

Lumbar Herniated Degenerated Disc: Simple Discectomy or Fusion?

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Abstract

Background Data: Low back pain is estimated to occur in 84% of individuals at some point of their life. Lumbar disc degeneration is one of the most common finding in the work up of low back pain. Mechanical, nutritional, and genetic factors may play a role in the pathogenesis of disc degeneration. The etiology of back pain in degenerated disc is a complex process, and appears to be a combination of mechanical deformation and the release of inflammatory mediators. Being a recently highlighted illness, still there is a great controversy concerning the surgical treatment of degenerated lumbar disc hernia.

Study Design: Prospective comparative clinical case study.

Purpose: To compare the clinical outcome of patients presented with single degenerated lumbar disc hernia treated with fusion to those treated only with simple discectomy.

Patients and Methods: Two groups of patients were recruited for this study included 20 patients each. Group A; patients treated with fusion and instrumental fixation. Group B; patients treated with simple discectomy. Both groups were homogeneous in terms of clinical presentation and imaging data. The VAS was used to evaluate leg and back pain, while ODI was used to evaluate the functional status both pre and post operatively.

Results: Preoperatively, all patients suffered back pain, where 16 had moderate and 4 had severe pain in group A, and 14 had moderate and 6 had severe pain in group B. The ODI showed that, 16 and 17 patients had moderate disability in group A and B respectively. According to VAS, 12 patients had moderate and 8 had severe sciatica in group A, and 15 patients had moderate and 5 had severe sciatica in group B. With follow-up, back pain improved according to VAS, where 14 patients had no pain, 3 had mild and 3 had moderate pain in group A, and 18 (90%) patients had severe pain in group B. the ODI showed that 17 (85%) patients had minimal disability and 18 (90%) patients had moderate disability in group A and B respectively. According to VAS, 18 (90%) patients were pain free while 2 had mild sciatica in group A, and 17 patients became pain free in group B, however, 4 patients re-experienced moderate and 2 complained of severe pain due to recurrent disc.

Conclusion: Despite the controversies regarding its ideal management, the results of discectomy and fusion stand better when compared with simple discectomy. However the disease needs more study to understand its pathogenesis. (2012ESJ034)

Key Words: degenerative disc disease, disc hernia, simple discectomy, lumbar fusion.

Introduction

The sequelae of disc degeneration remain among the leading causes of functional incapacity in both sexes and are a common source of chronic disability in the working years.¹⁰ In accordance with its incidence, morbidity, and socioeconomic impact, degenerative disc has given and continues to give extensive research efforts into its epidemiology, anatomy, biomechanics, biochemistry and neuromechanics²² The term lumbar disc degeneration lacks a standard definition and its pathogenesis is not completely understood. Studies have suggested a multifactorial etiology including mechanical stresses, nutritional factors, age dependant disc degeneration, biochemical factors and genetics.⁹ There are certain consistent MR imaging changes indicative of disc degeneration. A defining characteristic is the decrease in signal intensity in T2 weighted sequences. There is great controversy concerning the surgical treatment of degenerated lumbar disc hernia.⁵ In our study we compare the clinical, radiological and surgical data of 20 patients with degenerated lumbar disc hernia treated by lumbar fusion versus those with of the same number of patients treated by simple discectomy.

Patients and Methods

This study was done at the Neurosurgical department, Alexandria University Hospital during the period from March 2010 till July 2011. Inclusion criteria included active middle aged persons (25-45 years) patients with single degenerated lumbar disc hernia from L3-4 to L5-S1 disc. All patients failed proper conservative therapy for at least 3 months and suffering chronic recurring back pain prior to the onset of sciatica. Exclusion criteria included; patients with multilevel degenerated disc disease, spondylolisthesis, previous lumber surgery, spinal deformity, connective tissue diseases. Two groups of patients were prospectively recruited for this study including 20 patients each. Group A; was treated with discectomy, bony fusion and instrumental fixation, where group B was treated with simple discectomy. Patients' allocation was at random. We used the Visual Analogue Scale (VAS) to evaluate leg and back pain, and the Oswestry Disability index (ODI) to evaluate the functional status of patients in both groups pre as well as postoperatively. All patients were fully assessed

clinically pre/and postoperatively. All patients were submitted for full imaging study including plain radiographs in AP, Lateral, and dynamic study as well as MRI of lumbosacral spine. Post operative back pain assessment by the VAS started from the third month. The functional state of the back was assessed by ODI preoperatively and at the end of the period of follow up.

