Original Article

Does disk space degeneration according to Los Angeles and Modic scales have relation with recurrent disk herniation?

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Abstract

Background: After single disk herniation operation, about 5–20% recurrences may occur. Different etiology may affect the prevalence of recurrence. Disk degeneration according to Modic and Los Angles scales could affect recurrence rate. This study wants to show the relationship between disk space degeneration according to these scales on severity, time, and prevalence of disk herniation recurrence.

Materials and Methods: Thirty-four patients presented with radicular pain (with or without back pain) and history of lumbar disk surgery was included in this prospective study. Pre- and postoperative T2-weighted sagittal magnetic resonance imaging (MRI) compared for Modic and Los Angeles disk degeneration grading, then, data analysis on SPSS (version 20) software, paired *t*-test, and others.

Results: The result of study shows for first operation that grade (II) Los Angeles is the most common, but, for second procedure grade (IV) was less common and the mostly decreased (from 14.7 to 9.2%). In addition, Wilcoxon test shows no change of Los Angeles grading for both first and second surgery ($P = 0.06$). Whereas; based on Modic criteria grading was different from first operation, in other words, grade (I) (41.2%) in first operation was changed to 20.6% in second operation ($P = 0.007$).

Conclusion: Our study showed that the Los Angeles criterion is more practical and useful for prediction of recurrence and in the patients with Los Angles grade III and IV and grade II and III on Modic scale, the chance of recurrence is less than patients with lower grades.

Key Words: Disk herniation recurrence, disc space degeneration, Los Angeles scale, Modic scale

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INTRODUCTION

Lumbar disk herniation is one of the most prevalent operations in neurosurgery and a lot of single level diskectomy is performed daily in many medical centers.[1] At different studies about 15–20% of this surgery perform as foraminotomy that may recur later. Thing that is not attenuated until now is patient disk grading before operation. Primary survey showed at lower grade disk herniation, as surgeon spent more effort and time for complete evacuation, there is less likelihood of recurrence later.[2] At the higher grade, there is not necessary to more manipulation at the disk space and operation can be limited only to disk free fragments evacuation and root decompression.[3] In the spine, vertebrae connect together with disk, facet joints, and spinal ligamentous. Each disk complains of two segments, annulus fibrosus at peripheral and nucleus pulpous at central.[4] In the spinal column, disk

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acts as pincushion for adjusting mechanical stress. With age and depending on the severity of this stress, disk degeneration process occurs because of annulus rupturing and decrease glycoprotein production by chondrocytes. This process contains of dehydration, protrusion, extrusions, and sequestration.[1] Posterior longitudinal ligamentous fibers in the lateral portion is more weak rather than medial portion, therefore most of the disk herniation are from posterolateral type, only 10% are far lateral and central herniation in little cases.[4,5] Diagnosis of disk herniation is based on physical examination and paraclinical investigations. MRI has fundamental role in diagnosis.[2] MRI finding basis on the Los Angeles and Modics scale have five and three stages, respectively [Table 1].

Treatment modalities consist of complete resting, open surgery for root decompression, and physiotherapy.[6,7] Recurrence is one of the most common complications that may happen in 5–15% of the operations[8] which defines as relapse of radicular pain with or without low back pain after primary operation.[9] It may occur at the same level or others and may be ipsilateral or contralateral.[10] There are many effective factors in recurrence including age, gender, occupation, weight, mechanical and traumatic stress, level of herniation, amount of evacuation, underlying deformity, and stenosis.[11]

MATERIALS AND METHODS

This prospective study performed at Alzahra and Kashani hospitals during 2010–2011 in Isfahan. Conditions for entrance to the study were patients with history of single level operation that return with radicular pain ± low back pain and MRI described recurrence at the same level. Patients excluded from study had the presence of multilevel disk herniation, canal stenosis, if in the operation other technique except laminotomy or foraminotomy was performed, or if there was neurological deficit in primary examination, or if there was complication such as root injury or thecal sac rupture, or if there was evidence of diskitis, or spinal instability (in dynamic X-ray), or epidural scarring (in MRI with contrast), or if history of operation except of disk herniation at lumbar region. Basic information collected from patients after primary examination and MRI ± contrast and grading was determined before and after operation. Then data analyzed with SPSS version 20, Students and paired *t*-test, analysis of covariance.

