Results and predictive factors for single level L4-5, and L5-S1 disc herniation surgery

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ABSTRACT

Background: The disc prolapse is a common condition especially in young adults. Different levels are affected in the lumber region; the L4/L5 disc is more susceptible to longitudinal load and is the most common site of lumbar disc prolapse. The L5/S1 disc is protected from torsion load by strong ilio-lumbar ligaments but it is more susceptible to axial compressive forces. Many factors affect the result and outcome of surgery in these levels.

Objective: The aim of this study is to correlate operative data, short-term results, complications, and prognostic factors (age, gender, mobility, hospital stay, and level of pain) for one-level lumber discectomybetween different levels (L4-L5 vs. L5-S1).

Methods In this prospective study, 32 patientsin Al-Yarmouk teaching hospital undergoing survey form March 2008-December 2012.Six patients were excluded from this study because they were diabetics and multilevel disc degeneration .Fifteen (57.6%) patients undergoL5-S1 discectomy and 11 (42.4%) patients undergoL4-5 discectomy. Questionnaires for leg and back pain intensity (Visual Analogue Scale ;VAS), duration of leg pain, and disability (Oswestry Disability Index; ODI), were obtained preoperatively, 3 months, 6 months, 1-year- and 2 year follow-up.Analyses were utilized to evaluate the relationship between surgical outcomes and variable (gender, age, lumber segment, pre-operative ODI, and pre-operative VAS).

Results: Mean operative time was[73.44 ± 26.25] min, mean hospital stay was [3-7] days, and mean mobilitywas [2.55 ± 0.93] days. At 2-year follow up, patients revealed a statistical significant improvement in VAS pain ($P < 0.05$), and ODI lumbar function ($P < 0.05$).The complications rate were 20.3 %.

Our study elaborates good results for one-segmental L5-S1overL4-L5 discectomy. Discectomy of the L4-L5 disc wasassociated with an increased risk of complication ($P < 0.05$). The comparison revealed that operative time was influenced by age ($P = 0.034$); hospital stay was influenced by level ($P = 0.036$) and pre-op VAS ($P = 0.006$); while complications were influenced by level ($P = 0.001$) and pre-op ODI ($P = 0.049$

Conclusion: The study revealed significant results for L5-S1 discectomy over L4-L5 discectomy in the late follow up period; the complications rate were higher in L4-L5 level discectomy.

Keywords: Predictive factors, Disc herniation, one level discectomy,Outcome results

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A majority of the patients suffering from sciatica caused by a lumbar disc herniation experience a positive natural history and respond well to nonsurgical treatment [1]. Lumbar disc herniation surgery is most commonly performed electively in patients where conservative therapies have failed to gain improvement of leg pain and disability. Only in rare cases, acute surgery need to be performed, e.g. when a large disc herniation result in cauda equina syndrome.[2]

Discogenic low back pain, or symptomatic degenerative disc disease (DDD), is an endemic problem in our modern society, with important social and economic impacts. Currently, there are no clear and consensual guidelines for the treatment of DDD, which usually responds well to various conservative treatment measures. Pharmacological measures and physiotherapy are associated with good clinical results [3].

There is sound biomechanical reasoning to suspect a difference between spinal levels. The L4/L5 disc is more susceptible to axial torsion and is the most common site of lumbar instability. The L5/S1 motion segment is protected from torsional strain by extensive ilio-lumbar ligaments but is more exposed to axial compressive forces [4].

Short-term results after surgical treatment of symptomatic lumbar disc herniation has been reported to have a high success rate (70-95%), evaluated by validated outcome scores and patients satisfaction [5,6]. In more recent long-term follow-up studies, surgically treated patients demonstrated improved satisfaction with treatment and better leg pain relief compared with a conservative regime [2].

To evaluate the outcome after a certain treatment, the patients' subjective satisfaction has lately been suggested to be as important as objective outcome instruments [7]. Furthermore, it is of importance to separate the surgical effects on back and leg pain in disc herniation patients, since the mechanisms behind these symptoms are considered to have different mechanisms and are treated differently[7].

