Study of Clinical Variables Affecting Long Term Outcome after Microdisectomy for Lumbar Disc Herniation.

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ABSTRACT

Background

Outcome of lumbar disc herniation are influenced by various clinical, socioeconomic and psychological factors. In the absence of provision of medical insurances, worker's compensation and sick leave, predictors for outcome after lumbar disc herniation surgery will be different in Nepalese population.

Objective

To evaluate different clinical variables that can affect outcome after lumbar disc herniation surgery.

Method

Among 88 patients who underwent microdisectomy for lumbar disc herniation, 63 patients (43 male, 20 female) with follow up at least six months were retrospectively evaluated for clinical variables which can affect Oswestry disability index (ODI) score, its interpretation and Mcnab classification of post operative outcome.

Result

Average age of patients was 42.54±8.60 years. Mean follow up period was 34.89±23.80 months (range 6 -111 months). Thirty four patients had follow up period > 24 months. Mean ODI score before surgery and at final follow up was 37.87±8.76 vs 7.78±7.7; (p=0.00). Success rate was 90.47% (change in ODI score at least by 10), 93.65% (ODI score interpretation <40%), and 85.71%. (Mcnab outcome excellent and good). Significant correlation was found between age and ODI at final follow up but not with duration of symptoms. Male, non alcoholic, low level of education, numbness as a predominant symptom, disc at L4-L5 were significantly associated with better ODI at final follow up. For ODI score interpretation, gender, smoking habit, presence of leg pain as a predominant symptom were statistically significant factors whereas smoking and drinking habit, level of education, occupation, back pain and numbness as predominant pre-operative symptom, types of disc in MRI were significantly related to Mcnab outcome. There was 9.5% peri- or post-operative complications and recurrence in seven patients.

Conclusion

Age, gender, smoking and drinking habit, level of education, occupation, types of disc in MRI are important variables for ODI score, ODI score interpretation and Mcnab outcome.

KEY WORDS

Lumbar disc herniation, microdisectomy, oswestry disability index, sciatica

INTRODUCTION

Lumbar disc herniation (LDH) is one of the most common reason of sciatica. Though more than 90% of LDH improves with non-surgical treatment, lumbar vertebral discectomy is one of the most commonly performed procedures in spinal surgeries.[1] Surgery of LDH has evolved from wide laminectomy and transdural resection of prolapsed disc in 1909 to standard laminotomy and technically demanding procedures like microdiscectomy, micro-endoscopic discectomy and percutaneous endoscopic discectomy at present era.[2] Conventional open discectomy and microdiscectomy are two commonly performed technique of lumbar disc herniation surgery in Nepal.

Both long term and short term outcome after LDH surgery has been reported in great detail by various author. Weber H et al. showed that patient with operative treatment had better outcome at one year follow up but not at four years as compared to non operatively managed patients.[3] But recent studies with follow up to 10 years contradict Weber's finding and revealed better outcome with operative treatment.[4-6] All of these studies, based upon western population, have found three important variables; medical insurances, worker's compensation and sick leave as important predictors of outcome after LDH surgery.[7,8] But these predictors are not present among Nepalese population because of different social, economic and cultural factors. Hence, it can be assumed that predictors for outcome after LDH surgery will be different in Nepalese population. Among three published Nepalese articles on LDH surgery, only two have mentioned outcome after surgery after follow up period of 6-24 months, but have not analyzed variables that influence outcome.[9-11] The objective of the current retrospective study is to evaluate different clinical variables related to LDH which can affect outcome after LDH surgery.

METHODS

Hospital records of patients, operated for LDH between Jan. 2006 to Dec. 2014 in Dhulikhel Hospital, Kathmandu University Hospital with microdisectomy were retrieved. Patient's demographic details, duration of symptoms, predominant clinical symptoms, type of non-surgical management, type of disc herniation in MRI reports, peri-operative findings and complication were recorded. In subsequent follow up's post-operative complications, reoccurrence or appearance of new symptoms were recorded.

