/King Edward Medical University, Lahore from September 2014 to December 2015 with diagnosis of Lumbar disc herniation suggested by clinical findings and confirmed by plain

MRI. Patients ranged from 14 – 70 year with sample size of 70 of both genders as calculated by taking prevalence (percentage) of neurological improvement in patient with lumbar disc herniation as 76%,[15] confidence level of 95% and permissible error of 10%. Patient with previous disc surgeries, other spinal pathologies and with systemic illness were excluded from the study. In study duration of a year, samples were selected by non-probability sampling technique as it was a hospital based study with no sampling framework is available so all consecutive patients with lumbar disc herniation meeting inclusion criteria were studied until sample size was achieved.

At first data collection permission was taken from the University and Neurosurgery department. The detailed history was taken and relevant neurological examination was performed in patients attending Neurosurgery out-patient department of Mayo hospital, Lahore with complains of symptoms associated to lumbar disc herniation. After history taking, examination done and confirming the disc pathology lied at lumbar region, MRI was ordered (plain). All preoperative investigation and anesthetic fitness for general anesthesia was from either outdoor or indoor basis. With patient ready for surgery with all investigations done, getting anesthesia fitness and arranged 1 pint of blood they were put on elective operation list. Data was only collected if patient met inclusion criteria. Informed consent was taken from patient if they were capable of doing so if not was taken from their nearest relatives available. The patient not under the study was dealt as per ward rule but they were not included in the study. The candidates, who gave consent, fit for general anesthesia, met inclusion criteria were then asked for detail history, and neurological examination was performed before the surgery. Pre-tested, interviewer administered questionnaire was used to collect data socio-demographic variables, disease profile whereas MRI findings were noted in checklist. For standardized and unbiased results the surgery was performed only by the consultants and residents assisted them. Post-surgical neurological examination was conducted on 1st, 7th, 21st and 42nd post-operative day. The patient 1st post-operative day's neurological examination was performed in the ward, whereas on 7th, 21st and 42nd day the assessment was done in the neurosurgery ward or out-patient department depending on their day of discharge. The validation of the Performa was done with the help of a Neurosurgeon and a Statistician.

After data collection was completed, they were carefully checked for possible mistakes. Then they were exported and analyzed in SPSS version 15. Continuous variables either background, neurological status were expressed in the form of Mean ± SD. Categorical variables were expressed in the form of frequency and percentage. Mc Neumer's chi square test and paired t test were used to see association between pre-operative and post-operative Neurological status depending on their nature viz: qualitative or quantitative respectively. P value of < 0.05 was regarded as level of significance and all tests were 2 tailed.

RESULTS

Socio-demographic Characteristics

Mean age of the patients was 37.6 years and the standard deviation was 13.0 years. Patients' age ranged from 14 to 70 making median age as 35.0 years (Table 1). Sex distribution of the patients was fairly male dominate (n = 52, % = 74.3) (Figure 1). Majority of the patients were housewives (n = 16, % = 22.9) and in terms of occupation where both males and females may actively get involved, Laborer category had maximum number of patients (n = 12, % = 17.2). Only few had white collar jobs (Figure 2). Major portion of the samples were illiterate (n = 51, n = 72.9), about 15% held bachelor's degree and above (Figure 3).

Table 1: *Age Distribution.*

Mean (years)	Median (years)	Standard Deviation (years)	Range (years)
37.6	35.0	13.0	14 – 70