Patients who fail to recover from sciatic pain are at risk to develop chronic pain syndromes, which emphasizes the importance of identifying factors that can predict the

outcome, both regarding short- and long-term results. Therefore, possible predictive factors for the surgical outcome have been studied, factor as age [8], gender [9], duration of leg pain [10], time to surgery [11], working status [12], type and level of disc herniation [13,14] and psychosocial factors [15,16].

Long lasting pain more than 6 weeks and functional impairments are indications for discectomy, microdiscectomy have relatively smaller incision, less soft tissue damage, therefore reduced postoperative pain, early discharge from hospital and return to work compared to open discectomy [16].

The aim of the present study was to investigate the results after lumbar disc herniation surgery and to investigate if any demographics such as psychological, social or physiological factors could predict the surgical outcome. The outcomes were neurological evaluation of surgical outcome and improvement of leg and back pain at 2-year follow-up after surgery.

Method: From March 2008- December 2012, 32 patients in Al-Yarmouk teaching hospital undergoing survey for back pain by history, examination and MRI of the lumbosacral spine. Six patients were excluded from this study because they were diabetics and multilevel disc degeneration. A 26 patients undergone surgical discectomy(diagnosed by MRI) for one-level disc herniation on L4-L5 or L5-S1 level at Al-Yarmouk teaching hospital.

The study population had a mean age of 35 ± 11 years and 19 (73.1 %) of the patients were females and 7 (26.9 %) were males. 15 (57.6%) patients L5-S1 discectomy and 11 (42.4%) L4-5 discectomy.All patients had failure of conservative treatment for at least 6 months (lumbosacral brace, drugs, and various kind of manipulative or physical therapies).

Pre-operative diagnosis was made on the basis of the clinical signs and symptoms.Physical examinations of the preoperative patients included motor, sensation, reflexes, degree of pain-onset by the straight leg raising test, lumbar standard and dynamic radiographs (anteroposterior, lateral, flexion and extension view images), and lumbosacral MRI.

Preoperative questionnaires were used to collect information about baseline data (gender, age, smoking habits, operating time, mobility, duration of hospitalization, lumber disc level). The degree of leg and back pain was assessed at baseline and at follow-up time-points using the Visual Analogue Scale (VAS), and the Oswestry Disability Index (ODI).

ODI is validated questionnaire. The ODI describes back-related disability with a combination of physical and social restrictions. It contains 10 questions covering different dimensions of daily living. The sum can reach from 0%, representing no disability, to 100%, the worse possible disability [17, 18].

The postoperative evaluation was conducted in nearly the same manner as the preoperative examination.

Surgical procedure: A midline approach was used to dissect the paravertebral muscles down to the laminae and the interlaminar ligaments were resected. A partial laminotomy was performed when necessary. Herniated disc material and loose fragments from the disc were removed to decompress the affected neural structures.

Statistical analysis: Data were expressed as means ± SE. Statistical significance of the difference between the means was performed with Student's test.

Results:

Table 1.Gender distribution.

gender	No. (%)
male	7 (26.9%)
female	19 (73.1%)
total	26 (100%)

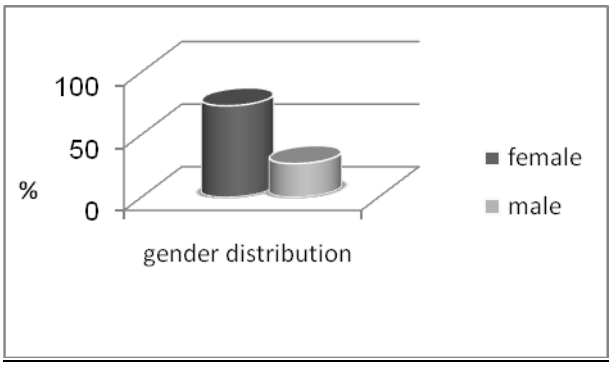


Figure 1. Gender distribution

Table 2.Age distribution.