Patients with diagnosis of LDH with typical radiculopathy and/or neurological symptoms (motor or sensory or reflexes), corresponding with MRI findings; had shown no improvement with at least of eight weeks of non surgical management; had undergone microdiscectomy with minimum follow up of six months were included in the study. Non surgical management consisted of one or combination or all of the following; physiotherapy, pharmacotherapy (Non steroidal anti inflammatory drugs, opioids, anti-anxiety drugs, steroids), epidural steroids or selective nerve root block. Patients with established cauda equina syndrome, degenerative disc diseases, previous spine surgery, infective spondylitis, and LDH associated with pregnancy or malignancy were excluded.

Two different measurement tools, Oswestry Disability Index (ODI), patient self-reporting measurement scale and Mcnab classification of post operative outcome, objective assessment by health personal were used for outcome analysis.[12,13] Since patients were not followed up at regular interval, the last follow up was considered as final follow up for analysis ODI and Mcnab outcome. Visual analogue scale (VAS) in 100 and ODI questionnaires were filled by either patient himself/herself or by trained health assistant, not directly involved in study on telephone interview. Nepalese version of ODI was made available only in 2014, which we used for all the patients for pre-operative and final follow up status.[14] We were aware that this could create recall bias but we considered that questionnaires in ODI were very specific about daily life and hence it would not be difficult for patients to recall about pre-operative status even when asked to fill up later on.

Success of surgery was defined as change in ODI score at least by 10 or ODI interpretation less than 40% or Mcnab excellent and good outcome.[7,8] Recurrence was defined as appearance of symptoms of LDH, confirmed by MRI at the same site and level or another level and re-operation was defined for re-surgery for recurrence or any other complication related with index surgery.

Surgical Procedure

All surgeries were performed under general anesthesia on prone position on a radiolucent table following principles of microsurgical technique. After confirmation of level with help of C-arm, skin incision was made; sub-cutaneous tissue and deep fascia was cut and para-spinal muscles reflected subperiosteally and retracted with Casper MLD retractor system. Reconfirmation of level was done with C-arm image before flavotomy and laminotomy, if required. Dural sleeve and nerve root was identified and retracted medially to identify the intervertebral disc. If herniated disc as extruded or sequestrated, disc material was removed and annular tear was identified. If annulus was intact, annulotomy was performed to remove prolapsed disc. No attempts of curettage and removal of nucleus pulposus were done. Nerve root and dural sleeve was explored for any free fragment. Intervertebral disc space was irrigated with 20 ml normal saline to remove any loose fragment. Before closure of the wound, disc space was irrigated with 80 mg gentamicin and 40 mg of triamcelone was instilled around decompressed nerve root and into inter-vertebral foramen. No fat graft or other artificial materials were used to cover exposed dura. Patients were mobilized next day.

Statistical analysis

Statistical analysis was performed by using SPSS software version 20. Data were expressed as mean±SD for descriptive purpose. Mann-Whitney or Kruskall-Wallis test was used to compare means of continuous outcome variable when data distribution was not normal. Wilcoxon rank sum test was used to compare changes in continuous variable within group. Chi square test of independence was used for analysis of relation between two categorical variables. Multiple regression analysis was performed for test of relationship of various clinical variables as predictor for outcome after surgery. Significance level was set at p value ≤ 0.05.

RESULTS

Among 88 patients who underwent microdisectomy for LDH, 63 patients (43 male, 20 female) were followed up with mean follow up period 34.89±23.80 months (range 6-111 months). Thirty four patients had follow up period more than 24 months. Average age of patients was 42.54±8.60 years. Twenty nine patients had LDH at L4-L5; 20 had L5-S1 and multiple level in 14. Magnetic resonance imaging reported protrusion in 20 patients, extrusion in 36 and sequestration in seven.

Mean ODI score and VAS for back pain before surgery and at final follow up were 37.87±8.76 vs 7.78±7.70; (p=0.00) and 93.65±10 vs 21.83±21.40 (p=0.00) respectively. According to two criteria, change in ODI score at least by 10 and ODI interpretation <40%, success rate after microdisectomy was 90.47% and 93.65% respectively. Success rate according to Mcnab classification of post-operative outcome was 85.71%. Leg pain was predominant symptom which improved after surgery (77.5%) followed by back pain and leg pain, numbness and only back pain. Fifty two (82.5%) patients resumed either original or new job. ODI interpretation before surgery and at final follow up is shown in table 1. Three patients have no change and two deteriorated from moderately disabled to cripple in ODI interpretation.