The mean age of group A patients was 32.7 while that of group B was 36.2 years. Fifteen patients of group A were females; while in group B, 11 were females. In both groups, patients were not operated before the laps of 3 months from a newly onset sciatica that failed to respond proper medical therapy. Plain Radiography was negative for gross instability, and MR images revealed single level affection from L3-4 to L5-S1 in all patients. Posterior lumbar interbody fusion using laminar bone chips was used for all patients of group A, while discectomy through fenestration was done for all patients of group B.

Operative Procedure:

Group A. all patients were operated under general anesthesia in the prone position. The affected level was determined, and about 5-7 cm skin incision was made in the mid line. The spinous process was removed as one piece, and complete bilateral laminectomy was done. The ligamentum flavum of the above level was removed to prevent future segmental stenosis at that level. Unless a huge central disc or bilateral sciatica was present, unilateral discectomy was done. The cartilaginous end plate was properly removed and with some distraction the laminar bone chips were packed in the disc space. The whole spinous process was tailored to be placed as a single bone strut overlying the laminar bone chips. Placed by this way, the strut spinous process bone graft traps the smaller bone chips anterior to it preventing their extrusion to the spinal canal; meanwhile omits the need for the use of metallic cages. Relieving the distraction, the bone was left impacted in the disc space. Top loaded pedicle screw fixation was used to fix this motion segment in the traditional way.

Group B: through 2-3 cm skin incision and after fluoroscopic level determination, the herniated disc was removed through fenestration.

Patients of both groups were followed-up in the out-patient clinic for assessment of the back pain

and sciatica ten days, then one, three, six and twelve months postoperatively.

Results

Clinical data:

Group A: All cases complained of chronic back pain before the onset of the recent sciatica for a period ranging from 1 to 5 years (mean 2.7 years). According to VAS, 16 patients had moderate pain (Grade 4-6) and 4 had severe pain (Grade 7-10). Seventeen patients had low back local tenderness, 13 had marked paravertebral muscle spasm, and 2 had acquired scoliosis. The low back ODI showed that, 1 patient was crippled (60-80%), 3 were severely disabled (41-60%), and 16 were moderately disabled (21-40%). Left side sciatica was present in 13 patients. All patients had severe sciatica (Grade 7-10) at the beginning of the disease, but at the time of surgery only 8 patients were still complaining of severe sciatica according to VAS. None of the patients had motor weakness or sphincteric affection.

Group B: All patients had chronic back pain preceding the sciatica ranging between 1 and 7 years (mean of 3.2 years). Fourteen patients had moderate (Grade 4-6), while 6 patients had severe back pain (Grade 7-10) according to VAS. The low back ODI showed that, 3 patients were severely disabled (41-60%), and 17 were moderately disabled (21-40%). Left side sciatica was present in 11 patients. At the time of surgery, 15 patients had moderate and 5 had severe sciatica according to VAS. Motor weakness or sphincteric affection was not present in all patients. Table (1) presents the preoperative clinical findings in both groups. There were no significant co-morbidities reported in both groups.

Radiologic data:

Group A: Fourteen patients had L4-5 disc herniation. Six patients showed facet joint gapping with hydroarthrosis, and 8 patients showed coronal facet orientating.

Group B: Eleven patients had L4-5 disc herniation. Nine patients showed facet joint gapping with hydroarthrosis, and 3 patients showed coronal facet orientation. Table (2) presents the different radiologic findings in both groups.

Operative data:

The operative time in group A ranged between 95 and 120 minutes with a mean of 105 minutes. The operative time in group B ranged between 25 and 50 minutes with a mean of 37 minutes. The mean blood loss in group A was 350 cc (160-600), while that in group B was 50cc (200-50cc).

Post-Operative clinical Data:

Back manifestations:

Group A: 3 months after surgery, 12 patients had moderate pain and 8 patients had mild pain. At the end of follow up, 14 (70%) patients had no pain and 3 patients had moderate pain by the VAS. The ODI at the end of follow up showed 17(85%) patients to had a score of 0-20 %, while only 3 (15%) patients continued to have some back complaints making them by the ODI to be moderately disabled (score of 21-40%).

