ORIGINAL ARTICLE

Roles of Sociodemographic Characteristics in Determining Neurological Outcomes in Patients with Lumbar Disc Herniation after Microdiscectomy

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ABSTRACT

Introduction: *Socio-demographic characteristics like age, gender, occupation has important role in causation of lumbar disc herniation which may even affect their recovery after the surgery. We want to explore the difference in improvement in Neurological status in terms of difference in socio-demographic characteristics of patients.*

Objective: *To find variation in improvement in Neurological status in post microdiscectomy lumbar disc herniation patient stratified in terms of socio-demographic characteristics.*

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). Comparisons between categorical and continuous variables were done with the help of t test and one way ANOVA and comparison between both categorical variables was done with the help of chi square test in SPSS version 15.*

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. Improvement in motor power, sensory status was not dependent on any of socio-demographic characteristics. Improvement on SLR was associated with male genders on 1st (p = 0.03) as well as 7th, 21st and 42nd PODs (p = 0.001).*

Conclusion: *Except gender in SLR value improvement, no other socio-demographic characteristics alter the improvement status in LDH patient after microdiscectomy.*

Key words: *LDH, Pattern of improvement, 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 purported benefit of the minimally invasive approach is that it would allow patients to recover more quickly because of less tissue trauma.[2] 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.

Socio-demographic characteristics have a great

role in causation of determining lumbar disc herniation. Some have shown females[4.5], laborers[5,6], middle age,[7] illiterates[8] have more chances of having lumbar disc herniation. But majority of studies are inconclusive about the causation on the basses of socio-demographic.[9-11] Regards improvement in the Neurological status in terms of difference in socio-demographic features are only done by few cases.[5,6,8,11]

Rationale

Socio-demographic status like age, gender, occupation has big role in causation of lumbar disc herniation which may even affect their recovery after the surgery. We want to explore the difference in improvement in Neurological status in terms of difference in socio-demographic characteristics.

Objective

To find variation in improvement in Neurological status in post microdiscectomy lumbar disc herniation patient stratified in terms of socio-demographic characteristics.

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%,[12] 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. Comparisons between categorical and continuous variables were done with the help of t test and one way ANOVA and comparison between both categorical variables was done with the help of chi square test. 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). Gender 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

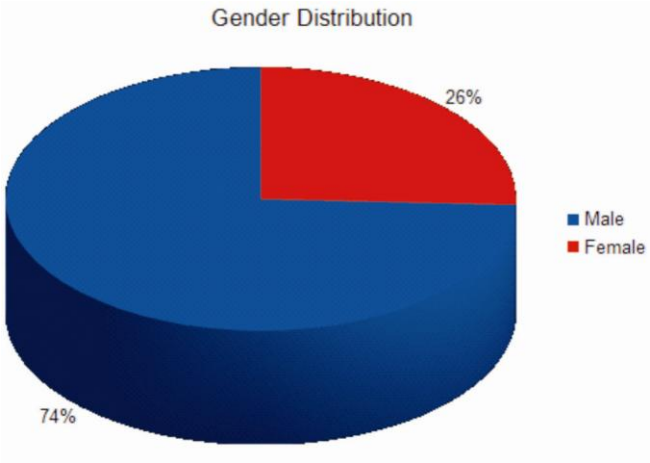

Fig. 1: *Gender Distribution.*

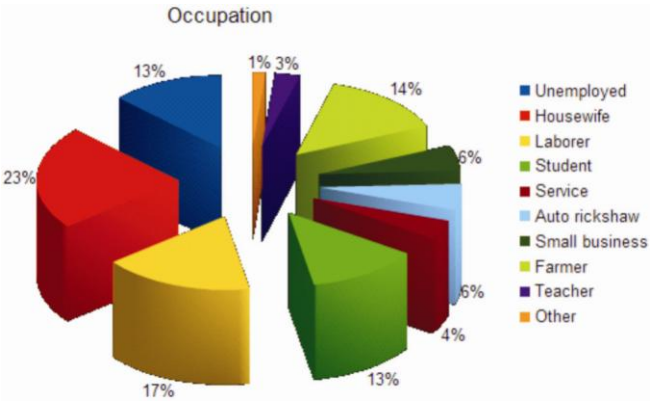

Fig. 2: *Occupation.*

Descriptive Statistics

As measured through VAS mean pain score in the back before surgery was 2.8 and pain score ranged from 0 to 8 (min 0, max 10 in VAS). Median pain score was 2 which showed half of the patient had pain less than 2 (Table 2). Pain intensity in legs were more severe with mean 7 and the score ranged from 0 to 10 and 7 halves the samples into 2 parts with respect to pain intensity in legs where sciatica was seen (Table 3).

