Original Article

Lumbar Disc Herniation in Adolescents. Clinical Experience and Surgical Outcome

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ARTICLE INFO

ABSTRACT

**Background:** Lumbar disc herniations in adolescence are a relatively rare condition reported to occur in less than 3% of those presenting with low back pain. The clinical presentations of adolescent disc herniation differ from those of the adults. Back pain is not all marked in adolescent patients. Persistent postural disturbances and lack of history of injury are the prevalent presentations. **Objective:** This study was subjected to discuss the etiology, diagnosis and treatment modalities of lumbar disc herniation in adolescents. **Patients and Methods:** During the period from September 2011 to August 2013, twenty-five patients between 13 and 19 years old (teenage years) underwent lumbar discectomy in the Neurosurgery Department, Al-Menoufia University with follow-up period up to 12 months post-operative. **Results:** Twenty patients (80%) presented with low back pain with or without radiculopathy, and fifteen patients (60%) presented with sciatic pain as the first symptom. The most common levels affected were L4/5 in fourteen patients (56%), L5/S1 in eight patients (32%) and L4/5 + L5/S1 in three patients (12%). Surgical modalities were microdiscectomy in fifteen patients (60%), open discectomy in six patients (24%) and percutaneous endoscopic discectomy in four patients (16%). Post-operative complications were persistent back pain in three cases (12%), transient cerebrospinal fluid (CSF) leakage in two cases (8%) and wound infection in one case (4%). **Conclusion:** Disc herniation in the adolescent is a rare cause of low back pain. The natural history is not known. Conservative treatment is the mainstream care. Good selection and meticulous surgical procedures give satisfactory outcome.

INTRODUCTION

Lumbar disc herniation is a common disorder among adults, with reported lifetime occurrence as high as 40%. Although the true frequency of this condition in children and adolescents is not precisely defined, it is generally believed to be much lower than that in adults. It was reported that pediatric patients constitute only 0.5–6.8% of all patients hospitalized for lumbar disc herniation (LDH), which was much lower than the estimated percentage of children and adolescent's population (27%).

It has long been noticed that lumbar disc herniation (LDH) affects not only adults but also children and adolescents. Adolescence (from Latin adolescere, meaning "to grow up") is a transitional stage of physical and psychological human development that generally occurs during the period from puberty to legal adulthood (teenage years).

Over the years, the number of studies in this regard was on a rise, which led to an ever increasing understanding of this entity. Yet to the present date, it has not been fully reviewed as to the treatments available for pediatric LDH and the effect of each treatment.

The etiology and clinical presentation of lumbar disc herniation in the younger age group also differs from that of adults. Although in the latter group it remains an area of controversy, there seems to be some agreement amongst authors that trauma is an etiological factor. A known difference is that children and adolescents may or may not have an associated apophyseal ring fracture.

Most of the patients with herniated discs can be successfully managed using conservative treatment. Since many of the adolescents with back and leg pain, have negative lumbar radiographs, the diagnosis of disc herniation is only considered as a possibility. Causes for the rarity of discectomy in adolescents are not clear, and the features of the few adolescent patients who required surgery have seldom been discussed.

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There are a number of differential diagnoses to be considered in an adolescent with herniated disc. The most important ones to rule out are apophyseal ring fracture, disc infection and tumors causing a radiculopathy.22

Conservative treatment is the recommended first choice of care. Surgery is not recommended in the first six to twelve weeks because of a favorable natural history. The goal of treatment of adolescent lumbar disc herniation is to relieve symptoms and allow early return to school.8

As outlined in the Clinical Guidelines for Chiropractic Practice in Canada, the progression in neurological signs and the worsening of symptoms prompted a surgical consult. Following the consult, the patient was referred back to the chiropractor for a second trial of therapy with concurrent anti-inflammatory medication.10

Indications for surgery differ slightly from adults and include: strongly positive Laseque's test, restricted lumbar range of motion with an associated guarding scoliosis, or persistent positive signs despite adequate conservative care.11,14

In this study, we reviewed the adolescent patients who had proven disc herniation to clarify the distinguishing features from those in the adults and the risk factors that show the need for surgical intervention.

