Volume: 30, Issue: 2, April 2019 pp: 121-126 ORIGINAL ARTICLE

EVALUATION OF THE DEMOGRAPHIC AND SOCIOECONOMIC FACTORS AFFECTING RECURRENCE OF LUMBAR DISC HERNIATION: A PROSPECTIVE STUDY*

Anas ABDALLAH[1]
Mehmet Hakan SEYİTHANOĞLU[1]

[1]*Department of Neurosurgery, Bezmialem Vakif University, Vatan Street, 34093 Fatih, Istanbul, Turkey.*

ORCID Number:
Anas ABDALLAH: 0000-0003-3600-089X
Mehmet Hakan SEYİTHANOĞLU: 0000-0002-6072-0347

*This study was approved under decision number: (14207/2015) by the medical ethics committee of Health Science University, Bakırköy Research and Training Hospital for Neurology Neurosurgery, and Psychiatry (BRSHH) in Istanbul-Turkey.

Address: Department of Neurosurgery, Bezmialem Vakif University, Vatan Street, 34093 Fatih, Istanbul, Turkey.
E-mail: abdallahanas@hotmail.com; aabdallah@bezmialem.edu.tr
Phone: +90 212 523 22 88 / 2175
Cell-Phone: +90 553 223 35 35
Fax: +90 212 453 17 00
Received: 11th October, 2018.
Accepted: 11th March, 2019.

ABSTRACT

Aim: Reherniation is the experience of another lumbar disc herniation (LDH) at the same level and same side after a pain-free period. In this study, socioeconomic factors affecting reherniation after discectomy prospectively have been investigated.

Material and Methods: 816 patients were underwent discectomy surgery at Neurosurgery department of BRSHH between the years 2014 and 2015, the patients who followed up at least 36-month and appropriate to our study criteria were included. The patients' demographic characteristics such as age, gender, job, BMI, clinical presentations were recorded. The patients were divided into who had recurrent LDH (RLDH) and others (control group) and the comparison had been performed between both groups using all above parameters prospectively.

Results: 816 (430 women, 386 men) patients were underwent discectomy for LDH. 842 disc levels were operated. The mean age was 46.9 (17-82). The mean follow-up period was 47.8 (36-61) months. The mean of preoperative leg and back VAS score were 8.9 and 3.1, respectively. The mean of 12th and 24th month postoperative leg and back VAS score were 1.9, 1.64, 1.9, and 1.82, respectively. The mean of preoperative ODI, 12th and 24th month postoperative ODI were 73.3, 15, and 18.2, respectively. Gender, age, symptom's duration, surgery condition and period, trauma, comorbidities, smoking, and early returning to duties are not related to recurrence of LDH in our patients.

Conclusion: Motor deficits on presentation may reduce RLDH risk. Intact neurologic examination may increase the RLDH risk. Select the correct patient may lead to reduce the risk of RLDH.

Key Words: Lumbar disc herniation, recurrent lumbar disc herniation, risk factors, clinical presentation, socioeconomic factors.

Level of Evidence: Prospective clinical study, Level II.

INTRODUCTION

Lumbar disc herniation (LDH) is one of the most common diseases can affect adults. Lumbar discectomy is the most common surgical operation applied for patients with back and low extremity symptoms [6]. The proportion of patients undergoing surgery to treat sciatica from LDH varies from 2 % to 10 % [14]. Despite the fact that most symptomatic patients whom treated with discectomy had recovered from their symptoms, reherniation is still serious entity.

Reherniation is the experience of another LDH at the same level and same side after a pain-free period [7]. Reherniation is a challenging problem for both of neurosurgeon and patient. The rate of reherniation is accounting for 7-26 % of the patients who underwent discectomy surgery [5]. Causes for a recurrent disc can be multifactorial. Several estimated risk factors for RLDH, such as age, gender, job, body mass index, presence of chronic diseases, and herniation type, are increasingly being investigated in previous studies [2-3,9]. However, there was no always consistent between the results of these studies.

In the literature, many reherniation's risk factors had been described [1,7]. In this study, clinical presentations and socioeconomic factors affecting reherniation after discectomy prospectively have been investigated.

MATERIAL AND METHODS

Patient data, study design and study criteria

Medical data and demographic characteristics were prospectively recorded for LDH cases which diagnosed and underwent surgery in Department of Neurosurgery from 2014 to 2015. The patients who underwent only first-time discectomy constituted the core sample for this study.