Table 1. ODI score interpretation before surgery and at final follow up.

ODI score interpretation before surgery	ODI score interpretation at final follow up					Total
	Minimal disability	Moderate disability	Severe disability	Crippled	Bed bound	
Minimal disability	0	0	0	0	0	0
Moderate disability	0	3	0	2	0	5
Severe disability	0	1	0	0	0	1
Cripple	22	3	0	0	0	26
Bed bound	22	8	1	1	0	31
Total	44	15	1	3	0	63

Analysis of factor affecting ODI score at final follow up and Mcnab classification of post-operative outcome.

Male patients, non alcoholic status, low level of education, numbness as a predominant symptom before surgery, discectomy at L4-L5 were significantly associated with better ODI at final follow up. For ODI interpretation, gender, smoking habit, presence of leg pain as a predominant symptom were statistically significant factors whereas smoking and drinking habit, level of education, occupation, back pain and numbness as predominant pre-operative symptom, types of disc prolapse in MRI were significantly related to Mcnab outcome.(Table 2) Significant correlation was found between age and ODI at final follow up; Pearson correlation r (61) =-0.41 (p=0.01) and but not with duration of symptoms and ODI at final follow up and r (61) =0.21 (p=0.09).

Multiple regression analysis revealed age, gender, occupation, level of education, smoking habit, back pain as a predominant symptom before surgery, types of disc on MRI and ODI score interpretation before surgery were significant predictors of final ODI score.(Table 3)

There were six (9.5%) peri- or post-operative complications; dural tear, pseudo meningocele one each and two discitis and two wound infections. Seven patients developed recurrence either at same site or contra lateral site or at different level but only two of them underwent re-surgery.

DISCUSSION

Pain perception and response to pain is influenced by socioeconomic, psychological, cultural and incentive related factors which are not similar in different countries and in different group of population. In the absence of important variables such as workman compensation, medical insurance, injury claim and provision of sick leave which has been reported as strong predictors of unsuccessful outcome after LDH surgery, it is important to analyze other factors related to outcome after LDH surgery in Nepalese population.[4-6] Though this is hospital based retrospective study, it provides relevant information related to clinical characteristic of patients which affects outcome after surgery and hence are important for patient counseling before decision on surgery. Since there are no uniform method of assessing outcome in different studies, it is not only difficult to compare different series but also difficult to use one single method to study outcome after surgery for LDH. We used two different outcome measurement tools; ODI score and its interpretation as a patient centred questionnaires and Mcnab classification of post operative outcome score based upon physician assessment. As there was no aim of comparing different methods of outcome assessment tool, both the tools are presented in the preset study.

Outcome after LDH surgery are influenced by multiple factors. The present study revealed male gender,

Table 2. **Analysis between clinical variables and final ODI score, ODI interpretation and Mcnab classification of post operative outcome.**

