



## Lumbar Disc Disease, Clinical Presentation and Surgical outcome

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### Abstract

Back pain is an extremely common phenomenon. It was estimated that almost 80 percent of individuals experience back pain at some in their lives. To evaluate clinical features of lumbar disc herniation and their relation with the outcome of the treatment, a prospective study conducted in the period from April 2005 to May 2008 included 40 Iraqi patients who met the inclusion criteria. MRI was the main diagnostic tool. The outcome of surgical treatment; was evaluated for 6 months postoperatively depending on kamofskys scale. The patients were 31 males and 9 females. With a mean age of 36.87 years. The range of the duration of the clinical features was between 3days to 18months. Laminectomy and discectomy was performed to all patients & the commonest operative finding was posterolateral disc herniation. Three types of complications were encountered which are surgical wound infection, cerebrospinal fluid leak and discitis. The outcome of disc surgery is affected by, technique and skills and other factors. Duration of backache and sciatica less than 6 months before operation, was good prognostic factor while Preoperative paresis of grades (2, 1, 0) and presence of comorbidities were poor prognostic factors.

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## Introduction

### Background

In many parts of the world, the treatment of lumbar disc disease takes up most of neurosurgeons times. Patients with lumbar disc herniation offer a wide range of joys and frustrations to the surgeon. After treatment, they may be grateful or angry, athletic or disabled, hopeful or depressed.

The symptoms of lumbar disc disease were known in ancient times (1). Sciatica was first described in the Edwin Smith papyrus and later by Greek and Roman

writers. In the 19th century, descriptions of herniated discs were provided by Virchow, Von Luschka, and Kocher (2). Von Luschka postulated that sciatica might result from herniated discs, and Kocher emphasized that trauma could lead to disc protrusions.

The scientific evolution of lumbar disc disease as a surgical disorder began in 1934 when Mixter and Barr published the first clinically adequate description of lumbar disc herniation as the cause of leg pain (3). Interest in the condition subsequently increased, but it was not until after the Second World War that surgery for it gradually became one of the most common elective procedures in the United States (4).

## **Epidemiology**

Back pain is an extremely common phenomenon. Nachemson estimated that 80 percent of individuals experience back pain at some in their lives (5). Horal noted that 35 percent of patients with low back pain will at some time develop sciatica (6). The prevalence of the problem is demonstrated in Nachemson's review, which indicates that 4.8 percent of the male population and 2.5 percent of the female population beyond the age of 35 will at some time in her life experience sciatica (5). Although back pain and lumbar disc disease may be seen in childhood, the condition more typically begins in the third decade and continues to the sixth decade. Lumbar disc herniation and sciatica occurs in a much smaller percentage of the population estimated at between 2 and 40%. The peak incidence is in the third and fourth decades. Risk factors for the disease include certain occupations that require heavy repetitive lifting, the operation of vehicles and pregnancy (7).

## **Biomechanics of intervertebral disc**

Contrary to popular belief, the intervertebral disc is relatively resistant to failure under compressive loads. The vertebral end plate usually fails first in both normal and degenerative discs (8). However, in torsion the disc is the part that fails first. Another loading situation that causes disc herniation is the sudden application of axial compression force while the spine is laterally bent and hyper flexed. The load on the spine has been shown to vary considerably with posture and external loads and is much larger than generally believed. At the L3-L4 interspace, a person sitting has a higher intradiscal pressure than when standing and the lowest pressures are obtained when the person is lying on the back (9). Because the spine acts as a flexion boom to the high - wire actions of the paraspinal muscles, it is the fulcrum of a lever system in which loading has a considerable mechanical advantages. Spectral analysis indicates that extremely high pressures are transmitted to this fulcrum when a heavy object is lifted with the hands (up to 15 times the weight of the object). Fortunately, other muscles dissipate some of these pressures. Actual recordings have revealed intradiscal pressures of 220 kg. when a 70 kg person lifts a 50 kg weight (10). Additional intradiscal pressures of about 15 kg are induced by "preloading". Preloading results from the inherent tension of the intervertebral ligaments. It is given a value of 15 kg because that is the weight that is required to restore the original thickness of the disc after the ligaments have been divided (4).

