Lumbar Disc Herniation in Adolescents and Young Adults in Erbil Teaching Hospital: A clinical, Radiological and Surgical Study

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Abstract

Background: Degenerative changes in the intervertebral disc begin at the late teens and early adult life, after the completion of the physical growth and development. Lumbar disc herniation is rare in children and adolescents. The clinical presentation and etiology of lumber disc herniation may differ from that in adults.

Objective: To determine the rate of lumber disc herniation among adolescents and to describe the radiological, clinical features and surgical outcomes of lumber disc herniation in a group of adolescent and young adult patients.

Patients and Methods: A retrospective revision of 1045 cases of lumbar disc excisions performed at the neurosurgical unit of Erbil teaching hospital between 2001 and 2015 was done. In all cases, the diagnosis was achieved pre-operatively by lumbar spine MRI with or without CT scan. Initially all patients were treated conservatively for more than 3 months without success. The indications for surgery were failure of conservative treatment, intractable pain and/or progressive neurological impairment. Surgical posterior discectomy with fenestration or partial laminectomy or hemi-laminectomy was performed. On the day of discharge Kirkaldy-Willis criteria was used to assess the patient post-operatively.

Results: Thirteen (1.22%) of the 1045 patients were adolescents and young adults between 13 and 21 years of age with a male: female ratio of 1.16: 1. Nearly 70 % of patients had a history of trauma. Lumbar back pain and radicular sciatica were the main complaints in 77% of the patients. Two patients had radicular leg pain. Only one patient of the 13 patients experienced lumbar back pain without leg pain. Only one patient was found to have neurological deficit with partial foot drop. Prior to surgical intervention, straight leg raising test was positive in all 13 patients. All of the patients had symptoms duration for more than 3 months. The radiological and surgical findings revealed a protruding disc in eleven cases, one lateral recess stenosis and one lumbar synovial cyst. Epiphyseal ring fracture was found in 4 of the 5 patients who underwent CT study. Results of Kirkaldy-Willis criteria were excellent or good in 92 % of patients. The follow-up period ranged from 4 months to 2 years with an average of 14 months.

Conclusion: Young adults and adolescents disc herniation is uncommon and is often precipitated by trauma. Surgical treatment of such patients relieves clinical symptoms quickly and is associated with good and excellent results in nearly all patients.

Key words: Lumber disc herniation, Lumber back pain, Sciatica, Adolescents, Kirkaldy-Willis criteria.

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Introduction

Degenerative changes in the intervertebral disc begin at the late teens and early adult life, after the completion of the physical growth and development, during which posterior herniation of the nucleus pulposus can cause sciatica because of nerve root compression [1].Symptomatic low back pain and monoradicular leg pain are rare in patients under age of 20 years [2-4]. There are a number of differential diagnoses to be considered in patients with the mentioned complaints [5]. Most often they are due to lumbar disc herniation (LDH). Radiculopathy in adolescents could be due to spinal tumors. Many of them may present with neurologic deficits [7]. Epiphyseal ring fracture, disc space infection[5-6]. Congenital malformations and spinal synovial cysts could also be considered [5,6,8,10]. Lumbosacral intervertebral disc changes that cause sciatica and other neurological manifestations in the lower extremities are generally thought to be encountered mostly among the adults in the third decade of their life or later [11].

Lumbar disc herniation is rare in children and adolescents [12]. The clinical presentation and etiology of LDH may differ from that in adults [5,13]. While the true incidence is not known, studies have shown that of all patients operated on for disc herniation, less than 3% are under 20 years of age [14,15]. Like the incidence, the etiology and clinical presentation of LDH in the younger age groups also differ from that of the adults [12,16,17]. The duration is relatively short and sometimes combined with a degenerative process and a bony spur such as posterior Schmorl's node [18,19].

The aim of the present investigation was to draw attention to this condition in young patients, in order to encourage earlier diagnosis and treatment. The objective was to determine the rate of LDH among adolescents and to describe the radiological, clinical features and surgical outcomes of lumbar disc herniation in adolescent and young adult patients with symptomatic lumbar back pain and mono-radicular leg pain.

Materials and Methods

Revision of 1045 outpatient cases of lumbar disc excisions was performed at the neurosurgical unit of Erbil teaching hospital between 2001 and 2015. In all cases, the diagnosis was achieved preoperatively by lumbar spine magnetic resonance imaging (MRI) (Figure 1). Straight leg raising test was used for pre-operative diagnosis of neurological deficits. Five patients had computerized tomography (CT) scans followed by lumbar spine MRI for establishing the proper diagnosis.