RESULTS

Thirty-four patients with degenerative spinal disease evaluated. Mean age was 29.5 ± 4.5 year with range of 20–39 years. Nineteen patients were male (55.9%) and 15 were female (44.1%). Majority of them had range of 25–34 years. Mean age of males and females were 29.9 ± 5 and 28.9 ± 4.8, respectively. *t*-test showed no significant difference between men and women ($P = 0.58$). Average of body mass index (BMI) was 26.9 ± 2.9 with range of 22–32. Most of them had overweight or obesity (55.9% males, 20.6% females). The most common occupation was farming (38.2%). Eighteen patients were smoker (52.9%). Table 2 shows the percentage of demographic features of the patients.

Level of operation was L_{4-5} in 15 patients (44.1%), L_{3-4} in four patients (11.8%), and L_5-S_1 in 15 patients (44.1%). Side of operation was right at 17 patient and left at 17 patients. Type of operation was hemilaminectomy in nine patients and foraminotomy in 25 patients. Median time from beginning of radicular pain and primary operation was 5.1 ± 2.2 months with range of 2–10 months. Median time of radicular pain at secondary operation was 4.2 ± 1.2 with range of 2–6 months and based on paired *t*-test, there was significant difference in the first and second surgery time ($P = 0.04$) [Table 3]. In Figure 1, the distribution of radicular pain time in two operations is shown. Upon *t*-test and analysis of covariance, none of these variable elements was effective on incidence of recurrent radicular leg pain ($P > 0.05$).

In Figures 2 and 3 distribution of prevalence upon Modics and Los Angeles scale has been shown.

Table 1: Disk herniation grading based on Los Angeles and Modics scales

Stage	Los Angeles scale	Modics scale		
		T1	T2	Significant
I	Normal disk height without dehydration	Hypo	Hyper	Edema
II	Normal disk height with dehydration	Hyper	Hyper	Fatty degeneration
III	Disk height decreased by less than 50%	Hypo	Hypo	Bony sclerosis
IV	Disk height decreased at least by 50%			
V	Disk height obliterated			

Table 2: Demographic features of the studied patients (%)

Age	<25	25-29	30-34	≥35
	11.8	32.4	38.2	17.6
Male	55.9			
Female	44.1			
BMI	Normal	Overweight		Obese
	23.5	55.9		20.6
Occupation	Farmer	Homemaker	Worker	Business
	38.2	23.5	17.6	20.6
Smoking	52.9			
Nonsmoking	47.1			

The values have been shown in percentage. BMI: Body mass index

Before the first operation, 14 patients (41.2%) had Modics grade I, 12 (35.3%) and eight (23.5%) were in grade II and III, respectively; but after recurrence seven (20.6%), 17 (50%), and ten (29.4%) have been changed to grade I, II, and III, respectively. According to Los Angeles criteria, before the first surgery ten patients (29.4%) had grade I, 14 (41.2%) had grade II, six (17.6%) had grade III, 4 (11.7%) had grade IV, and none had grade V; however, before secondary operation, six (17.6%), 16 (47.1%), six (17.6%), three (8.8%), and three (8.8%) patients had grade I, II, III, IV, and V, respectively. Modics criteria's grading differed from first to second surgery as incidence of grade I changed from 41.2 to 20.6% (P = 0.007). However, Los Angeles scale did not show significant difference (P = 0.06).

Mean volume of total herniated disk were 15.5 ± 3.4 cm^3 with range of 10–25 in the first surgery and 14 ± 3.3 cm^3 with range of 10–25 in secondary operation. Upon t-paired test, amount of total disk volume had significant difference (P = 0.001), but mean volume of herniated disk were 2.88 ± 0.84 cm^3 and 3.32 ± 1.12 cm^3, respectively that had no significant difference (P = 0.062). In Figures 4 and 5 distribution of herniated disk volume has been shown.