Inclusion criteria were: 1) patient who underwent surgical discectomy for defined side and level herniated LDH causing refractory radiculopathy (bilateral discectomy to the same level cases were excluded); 2) a diagnosis of sciatica was supported with magnetic resonance imaging (MRI) or computerized tomography (CT) findings in line with predominantly radicular symptoms, such as lower extremity symptoms being greater than back or buttock symptoms; 3) presence of preoperative neurologic deficit or failure of conservative treatment for at least three months; and 4) no age restriction.

Exclusion criteria were: 1) patients who underewent total laminectomy, posterior instrumentation or posterior fusion with arthrodesis inside discectomy; 2) a history of one or more of spinal abnormalities such as scoliosis, kyphosis, spondylolysis, spondylolisthesis, inflammatory arthritis, and metabolic bone disease; 3) a history of any infection or tumor in whole the body; 4) a history of a previous back surgery; 5) patients were operated for an acute LDH casing neurologic deficits (i.e., cauda equina and conus medullaris syndromes); 6) presence of contraindication for performing MRI; 7) patients who underwent bilateral discectomy to the same level; and 8) an extraspinal cause of neurologic deficits or sciatica.

The patients were divided into two groups recurrent LDH (cohort) group and others (control). The comparison had been prospectively performed between both groups using preoperative MRI findings, radiographic parameters and intraoperative LDH types.

816 patients were underwent discectomy surgery at Neurosurgery department of BRSHH between the years 2014 and 2015, the patients who followed up at least thirty-six months and appropriate to our study criteria were included. The patients' demographic characteristics such as age, gender, job, BMI, clinical presentations, chronic diseases, cigarette smoking and pre- and postoperative clinical status had been evaluated via Oswestry Disability Index (ODI) scale and the visual analog scale (VAS) for low back pain and leg pain scores [9]. The patients were divided into who had recurrent LDH (study group) and others (control group) and the comparison had been performed between both groups using all above parameters prospectively.

This prospective study was approved by the medical ethics committee of our hospital under decision number 14207/2015.

Clinical outcomes mesures and patient follow-up

Postoperative clinical outcomes had been evaluated using ODI scale and VAS for low back pain and leg pain scores at early postoperative, 6 weeks, 3, 6, 9, 12, 24, and 36 months after surgery. For patients who were followed up more than 30 months, yearly follow-up was applied. In the case of presence of the same intensity of preoperative pain on early postoperative (< one month), the patients underwent MRI of the lumbar spine with and without gadolinium contrast. If there were residue fragments, the patients were accepted to have residual LDH and were excluded from this study. If the patients had not experienced any new neurological deficits or serious radicular pain similar to their preoperative pain intensity, the patients underwent MRI without gadolinium contrast yearly after surgery. Patients experiencing symptoms indicative for RLDH underwent MRI with and without gadolinium contrast at the time of symptom onset to assess for same-level and same-side reherniation.

Patients were recommended to reoperation only when: 1) same-level and same-side RLDH was present and localized to the patient's recurrent symptoms, and 2) failure of 6 weeks conservative management which followed by foraminal and cuadal steroid injection.

Statistical analysis

All data are expressed as the median or mean ± standard deviation with the range shown in parentheses. Univariate analyses are conducted to examine the association between radiological and histopathological features. Differences between groups were assessed by a one-way analysis of variance (ANOVA) using the SPSS 21.0 statistical package. Significance in the multivariate model was determined using a p value of < 0.05, and trend-level effects were defined as $p = 0.05–0.10$. All p values were presented with an odds ratio (OR). When OR could not be calculated, relative/risk ratio (RR) was calculated. The corresponding 95% confidence intervals (CIs) were obtained. All tests were two tailed.