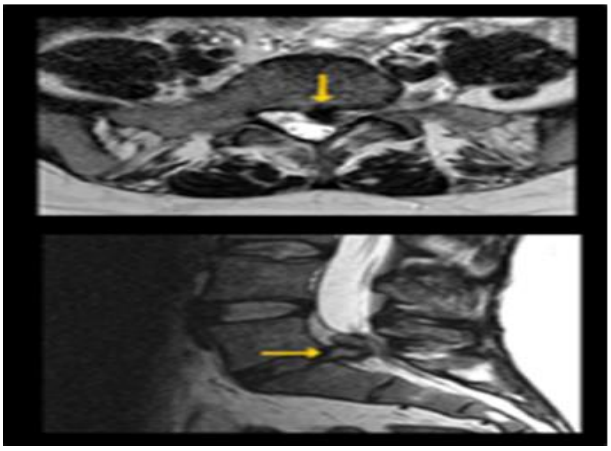

Figure (1): T 2-weighted MRI showing left-sided disc herniation at L5/S1 level, impinging the left S1 nerve root.

All patients had been treated with at least one of the following: bed rest, physiotherapy, medication, and conservative treatments. Surgical intervention was carried out when there was intractable pain and failure of the conservative treatment for more than 3 months, radiographic diagnosis of intervertebral disc herniation or other nerve root compression based on CT or MRI, and/or a progressive neurological impairment. Surgical posterior discectomy with fenestration or partial laminectomy or hemi-laminectomy was performed to remove the herniated part of the disc and decompress the affected nerve root.

Subjective complaints and neurological findings were recorded one day before surgery and on the day of discharge (3–12 days following surgery, mean 8 days). The follow-up period ranged from 4 months to two years with an average of 14 months; patients were monitored on an out-patient basis and by questionnaire or telephone interview. On the day of discharge the results were analyzed by the Kirkaldy-Willis criteria [20] Table (1).

Table (1): The criteria of Kirkaldy-Willis, *et al.,[*20]) for the functional outcome.

Criteria	Description
Excellent	The patient has returned to his normal work and other activities with little or no complaint
Good	The patient has returned to his normal work but may have some restriction in other activities and may on occasion after heavy work have recurrent back pain requiring a rest for a few days
Fair	The patient has to reduce his working capacity, taking a lighter job or work part-time, and may occasionally have recurrence of pain requiring absence from work for one to two weeks, once or twice a year
Poor	The patient does not return to work

Statistical analysis

The protocol of the study was approved by the research ethics committee of the college of medicine of Hawler medical university. An informed consent was obtained from all patients or their guardian before being enrolled in the study. Descriptive statistical analysis was performed and the results are presented in tables.

Result

The revision revealed that 13 (1.22%) of the series of 1045 patients with lumbar disc excisions were adolescents and young adults between 13 and 21 years (Mean = 17.9 years). Seven of them were males giving a ratio of 1.16: 1. Nine patients (69.2%) had history of trauma.

Clinical findings: Lumbar back pain and radicular sciatica were the main complaints in 77% of the 13 patients. Two patients had radicular leg pain. Only one patient among the 13 patients experienced lumbar back pain without leg pain. Forward flexion of the spine had been limited in all patients. Paresthesia had been present in 7 (53.8%) patients; in 6 of them the S1 dermatome had been involved and one had L5 dermatome involved. Only one patient was found to have neurological deficit with partial foot drop. Prior to surgical intervention, straight leg raising test was positive in all 13 patients. All the 13 patients had symptoms duration for more than 3 months, and 5 patients had symptoms duration of one year or more (Table 2).

Table (2): Clinical findings of patients prior to surgery.

Clinical findings	Number of patients	(%)
Lumbar back pain and radicular sciatica	10	(77.0)
Radicular leg pain	2	(15.4)
Lumbar back pain without leg pain	1	(7.7)
Forward flexion of the spine	13	(100.0)
Paresthesia	7	(53.8)
S1 dermatome	6	
L5 dermatome	1	
Neurological deficit with partial foot drop	1	(7.7)
Duration of symptoms		
> 3 months	13	(100.0)
≥ 1 year	5	(38.5)
Positive straight leg raising test	13	(100.0)