Group B: After 3 months of surgery, all patients continued complaining of back pain. 17 patients had moderate, while 3 patients had severe back pain by the VAS. At the end of follow up, 18 patients (80%) had severe pain (Grade 7-10) while 2 patients had moderate pain (Grade 4-6). Table (3) presents the pre and postoperative assessment of the back pain by the VAS. The ODI showed 18 (80%) patients had moderate and 2 (10%) patients had severe disability. Table (4) presents the functional outcome state of both groups of patients both pre and postoperatively.

Leg manifestations:

Group A: By the end of follow up, 18 patients (90%) became free of the leg pain, while 2 patients still having mild sciatic pain (Grade 1-3).

Group B: Ten day after surgery; 17 patients showed complete recovery from the sciatic pain (Grade 0), while only 3 patients continued experiencing mild sciatica. At the end of follow up, 14 (70%) patients continued be pain free, and due to same level recurrence of disc herniation, 4 patients got sever and 2 patients got moderate sciatica. Table (5) presents the severity of the sciatic pain both pre and post operatively in both groups.

Patients of both groups were discharged from the hospital in the first postoperative days, except 4 patients of group A that were discharged in the second postoperative day due to their request.

Table (1). Summary of the Preoperative Clinical Data of he Study Patients.

	Group A	Group B
Back Data		
Back Pain	Moderate 16	Moderate 14
	Severe 4	Severe 6
Tenderness	17	19
Spasm	13	15
Scoliosis	2	0
Leg Data		
Sciatica	Left 13	Left 11
	Right 7	Right 9
Severity	Moderate 12	Moderate 15
	Severe 8	Severe 5
Sensory affection	16	11
Lasigue test, +ve	19	16
Weakness/Sphincter	0	0

Table (2). Radiologic Data in Both Groups.

Group	Disc affected		Facet pathology	
	L4-5	L5-S1	Gapping	Coronal orientation
Group A	14	6	6	8
Group B	11	9	9	3

Table (3). Pre & Post-Operative Back Pain According to VAS in Both Groups.

VAS	Group A				Group B			
	PreOp	PostOp			PreOp	Postop		
		3 Mo	6 Mo	1 Yr		Mo 3	6 Mo	1 Yr
Non pain	-		12	14	-	-	-	-
Mild pain	-	8	2	3	-	-	-	-
Moderate pain	16	12	6	3	14	17	2	2
Severe pain	4	-	-	-	6	3	18	18

NB. D: day, Mo: month, Yr: year, PostOp: postoperative, PreOp: preoperative.

Table (4). Pre & Postoperative Back Pain According to ODI in Both Groups.

ODI	Group A		Group B	
	PreOp	PostOp	PreOp	PostOp
Mild disability (0-20%)	-	17	-	-
Moderate disability (21-40%)	16	3	17	18
Severe disability (41-60%)	3	-	3	2
Crippled (61-80%)	1	-	-	-
Bed bounded (81-100%)	-	-	-	-

NB. PostOp: postoperative, PreOp: preoperative.

Table (5). Pre & Post-Operative Sciatica According to VAS in Both Groups.

VAS	Group A					Group B				
	PreOp	PostOp				preOp	PostOp			
		10 D	1 mo	6 mo	1 yr		10 D	1 mo	6mo	1 yr
Non pain (0)	-	15	17	18	18	-	17	19	16	14
Mild pain (1-3)	-	3	1		2	-	3	1	1	-
Moderate pain (4-6)	12	2	2		-	15	-	-	3	2
Severe pain (7-10)	8		-		-	5	-	-		4

NB. D: day, Mo: month, Yr: year, PostOp: postoperative, PreOp: preoperative.

Figure (1). A: Sagittal and B: axial T2 w MR images for a 19 yrs old ballet dancer girl with herniated degenerated L4-5 disc. C: Post operative control lateral plain x-ray showing PLIF and pedicle screw fixation.