Surgery

The patient is placed in the prone position on the operation table. Fluoroscopy is used for localization. A 2 to 3 cm midline incision is made. A subperiosteal dissection of tissue from spinous process and lamina on the ipsilateral side is performed. Supraspinous and interspinous ligaments should be preserved. A Taylor retractor is placed. To get better brightness, the operative microscope is brought over the field. Using a high-speed drill or kerrison rongeurs, a hemilaminectomy is performed by drilling the inferior part of the superior level. Ligamentum flavum is removed. If our purpose is preserving the ligamentum flavum to reduce the extent of postoperative adhesion, the superficial layer of the ligament is removed by horizontal splitting. Additional horizontal splitting of the ligament yields a paper-thin deep layer. Lateral vertical splitting and retraction is then carried out to provide a sufficient operative window. The split ligament returns to its original position after releasing the retraction, thereby closing the operative window. So, ligamentum flavum acts as a physical protective barrier. The nerve sleeve and dura are gently retracted medially. The nerve and the thecal sac is padded to preserve it, herniated disc is exposed. The posterior longitudinal ligament and annulus fibrosus are incised and disc material is removed [4].

RESULTS

Patients characteristics and operated levels

816 (430 women, 386 men) patients were underwent discectomy for LDH. 842 disc levels were operated. 58 (30 women, 28 men) patients (7.0 %) were experienced recurrent LDH (study group). The remaining (400 women, 358 men) patients (93.0%) were control group. The mean age was 46.9 (17-82) (Figure-1 and Figure-2).

The mean follow-up period was 47.8 (36-61) months. The most operated level was L4-5 level which was operated on 414 patients from control group versus 39 patients from study group (Figure-3).

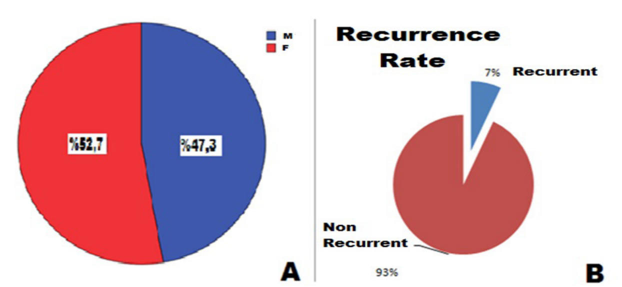

Figure-1. (a) Gender distribution of our operated LDH patients; **(b)** Recurrence rate of our operated LDH patients

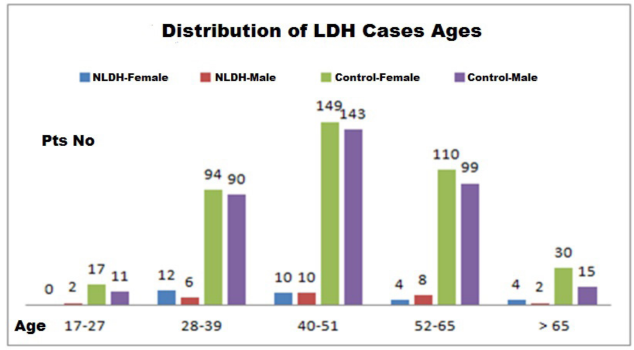

Figure-2. Distribution of LDH cases to age groups.

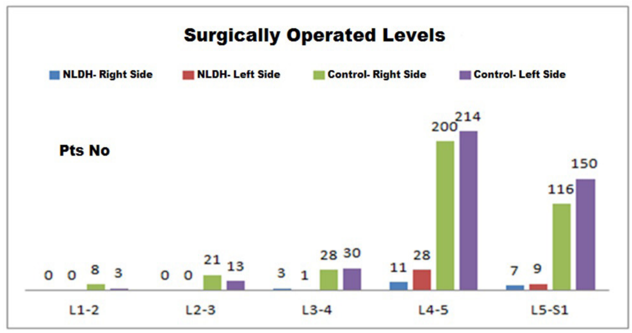

Figure-3. Surgically operated levels.

Clinical presentation, neurological examination, socioeconomic factors (occupational work), and comorbidities

The most common symptom for all patients was leg pain (100 %). Between presenting symptoms there were three symptoms (motor deficit, loss of sensation, and neuropathic pain) showed association with recurrence of LDH. Presentation with motor deficits, loss of sensation, and neuropathic pain are independent risk factors for reducing recurrence of LDH (OR 0.3 (0.2 – 0.6); $p < 0.001$)); (OR 0.3 (0.16 – 0.55); $p < 0.001$)); and (OR 0.42 (0.2 – 0.85); $p = 0.013$)), respectively. Comparison of presenting symptoms between recurrent LDH and control group is given in Table-1.