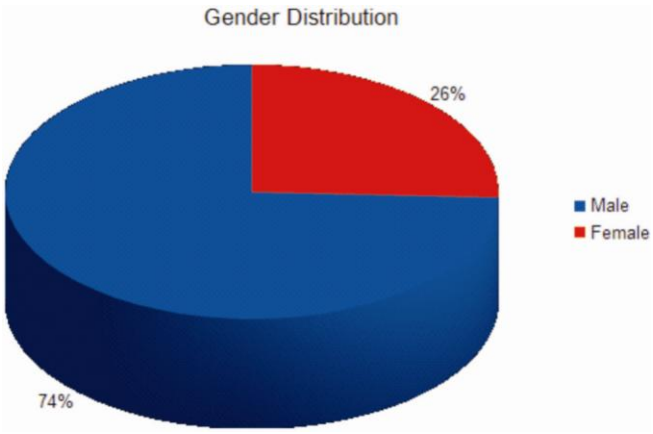

Fig. 1: *Gender Distribution.*

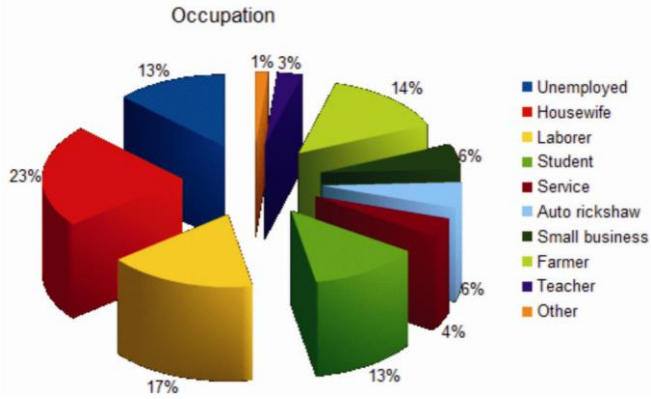

Fig. 2: *Occupation.*

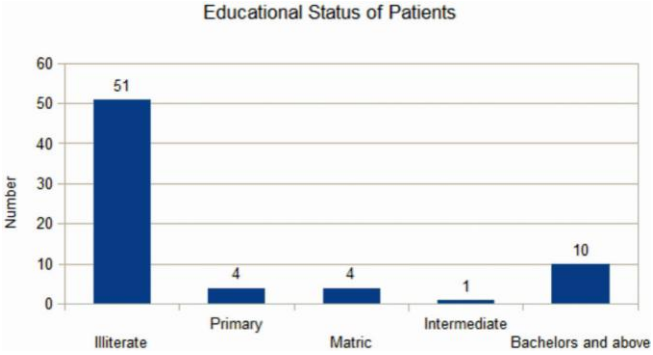

Fig. 3: *Education.*

Descriptive Statistics

More than quarter (27.1%) of the patients had no motor deficits and the most affected myotome was right L5 (n = 16, % = 22.6). The overall range of pre-operative muscle power was 0-5 (Table 2). Nearly half (44.3%) had no sensory deficit in preoperative period. The most commonly affected dermatome before surgery was Left S1 (n = 11, % = 15.7), where 8 had complete losses of sensation and 3 had diminished sensation. In total 23 (32.9%) had lost sensation and 15 (21.4%) had diminished sensation in their respective affected dermatomes because of nerve compression by herniated disc (Table 3). Fairly right and left side equally had SLR distribution with minimum SLR as 20 and maximum as 80 degrees. Mean SLR value was 52.9 and 50 degrees was the cut off to divide the samples into equal numbers (Table 4). Figure 2.2 shows level of disc herniation as reveled from MRI lumbosacral spine. The most common level of disc herniation was L4-L5 (n = 39, % = 55.7). Level L4-L5 and L5-S1 contributed to 95.7% (n = 67) of total disc herniation (Figure 4). Referring to the sagittal and axial slices of MRIs most common presentation of the herniated disc were prolapse (n = 30) and extrusion (n = 30), both contributing to more than 85% of the presentation (Figure 5).

Table 2: *Pre-operative Affected Myotome and Pre-operative Power.*

S. No.	Myotome	Number	Percentage	Muscle Power by MRC Grade			
				Mean	Median	SD	Range
1.	None	19	27.1	5.0	5.0	0.0	5 – 5
2.	Right L2	1	1.4	3.0	3.0	3.0	3 – 3
3.	Right L5	16	22.9	2.9	3.0	0.9	2 – 4
4.	Right S1	10	14.3	3.0	3.0	0.8	2 – 4
5.	Left L5	9	12.9	2.4	2.0	1.2	0 – 4
6.	Left S1	13	18.6	2.4	3.0	1.1	0 – 4
7.	Total	70	100	3.4	3.0	1.3	0 – 5

Table 3: *Pre-operative Affected Dermatomes and Pre-operative Level of Sensation.*

S. No.	Dermatome	Number	Percentage	Lost	Dimished	Normal
				n (%)	n (%)	n (%)
1.	None	31	44.3	0 (0)	0 (0)	31 (100)
1.	Right L2	1	1.4	0 (0)	1(100)	0 (0)
2.	Right L4	2	2.9	1 (50)	1(50)	0 (0)
3.	Right L5	11	15.7	5 (45.5)	5 (45.5)	1 (9.0)
4.	Right S1	8	11.4	4 (50)	4 (50)	0 (0)
5.	Left L5	6	8.6	5 (83.3)	1 (16.7)	0 (0)
6.	Left S1	11	15.7	8 (72.7)	3 (27.3)	0 (0)
7.	Total	70	100	23 (32.9)	15 (21.4)	32 (45.7)

Table 4: *Pre-operative SLR and pre-operative SLR value.*

S. No.	SLR side	Number	Percentage	SLR value			
				Mean	Median	SD	Range
1.	Right	34	48.6	52.8	50.0	15.0	20 – 80
2.	Left	36	51.4	52.9	55.0	15.7	25 – 75
3.	Total	70	100	52.9	50.0	15.3	20 – 80