Age	No.
20-29 years	4 (15.4 %)
30-39 years	14 (53.8 %)
40-49 years	8 (30.8 %)
Total	26 (100 %)

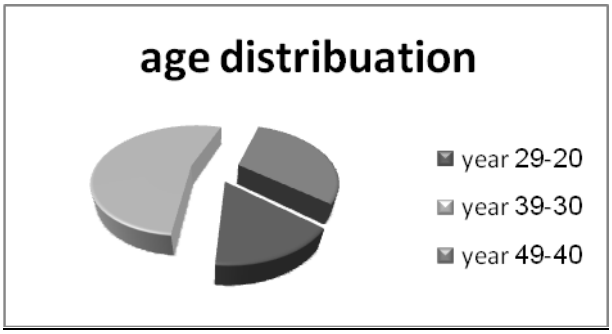


Figure 2. Age distribution

Table 3. Side distribution.

Side of disc herniation	Number of cases
Predominant Left sided herniation	12 [46.17%]
Predominant Right sided herniation	8 [30.76%]
Central herniation	6 [23.07%]
Total	26 [100%]

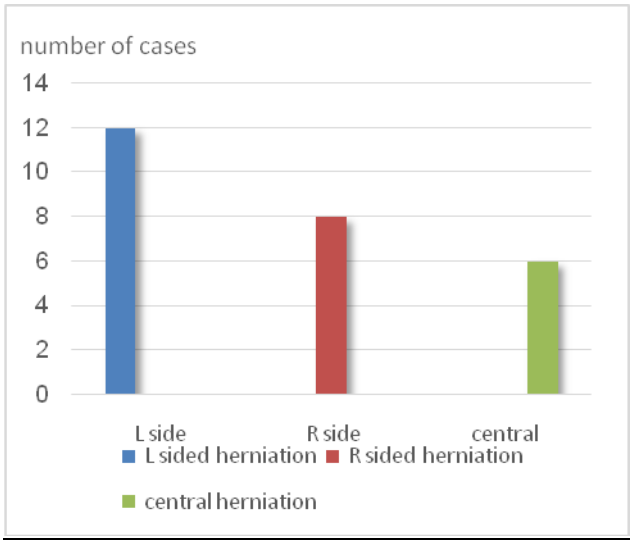


Figure 3. Side distribution

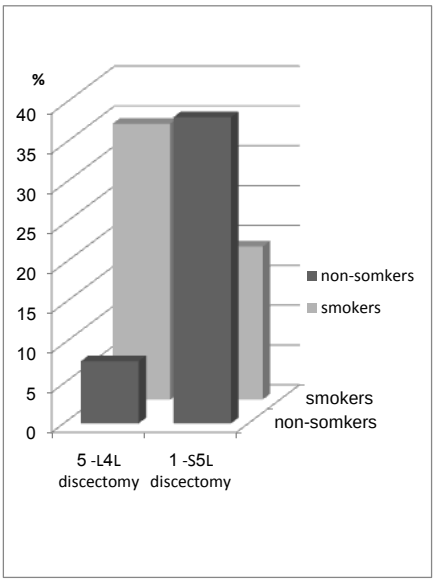


Table 4.Smokers and non-smokers.

Discectomy level	Smokers	Non-smokers
L4-L5 discectomy	9 (34.6 %)	2 (7.8 %)
L5-S1 discectomy	5 (19.2 %)	10 (38.4 %)

Table 5: Operative time (min.) for both levels surgery

Level operated	**time**
L4-L5 discectomy	81.32 ± 18.25
L5-S1 discectomy	65.56 ± 34.24
P value	P < 0.05