## **Clinical presentation**

The initial symptom is most commonly backache that may be acute or gradual in onset. There may be history of prior episodes of focal back pain without sciatica which resolved spontaneously. Back pain may persist for several days or weeks and then it may be followed by incapacitating radiating pain into the leg. This may be accompanied by parasthesia or numbness in the affected dermatome. It also may be followed by weakness in selected muscle groups. Occasionally, the clinical picture is one of severe and cramping leg pain which occurs very soon after the onset of symptoms. In either case, the pain is often aggravated by sitting, standing and walking as well as by coughing, sneezing, or straining. In some patients, it may be increased by sitting but relieved by lying down, particularly with the hip and knee flexed (7).

Moderate compression of a nerve root in the absence of inflammation will produce parasthesia, not pain, according to the studies of MacNab. When inflammation is present, the pain response is more easily elicited (4).

Back and leg pain may persist together, but it often happens that the back pain is decreased with the onset of sciatica. Apparently, this phenomenon is due to reduction in the stretch of pain fibers in the annulus, and posterior ligament that occurs with extrusion of the disc. Similarly, on rare occasions, severe sciatica may be suddenly relieved; however this is usually associated with motor weakness and sensory loss because of physiological interruption of function in a severely compressed nerve root. In older patients, there may be little or no antecedent back pain, and leg pain dominates the clinical picture from onset (4). In the presence of a narrow canal and a large midline protruded disc, the patient may complain principally of back pain and vague leg pain that alternates in intensity from side to side. Urinary retention has been described as the only manifestation of protruded disc in some female patients, although many patients without bladder symptoms have abnormal results on test of urinary function (11,12). It is not unusual to see irritative symptoms including urinary urgency, frequency (including nocturia), and increase post void residual. Less commonly enuresis, and dribbling incontinence are repeated in radiculopathy (13). Occasionally a herniated lumbar disc may present only with bladder symptoms which may improve after surgery (14). The back of the patient with a herniated disc may be normal appearing, or it may be flattened with a slight forward tilting of the trunk and flexion of the hip and knee on the affected side. Scoliosis, directed

toward or away from the affected side, may be present. Percussion of the back may produce focal pain over the affected vertebrae. Patient stand and change position in a slow, deliberate manner. Forward bending is limited to a variable degree because of splinting of the spine. Passive movement of the lumbar spine may produce pain. The following tests were elicited on the patient: Lasegue's sign. (Straight Leg Raising Test, SLR), Cram Test, Crossed SLR (Fajersztajn's Sign), Femoral Stretch Test (Reverse SLR), Bowstring Sign, Sitting Knee Extension Test, Naffziger's Test (7, 15-17).

Cauda Equina Syndrome (CES) may be due to compression from massive ruptured disc, usually midline, most common at L4 - 5, often superimposed on a pre-existing condition (spinal stenosis, tethered cord) (18).

### **Investigations**

Conventional Radiographs of the Lumbosacral Spines, MRI, C.T. scanning, Myelography, Discography and Epidural venography (4, 7, 19-23).

### **Management**

**Non-Operative Management:** Bed rest, traction, manipulation, medications, Gravity traction, specific exercise programs, shoe lifts for unequal leg length, and so forth, have enjoyed periodic enthusiasm. A brace may provide relief for the ambulatory patient with an acute herniated disc, injection of long- acting steroids into the epidural space and transcutaneous electrical nerve stimulation (TENS) has been used to relieve low back and leg pain (4,24).

**Operative management:** Indications for Surgery include a massive midline protrusion that causes compression of the cauda equina, resulting in motor and sensory paresis and loss of sphincter control. Nerve root compression associated with significant quadriceps weakness or a foot drop (7, 25), Sciatica, with or without neurological deficit that does not improve on a period of non-operative management and the recurrence of incapacitating episodes of back pain and sciatica that prevent the patient from living a reasonably normal life (7). Prior to decide the operative option, medical and other non-operative managements should be tried first particularly when there is a response to these managements. Surgery for acute lumbar disc herniation is categorized into three types; surgery without

magnification, surgery with the aid of magnifying loupes, and surgery' with the operating microscope (4, 25,26).

### **Complications of Surgery**

Injuries to the great vessels, penetration of dura, nerve roots injury, disc space infection, spasm: occasionally, patients develop postoperative back pain without evidence of discitis. they can be treated best with adequate administration of pain medication and, in selected cases, with oral preparations of muscle relaxants. Pseudarthrosis and lumbar instability after simple disc excision, venous air embolism. This is an extremely unusual complication and ther complication could occur early or at late postoperative (4).