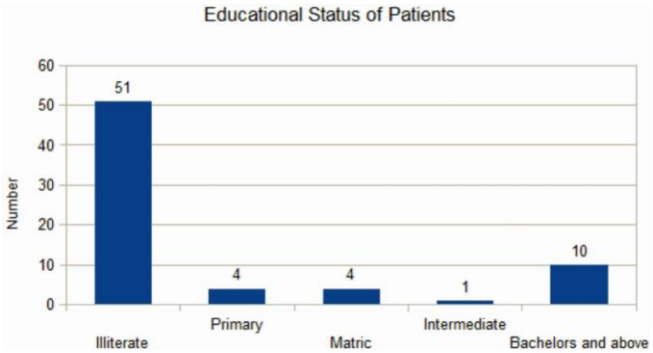

Fig. 3: *Educational Status.*

Table 2: *Pre-operative Back Pain Score by Visual Analogue Scale.*

Mean	Median	Standard Deviation	Range
2.8	2.0	2.1	0 – 8

Table 3: *Pre-operative Back Pain Score by Visual Analogue Scale.*

Mean	Median	Standard Deviation	Range
7.0	7.0	1.5	0 – 10

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 4). 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 5). 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 6).

Analytical Statistics

There was no gender based difference in improvement of MRC grade post operatively whatever be the post-operative day. Numerically males seem to have improved their muscle power in post-operative days but all the findings are statistically insignificant (Figure 4). As the age categories are divided into 14-30, 31-45 and more than 54 years and compared with post-operative MRC score the improvement in all age groups

Table 4: *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 5: *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)
2.	Right L2	1	1.4	0 (0)	1(100)	0 (0)
3.	Right L4	2	2.9	1 (50)	1(50)	0 (0)
4.	Right L5	11	15.7	5 (45.5)	5 (45.5)	1 (9.0)
5.	Right S1	8	11.4	4 (50)	4 (50)	0 (0)
6.	Left L5	6	8.6	5 (83.3)	1 (16.7)	0 (0)
7.	Left S1	11	15.7	8 (72.7)	3 (27.3)	0 (0)
8.	Total	70	100	23 (32.9)	15 (21.4)	32 (45.7)