Table 3: Mean and standard deviation of radicullar leg pain based on variable condition

Variant	Level	Periods of RLP before first operation	Periods of RLP before second operation
Gender	Male	5.5±4.2	1.4±2.1
	Female	7.4±9.1	5.4±1.1
	P value	0.34	0.32
Job	Farmer	7.4±2	1.4±1
	Homemaker	4.4±8.1	8.4±2.1
	Worker	7.6±3	4±3.1
	Business	6.5±2	1.4±5.1
	P value	0.2	0.59
Level of operation	L4-L5	5±6.2	9.3±92.0
	L3-L4	5±6.2	4±82.0
	L5-S1	3.5±7.1	7.4±4.1
	P value	0.91	0.17
Side of operation	Right	1.5±7.2	4±93.0
	Left	2.5±6.1	5.4±4.1
	P value	0.82	0.25
Age (years)	>25	8.3±5.1	4±0
	25-29	3.5±5.2	4.4±3.1
	30-34	5.5±1.2	9.3±2.1
	<35	2.5±2.2	8.4±3.1
	P value	0.61	0.45
Kind of operation	Hemilaminectomy	7.5±7.1	7.3±4.1
	Foraminectomy	5±4.2	4.4±1
	P value	0.42	0.09
BMI	Normal	6.4±8.1	5.4±4.1
	Overweight	8.4±2	3.4±1
	Obesity	9.6±6.2	9.3±3.1
	P value	0.07	0.58

BMI: Body mass index, RLP: Radicullar leg pain

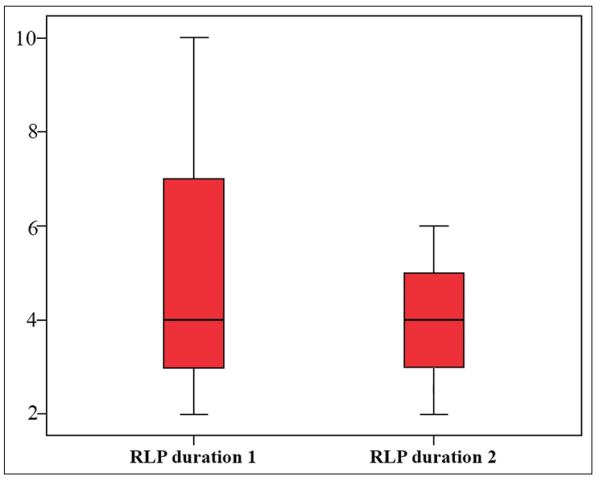


Figure 1: Mid, range, and percentile 25 and 75 of radicular pain before first and secondary operation

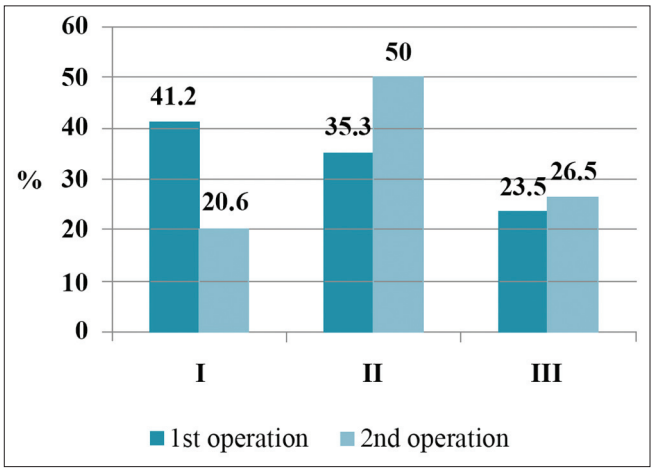


Figure 2: Distribution of Modics scales before first and second operation

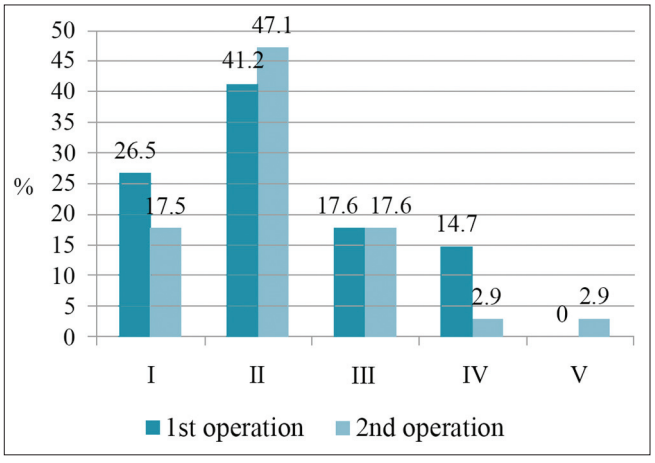


Figure 3: Distribution of Los Angeles scales before first and second operation

Median time between the first surgery and recurrence was 5.4 ± 1.2 with the range of 3–8 months. Twenty-three people (67.6%) had reinforcing factors but 11 patients (32.4%) did not have any factors.