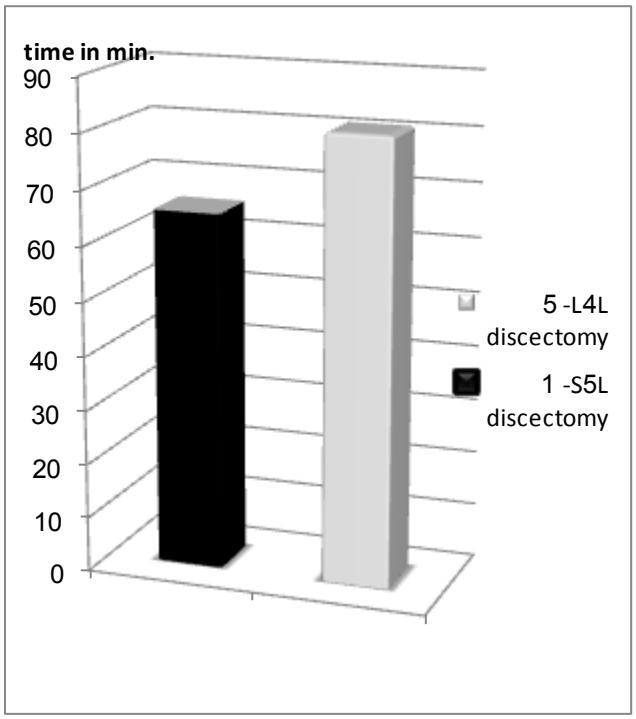


Figure 5: Operative time (min.) for both levels surgery

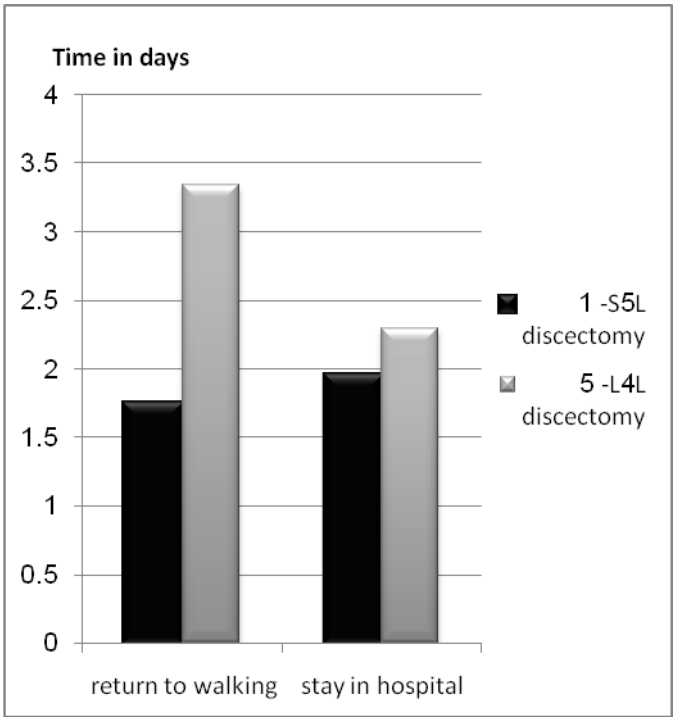


Figure 6. Mobility and stay in hospital in days for both level discectomy

Table 6.Mobility and stay in hospital in days for both level discectomy.

Operatev level	Mobility (days)	Stay in hospital (days)
L4-L5 discectomy	3.34 ± 1.05	2.30 ± 1.45
L5-S1 discectomy	1.75 ± 0.80	1.95 ± 1.05
P value	*P*<0.05	*P*>0.05

Table 7: follow-up of patients with both levels discectomies from pre-operative to 2 years period by VAS system

VAS	L4-L5 discectomy	L5-S1 discectomy	*P* value
Pre-operative	80.45 ± 12.95	79.95 ± 11.65	*P* = 0.3759
3rd month	63.55 ± 17.84	58.46 ± 12.63	*P* = 0.1368
6th month	44.48 ± 12.39	39.71 ± 10.48	*P* = 0.3432
1st year	35.00 ± 27.15	29.85 ± 28.35	*P* = 0.2995
2nd year	23.29 ± 12.07	19.64 ± 11.38	*P* = 0.1518