PATIENTS AND METHODS

This retrospective study was conducted on twenty five patients between 13 and 19 years old at the time of diagnosis among twenty nine patients presenting with lumbar disc herniation, admitted and managed at the Neurosurgery Department, Al-Menoufia University Hospitals in the period from September 2011 to August 2013 with 12 months follow-up period. All patients had received at least one of the following conservative treatments: Absolute bed rest and medical treatment in eighteen patients (62% of total population), physical therapy and traction in eight patients (27%) and epidural injection in three patients (11% of total population).

A) Inclusion Criteria:
1- Intractable back and/or sciatic pain.
2- Failure of conservative treatment for up to 12 weeks.
3- Radiological diagnosis of disc herniation by Magnetic Resonance Imaging (MRI) as shown in Fig. (1 & 2).

B) Exclusion criteria:
1- Previous disc surgery.
2- Refusal of surgery.

After selection of patients and consent from patients and their relatives, one of the following surgical procedures was included:
1- Open lamiectomy and discectomy.
2- Microdiscectomy.
3- Percutaneous endoscopic discectomy.

Follow-up of patients was done at three, six and twelve month's post-operative through both: Clinical follow-up: The clinical symptoms were assessed at each interval. The JOA score (Japanese Orthopedic Association’s evaluation system for low-back pain syndrome) was determined via direct questioning to assess subjective symptoms, clinical signs and the restriction of activities of daily living.9 Radiological follow-up: Follow up MRI was done at the end of the study as shown in Fig. (3). An independent radiologist was invited to evaluate the status based on radiographic study. Surgical outcome was classified using a four-grade scale: 1- Excellent, improvement of over 90%; Good, 75% to 89% improvement; Fair, 50% to 74% improvement; and Poor, below 49% improvement.25

Fig. 1: Pre-operative MRI of 14 years old teenage with L5-S1 disc herniation.

Fig. 2: Pre-operative MRI (axial plane) with L5-S1 left disc herniation.

Fig. 3: Post-operative MRI T2-WI showing complete removal of the disc herniation.
RESULTS

Regarding the age distribution among twenty five patients in our study, the peak incidence was between 17 and 19 years old (55% in males and 58% in females) and the least incidence was between 13 and 15 years old (11% in males and 14% in females), the mean age was 16 years. Most of patients in our study were males (eighteen patients, 72%), while only seven patients (28%) were females with M: F ratio (2.5: 1) and this was due to the nature of the heavy work of males in the agricultural society and higher susceptibility to trauma as shown in table (1).

Table 1: Age and sex distribution among the studied group

<table>
<thead>
<tr>
<th>Age group</th>
<th>Sex Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
</tr>
<tr>
<td></td>
<td>No.</td>
</tr>
<tr>
<td>13-15</td>
<td>2</td>
</tr>
<tr>
<td>15-17</td>
<td>6</td>
</tr>
<tr>
<td>17-19</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>18</td>
</tr>
</tbody>
</table>

The most common presenting feature in our study was low back pain in twenty patients (80%); sciatic pain was the first presentation in fifteen patients (60%), while partial unilateral foot drop was observed in only two cases (8%) as shown in table (2).

Table (2): Clinical presentations among the studied group

<table>
<thead>
<tr>
<th>Clinical presentations</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persistent low back pain</td>
<td>20</td>
<td>80</td>
</tr>
<tr>
<td>Unilateral and/or bilateral sciatica</td>
<td>15</td>
<td>60</td>
</tr>
<tr>
<td>Sensory deficit</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>Motor deficit</td>
<td>2</td>
<td>8</td>
</tr>
</tbody>
</table>

According to MRI of lumbosacral spine (investigation of choice), the most common level affected was at L4-5 (fourteen patients, 56% of cases), while double level affection was found in only three patients (12% of cases) as shown in table (3).