Table 6: *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

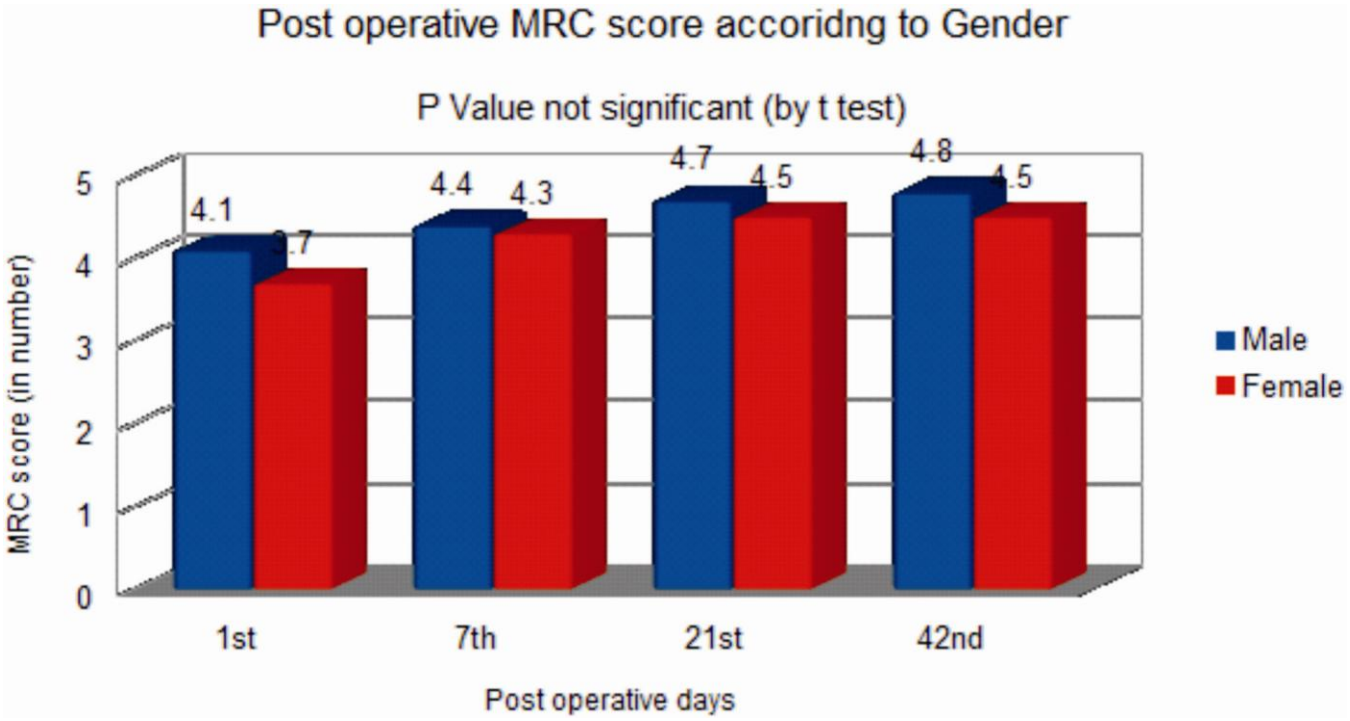

Fig. 4: *Comparison of Postoperative MRC Grades (Myotome's Power) According to Gender.*

are seen but no difference was not statistically significant (Figure 5). No statistical difference was seen as postoperative MRC score were compared with patients' educational status (Figure 6), Occupation (Figure 7).

Postoperatively improvement in sensory status

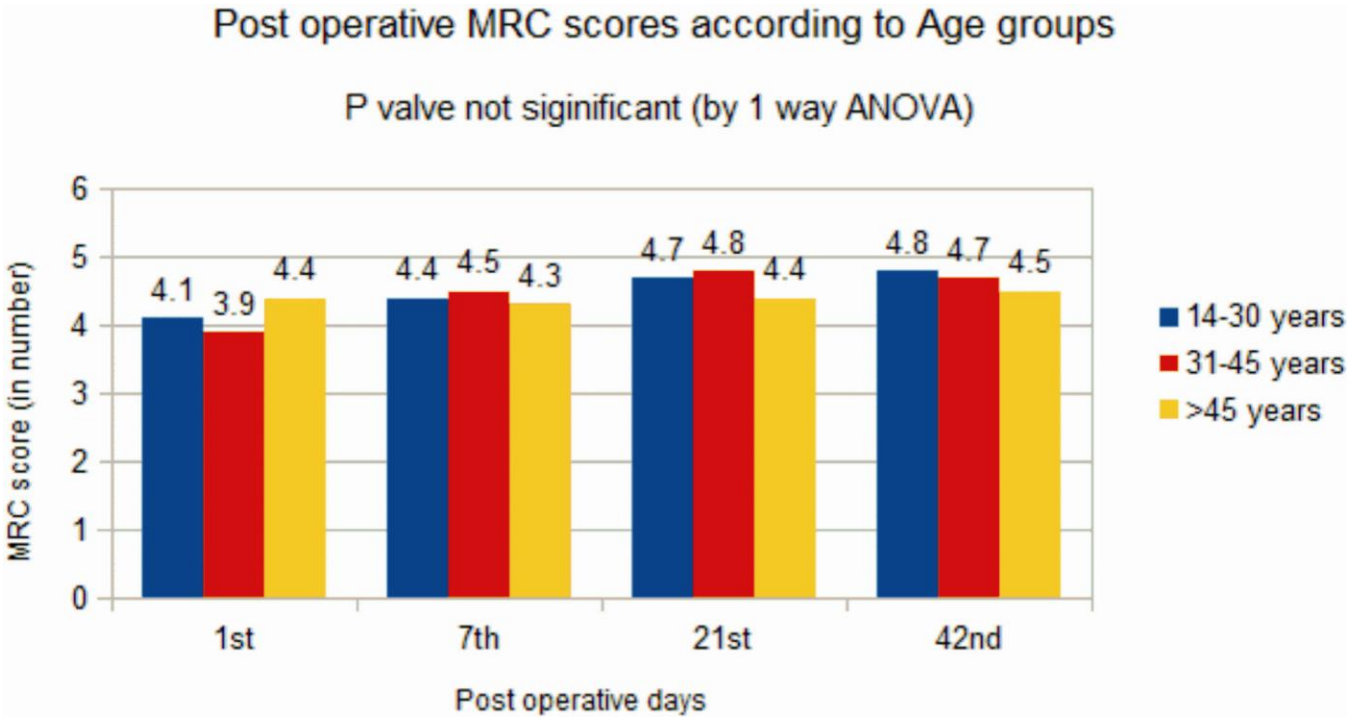

Fig. 5: *Comparison of Postoperative MRC Grades (Myotome's Power) According to Age.*