	Final ODI Score		p	ODI Score interpretation					p	Mcnab outcome				p
Gender	**N**			**Minimal**	**Moderate**	**Severe**	**Cripple**	**Bed Bound**		**E**	**G**	**F**	**P**	
Male	43	5.95±5.3	0.029	35	7	1	0		0.005	15	22	3	3	0.08
Female	20	11.70±10.3		9	8	0	3			2	15	0	3	
Smoking														
Yes	23	9.48±8.14	0.002	21	1	1	0		0.009	10	11	2	0	0.029
No	40	4.83±6.10		23	14	0	3			7	26	1	6	
Drinking														
Yes	7	7.86±7.42	0.028	5	2	0	0		0.558	2	4	1	0	0.031
No	30	6.97±9.34		23	4	1	2			13	13	2	2	
Occasional	26	8.69±5.70		16	9	0	1			2	20	0	4	
Level of education														
Illiterate	8	2.63±1.68	0.021	8	0	0	0		0.194	5	3	0	0	0.026
Literate	30	7.10±6.60		21	8	1	0			7	20	3	0	
College	24	10.25±9.40		15	6	0	3			5	13	0	6	
University	1	10		0	1	0	0			0	1	0	0	
Occupation														
Light	46	8.13±7.90	0.34	31	12	0	3		0.228	12	28	0	6	0.015
Heavy	17	6.82±7.30		13	3	1	0			5	9	3	0	
Management before Surgery														
Physiotherapy and Medicines	49	7.29±7.71	0.32	36	10	0	3		0.119	14	31	1	3	0.069
Physiotherapy and Medicines and epidural or nerve root block	14	9.50±7.88		8	5	1	0			3	6	2	3	
Back pain as predominant symptom														
Yes	28	9±9.20	0.59	20	5	1	2		0.45	3	21	2	2	0.044
No	35	6.80±6.23		24	10	0	1			4	16	1	4	
Leg pain predominant symptom														
Yes	53	6.92±5.70	0.657	37	15	0	1		0.003	15	32	2	4	0.489
No	10	12.30±13.29		7	0	1	2			2	5	1	2	
Numbness predominant symptom														
Yes	5	2.80±4.00	0.026	5	0	0	0		0.504	4	1	0	0	0.05
No	58	8.21±7.80		39	15	1	3			13	36	3	6	
Back and Leg pain predominant symptom														
Yes	14	0.29±4.42	0.15	10	4	0	0		0.724	1	12	1	0	0.079
No	49	7.65±8.49		34	11	1	3			16	25	2	0	
Duration of symptoms														
<6 months	39	7±5.90	0.549	26	12	1	0		0.079	15	19	2	3	0.14
6-12 months	11	5.64±2.50		10	1	0	0			2	9	0	0	
13-24 months	5	14±12.93		3	1	0	1			0	4	0	1	
>24 months	8	10.63±13.60		5	1	0	2			0	5	1	2	
Types of disc in MRI														
Protrusion	20	8.60±7.16	0.30	11	8	0	1		0.334	3	13	0	4	0.03
Extrusion	36	8.11±8.63		26	7	1	2			14	17	3	2	
Sequestration	7	3.71±7.56		7	0	0	0			0	7	0	0	
Disc level														
L4-L5	29	6.76±6.35	0.057	23	5	0	1		0.291	8	19	1	1	0.346
L5-S1	20	11.25±10.09		10	7	1	2			4	12	2	2	
Multilevel	14			11	3	0	0			5	6	0	3	

Table 3. **Multiple linear regression analysis between clinical factor as predictor and final ODI score as outcome.**

Independent variables	Unstandardized Coefficients		Standardized Coefficients	t-test	p value	95% Confidence Interval for B	
	B	Std. Error	Beta			Lower	Upper
Age	-.223	.068	-.367	-3.283	.002	-.360	-.086
Gender	7.827	1.967	.474	3.979	.000	3.867	11.787
Occupation (Light or heavy work)	6.107	2.220	.353	2.751	.008	1.639	10.575
Education (Illiterate, Literate, College, University)	3.028	1.330	.274	2.278	.027	.352	5.704
Smoking	-4.302	2.083	-.269	-2.065	.045	-8.495	-.109
Drinking	-.054	1.155	-.005	-.046	.963	-2.378	2.271
Treatment before surgery (Physiotherapy and Medicines, Physiotherpay and Medicines and Epidural or Nerve Root Block)	2.424	1.991	.128	1.217	.230	-1.584	6.431
Back pain as a predominant symptom	9.648	3.571	.622	2.701	.010	2.459	16.837
Leg pain as a predominant symptom	15.567	3.853	.742	4.040	.000	7.811	23.322
Numbness as predominant symptom	1.038	2.840	.037	.366	.716	-4.678	6.755
Back pain and leg pain as a predominant symptom	-12.213	3.788	-.662	-3.224	.002	-19.837	-4.588
Duration of symptoms (<6 months,6-12 months, 13-24 months, >24 months)	.750	.792	.103	.946	.349	-.845	2.345
Type of MRI findings (Protrusion, extrusion, sequestration)	-3.779	1.728	-.303	-2.186	.034	-7.258	-.300
Disc level (L4-L5,L5-S1,Multiple level)	1.308	1.018	.132	1.285	.205	-.741	3.357
ODI Score interpretation	-4.036	.979	-.421	-4.122	.000	-6.007	-2.065