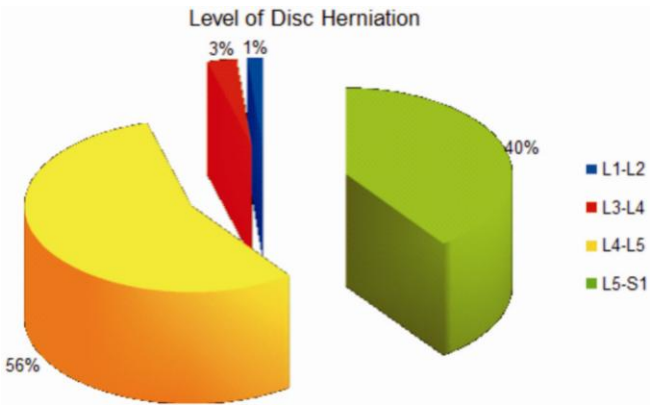

Fig. 4: *Level of Disc Herniation.*

Analytical Statistics

With respect to pre-operative muscle power (mean MRC score 3.4) muscle power substantially increased in 1st (mean MRC score 4.0), 7th (mean MRC score 4.4), 21st (mean MRC score 4.7) and 42nd (mean MRC score 4.7) post-operative days and all MRC scores improvements were statistically significant as compared to preoperative status ($p < 0.001$) (Figure 6). Highest correlation was seen among pre and 1st POD MRC ($r = 0.85$), whereas the least correlation was seen between pre-operative and 42nd follow up day ($r = 0.54$).

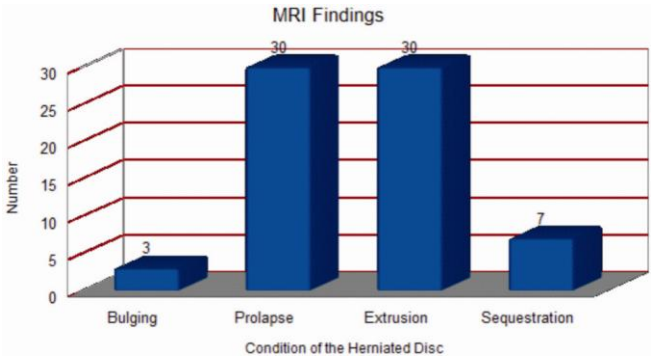

Fig. 5: *MRI Finding.*

Post-operative sensory status significantly improved after the surgery in all post-operative days ($p < 0.001$). Most significant improvement was seen in 1st post-operative day (chi square value 75.9) and in

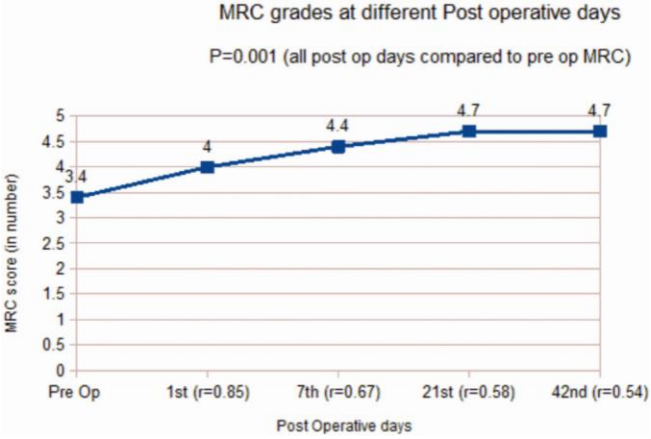

Fig. 6: *Comparison between Pre and Post-operative MRC Grades.*

7th, 21st and 42nd days subsequent improvement were seen but improvement was slow shown by Mc. Neumer's Chi square test but still they were statistically significant as compared to pre-operative status. Half of the patients had normal sensory status on 1st post-operative day which increased to 72.9% at the last follow up (Table 5).

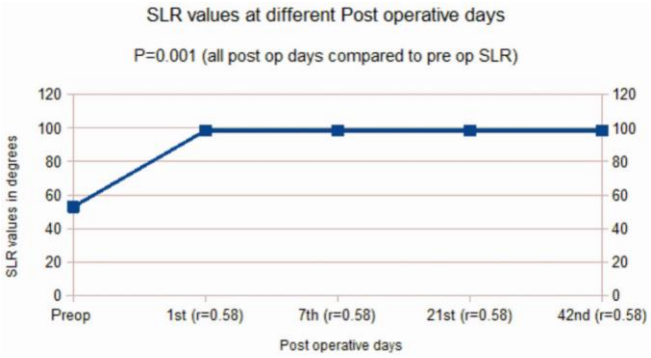

Fig. 7: *Comparison between Pre and Post-operative SLR Values.*

Pre-operative mean SLR was 52.9 degrees whereas mean post-operative SLRs on 1st, 7th, 21st and 42nd post-operative days was 98.6 degrees. The overall improvement which was to be gained was achieved in 1st operative day itself. The improvement in SLR degrees were statistically significant in all post-operative days as compared with preoperative status ($p < 0.001$) (Figure 7). Highest correlation was seen among pre and 1st POD SLR ($r = 0.58$), which was similar in all post-operative days.