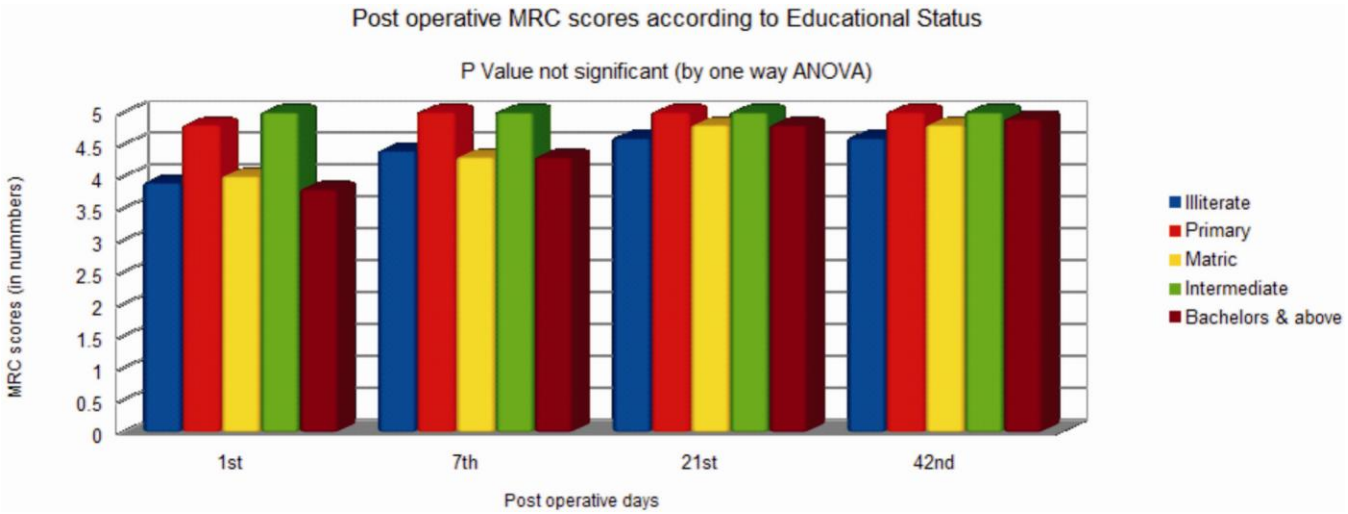

Fig. 6: *Comparison of Postoperative MRC Grades (Myotome's Power) According to Education.*