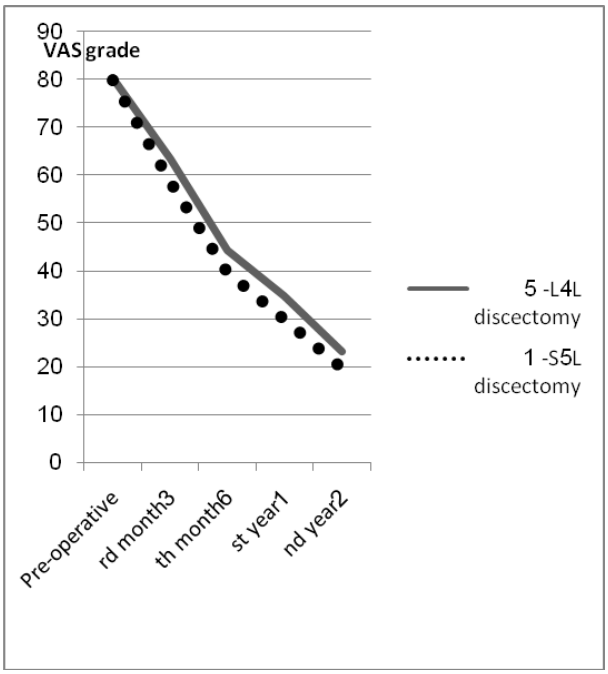


Figure 7: follow-up of patients with both levels discectomies form pre-operative to 2 years period by VAS system

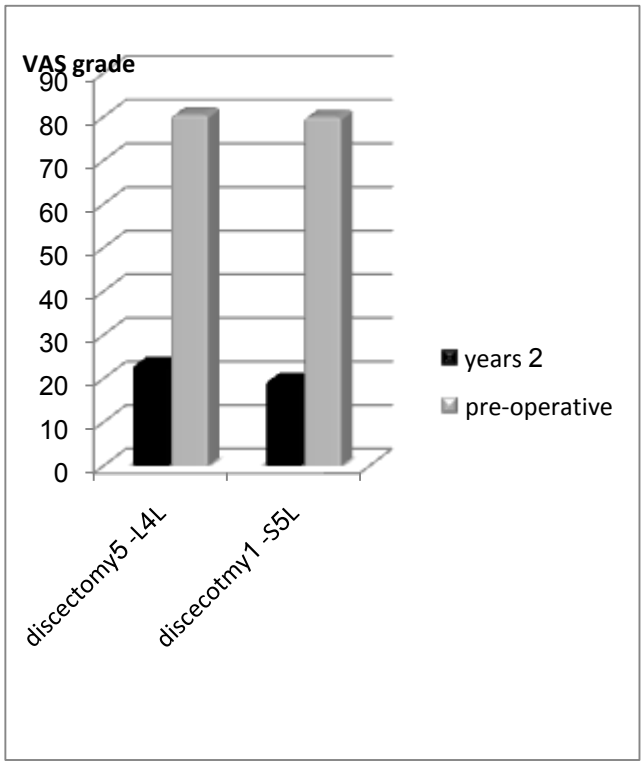


Figure 8: the results of 2 yrs follow-up in patients with L4-L5 and L5-S1 discectomies according to VAS system

Table 8: the results of 2 yrs follow-up in patients with L4-L5 and L5-S1 discectomies according to VAS system.

Operated level		VAS
L4-L5 discectomy	Pre-operative	80.45 ± 12.95
	2 yr	23.29 ± 12.07
	P-value	P<0.05
L5-S1 discectomy	Pre-operative	79.95 ± 11.65
	2 yr	19.64 ± 79.38
	P-value	P<0.05

L4-L5 discectomy patients with higher VAS leg pain pre-operatively (80.45 ± 12.95) have good improvement after 2 years (23.29 ± 12.07) ($p<0.05$), and (79.95 ± 11.65 vs. 19.64 ± 11.38) ($p<0.05$) for L5-S1 discectomy respectively.

Table 9: follow-up of patients with both levels discectomies form pre-operative to 2 years period by ODI system.