Table 3: Levels of lumbar disc herniations in the study

<table>
<thead>
<tr>
<th>Disc level</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>L4-5</td>
<td>14</td>
<td>56</td>
</tr>
<tr>
<td>L5-S1</td>
<td>8</td>
<td>32</td>
</tr>
<tr>
<td>L4-5/L5-S1</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td>100</td>
</tr>
</tbody>
</table>

Regarding surgical modalities in our study, lumbar microdiscectomy was the most common surgical procedure as it was used in fifteen patients (60%) followed by laminectomy and discectomy in six patients (24%) while percutaneous endoscopic discectomy was used in only four patients (16%) as shown in table (4).

Table 4: Surgical procedures included in the study

<table>
<thead>
<tr>
<th>Surgical procedures</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lumbar microdiscectomy</td>
<td>15</td>
<td>60</td>
</tr>
<tr>
<td>Open laminectomy and discectomy</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>Percutaneous endoscopic discectomy</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td>100</td>
</tr>
</tbody>
</table>

The commonest post-operative complications in our study were transient CSF leakage which was reported in two patients (8% of cases) and were managed conservatively by absolute bed rest, tight bandage and frequent aspiration until complete resolution with no collection till the end of the follow-up period. Superficial wound infection developed in only one patient (4% of cases) and was treated conservatively by bed rest, antibiotics and daily dressing until complete healing as shown in table (5).

Table 5: Post-operative complications included in the study

<table>
<thead>
<tr>
<th>Complications</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persistent back pain</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>Transient CSF leakage</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Wound infection</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
<td>24</td>
</tr>
</tbody>
</table>

Regarding the outcome of patients in our study, it was excellent in twenty patients (80% of cases) with complete resolution of pre-operative symptoms and patients return to their daily activities at the end of the follow up period, good in three patients (12% of cases) with improvement of pre-operative symptoms and had their sedentary life with restriction of heavy work, while only two patients (8% of cases) had fair outcome and continue on some medical treatment and physical therapy program due to long standing pre-operative motor deficit and neglection for long time before surgical interference as shown in table (6).
Table 6: Surgical outcome according to the four-grade scale

<table>
<thead>
<tr>
<th>Outcome</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent (&gt;90% improvement)</td>
<td>20</td>
<td>80</td>
</tr>
<tr>
<td>Good (75-89% improvement)</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>Fair (50-74% improvement)</td>
<td>2</td>
<td>8</td>
</tr>
</tbody>
</table>

DISCUSSION

The incidence of lumbar herniation in pediatric patients is relatively rare, and the exact number has been debated. In adolescent patients presenting with back pain, 3-3.7% have been reported to have a disc herniation. 16

Out of the total population of discectomy procedures, 0.4-3% has been reported to be on adolescent patients and up to 15.4% in a study out of Japan. Although not common, the prevalence of lumbar disc herniation in adolescent patients remains, along with the difficulty in determining the correct course of action for these patients. 16

Numerous studies have attempted to evaluate treatment of lumbar herniation in adolescent patients. Some studies have recommended conservative therapy while others have stated surgery is necessary in many of these patients due to conservative therapy resulting in unsatisfactory results. Recent studies have shown favorable results in lumbar surgery in adolescent patients for lumbar disc herniation. 18

In our short series, twenty five (86%) out of twenty nine adolescents between 13 and 19 years old at the time of diagnosis presenting with lumbar disc herniation, admitted and managed at the Neurosurgery Department, Al-Menoufia University Hospitals in the period from September 2011 to August 2013. The reminder four patients (14%) were excluded from the study because they refused surgery and continued on medical treatment due to higher pain threshold among those farmers. This high incidence in young age could be attributed to the agricultural environment in our locality as all these patients are farmers and have heavy work since young age and also due to the high flow of patients suffering from spinal trouble to our outpatient clinics due to low socioeconomic standard among the studied group.