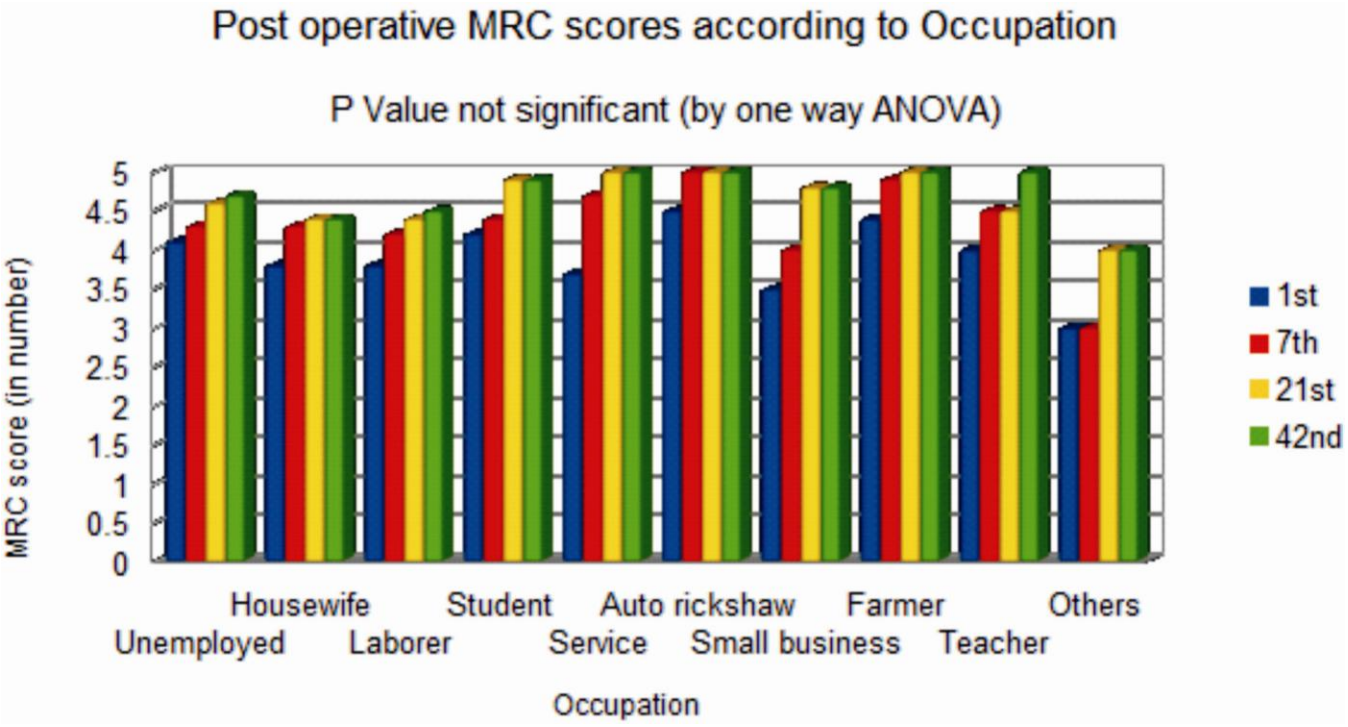

Fig. 7: *Comparison of Postoperative MRC Grades According to Occupation.*

(dermatomal deficits) were statistically not significant with gender (Table 7), Age groups (Table 8), Education status (Table 9), Occupation (Table 10), which means improvement in sensory status is not dependent on these variables.

Improvement in SLR was depended on gender, where male has higher means SLR value improvement than their female counter parts (1st post-operative day $p = 0.03$; 7th, 21st and 42nd post-operative day $p < 0.001$) (Table 11). Improvement in SLR postoperatively was not dependent on Age (Table 12), Education (Table 13) and Occupation (Table 14).

Table 7: *Comparison of Postoperative Sensory Status (Dermatomal Status) According to Gender.*

Gender n (%)	Postoperative Sensory Status				Chi sq value	P-value
	Day	Absent n (%)	Diminished n(%)	Normal n(%)		
Male	1	12 (17.1)	14 (20.0)	26 (37.1)	0.45	0.8
Female		3 (4.3)	6 (8.6)	9 (12.9)		
Male	7	2 (2.9)	22 (31.4)	28 (40.0)	0.14	0.93
Female		1 (1.4)	7 (10.0)	10 (14.3)		
Male	21	1 (1.4)	19 (27.1)	32 (45.7)	0.66	0.72
Female		1 (1.4)	6 (8.6)	11 (15.7)		
Male	42	0 (.0)	14 (20.0)	38 (54.3)	3.0	0.22
Female		1 (1.4)	4 (5.7)	13 (18.6)		

P value for Pearson's Chi square test

Table 8: *Comparison of Postoperative Sensory Status (Dermatomal Status) According to Age.*

Age Group (Years)	Postoperative Sensory Status				Chi sq value	P-value
	Day	Absent n (%)	Diminished n (%)	Normal n (%)		
14 – 30	1	7 (10)	3 (4.3)	12 (17.1)	7.0	0.14
41 – 45		5 (7.1)	13 (18.6)	12 (17.1)		
> 45		3 (4.3)	4 (5.7)	11 (15.7)		
14 – 30	7	2 (2.9)	8 (11.4)	12 (17.1)	5.3	0.25
41 – 45		0 (0.0)	16 (22.9)	14 (20.0)		
> 45		1 (1.4)	5 (7.1)	12 (17.1)		
14 – 30	21	1 (1.4)	9 (12.9)	12 (17.1)	3.2	0.51
41 – 45		0 (0.0)	12 (17.1)	18 (25.7)		
> 45		1 (1.4)	4 (5.7)	13 (18.6)		
14 – 30	42	1 (1.4)	4 (5.7)	17 (24.3)	5.3	0.25
41 – 45		0 (0.0)	11 (15.7)	19 (27.1)		
> 45		0 (0.0)	3 (4.3)	15 (21.4)		

P value for Pearson's Chi square test

Table 9: *Comparison of Postoperative Sensory Status (Dermatomal Status) According to Education.*

Day	Education	Postoperative Sensory Status			Chi sq Value	P-value
		Absent n (%)	Diminished n (%)	Normal n (%)		
1	Illiterate	10 (14.3)	13 (18.6)	28 (40.0)	8.1	0.43
	Primary	1 (1.4)	0 (0.0)	3 (4.3)		
	Matric	1 (1.4)	2 (2.9)	1 (1.4)		