Motor paresis/plagia, and painful walleix points in neurological examination are independent risk factors for reducing recurrence of LDH (OR 0.3 (0.2 – 0.6); $p < 0.001$)); and (OR 0.35 (0.19 – 0.6); $p < 0.001$)), respectively. Comparison of neurological examination between both groups is given in Table-2.

Cigarette smoking was an independent factor associated with increasing risk of recurrent LDH but only with trend-level significance (OR 1.7 (1.0 – 2.8); $p = 0.07$)). Heavy physical labor leads work (Hard occupational) was an independent factor associated with increasing risk of recurrent LDH but only with trend-level significance (OR 0.6 (0.35 – 1.1); p = 0.097)). Comparison of socioeconomic factors and comorbidities is given in Table 3. Gender, age, symptom's duration, surgery condition (urgent vs elective) and surgical duration, history of trauma, comorbidities, smoking, and early returning to occupational works are not related to recurrence of LDH in our patients.

Table-1. Comparison of demographic characteristics and presenting symptoms between recurrent LDH and control group.

	Is there recurrent LDH?					
	Yes		**No**		**t**	**P**
Age (M±SD)	46.2	11.9	47.0	12.1	0.688	0.968
Clinic Course (M±SD)*	26.4	36.3	33.0	49.6	0.582	0.296
Follow Up (M±SD)*	47.9	7.7	47.8	7.2	0.588	0.680
	N	**%**	**N**	**%**	**X^2**	**P**
Gender						
Female	30	51.7	400	52.8	FET	0.892
Male	28	48.3	358	47.2		
Symptoms						
1. Leg pain	58	100	758	100	0.000	1.000
2. Low back pain	50	86.2	711	93.8	0.543	0.46
3. Loss of sensation	19	32.8	457	60.3	11.22	***< 0.001***
4. Motor deficit	13	22.4	377	49.7	13.57	***< 0.001***
5. Neuropathic pain	10	17.2	251	33.0	6.88	***0.013***
6. Loss of sphincter	5	8.6	42	5.5	1.34	0.25
7. ECS	3	5.2	29	3.8	0.44	0.51

p>0,05; M: Mean; SD: standard deviation; N: number of patients * Clinic course and follow-up period were given in months; ECS: equina cauda syndrome, t: t test, X^2: Chi-Square test, FET: Fisher's exact test

Table-2. Comparison of findings in neurological examination between recurrent LDH and control group.

	Is there recurrent LDH?					
	Yes		**No**		**t**	**P**
Age (M±SD)	46.2	11.9	47.0	12.1	0.688	0.968
Clinic Course (M±SD)*	26.4	36.3	33.0	49.6	0.582	0.296
Follow Up (M±SD)*	47.9	7.7	47.8	7.2	0.588	0.680
	N	**%**	**N**	**%**	**X^2**	**P**
Finding						
1. Straight leg test	47	81.0	517	68.2	2.382	0.12
2. Hypoesthesia	31	53.4	445	58.7	0.414	0.52
3. Walleix points (+)	16	30.2	406	53.6	9.01	***< 0.001****
4. Motor deficit	13	22.4	377	49.7	15.12	***< 0.001****
5. Contra-laseque	9	15.5	67	8.8	4.16	1.0
6. Loss of sphincter	5	8.6	42	5.5	1.34	0.25
7. Atrophy	0	0.0	21	2.8	0.014	0.91
8. No finding	4	6.9	21	2.8	FET	0.1

p>0,05; M: Mean; SD: standard deviation; N: number of patients * Clinic course and follow-up period were given in months; ECS: equina cauda syndrome; Walleix point (+): painful walleix points; Contra-laseque: straight leg test positive on the opposite side; Motor paresis/plagia, and painful walleix points in neurological examination are independent risk factors for reducing recurrence of LDH.
X^2: Chi-Square test
FET: Fisher's exact test

Table-3. Comparison of occupational work, smoking cigarette, obesity (body mass index), history of trauma, and chronic diseases between recurrent LDH and control group.