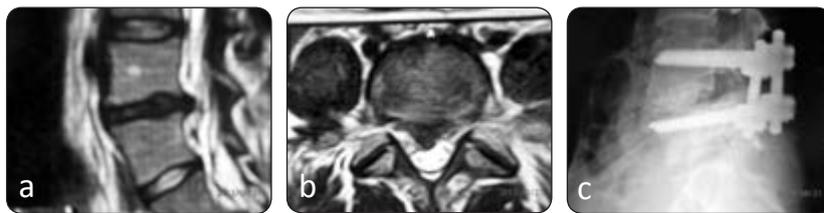


Figure (2). A: Sagittal and B: axial MR images for a 27 yrs old lady operated by simple discectomy through fenestration for herniated Lt L5-S1 disc with same level same side recurrence after 5 months

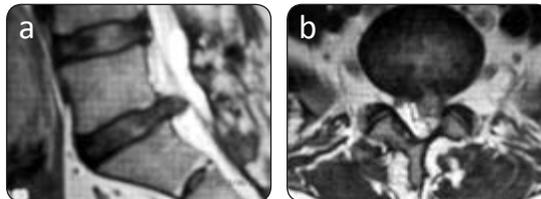
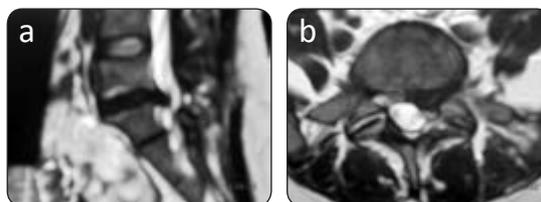


Figure (3). A: Sagittal and B: axial MR images of a 34 years old female operated by simple discectomy for Lt L5-S1 disc herniation with same level same side recurrence after 8 months. Note the bilateral gaping of the facet joints.



Discussion

Degenerative disc disease or internal disc disruption associated with axial back pain is a disease entity that was recognized about two decades ago as a disorder amenable to surgical treatment.⁴ Patients presenting with axial back dominant pain with minimal or absent radicular pain were not thought to be good candidates for surgical intervention. The recent advances in different related fields, including a better understanding of the anatomical, physiological, and biochemical factors of pain generators in the intervertebral disc, refinements in the technique of lumbar discography, improved resolution in MR imaging, development of newer surgical approaches to lumbar disc (open or laparoscopic), and the critical evaluations of surgery related results following lumbosacral fusion, these advances are contributing to rapid contemporary evolution in understanding to discogenic pain syndrome.²⁰

Traditionally disc degeneration has been linked to mechanical loading; nevertheless traumatic, nutritional and genetic factors all play a role in the pathogenesis of disc degeneration. Repetitive or continuous axial overloading is the key determinant in the pathogenesis of lumbosacral disc degenerative diseases. The importance of mechanical factors has been emphasized by experiments on cadaver spine with both severe single and relentless loading.²

Occupation is a very important determinant. Workers performing strenuous works with typical axial loading, laborers exposing to whole body vibratory forces, and vigorous and compulsive athletic activities are more predisposed to accelerated disc degeneration.^{16,1}

The importance of normal blood flow to the homeostatic nutritional process in the intervertebral disc complex has been suggested to explain the association of atherosclerosis and aortic calcification with increases disc degeneration and subjective low back pain.²⁰ Several additional studies suggest that not just the process of DDD but perhaps its sequelae are strongly influenced by genetic factors.¹⁸ Defects in the DNA for collagen have been identified in family clusters predisposed to degenerative disc disease. Other genetic defects resulting in impaired proteoglycan synthesis are being explored.²⁰ Richardson et al,¹⁷ noticed the presence of a familial disposition to back pain. Degenerative disorders involving family clusters tend to manifest as multilevel disc herniation at a younger age.

The etiology of symptoms in patients with DDD is complex. The symptoms complex is more often characterized by variability and periodicity rather than stability.²¹ Pain is the most common complaint, and mechanisms which usually act in combination include (a) instability with the associated disc degeneration, facet hypertrophy or arthropathy; (b)

mechanical nerve compression; and (c) the release of biochemical pain and inflammatory mediators.¹⁰ Kuslich et al,⁷ stated that annulus fibrosus is the most pain sensitive structure. Histopathologic studies have shown heavy innervations of the annulus by both autonomic and somatic nerves.²⁴ Coppes³ noticed the more active sprouting of nerve terminals in pathologic than normal disc. The concept of disc tissue producing an inflammatory response is not new, the recently introduced monoclonal antibody technology and other assay techniques demonstrated chemical radiculitis related to nuclear material and its glycoproteins as being highly irritant to nerve tissue.¹⁴