	Intermediate	0 (0.0)	0 (0.0)	1 (1.4)		
	Bachelors and above	3 (4.3)	5 (7.1)	2 (2.9)		
7	Illiterate	2 (2.9)	20 (28.6)	29 (41.4)	9.5	0.30
	Primary	0 (0.0)	1 (1.4)	3 (4.3)		
	Matric	1 (1.4)	1 (1.4)	2 (2.9)		
	Intermediate	0 (0.0)	0 (0.0)	1 (1.4)		
	Bachelors and above	0 (0.0)	7 (24.1)	3 (7.9)		
21	Illiterate	2 (2.9)	16 (22.9)	33 (47.1)	4.7	0.79
	Primary	0 (0.0)	1 (1.4)	3 (4.3)		
	Matric	0 (0.0)	2 (2.9)	2 (2.9)		
	Intermediate	0 (0.0)	0 (0.0)	1 (1.4)		
	Bachelors and above	0 (0.0)	6 (8.6)	4 (5.7)		
42	Illiterate	1 (1.4)	13 (18.6)	37 (52.9)	2.1	0.97
	Primary	0 (0.0)	1 (1.4)	3 (4.3)		
	Matric	0 (0.0)	2 (2.9)	2 (2.9)		
	Intermediate	0 (0.0)	0 (0.0)	1 (1.4)		
	Bachelors and above	0 (0.0)	2 (2.9)	8 (11.4)		

P value for Pearson's Chi square test

Table 10: *Comparison of Postoperative Sensory Status According to Occupation.*

Day	Occupation	Postoperative sensory status			Chi sq Value	P-value
		Absent n (%)	Diminished n(%)	Normal n(%)		
1	Unemployed	2 (2.9)	2 (2.9)	5 (7.1)	17.5	0.49
	Housewife	2 (2.9)	5 (9.1)	9 (12.9)		
	Laborer	4 (5.7)	2 (2.9)	6 (8.6)		
	Student	3 (4.3)	1 (1.4)	5 (7.1)		
	Service	1 (1.4)	2 (2.9)	0 (0.0)		
	Auto rickshaw	1 (1.4)	1 (1.4)	2 (2.9)		
	Small business	1 (1.4)	2 (2.9)	1 (1.4)		
	Farmer	1 (1.4)	2 (2.9)	7 (10.0)		
	Teacher	0 (0.0)	2 (2.9)	0 (0.0)		
	Others	0 (0.0)	1 (1.4)	0 (0.0)		
7	Unemployed	1 (1.4)	3 (4.3)	5 (7.1)	10.5	0.91
	Housewife	1 (1.4)	5 (7.1)	10 (14.3)		
	Laborer	0 (0.0)	6 (8.6)	6 (8.6)		
	Student	1 (1.4)	3 (4.3)	5 (7.1)		

	Service	0 (0.0)	2 (2.9)	1 (1.4)		
	Auto rickshaw	0 (0.0)	2 (2.9)	2 (2.9)		
	Small business	0 (0.0)	2 (2.9)	2 (2.9)		
	Farmer	0 (0.0)	2 (2.9)	0 (0.0)		
	Teacher	0 (0.0)	2 (2.9)	0 (0.0)		
	Others	0 (0.0)	1 (1.4)	0 (0.0)		
21	Unemployed	1 (1.4)	1 (1.4)	7 (10.0)	12.8	0.80
	Housewife	1 (1.4)	4 (5.7)	11 (15.7)		
	Laborer	0 (0.0)	6 (8.6)	6 (8.6)		
	Student	0 (0.0)	4 (5.7)	5 (7.1)		
	Service	0 (0.0)	2 (2.9)	1 (1.4)		
	Auto rickshaw	0 (0.0)	2 (2.9)	2 (2.9)		
	Small business	0 (0.0)	2 (2.9)	2 (2.9)		
	Farmer	0 (0.0)	2 (2.9)	8 (11.4)		
	Teacher	0 (0.0)	1 (1.4)	1 (1.4)		
	Others	0 (0.0)	1 (1.4)	0 (0.0)		
42	Unemployed	0 (0.0)	1 (1.4)	8 (11.4)	13.2	0.78
	Housewife	1 (1.4)	4 (5.7)	11 (15.7)		
	Laborer	0 (0.0)	5 (7.1)	7 (10.0)		
	Student	0 (0.0)	1 (1.4)	8 (11.4)		
	Service	0 (0.0)	1 (1.4)	2 (2.9)		
	Auto rickshaw	0 (0.0)	1 (1.4)	3 (4.3)		
	Small business	0 (0.0)	2 (2.9)	2 (2.9)		
	Farmer	0 (0.0)	1 (1.4)	9 (12.9)		
	Teacher	0 (0.0)	1 (1.4)	1 (1.4)		
	Others	0 (0.0)	1 (1.4)	0 (0.0)		