ODI	L4-L5 discectomy	L5-S1 discectomy	*P* value
Pre-operative	38.55 ± 16.15	40.96 ± 13.18	*P* = 0.3759
3rd month	30.49 ± 13.85	32.85 ± 16.83	*P* = 0.4568
6th month	25.19 ± 17.89	24.28 ± 14.29	*P* = 0.5732
1st year	22.20 ± 17.05	21.95 ± 14.55	*P* = 0.4695
2nd year	17.47 ± 12.78	15.49 ± 11.47	*P* = 0.4118

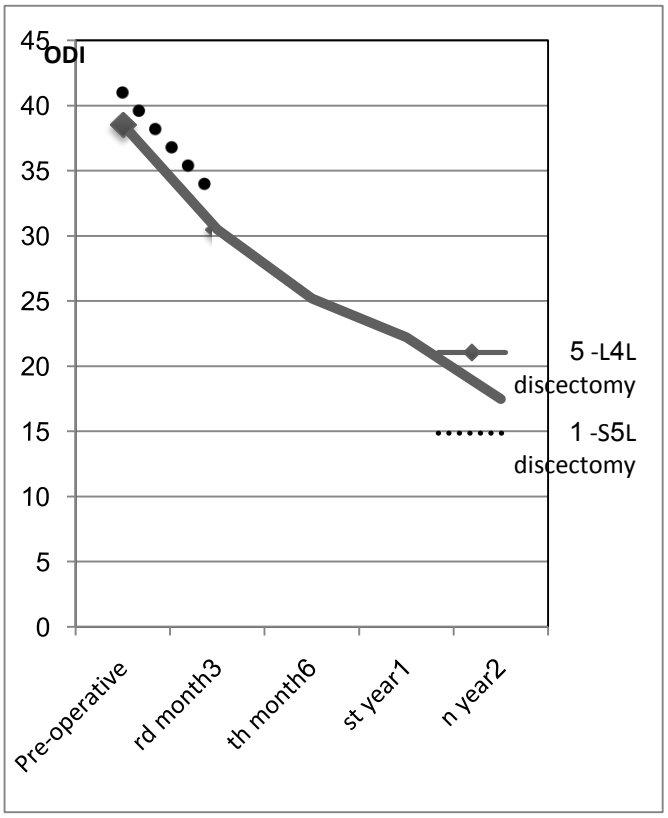
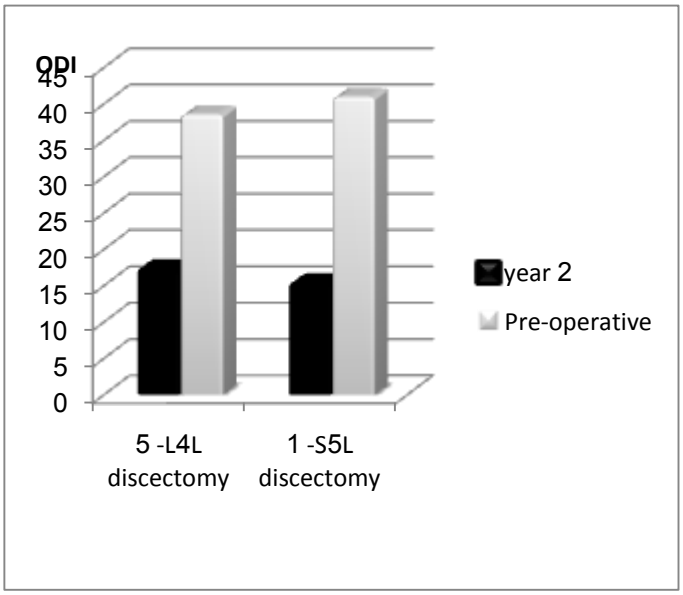


Figure 9: follow-up of patients with both levels discectomies form pre-operative to 2 years period by ODI system

Table 10: the results of 2 yrs follow-up in patients with L4-L5 and L5-S1 discectomies according to ODI system.