	Is there recurrent LDH?					
	Yes		No			
	N	%	N	%	X^2	P
Occupational Work						
1. Housewife	24	41.4	298	39.32	0.094	0.76
2. Slogger (Hard)	18	31.0	324	42.74	2.848	**0.097***
3. Conform work	16	27.6	152	17.94	4.334	0.18
Smoking cigarette						
Yes	31	53.4	447	58.97	FET	**0.07***
No	27	46.6	311	41.03		
BMI(M±SD)	25.13	3.07	25,23	2.88	0.0104	0.919
DM	11	19.0	107	14.11	FET	0.110
HT	13	22.4	253	33.38	FET	0.331
Thyroid dysfunction	8	13.7	91	12.0	FET	0.676
CAD	5	8.6	96	12.66	FET	0.533

p>0,05; M: Mean; SD: standard deviation; N: number of patients; CAD, coronary artery diseases; DM, diabetes mellitus; HT, hypertension; BMI: body mass index; * Cigarette smoking and hard occupational works were independent factors associated with increasing risk of recurrent LDH but only with trend-level significance.
X^2: Chi-Square test
FET: Fisher's exact test

Surgical Outcomes

The mean of preoperative leg and back VAS score were 8.9 (7-10) and 3.1 (1-6), respectively. The mean of 12th and 24th month postoperative leg and back VAS score were 1.9 (1-3), 1.64 (0-4), 1.9 (1-3), and 1.82 (0-5), respectively. The mean of preoperative ODI, 12th and 24th month postoperative ODI were 73.3 (52-88), 15 (0-24), and 18.2 (0-26), respectively.

DISCUSSION

In the neurosurgical practice the lumbar microdiscectomy is the most commonly used surgical approach. It is a safe and effective procedure when symptomatic herniated lumbar disc is found. The aim of our prospective study was to investigate the relation between demographic characteristics as risk factors for RLDH. Previously published studies have explored many potential risk factors for RLDH, such as age, gender, BMI, smoking, chronic diseases such as diabetes, type of LDH, occupational work [1-3,5,7,9,14].

Recently published systematic metaanalysis showed that smoking, disc protrusion, and diabetes had significantly association with RLDH [7]. The exact mechanism of smoking how leads to RLDH is still incompletely understood. Some studies have suggested the potential mechanism. Toxins generated by cigarette smoking may impair or delay tissue repairing which is a normal condition [7,11]. After discectomy procedure, healing of annular defects in normal physiological condition is usual, but with smoking the defect in the annulus fibrosus and posterior longitudinal ligament may be delayed with cigaratte smoking. One study showed that nicotine affected disc annulus nutrition and oxygenation [15]. Our study showed that smoking was a factor associated with increasing risk of recurrent LDH but only with trend-level significance.

One systematic review showed that diabetes mellitus disease (DM) correlated with RLDH, with the pooled OR 1.19 (95 % CI, 1.06 - 1.32) [7]. Kim et al. study showed that the weight may be another risk factor for RLDH [8]. In effort to understand the mechanisms of this negative impact of DM, Robinson et al. conducted comparison of the intervertebral discs between nondiabetic and diabetic patients using discarded discs from discectomies. They found that the proteoglycans from diabetic cases were banded at a lower buoyant density, which indicated a lowered glycosylation rate and a lower number of sugar side chains per core protein. The same study also suggested that there was a slight increase in the chain length of chondroitin sulfate in the diabetic patients and further analysis of the glycosaminoglycan chains demonstrated a decreased amount of keratan sulfate glycosaminoglycan [12]. The study concluded that these changes might lead to increased susceptibility to disc prolapse. For diabetic patients, annulus fibrosis healing might take longer time and not be as sturdy as nondiabetic patients [7].

There are several other reported risk factors such as age, gender, BMI, occupational work, level of disc herniation, and thyroid dysfunction. However, the results were not significant when combined with cohort studies [7]. BMI was another widely concerned risk factor for RLDH. Most published studies compared BMI as baseline data and these inconsistent results could not come to a conclusion. The combined OR of BMI > 25 by 2 case-control studies still found no significant relations between BMI and RLDH. According to our study there was no association between all of these demographic characteristics and chronic diseases.

With respect to occupational works, it is generally accepted that heavy physical labor leads to increased loading of lumbar disc, which may contribute to RLDH [10,13]. According to previous published studies we aimed to divided our patients to three groups: sloggers who involved with hard occupational and heavy physical labor leads, second group the patients who work in conform duties and did not involve with heavy physical labor leads. The third group is housewife who can involve with both hard and conform works. According to our results we found that slogger group may under high risk of recurrent LDH but only with trend-level significance.