P value for Pearson's Chi square test

Table 11: *Comparison of Postoperative SLR Values According to Gender.*

Gender	Day	Mean	t test value	P value
Male	1	99.0	4.8	0.03
Female		97.2		
Male	7	100.0	13.4	0.001
Female		98.3		
Male	21	100.0	13.4	0.001
Female		98.3		
Male	42	100.0	13.4	0.001
Female		98.3		

P value for independent sample t – test

Table 12: *Comparison of Postoperative SLR Values According to Age*

Age (years)	Day	Mean	F value	P value
14 – 30	1	97.3	0.16	0.85
31 – 45		99.3		

>45		98.9		
14-30	7	98.6	0.23	0.79
31-45		100.0		
>45		100.0		
14-30	21	98.6	0.73	0.49
31-45		100.0		
>45		100.0		
14-30	42	98.6	0.65	0.52
31-45		100.0		
>45		100.0		

P value for independent sample one way ANOVA

Table 13: *Comparison of Postoperative SLR Values According to Education.*

Education	Day	Mean	F value	P value
Illiterate	1	98.6	0.75	0.57
Primary		100		
Matric		100		
Intermediate		70		
Bachelors and above		100		
Illiterate	7	99.4	0.39	0.81
Primary		100		
Matric		100		
Intermediate		100		
Bachelors and above		100		
Illiterate	21	99.4	0.32	0.87
Primary		100		
Matric		100		
Intermediate		100		
Bachelors and above		100		
Illiterate	42	99.4	0.37	0.83
Primary		100		
Matric		100		
Intermediate		100		
Bachelors and above		100		

P value for one way ANOVA

Table 14: *Comparison of Postoperative SLR Values According to Occupation.*

Occupation	Day	Mean	F value	P value
Unemployed	1	100.0	0.57	0.82
Housewife		96.9		
Laborer		100.0		
Student		96.7		
Service		100.0		
Auto rickshaw		100.0		
Small business		100.0		
Farmer		98.0		
Teacher		100.0		
Others		100.0		
Unemployed	7	100.0	0.69	0.72
Housewife		98.1		
Laborer		100.0		
Student		100.0		
Service		100.0		
Auto rickshaw		100.0		
Small business		100.0		
Farmer		100.0		
Teacher		100.0		
Others		100.0		
Unemployed	21	100.0	0.59	0.80
Housewife		98.1		
Laborer		100.0		
Student		100.0		
Service		100.0		
Auto rickshaw		100.0		
Small business		100.0		
Farmer		100.0		
Teacher		100.0		

Others		100.0		
Unemployed	42	100.0	0.59	0.80
Housewife		98.1		
Laborer		100.0		
Student		100.0		
Service		100.0		
Auto rickshaw		100.0		
Small business		100.0		
Farmer		100.0		
Teacher		100.0		
Others		100.0		

P value for one way ANOVA

DISCUSSION

Our study showed only male gender benefited significantly in improving post-operative SLR valve as compared to female gender. All other socio-demographic features had no significant difference in determining improvement of neurological status after microdiscectomy. They all improved as compared to preoperative status but post-operative comparisons among their categories yielded no significance.

The most common cause of sciatica is lumbar disc herniation (LDH).[13,14] Sciatica prevalence, reported from different studies, ranges from 1.2% to 43%.[15] The pooled sensitivity of the straight leg raising test is estimated to be 91% with a corresponding pooled specificity of 26%.[16] The only test with a high specificity is the crossed SLR test with a pooled specificity of 88% but the sensitivity is only 29%.[16]

Socio-demographic characteristics have a great role in causation of determining lumbar disc herniation. Some have shown females,[4.5] laborers,[5,6] middle age,[7] illiterates[8] have more chances of having lumbar disc herniation. But majority of studies are inconclusive about the causation on the basses of socio-demographic.[9-11] Regards improvement in the Neurological status in terms of difference in socio-demographic features are only done by few cases.[5,6,8,11]

A study from US from New York showed forty-nine patients underwent minimally invasive discectomy, and 123 patients underwent open microsurgical discectomy. At baseline the groups did differ significantly with respect to age, but did not differ with respect to height, weight, sex, body mass index, level of radiculopathy, side of radiculopathy, insurance status, or type of preoperative analgesic use. No statistically significant differences were identified in operative time, rate of cerebrospinal fluid leak or need for a physical therapy consultation.

There is no difference in our setting may be because irrespective of age, gender, education and occupation; the cause that trigger's disc prolapse are simile to all patients. Some activities that may lead to LDH are; repetitive activities, trauma, bad posturing etc. The socio-culture factors of the country may be evenly distributed among all the patients.