Radiological findings: Disc herniation was demonstrated in 11 (84.6%) patients. The level of disc herniation was found to be L4-L5 in two (18.2%) patients and L5-S1 in nine (81.8%) patients. Disc herniation was found to be located laterally in 9 (81.8%) patients and 2 (18.2%) patients had central disc herniation. One patient had congenital stenosis at level L4-L5 and another patient had lumbar synovial cyst (LSC) at the same level. Epiphyseal ring fracture was found in 4 of the 5 patients who underwent CT study constituting 30.8% of total patients. The CT scan of the patient with LSC initially revealed nothing abnormal, thus the patient was treated conservatively for a year. One month prior the hospitalization the intensity of the low back pain had increased, spreading to his left leg. MRI revealed a 1.5-cm intraspinal synovial cyst originating from the left L4-L5 facet joint with low intensity on T1-weighted images and hyper intense on T2-weighted images, lying in the spinal canal at the L5 vertebral body level and extending into the neural foramen (Figure 2). The diagnosis in the other 8 patients was established with MRI only.

Figure (2): MRI showing a 1,5-cm intra-spinal synovial cyst originating from the left L4-L5 facet joint with low intensity on T1-weighted images (C) and hyper intense on T2-weighted images (B), lying in the spinal canal at the L5 vertebral body level and extending into the neural foramen (A).

According to the preoperative radiological findings the disc herniation was classified as protruding discs (7 discs), extruding (2 discs) and as bulging or sequestered disc (one disc for each). No segmental instability was found in the 13 patients Table (3).

Table (3): Radiological findings of the 13 patients underwent surgical excisions.

Variables	No. of patients	(%)
CT scan findings (n=5)		
Epiphyseal ring fracture	4	(30.8%)
MRI findings (n=13)		
Lumbar disc herniation	11	(84.6)
Congenital stenosis at L4-L5	1	(7.7)
Lumbar synovial cyst (LSC) at L4-L5	1	(7.7)
Location of disc herniation (n=11)		
Lateral	9	(81.8)
Central	2	(18.2)
Level of disc herniation (n=11)		
At L5-S1 vertebra	9	(81.8)
At L4-L5 vertebra	2	(18.2)
Preoperative radiological classification of disc herniation (n=11)		
Protruding discs	7	(63.6)
Extruding discs	2	(18.2)
Bulging disc	1	(9.1)
Segmental disc	1	(9.1)

Surgical results: In 7 patients a single-level unilateral incision was performed to remove the herniated disc and decompress the affected nerve root. The other six patients had uni-lateral hemilaminectomy or partial laminotomy for a central herniated disc, fractured apophysia or LSC. Two patients had subsequent re-operations. They had good results initially. The first patient had been re-operated upon 5 months after the initial discectomy. Recurrent disc herniation at the same level besides an incapacitating pain led to second operation. Excellent result had been achieved after the second operation. The second patient had deep wound infection and thus re-operated upon 3 months after the first discectomy. The infection had been cured and the final result was graded as good. For the re-operated patients, instrumented fusion was not considered as a necessary option, due to the young age.

On the day of discharge, Kirkaldy-Willis criteria were excellent or good in 92% of patients (Table 4). The follow-up period ranged from 4 months to two years with an average of 14 months.

Table (4): Proportions of Kirkaldy-Willis criteria in the 13 patients.

Kirkaldy-Willis criteria	No.	(%)
Excellent	10	(76.9)
Good	2	(15.4)
Fair	1	(7.7)
Poor	0	(0.0)
Total	13	(100.0)

Discussion

The rate of LDH in adolescent and young adults among the total LDHs varies in a wide range of 0.6- 6.8 % [6, 18,19]. Kuh et al reported rate of 4% in adolescents and young adults among 4530 patients operated on with LDH [19]. Authors have reported a rapid increase of LDH rate over the age of 22 years [6,17]. Giroux and Leclercq have found a rate of 1% of LDH in the age 13-21 years and 3.7% in the age 25-34 years [17]. The findings of this study are in agreement with those of previously mentioned studies with a rate of 1.22 % among adolescent and young adults.