### **Materials and Methods**

A prospective study conducted during April 2005 to May 2008 included 40 Iraqi patients. The data were obtained by direct interrogation and clinical examination. Patient's demographic and clinical data were gathered. Laboratory and Radiological Studies findings were reported, Plain x - rays of the lumbosacral spines and MRI were performed in all patients in addition to electrophysiological studies. All patients were operated on under general anesthesia in the prone position. Antibiotics were used both intra and post operatively. The type of the operation was total laminectomy and disc excision. The laminectomy included an upper single laminectomy (e.g in L4- L5 disc herniation, laminectomy of L4 was done). Additional lower partial laminectomy was done in 12 cases. No magnification was used and Fusion has not been added in any case. Patients were encouraged to leave their beds as early as possible postoperatively. All patients were followed up for six months. And their outcome was assessed using Kamofsky as a grading scale for the functional outcome (27).

Patients were selected according to the following criteria:

1. Clinical signs and symptoms suggestive of sciatica.
2. Radiological evidence of disc herniation.
3. Operative proof of disc herniation.
4. No previous surgery in the lumbosacral region.

All ethical issues were approved from the local scientific and research ethics committee at Al Sader Medical city. All patients' signed consents were obtained

**Statistical Analysis:** Through the statistical package for Social Sciences (SPSS) software for windows, version 16. Appropriate statistical tests were used accordingly.

## **Results and Discussion**

The mean age of the patients was 36.9 (Range: 22 – 57) years. Males were 77.5 % with a male to female ratio of 3:1. The majority of our patients aged more than 40 years. The commonest factor was repetitive lifting of heavy weights. The other precipitating factors included physical activity, child delivery in lithotomy position, sudden lifting of heavy weights, and trauma to the back. Herniated intervertebral lumbar disc is almost equally distributed between L4-L5 and L5-S 1 intervertebral discs (Table 1). Backache and sciatica were present in 40 cases (100%). The duration of backache and sciatica was variable ranged 3 days to 18 months and 70% of the patients had their complaint for 6 months or less (Table 2). Motor weakness was present in 16 cases (40%). The motor power grade and the number of cases for each grade are shown in (Table 3), only one case with power grade 0 was a case of cauda equina syndrome with right foot drop of 3 days duration. Tendon reflexes were absent in ankle and knee and were either unilateral or bilateral, (Table 4), Scoliosis was present in 24 cases (60%) and sensory changes in 28 cases (70%), of them one case was complaining of saddle anesthesia and he was having cauda equina syndrome, while the remaining cases were complaining of hyperesthesia in dermatomal distribution according to the nerve root involved. Retention of urine was present in 3 cases (7.5%). two of them were having cauda equina syndrome. Neurogenic claudication was present in 2 cases (5%). The walking capacity was less than 500 meters. Both cases were above 50 years of age. Straight Leg Raising (SLR), Crossed Straight Leg Raising (CSLR), and Reversed Straight Leg Raising Tests (RSLR) were applied, results of these tests are shown in (Table 5). Radiological studies: Plain X-rays, revealed loss of lordotic curve in 29cases (72.5%), scoliosis in 19 cases (47.5%), Narrowing of the disc space in 18 cases (45%), posterior osteophyte formation in 9cases (22.5%) and transitional vertebrae in 2cases (5%). MRI showed postero-lateral disc herniation in 24 cases (60%), bulging of the disc in 13 cases (32.5%), and central disc herniation in 3cases (7.5%).

## **Operative findings**

Laminectomy and disc excision was performed in all cases, the commonest finding was posterolateral disc

herniation (24cases) with only 2 of them with extreme lateral disc herniation. Bulging of the disc in 13 cases and central disc herniation in 3 cases only. These findings correlate highly with the MR I findings. No intradural rupture of the disc or sequestered segment was found. There was no macroscopical dural tear or neural injury encountered intraoperatively. Calcified disc was found in 2 cases, both -cases were above 50 years of age.

## **Postoperative complications**

Only one patient (2.5%) had wound infection, he showed good response to conservative management which included good antibiotics cover according to culture and sensitivity tests, and frequent meticulous dressing. CSF leak from the surgical wound was encountered in one case only (2.5%), Discitis developed in one case, (2.5%) the patient had relieved from his symptoms post operatively, but he developed backache and sciatica again after 2weeks. MRI was done for him and showed signs of disc space infection at the same level operated upon. The patient showed good response on heavy antibiotic cover, analgesics, anti-inflammatory drugs and complete bed rest.