In terms of age, disc prolapse should be more[7] according to literature but in our setting it is not. May be because many don't seek medical help or those who seek help may present in late stages that already have caudal equina syndrome or listhesis. In terms of gender, there was male preponderance in improvement. It may be because Pakistan is a male dominated country; they will get proper nutrition, post-operative care and seek better health care than female. It may be also because nature of prolapse may be better than those presented by females.

Irrespective of education, the outcomes is similar after the surgery in LDH patients. Either many social, cultural or other factors have acted by as confounders so the education status had no role in determining difference in the outcomes.

Occupation definitely needs to have some role in the ethology because the occupation defines activity and there are certain activities which lead to LDH. But again there is no association post operatively between occupation and outcome.

CONCLUSION

Except gender in improvement of SLR value in post-operative period, no other socio-demographic characteristics alters the improvement status in LDH patient after microdiscectomy.

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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REFERENCES

1. Osterman H, Seitsalo S, Karppinen J, et al. Effectiveness of microdiscectomy for lumbar disc herniation: a randomized controlled trial with 2 years of follow-up. *Spine*, 2006; **31**: 2409–14.
2. Lau D, Han SJ, Lee JG, Lu DC, Chou D. Minimally invasive compared to open microdiscectomy for lumbar disc herniation. *J Clin Neurosci.* 2011; 18 (1): 81-4.
3. German JW, Adamo MA, Hoppenot RG, et al. Perioperative results following lumbar discectomy: comparison of minimally invasive discectomy and standard microdiscectomy. *Neurosurg Focus*, 2008; **25**: E20.
4. Chi JH, Dhall SS, Kanter AS, et al. The mini-open transpedicular thoracic discectomy: surgical technique and assessment. *Neurosurg Focus*, 2008; **25**: E5.
5. Righesso O, Falavigna A, Avanzi O. Comparison of open discectomy with microendoscopic discectomy in lumbar disc herniations: results of a randomized controlled trial. *Neurosurg*. 2007; **61**: 545–9.
6. Nowitzke AM. Assessment of the learning curve for lumbar microendoscopic discectomy. *Neurosurg.* 2005; **56**: 755–62.
7. Wu X, Zhuang S, Mao Z, et al. Microendoscopic discectomy for lumbar disc herniation: surgical technique and outcome in 873 consecutive cases. *Spine*, 2006; **31**: 2689–94.
8. Harrington JF, French P. Open versus minimally invasive lumbar microdiscectomy: comparison of operative times, length of hospital stay, narcotic use and complications. Minim Invasive *Neurosurg*. 2008; **51**: 30–5.
9. Cole JS, Jackson TR. Minimally invasive lumbar discectomy in obese patients. *Neurosurg.* 2007; **61**: 539–44.
10. Ryang YM, Oertel MF, Mayfrank L, et al. Standard open microdiscectomy versus minimal access trocar microdiscectomy: results of a prospective randomized study. *Neurosurg*. 2008; **61**: 174–82.
11. Arts MP, Peul WC, Brand R, et al. Cost-effectiveness of microendoscopic discectomy versus conventional open discectomy in the treatment of lumbar disc herniation: a prospective randomized controlled trial. *BMC Musculoskelet Disord*. 2006; **7**: 42.
12. Postacchini F, Giannicola G, Cinott Gi. Recovery of motor deficits after microdiscectomy for lumbar disc herniation. *J Bone Joint Surg*. 2002; **84**: 1040-5.
13. Leeuw M, Goossens MEJB, Linton SJ, Crombez G, Boersma K, Vlaeyen JWS. The fear-avoidance model of musculoskeletal pain: current state of scientific evidence. *Journal of Behavioral Medicine*, 2007; 30 (1): 77-94.
14. Lundberg M, Frennered K, Hagg O, Styf J. The impact of fear-avoidance model variables on disability in patients with specific or nonspecific chronic low back pain. *Spine.* Sep. 1 2011; 36 (19): 1547-1553.
15. Celestin J, Edwards RR, Jamison RN. Pretreatment psychosocial variables as predictors of outcomes following lumbar surgery and spinal cord stimulation: a systematic review and literature synthesis. *Pain Medicine.* May-Jun. 2009; 10 (4): 639-653.
16. Deville WL, van der Windt DA, Dzaferagic A, Bezemer PD, Bouter LM. The test of Lasegue: systematic review of the accuracy in diagnosing herniated discs. *Spine*, 2000; **25** (9): 1140-1147.

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