Operated level		ODI
L4-L5 discectomy	Pre-operative	38.55 ± 16.15
	2 yr	17.47 ± 12.78
	P-value	*P*<0.05
L5-S1 discectomy	Pre-operative	40.96 ± 13.18
	2 yr	15.49 ± 11.47
	P-value	*P*<0.05

Figure 10: the results of 2 yrs follow-up in patients with L4-L5 and L5-S1 discectomies according to ODI system



L4-L5 discectomy patients with higher ODI pre-operatively (38.55 ± 16.15) have good improvement after 2 years (17.47 ± 12.78) ($p<0.05$), and (40.96 ± 13.18 vs. 15.49 ± 11.47) ($p<0.05$) for L5-S1 discectomy respectively.

The complications rate were 23.1 %. Complications were particularly higher in L4-L5 group (4/11) (36.4 %) than in L5-S1 group (2/15) (13.3 %) ($P = 0.005$). This was especially for complications secondary to the surgical approach (36.4 % in L4-L5 vs. 13.3 % in L5-S1). Complications secondary to the surgical approach were wound dehiscence (1/26 = 3.8 %), urinary problems(1/26 = 3.8%), discitis (3/26 = 20 %), and posterior facet degeneration (1/26 = 3.8 %) which was treated with infiltrations; and persistent back pain (4/26 = 15.4 %). In 3 patients (11.1%), there was recurrence of disc herniation at the same level or at different level.

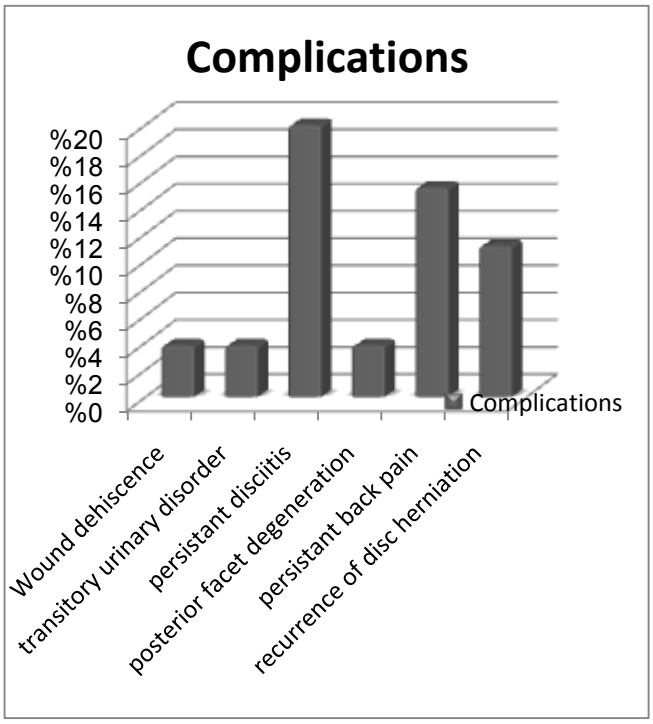


Figure 11. Complications.

Univariate linear regression and binary logistic regression were utilized to evaluate the relationship between surgical outcomes (operative time, return to walk, hospital stay, and complications) and covariates as gender, age, operated disc, pre-op VAS, and ODI.

Table 11 : operative time, mobility , hospital stay and complications

	Operative time (min.)		Mobility (days)		Hospital stay (days)		complications	
Mean ± SD	73.44 ± 26.25		2.55 ± 0.93		3-7		20.3 %	
		P value		P value		P value		P value
Gender	-21.3	0.095	-0.71	0.181	0.58	0.822	0.24	0.134
Age	12.03	0.034	0.08	0.727	-0.99	0.368	2.00	0.609
Level L4-L5	-8.45	0.597	-0.47	0.653	-1.04	0.179	0.84	0.112
Level L5-S1	-14.86	0.280	-0.21	0.725	-1.98	0.036	1.29	0.001
Pre-op VAS	-0.21	0.585	0.03	0.133	0.20	0.006	1.08	0.067
Pre-op ODI	-0.46	0.304	0.02	0.368	-0.07	0.426	1.08	0.049

This comparison revealed that operative time was influenced by age ($P = 0.034$); hospital stay was influenced by level ($P = 0.036$) and pre-op VAS ($P = 0.006$); while complications were influenced by level ($P = 0.001$) and pre-op ODI ($P = 0.049$).