DISCUSSION

Mean ± SD of patients in our study was 37.6±13.0 years which were younger than microdiscectomy (47.5 ± 2.0) and open discectomy (41.8 ± 1.1) group of a study by German JW et al[3]. Our patient were relatively younger as compared to another study where average age was 41.2 years[8]. The reason could be low socio-economic status of the patient in Pakistani setting and also much of the people visiting our center are poor and middle class who work as laborers, housewives and other blue collar job.

Main activity that led to LDH was poor lifting technique in our study. Chief complaints were back and leg pain with motor and sensory loss. Out of 10, mean back pain score was 2.8 as compared to 7.0 for leg pain due to sciatica. As like our study Cole JS and Jackson TR found there was minimal back pain but leg pain as compared to them was more in our patients[9].

The most affected muscle group was right L5 myotome with average pre op power 2.9 whereas Left S1 dermatome had majority of lost sensations. Post operatively on 1st day mean muscle power was 4.0 in 1st POD while it was 4.7 in 42nd POD statistical significant improvement from pre-operative status. Sensation improved from 32 (45.7%) normal pre-operative

Table 5: *Comparison between Pre and Post-operative Sensory Statuses.*

Preoperative Sensory Status			Postoperative Sensory Status				Chi sq value	P value
Absent n (%)	Diminished n (%)	Normal n (%)	Day	Absent n (%)	Diminished n (%)	Normal n (%)		
23 (32.9)	15 (21.4)	32 (45.7)	1	15(21.4)	20 (21.4)	35 (50.0)	75.9	< 0.001
			7	3 (4.3)	29 (41.4)	38 (54.3)	48.0	< 0.001
			21	2 (2.9)	25 (35.7)	43 (61.4)	44.6	< 0.001
			42	1 (1.4)	18 (25.7)	51 (72.9)	23.2	< 0.001

P value for Mc. Neumer's Chi square test

sensation to 51 (72.9%) normal sensation at the end of 42nd POD.

Pre-operative SLR values was 52.9 with left preponderance (51.4%). All the improvement was seen in the SLR in the 1st POD itself which did not increase beyond this (98.6%) L4-L5, L5-S1 disc herniation comprised 96% of total PIVD.

Total patient in the current study is 70 whereas Khan Z[16] (microdiscectomy) had 225 samples and Raja RA[17] (open discectomy) had 45 patients. In all 3 studies males were predominant; current (male = 74.3%, female = 25.7%, Khan Z male = 60%, female = 40% and Raja RA male = 64.4%, female = 35.6%). Khan Z didn't mention about the motor weakness preoperatively whereas there are lots of difference in motor weakness between the current study (72.9% weakness) and study by Raja RA (17.8% weakness). Raja RA showed numbness in affected dermatome by 88.9% whereas our study showed sensory loss in only 54.3% patients. In all 3 studies SLR were positive in every case. Majority of patient had pre-operative SLR in between 30 – 60 degree, 77.3% in Khan Z, 64.3% in current study and there is no mention about it in Raja RA study. After the surgery in 1st postoperative day SLR improvement was seen in 88.4% cases in Khan Z and 94.3% in the current study. In all 3 cases most common level of disc herniation were L4-L5 and L5-S1. These 2 levels contributed to 85.8% in Khan Z study, 100% in Raja RA and 95.7% in the current study. Preoperative leg pain was most common in the current study (98.6%) whereas Khan Z had 42% and Raja RA had 69% cases with leg pain. In case of back pain too the current study had the majority of samples (78.6%); Khan Z had 38% patient and Raja RA had 84.4% cases with back pain preoperatively. As we compare 1st post-operative day improvement in the leg pains; 77.1% were improved in the current study whereas 91.5% and 82.2% respectively improved in Khan Z and Raja RA studies. In case of improvement in back pain improvement the current study topped the list with 71.4% improvement with Khan Z having 69.3% and Raja RA showing 50% improvement. In both leg and back pain improvement of 2 or more score in VAS is regarded as improvement.

CONCLUSION

Microdiscectomy is one of the effective procedures which can be adopted for symptomatic unilateral lumber disc herniation with significant improvement in Neurological statuses.

Conflict of Interest

Authors declare no competing financial or non-financial conflict of interest.

The study is not funded by any pharmaceutical company directly or indirectly involved in production of medication, instruments used for the management of this condition.

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