R^2=0.702, Adjusted R^2=0.607

non-alcoholic, low level of education, LDH at L4-L5 and patient having numbness as a predominant symptoms had significantly better ODI score. However, when ODI score was interpreted for disability, only gender and smoking habit was significant. On the other hand, gender was not significant for Mcnab outcome but smoking and drinking habit, level of education, occupation, back pain as a predominant symptom and types of LDH in MRI were significantly related. According to criteria for minimal important change (MIC), decrease in ODI score by 10 was considered successful outcome. Similarly ODI interpretation <40% and Mcnab's excellent and good outcome were considered successful outcome in the present study. With these criteria success rate was 90.47%, 93.65% and 85.71% respectively with average rate of 89.94% which is comparable to other series. Success rate of LDH surgery has been reported from 49% to 90% by various authors depending upon different measurement tools used, different techniques of surgery and even indications for surgery.[6,15]

Multiple regression analysis revealed age, gender, occupation, education, smoking, back pain and leg pain, types of disc herniation in MRI and pre-operative ODI interpretation scores as significant predictor of final ODI. Detail analysis revealed potential multicollinearity between some predictors. Since the objective of the present study was not to establish equation model for prediction of final ODI, potential multicollinearity can be ignored.

Age is considered as a significant predictor. Asch HL et al. found 6% chances of decrease in likelihood of successful surgery for each additional year in between age 25-56 years.[7] Weber H et al. also reported age is one of the important factor for initial four year of surgery and only one important variable for another next 10 years of surgery.[3] But Nygaard OP et al. did not find age as important variable for clinical overall score after LDH surgery.[16] In the present study, both univariate and multiple regression analysis revealed significant negative correlation between age and final ODI showing better ODI for younger patients.

Gender as a predictor after LDH surgery has been issue of debate. Male patient showed better ODI and gender was significant predictor for final ODI score in the present study. Pain tolerance and coping mechanism towards pain in female was considered different with high threshold leading to delay in seeking treatment. Wilco CP et al. reported female have odds of 2.3 times poor outcome and slow recovery as compared to male. But some studies have found no difference in outcome or even contradict above findings showing better outcome in female.[17,18]

Duration of symptom before surgery is not significant factor in univariate analysis but is the significant predictor of final ODI score. Nygaard OP et al. reported patients operated after 8 months of symptoms have poor outcome, are less likely to resume previous work.[16] In Canada patient who have to wait for >6 months before surgery have poorer outcome than these those who had surgery within three months (30% vs 47%).[19] Average period of symptom before surgery was 13.8 months (range 2 to 12 months) in the present study. Some of the reasons, such as unavailability of health care system, economic constraints and certain misconception regarding spinal surgery are responsible for longer period of symptoms before surgery in Nepal which is unlike longer waiting period (average 51 weeks) because of Canadian health system.[20]

Among many social factors, education and occupation had been found to be related with outcome. We considered physically demanding occupation such as agriculture, plumbing, mechanical works as a heavy work and office works such as officer, teacher, shopkeeper as a light work. Significant relation was found between occupation and Mcnab outcome and was also significant predictor of ODI in regression analysis but not with final ODI score and its interpretation in univariate analysis. It is assumed that patients having heavy loads are vulnerable to have poor outcome.[21] Schoeggl A et al. reported poor outcome in patients with strenuous occupation where as Peul WC et al. did not find any difference in physical job.[2,21] Mcnab outcome was found to be better in the present study with lighter job but had no significant relation with final ODI score and ODI interpretation. Similarly patient with low level of education or illiterates had better ODI score and Mcnab outcome. Larger studies are required to further confirmation whether low level of education is associated to better outcome or not because behavior to pain can be different when illiterate patients are not influenced by incentive related factors or secondary gain. Smoking and drinking has effect on outcome after LDH surgery. Non-alcoholic and non smoker patient performed significantly well in final ODI. Peul WC et al. found smoking as unfavorable factor for LDH surgery but other studies did not find similar findings.[21,22] Dewing CB et al. found delay in returning to work among smoker but have no difference in outcome.[18]