## **Clinical outcome**

During the follow up period of 6 months all patients were evaluated based on the degree of severity and the duration in which their complaints had been present preoperatively. On last assessment of the patients, the outcome according to Kamofsky scale is shown in (Table 6).

In those cases with a score of 100 (28 cases), the duration of symptoms (i.e. backache and sciatica) preoperatively was less than 6 months. In those cases with a score of 90 (8 cases), two of them were diabetic and they were complaining of hypesthesia preoperatively and postoperatively and the duration of their symptoms preoperatively was less than six months, while in the other six cases the duration of symptoms was between six to twelve months. In those cases with a score of 80 (2 cases), the duration of their symptoms preoperatively was more In the case with a score 70 (1 case), it had a paresis of power grade 2 preoperatively and became power grade 4+ postoperatively. in the case with a score of 60, he had a paresis of power grade 0 (cauda equina syndrome) preoperatively, which became power grade-3 postoperatively in those patients complaining of motor weakness preoperatively, the results were the cases with power grade 3 and above preoperatively (14 cases),

regained normal power postoperatively. The case with power grade 2 preoperatively, became with 4+ power grade 3 days postoperatively. The case with power grade 0 preoperatively (1 case with cauda equina syndrome), became with power grade 4.

Three patients were complaining of retention of urine preoperatively, two of them with cauda equina syndrome, restored normal function of the bladder after 4 months postoperatively, while the other restored normal function of the bladder after 5 months postoperatively. The 3rd case regained normal function of the bladder 2 days postoperatively. Straight leg raising test was positive in 38 cases preoperatively.

This test was positive in 5 cases by the seventh postoperative day, 2 of them were having a Kamofsky score of 90. And other 2 of them were having a Kamofsky score of 80 and the last one was having a score of 70 on last assessment.

The peak incidence of lumbar disc herniation, according to Hardy.R. W, is in the fourth and third decades. Risk factors included mainly repetitive lifting and twisting (7). In our study, the peak incidence was in the fourth decade, followed by the fifth decade (range between 21 and 54 years).

The average age was 36.87 years. Male affected more than female (77.5% male, 22.5% female). The commonest precipitating factor was repetitive lifting of heavy weights (62.5%). This is true in our population because most of them having hard types of work and practicing their works with relatively old fashion facilities. Also lumbar disc herniation may occur as a complication of lithotomy position (28). This occurred in

2 female patients in our study who delivered by a normal vaginal delivery in lithotomy position. Patients with the duration of symptoms of less than six months had better results concerning outcome compared to patients with duration of six-twelve months and more than twelve months. The same results were obtained by Nygaard. *et al.*, (29). Motor weakness of power grade 3 and above preoperatively had good outcome postoperatively, while those with power grade of less than 3 had poor outcome. Early postoperative positive SLR in our patients correlated with inferior outcome until the last assessment. A study by Jonsson and Stromqvist concluded the same results (30). The ESR results preoperatively were within the normal limits for all our patients. Postoperatively, all the patients showed a homogenous pattern with rapid increase and decline to the normal values except in 2 cases, one of them had surgical wound infection. The 2nd case that showed a persistent elevated ESR results developed signs and symptoms of discitis. Jonsson *et al.*, (31) showed that patients with postoperative deep infection at the time of diagnosis show ESR elevation to a degree that usually makes the results diagnostic.

The prevalence of cauda equina syndrome among our patients was 7.5% while according to Devo.*et al.*, the prevalence was only 1-2% of herniated lumbar disc that come to surgery (32). In our cases with cauda equina syndrome, the retention of urine didn't improve immediately post operatively, but on follow up, the patient restored normal function of the bladder. Chang *et al.*, (33). Concluded in their study that on follow up of the patients with cauda equina syndrome, the short term recovery of bladder function is poor after lumbar disc surgery, but the long term outcome is not necessarily so (33).