The role of an imaging test is to provide accurate morphologic information and influence therapeutic decision making. There are certain consistent MR imaging changes indicative of DDD.^{11,15} A defining characteristic is the decrease in signal intensity in T2 weighted sequences obtained in the nucleus pulposus compared with the adjacent discs. The outline of the nucleus becomes irregular and the disc height decreases.¹⁹ The cortical endplate and the adjacent marrow show changes in three steps well, described by Modic.¹²

As a sound surgical principle, general conservative measures should be instituted first. In general, one third of patients with disc herniation at presentation had significant resolution or disappearance by 6 weeks and two thirds by 6 months.¹³ The decision for surgery is resorted only to cases that failed to respond to conservative therapy. Although numerous studies have been published, controversy still exists regarding fusion and simple discectomy for symptomatic degenerated herniated lumbar disc. Definite conclusions are difficult to draw because of differences in patient inclusion criteria, non operative treatment regimens, fusion techniques and clinical outcome measures used to determine success.⁸ Radiologic manifestations of instability were always reported to accompany lumbar disc degeneration in the form of retrolisthesis marked facet joint spondylotic changes, facet distraction and fluid in the joint space.^{4,23} There are great controversies concerning the treatment protocols for DDD as way of treating this still unclear disease is increasing aided by the more understanding of the nature of the disease process and the obtained postoperative results in either conditions of fusion or non fusion.

Conclusion

Despite the better surgical outcome we got in cases treated with discectomy and fusion, we consider the combination of more understanding of the disease nature and longer periods of follow up after the proposed surgical modality is needed for getting a more decisive surgical design. Degenerated lumbar disc hernia is a recent disease process that needs more detailed study and understanding.

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الملخص العربي

فتق الغضروف القطني المتحلل: الاستئصال البسيط أو الانصهار الفقاري

المقدمة: تحدث آلام الظهر بنسبة قد تصل إلى ٨٤٪ في وقت ما من عمر الإنسان ويعتبر جفاف الغضروف القطني واحد من أكثر الأشياء شيوعاً خلال الفحص والدراسة لحالات آلام الظهر. وهناك عوامل ميكانيكية وغذائية ووراثية قد تلعب دوراً في حدوث ذلك المرض. وسبب آلام الظهر في مرضى آلام الغضروف الجاف ليس بسيطاً والظاهر أنه يحدث نتيجة وجود كل من عدم استقرار الفقرات وخروج وسائط الالتهاب. هناك جدل واسع حول الطريقة المثلى لعلاج مرض جفاف الغضروف.

الطريقة: في هذه الدراسة تم مقارنة البيانات الإكلينيكية والجراحية لعشرين حالة عولجوا من هذا المرض عن طريق إزالة الغضروف من تثبيت الفقرات حول الغضروف بقضبان ومسامير بعد وضع شرائح عظمية (مجموعة أ) مع بيانات عشرين حالة أخرى عولجوا بمجرد إزالة الغضروف المنزلق بدون تثبيت الفقرات (مجموعة ب).

النتائج: قد أظهرت النتائج في (المجموعة أ) أن جميع المرضى كانوا يعانون من آلام بالظهر وآلام بالساق اليسرى أكثر من الساق اليمنى مع توسع بالمفصل الفقاري في ١٨ حالة. انزلاق الغضروف بين الفقرات الرابعة والخامسة كان موجود في ١٤ حالة. وقد حدث تحسن في ألم الظهر في ٩٠٪ من المرضى بعد العلاج بإزالة الغضروف مع تثبيت الفقرات. كانت النتائج في (المجموعة ب) كالتالي: آلام الظهر كانت موجودة في جميع الحالات أيضاً قبل الجراحة وكان الغضروف بين الفقرات الرابعة والخامسة أيضاً هو الأكثر تأثراً. وبعد الجراحة بإزالة الغضروف فقط وعدم تثبيت الفقرات. ظل جميع المرضى يشكون من آلام الظهر وحدث ارتجاع للغضروف في نفس المستوى في ١٤ مريضاً.

الاستنتاج: من السابق نستطيع أن ننجز أن مرض جفاف الغضروف هو مرض جديد نسبياً يحتاج لعمل وفهم أكثر لطبيعة وسلوك المرض. ورغم وجود جدل واسع حول العلاج الأمثل لهذا المرض إلا أن النتائج في هذا البحث تعضد العلاج بإزالة الغضروف وتثبيت الفقرات كطريقة أنجح من مجرد إزالة الغضروف لتلك الحالات.