Based on the Los Angeles scales, there was association about 35% between period from the first surgery and recurrence with disk grading, and upon Spearman association test this correlation was significant (P = 0.046). Although based on Modics scales there was an association in about 24% between this period and disk grading, this correlation was not significant (P = 0.17). The correlation between period and disk grading has been shown in Figures 6 and 7.

DISCUSSION

The total goal of this study was evaluation of correlation between degenerative changes grading of lumbar disk herniation based on the Los-Angeles and Modics scale with severity and time of lumbar disk recurrence. There are many studies, which used Modic scale to evaluate disk degenerative changes, but as we know, there is no study using these two scales all together. In this study, we evaluated 34 patients with history of disk operation that returned with recurrent disk herniation. Recurrence defined as occurrence of radicular leg pain and MRI findings upon Los Angeles and Modics criteria. In this study median time of radicular pain until first operation was 5.1 ± 2.2 months, mean time of recovery was 4.2 ± 1.2 months. Then symptoms restarted again. Period between beginning of pain and operation had significant difference at first and second surgery. Period at second was smaller. This could be because of severity of pain at recurrence or recourse after first surgery with unsatisfaction.

In a study by Aizawa *et al.*, in 2012, it was shown that the reoperation rate of overall revised excisions was

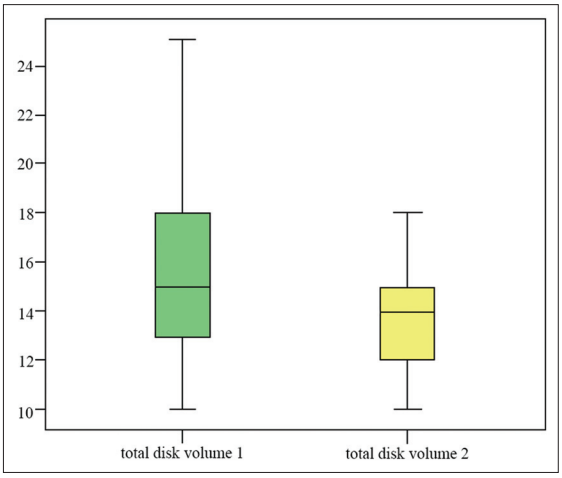


Figure 4: Mid, range, and percentile 25 and 75 of total (left) and herniated (right) volume disk at first and second surgery

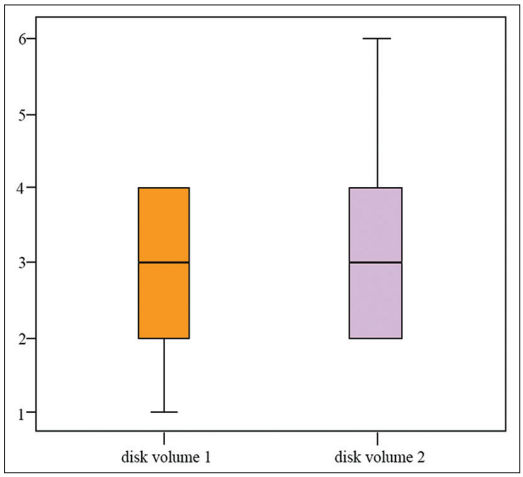
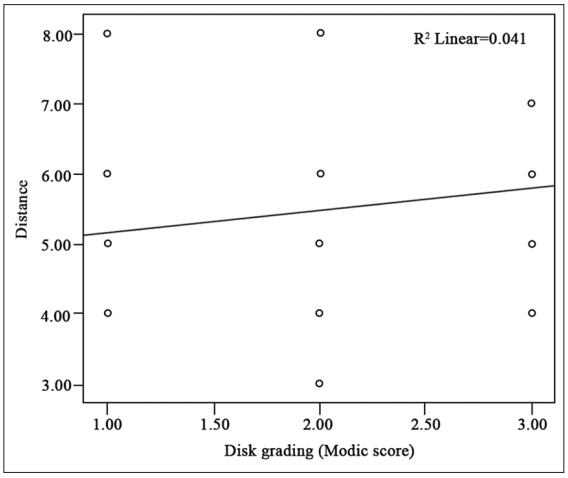