Discussion

Long-standing preoperative leg pain have been suggested to be a risk for the development of chronic pain and thereby a predictor of bad outcome [1, 12, 19]. Nygaard et al. found that patients with sciatica for more than 12 months have a less favorable outcome[20]. In the present study, duration of leg pain for less than 6 months were related to good/excellent outcome at 2-year. The influence of leg pain duration on postoperative results indicate that surgery for a lumbar disc herniation, when conservative treatment has failed for 6 months, should be performed after a relatively short waiting time.

There is statistical significance in gender distribution where 19 patients (73.1%) are female and 7 patients (26.9%) are male ($p<0.05$). This may be attributed to the heavy and long duration of standing in the daily activities and more body mass index and this is comparable to the study ofHakkinen et al [21].

There is statistical significance in age distribution ($p<0.05$) where 14 patients (53.8 %) within the range of 30-39 year old. These results may be explained by the heavy work at this active age group and increase body mass index and more flexibility of disc material and this is comparable to the result ofNygaard OP et al [20].

About the side distribution, there is significant correlation between L sided pain and disc herniation, where 18 feet (69.3%) are predominantly on the L side ($p<0.05$).Our results were nearly similar to the study of Hoogland T et al [22].

There is statistical correlation between smokers (more than 1 pack per day) and the level of herniation, in L4-L5 level more than L5-S1 level ($P<0.05$), and this is comparable to the result of Katayama Y et al [23].

There is statistical significance between operative time (min.) and level of discectomy ($p<0.05$). The operative time for L5-S1 discectomy is significantly shorter than L4-L5 discectomy and this may attributed to the peculiar anatomy of L5-S1 disc and L5, S1 vertebrae as compared to the Mariconda M et al and Osterman H studies[24, 25].

There is significant correlation between the duration of returning to work and mobility with the level of surgery ($p<0.05$), those patients with L5-S1 discectomies were return to work earlier than those patients with L4-L5 discectomies, as compared to the Puolakka K et al study [26].

There is no relation between stay in hospital time and the level of surgery ($p>0.05$) in our study. The same results were elaborated in the study of Weinstein JN et al [27].

The risk factor for complication was the pre-op ODI ($P = 0.049$). The higher the pre-op lumbar dysfunction value, the higher the risk of complication, and these results are comparable to the study of Yorimitsu E et al [28]. This was probably due to the difficulty of complete return to

normality in a globally compromised lumbar spine, especially in severe cases (high pre-op ODI). Anatomical factors such as muscle or posterior element degeneration, and even psychological and social factors such as spinal balance, habits, or confidence, could contribute to compromising outcomes.

Age ($P < 0.05$) was the only prognostic factor for operative time. Hospital stay was affected by pre-operative VAS ($P < 0.05$), while complications were affected by the level ($P < 0.05$) and pre-op ODI ($P < 0.05$).

A herniation of a disc is a complication of a disc degeneration process and may berelated to other types of spine problems such as chronic low backache, instability or progressive deformity. In the present study, 3/26 (11.5%) of the patients had undergone a new surgical procedure (revision discectomy) at the long-term follow-up and most commonly this was a new disc herniation at the same or another level. Hakkinen et al [21]founds that 10% of the patients had undergone a new spinal surgery within a 5-year period after surgery and 7% was performed because of a new disc herniation. In the study of Atlas et al andYorimitsu E et al[2, 28], a higher frequency of additional spine surgery were found, 25% of the patients in this study had undergone at least one additional lumbar spine operation after 10 years.

Conclusions

The study revealed significant results for L5-S1 discectomy over L4-L5 discectomy in the late follow up period; the complication rate was higher in L4-L5 level discectomy.The operative time was influenced by age; hospital stay was influenced by level and pre-operative; while complications were influenced by level and pre-operative ODI.

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