Symptomatic lumbar back pain and mono-radicular leg pain are rarely seen in adolescents and young patients [3,4,12,19]. The most common cause of such complaints is LDH [4,21-23]. Demonstrated in around 84% of cases in this study. The characteristics of adolescents LDH are soft protruded disc, no severe spine degeneration, typical discogenic pain, that is usually due to a single nerve root compression of relatively short symptom duration and it is frequently related to back trauma [19]. Traumatic events appear to be a factor in the occurrence of LDH in adolescent patients in contrast to adults [3,9,12,15]. Trauma is frequently reported as the primary causative factor with variable incidence. In this study, 9(69%) cases developed symptoms after trauma (sports, heavy lifting and falling); three of them additionally had been found to have apophyseal ring fractures. Rarely spinal tumors, apophyseal ring fractures, disc infections, vertebral anomalies, congenital stenosis or LSC could also be causative factors [5,6,8-10,23]. Congenital stenosis at L4-L5 and LSC at L4-L5 were diagnosed in two cases (7.7% for each) in current study.

The clinical presentation of adolescents LDH is generally similar to that observed in adults [12]. According to Kuh *et al* [19], most (87%) of adolescent LDH patients had low back and leg pain, only 8.6 % of the patients complained of low back pain alone. In this study 77% of patients complained of low back pain together with leg pain, 12 (92.3%) adolescent and young adult patients complained from leg pain alone, and just 7.7% of the 13 patients had low back pain only. Prior to the operation, straight leg raising test was positive in all 13 patients, but neurological deficit was detected in one case only. Positive straight leg raising test is a distinctive feature demonstrated in up to 90 % of patients, which could be anatomically explained with the finding that children and adolescents tend to have greater nerve root tension than adults [18].

In this study conservative treatment was always the first choice of treatment. Some authors reported a good outcome using conservative measures including bed rest, analgesics, corsets, heat and other physical therapies [5,12]. However, not all authors reported a good success rate with the conservative treatment, which could be

attributed to delay in diagnosis and delay in starting treatment. In a case series study, Chen et al reported that 28 adolescent patients suffered from pain and postural deformity for an average 9 months [14]. The authors believed that the delay of definitive diagnosis and surgery might have been due to the insidious onset of back pain in adolescents, or due to the fact that doctors are reluctant to send adolescents for surgery. In this study all the patients had symptoms duration for more than 3 months, and 5 patients had symptoms duration for a year or more; they have been unsuccessfully treated conservatively. Similar results were reported by studies of Kurth *et al.*,[4] Frino et al.,[20]. Kim *et al.*,[9] and Russwarm *et al*,.[15]. However, conservative treatment is still generally recommended as the first line treatment of LDH in adolescents and young adults without neurological deficit.

In all cases reported in this study, the diagnosis was achieved pre-operatively by MRI of lumbar spine. In five patients CT scans were performed followed by lumbar spine MRI, revealing epiphyseal ring fracture in 4 out of the 5 patients. The patient with LSC initially was not diagnosed by CT scan and was treated conservatively for more than a year. Later on MRI revealed the LSC. Therefore, young adolescents and young adults patients with lumbar back pain and radicular leg pain should always be examined with CT and MRI at the onset of the first complaints.

It is generally agreed on in the literature that surgical posterior discectomy with fenestration or hemi laminectomy and partial laminotomy is indicated for postero-lateral disc herniation, whereas partial laminotomy or laminectomy is required in cases of central disc herniation[6]. The results after surgical discectomy are generally excellent. Chen *et al.*, [14] in their review of 28 adolescent patients demonstrated good and excellent results in 93% of patients. In the case series of Kuh *et al.*, [19]. The success rate of discectomy was reported to be 97%. On the day of discharge 94% of patients of Kurth *et al.*, [4]. had excellent or good results. Dang and Liu[6] in their review of 22 published articles, summarized the short-term outcome of discectomy in 798 patients and reported that the success rate was ranging from 79% to 100 %. In this study, satisfactory results of surgical discectomy was achieved with a success rate of 92 %. Clinical symptoms disappeared quickly within 3 months of surgery.

In this case series one patient had definite recurrence of disc herniation and the other had recurrent back pain with deep wound infection. Recurrence of disc herniation was seen in 20% of the patients of Kuh *et al*,[19]. All recurrences were at the same level of initial herniation. In the case series of Durham *et al.*, [24]. Which included 24 operated on adolescents with follow-up period ranging from 5 months to 30.5 years, the rate of re-operation was 24% over the course of this long follow-up period, which is higher than that revealed by this study over the shorter period of follow-up.

In conclusion, young adults and adolescents disc herniation is uncommon and is often precipitated by trauma. Early CT or MRI examination of adolescent, and early adult patients with back or leg pain is recommended for proper diagnosis of disc herniation. Surgical treatment of such patients relieves clinical symptoms quickly and is associated with good and excellent results in nearly all patients.

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