The study has two limitations: first, the follow-up period is short. Second, the results are a single center results. Further prospective studies with large size and long follow-up period are necessary to systematically investigate these findings.

Conclusions

Selection of the correct candidate for discectomy depends on clinical presentation that supported with correlation of neurological examination and MRI findings, may be one of the best ways to reduce recurrence risk of LDH. Motor deficits on presentation may reduce RLDH risk. Intact neurologic examination may increase the RLDH risk. Select the correct patient may lead to reduce the risk of RLDH.

Disclosure of Potential Conflicts of Interest

The authors declare that they have no conflict of interest.

REFERENCES

1. Byung-Joon S. Risk factors for recurrent lumbar disc herniations. *Asian Spine J* 2014; 8(2): 211-215.
2. Carragee EJ, Han MY, Suen PW, Kim D. Clinical outcomes after lumbar discectomy for sciatica: the effects of fragment type and annular competence. *J Bone Joint Surg Am* 2003; 85-A: 102-108.
3. Carragee EJ, Spinnickie AO, Alamin TF, Paragioudakis S. A prospective controlled study of limited versus subtotal posterior discectomy: short-term outcomes in patients with herniated lumbar intervertebral discs and large posterior annular defect. *Spine* 2006; 31(25): 653-657.
4. Emel E, Abdallah A, Özer AF. Taking history and patient assessment in spinal surgery. In: Özer AF, Arslantaş A, Dalbayrak S (Eds.). *Principles of Spine Surgery*. Volume-1, İntertıp Yayınevi, İzmir 2017; pp: 99-108.
5. Fakouri B, Shetty NR, White TC. Is sequestrectomy a viable alternative to microdiscectomy? A systematic review of the literature. *Clin Orthop Relat Res* 2015; 473: 1957-1962.
6. Frymoyer JW, Pope MH, Clements JH, Wilder DG, MacPherson B, Ashikaga T. Risk factors in low-back pain. An epidemiological survey. *J Bone Joint Surg Am* 1983; 65-A: 213-218.
7. Huang W, Han Z, Liu J, Yu L, Yu X. Risk factors for recurrent lumbar disc herniation. *Medicine (Baltimore)* 2016; 95(2): 1-10.
8. Kim CH, Chung CK, Park CS, Choi B, Kim MJ, *Park* BJ. Reoperation rate after surgery for lumbar herniated intervertebral disc disease: nationwide cohort study. *Spine* 2013; 38: 581-590.
9. McGirt MJ, Ambrossi GLG, Datoo G, Sciubba DM, Witham TF, Wolinsky J-P, Gokaslan ZL, Bydon A. Recurrent disc herniation and long-term back pain after primary lumbar discectomy. Review of outcomes reported for limited versus aggressive disc removal. *Neurosurgery* 2009; 64(2): 338-344.
10. Mundt DJ, Kelsey JL, Golden AL, et al. An epidemiologic study of non-occupational lifting as a risk factor for herniated lumbar intervertebral disc. The Northeast Collaborative Group on Low Back Pain. *Spine* 1993; 18: 595-602.
11. Neaton JD, Wentworth D: Serum cholesterol, blood pressure, cigarette smoking, and death from coronary heart disease. Overall findings and differences by age for 316,099 white men. Multiple Risk Factor Intervention Trial Research Group. Arch Intern Med.1992; 152: 56-64.
12. Robinson D, Mirovsky Y, Halperin N, et al: Changes in proteoglycans of intervertebral disc in diabetic patients: a possible cause of increased back pain. Spine. 1998; 23: 849-855.
13. Schmidt H, Kettler A, Heuer F, Simon U. Intradiscal pressure, shear strain, and fiber strain in the intervertebral disc under combined loading. *Spine* 2007; 32: 748-755.
14. Weinstein JN, Lurie JD, Tosteson TD, Tosteson AN, Blood EA, Abdu WA, Herkowitz H, Hilibrand A, Albert T, Fischgrund J. Surgical versus nonoperative treatment for lumbar disc herniation: four-year results for the Spine Patient Outcomes Research Trial (SPORT). *Spine* 2008; 33: 2789-2800.
15. Yildiz D. Nicotine, its metabolism and an overview of its biological effects. Toxicon 2004; 43: 619-632.