Figure 5: Mid, range, and percentile 25 and 75 of total (left) and herniated (right) volume disk at first and second surgery



Figures 6: Correlation between the disk herniation operation time and recurrence according to Modic and Los Angeles scales

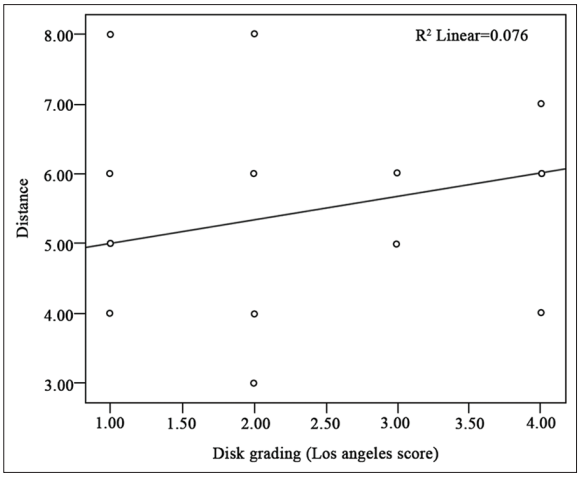


Figure 7: Correlation between the disk herniation operation time and recurrence according to Modic and Los Angeles scales

0.62% at 1 year, 2.4% at 5 years, 4.4% at 10 years, and 5.9% after 17 years and that of real recurrent herniations was 0.5, 1.4, 2.1, and 2.8%, respectively after 15.7 years. They revealed that real recurrent herniations had shorter intervals between primary and revision surgeries. Male patients with surgery at a younger age carried a higher risk of reoperation. The reoperation rate of overall revised excisions was 0.62% at 1 year, 2.4% at 5 years, 4.4% at 10 years, and 5.9% after 17 years and was 0.5%, 1.4%, and 2.1%, respectively, and 2.8% after 15.7 years for real recurrent herniations.[12]

Our study showed that effective factors on radicular pain were age, gender, weight, and occupation; so old and obese people or who had higher physical activity predisposed to disk recurrence. Except of operative techniques, regarding hygiene factors, caution by patients and level of knowledge were most effective factors in disk recurrence. For determining of disk grading and need for reoperation there were two method, Los Angeles and Modics criteria's. Our study described as patient who had lower grade before first operation they had more presumption of recurrence, so 41.2 and 67.7% of patients had lower grade in Modics (grade I) and Los Angeles (grade I, II) scale.

During a follow-up study by Rahme *et al*., in 2010, the prevalence of MCs increased from 46.3 to 78%, and 26 patients (63.4%) had Type 2 lesions at the operated level. Among 22 patients without MCs, four (18.2%) converted to Type 1 and nine (40.9%) to Type 2. From the five Type 1 lesions, three (60%) converted to Type 2, and 2 (40%) remained Type 1 but their size were increased.[13]

In contrast, none of the 14 Type 2 changes converted to another type, although ten (71.4%) increased in extent. There were no reverse conversions to Type 0. This has similarity with observed by Barth *et al*., in the first 2 years after lumbar diskectomy and what was shown by Albert and Mannichel in the year following lumbar disk herniation.[14,15]

Our finding is in concordance with Chin *et al*., who had documented similarly satisfactory results following lumbar discectomy in patients both with and without preoperative MCs.[16]

This is in disagreement with the findings of Barth *et al*., who documented a positive correlation between the increased prevalence of Modic lesions following lumbar diskectomy and postoperative low back pain.

CONCLUSION

This finding showed that most of patients with recurrence had lower grade at first operation and had higher grade after. We offered at lower grade as surgeon expends more effort and time for complete evacuation, there is less likelihood of recurrence later. It may be because the disk degeneration progressed, therefore we recommend early mobilization of patients after surgery to avoid collapse of disk space and predispose recurrence.

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