LDH can present with one or combination of various symptoms like radicular pain, numbness, motor or sensory deficits or back pain. Though radicular pain was predominant symptom in the present study, numbness as a predominant symptom was significantly related with final ODI score and Mcnab outcome and radicular leg and back pain was significant predictor of ODI score. Various other variables such as level of LDH, psychological factors, types or technique of surgery can influence outcome. But Carrage EJ et al. emphasized on fragment types found during surgery are important than clinical, social and demographic factors.[23] There can be inter or intra observer reliability variation in interpretation of types of disc prolapsed but extruded disc with small annular defect have lower reherniation (1%) than those with extruded disc with bigger annular defect (27%). Patients with disc protrusion with intact ligament and no detached fragment have more persistent or reoccurrence of sciatic symptoms. Dewing CB et al. also reported better outcome with non contained disc than contained disc which is similar to our study.[18] But Soliman J et al. found no difference in reoccurrence rate between contained and extruded disc protrusion.[4]

Peri and post operative complication after LDH surgery are reported in between 3% to 10% in various series.[24] Two patients who developed post operative discitis in the current study, improved without surgical interventions. Once we started irrigating disc space with gentamicin, we had only one case of discitis. Very few literature are available for use of intraoperative irrigation of antiseptics or antimicrobial solution as a prophylaxis of post operative infection in spine surgery.[25,26] One patient had dural tear and required laminectomy for repair. Incidental dural tear has been reported in 3% case by Pearson AM et al.[27] Re-surgeries for recurrent herniation has been reported 4 to 48% in various series. We have seven patients who developed LDH either at same level or other level but only two required surgery and both of them were at same level. In both cases, index surgery was done before two years of re-surgery. Since various factors can be responsible for or revision of surgery such as age related degenerative changes, occupation, it is difficult to set a time interval up to which one can attribute index surgery for reoccurrence or time related natural changes leading to new herniation at the same site.

Certain techniques which use microscope with tubular retractor for illumination and visualization are better for shorter hospital stay and blood loss but not different in terms of post operative analgesics requirement, ODI, recurrence and re-operation rate as compared to open discectomy. Katayama Y et al. in randomized control study with macro and micro discectomy compared post operative analgesic requirement, functional outcome and VAS score found difference in operation time (40 minute vs 45 minutes), blood loss (29 gm vs 25 gm) hospital stay (8.3 days vs 8.5 days)but none of them were clinically relevant.[28] Shorter hospital stays, less blood loss and operation time are not related with better clinical outcome and not a predictor of reoccurrence sciatica or re-herniation.[12] Choice of micro or macro discectomy should be based upon safety, successful outcome with less complication and reoccurrence and cost. Equal and effective success rate has been reported irrespective of surgical technique as long as correct principle is followed. Technique should be selected depending upon specific type of LDH.[20]

Amount of disc to be removed during discectomy is always debatable. In the absence of well-designed trials, it is extremely difficult to postulate correct amount of disc to be removed without further complications. McGirt MJ et al. have reported lower incidence of reoccurrence (3.5% vs 7%) in aggressive discectomy at cost of higher chance (2.5 times) of back pain than patients with limited discectomy.[29] We do not recommended end plate curettage or removal of entire nucleus pulposus or anterior annular ligament which are considered for responsible of chronic back pain. We routinely used intraoperative epidural steroid in LDH surgery for reduction of post operative pain and convalescence without risk of complication.[30]

CONCLUSION

Age, gender, occupation, level of education, smoking and drinking habit, duration of symptoms before surgery,

numbness of leg as predominate symptom before surgery, types of disc herniation in MRI are important clinical variable which influences outcome assessed by ODI score or ODI interpretation or Mcnab classification of pot operative outcome after micro disectomy for lumbar disc herniation. The findings of the present study, however could not be generalized because population included in the study are university hospital based and many other social and psychological factors could not be included. It provides base line findings for future study with larger cohort involving multiple centers.

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