The age restriction for adolescent patients has not been consistent. When looking at the literature, there was no consensus on what the restriction should be. 17 Due to the inconsistency of age limitation, it is difficult to compare incidence rates, and there has been some debate about what the true incidence is. In this study, all patients who underwent a discectomy were aged between 13 and 19 years old. This is comparable to the study by Dewing who reported that young, active patients do well following lumbar microdiscectomy without arthrodesis. Patients included in that particular study were between the ages of 14 and 19 years with a mean age of 16.5 years. 6

The most common clinical presentations in our study were persistent low back pain in twenty patients (80%) followed by radicular pain in fifteen patients (60% of cases) and motor deficit was present in only two cases (8%) and this correlates with Parisini et al. who reported that 65% of patients included in their study had only leg pain and signs of neurological deficit were often absent. 18

The most common level of disc herniation in our study was L 4-5 in fourteen patients (56%), eight (32%) at L 5-S1 and only three (12%) at both L 4-5 and L 5-S1 and this was relatively similar to the results of Lih-Huei Chen et al. in their series conducted on twenty eight patients where the level of disc herniation was L4-L5 in twenty three patients and L5-S1 in five patients. 15

Among the studied group, all patients had MRI to confirm diagnosis where disc herniation was located laterally in eighteen patients (72%) and seven patients (28%) had central disc herniation while in the study of Chia-Hsieh Chang et al. there were twenty-four patients underwent MRI studies; disc herniation was located laterally in nineteen patients (76%) and five patients (24%) had central disc herniation. 3

There were various surgical modalities used in our study as lumbar microdiscectomy was used in fifteen patients (60%), open discectomy in six patients (24%) and percutaneous endoscopic discectomy in only four patients (16%), while Kumar et al in their series conducted on thirty five adolescents preferred endoscopic discectomy in 57% of cases followed by microdiscectomy in 28% of cases while open lumbar discectomy was used in only 15% of cases. 14

Recent studies have shown favorable results for discectomy in adolescent patients. However, the debate over whether a fusion is necessary in such patients remains. Most of the studies done have included patients who had instrumentation or fusion done. This has resulted in varying results. Some have recommended the use of fusion, and have shown better follow-up results with less reinterventions. Other studies have stated that fusion is not necessary and that laminotomy without fusion is the best option. 7

In order to make a uniform study population, this study only included patients who did not have fusion or instrumentation. All patients were therefore able to have short procedure and did not necessitate long hospitalization and low financial cost on poor patients in our locality.

The rate of postoperative complications was relatively low and transient (24%) as we reported persistent back pain at the end of the follow-up period in only three patients (12%) and treated with short course of physical therapy program for relief of muscle spasm and return to their daily activities, transient CSF leak
was reported immediate postoperative in two patients (8%) and treated with strict bed rest, tight bandage and follow up until complete stoppage of the leakage, while superficial wound infection was reported in only one patient (4%) and was treated with bed rest, daily dressing and short course of antibiotics. This rate of complications correlates with Ahn, Lee in their series where they found that persistent back pain was the most common complication in adolescents.

One criticism of performing discectomy procedures on adolescent patients is the high incidence of reoperation and recurrent herniations. In this study, no patients needed revision surgery during the follow up period. Certainly, these patients are susceptible to having a subsequent herniation due to incomplete follow up and difficulty to had sedentary life style after operation. Higher rates of reoperations have been reported, ranging from 24 to 28% of all adolescent patients requiring a subsequent operation. 23

The results after surgical discectomy were generally satisfactory as our series demonstrated excellent and good results in 92% of cases and this correlated with Kuh et al. who reviewed one hundred and eighty five adolescent patients reported in the literature and in their series where the rate of excellent and good results after surgery was 93%. 13

CONCLUSION

Adolescent disc herniation is uncommon and is often caused by trauma. The natural history of disc herniation in adolescents is not known. Clinical presentation may be the same as that in adults with less hard neurological signs. Apophyseal ring fracture, disc space infection and spinal tumors should be ruled out. Conservative treatment is the mainstream care. Good selection and meticulous surgical procedures give satisfactory outcome in over 90% of cases.

REFERENCES