**Table.1** The levels of lumbar disc herniation

Level	No. of patients	%
L5-S1	20	50.0
L4-L5	18	45.0
L3 -L4	2	5.0
TOTAL	40	100.0

**Table.2** Duration of backache and sciatica

<b>Duration</b>	<b>No. of patients</b>	<b>%</b>
< 6 months	28	70.0
6-12 months	4	10.0
> 12 months	8	20.0
<b>Total</b>	<b>40</b>	<b>100.0</b>

**Table.3** Motor power grade and number of cases

<b>Power Grade</b>	<b>No. of patients</b>	<b>%</b>
0	1	2.5
1	0	0.0
2	1	2.5
3	1	2.5
4-	2	5.0
4	5	12.5
4+	6	15.0
<b>Total</b>	<b>16</b>	<b>40.0</b>

**Table.4** Sites of and number of patients with absent reflexes

<b>Reflex absent</b>		<b>No. of patients</b>	<b>%</b>
<b>Ankle</b>	Unilateral	14	<b>35</b>
	Bilateral	<b>3</b>	<b>7.5</b>
<b>Knee</b>	Unilateral	1	<b>2.5</b>
	Bilateral	0	<b>0</b>

**Table.5** Results of Straight Leg Raising (SLR), Crossed Straight Leg Raising (CSLR) and Reversed Straight Leg Raising Tests (RSLR) tests

Test		Herniated Disc level		
		L5 – S1 (n = 20)	L4 - L5 (n = 18)	L3 -L4 (n = 2)
SLR	<i>Positive &lt; 30°</i>	13	10	0
	<i>Positive 30°-60°</i>	7	8	0
	<i>Negative</i>	0	0	2
CSLR	<i>Positive 30°-60°</i>	17	16	0
	<i>Negative</i>	3	2	2
RSLR	<i>Positive 30°-60°</i>	2	1	0
	<i>Negative</i>	18	17	2

**Table.6** Clinical outcome of the patients according to Kamofsky scale

Score	No. of patients	%
100	28	70.0
90	8	20.0
80	2	5.0
70	1	2.5
60	1	2.5
Total	40	100.0

In another study by Shapiro S. among ten patients who had no incontinence after surgery, seven underwent surgery within 48 hours of onset. Of the four patients with persistent incontinence, all underwent surgery after 48 hours (18).

Also another study by Ahn. U.M., *et al.*, found that there was a significant advantage to treating patients within 48 hours versus more than 48 hours after the onset of cauda equina syndrome (34).

Jonsson and Stromqvist, found that there is an age-related change in the prevalence of certain parameters. Highly restricted positive SLR test results was most commonly found in the youngest patient group?

With increasing age there was a decreasing prevalence of highly restricted positive SLR test results, while the prevalence of severe reduction of walking capacity increased (35). These findings correlate with the findings in our study where the SLR test was more pronounced (<30 degrees) in younger age group (< 40 years of age)

and the 2 cases with neurogenic claudication were above 50 years of age.

The postoperative incidence of wound infection in our study was 2.5%. Currently an acceptable incidence of postoperative wound infection (in clean neurosurgery) is less than 5% (36). The incidence of discitis in our study was 2.5%. In other studies the incidence of discitis was variable. In one study by Ford and Key it was 0.27% (37), while in a study by Getty CJM the incidence was 3.6%. (38). CSF leak through the surgical wound happened in 2.5% of our cases. Two previous studies found CSF leak in 0.6% and 2% of the patients (38, 39).

Adults in the 4th decade of life and male gender are more affected with disc herniation. L4 - L5 and L5 – SI are the more affected levels. A paresis classified as grade 3 and above preoperatively have better outcome than grades 2, 1, and 0. A postoperative persistent positive SLR test correlates with an unfavorable surgical outcome. The younger patients group showed the most obvious clinical picture of disc herniation and, with increasing age, the clinical picture gradually changed towards the picture associated with spinal stenosis.

The duration of backache and sciatica before the operation has value as predictive factors having better results when the duration was less than 6 months. The long - term outcome expecting slow but steady recovery of bladder function. Complete recovery of the symptoms should not be expected in patients having additional diseases which may contribute to the clinical picture of lumbar disc herniation. Most patients had good surgical outcome after lumbar discectomy. The results of disc surgery depend not only upon the operative technique and skill, the degree of neurological impairment but also upon the correct selection of cases.

### **Recommendations**

Patients should be selected properly to be candidates for surgery, according to the indications, so as to obtain the best results. Aiming for more convincing results of the outcome after surgery, some sort of magnification should be used intra operatively. Other modalities for the treatment of lumbar disc herniation, such as percutaneous discectomy and chemonucleolysis, should be considered and practiced in our neurosurgical centers so that the results can be compared with the results of conventional types of surgery. Follow up of the patients postoperatively should be extended for a longer periods of time to determine the definitive outcome.

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