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Lumbar Disc Herniations in Children. A Five-Year Single Center Experience

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Abstract

Lumbar disc herniations represent one of the most common complications of degenerative disc disease in adults and have a favorable outcome with surgery. In children, on the other hand, disc prolapse is a relatively rare pathologic entity mandating cautious multimodal management. This paper presents the five-year long experience of a single pediatric neurosurgical unit and our management strategy for children diagnosed with lumbar disc prolapse.

Keywords: degenerative disc disease, lumbar disc hernia, prolapse, management, pediatric neurosurgery.

Rezumat

Hernia de disc lombară este una dintre cele mai frecvente complicații ale bolii discale degenerative a adultului. În general tratamentul chirurgical oferă o ameliorare rapidă a simptomelor cu rezultate favorabile pe termen lung. La copii, pe de altă parte, prolapsul discal este o patologie rară, încă neînțeleasă pe deplin, care necesită un tratament multimodal precaut. Lucrarea de față prezintă experiența clinicii de Neurochirurgie Pediatrică din Spitalul Clinic de Urgență pentru Copii „Grigore Alexandrescu" cu privire la hernia de disc pediatrică și algoritmul nostru de management.

Cuvinte cheie: boală degenerativă discală, hernie de disc lombară, management, neurochirurgie pediatrică.

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INTRODUCTION

Low back pain following degenerative disc disease is a topic under constant scrutiny and reevaluation in the adult population. As such, lumbar syndromes are considered to be the second most common reason for which adult patients seek medical aid in the emergency department and one of the leading reasons World-wide for sick-leave, professional reorientation, litigations and financial compensation demand. Surgery for disc prolapse in the adult population is frequently performed and generally yelds favorable results when patients are carefully selected[1,2].

Even though the first pediatric lumbar disc prolapse was reported as early as 1946[3], children have always been an overlooked group in the eyes of researchers for a few reasons: first, lumbar disc herniations were considered, over the last few decades, to exceptionally occur in children. Second: due to a lack of large series of cases needed for studying, data was insufficient and statistical value has been considered doubtful. Third: there are far fewer pediatric neurosurgeons (by comparisson with neurosurgeons dealing with adults) that are willing to commit their time to research on topics considered „trivial".

Even today, from a pathophysiologic point of view, degenerative disc disease in children has not yet been fully understood as relevant studies for this age group are still hard to come by. If adult disc degeneration is considered to be the result of environmental, occupational and genetic risks, the aetiology of pediatric disc herniations is still a topic open for debate, as disc prolapses have been diagnosed even before two years of age[4].

Studies dating back since the early sixties, seventies and eighties[4-6] considered that pediatric patients with lumbar prolapses account for approximately 0.5-6.8% of all patients hospitalized with lumbar disc herniations. In this respect, Garrido et al[5]., reported, in 1993, on a single-center group of 38 cases operated over a period of 20 years. In a study published in 1996, Shilito et al[6]., reported a single-center cohort of 60 children[5], operated for lumbar disc herniations between 1958 and 1995 (37 years), with 20 children under the age of 15. In 2007 Kumar et al[7]., reported that over a period of 11 years they had diagnosed and admitted 742 patients (aged 13-20) for low back pain, out of which they had operated on 25 patients. In 2009, Cahill et al[8]., reported another large single-center series of 87 lumbar microdiscectomies performed in children between 1999 and 2008. Note that available literature data – with regard to cases mandating surgery – states that patients younger than 25 years are 20 times less likely to need surgery by comparisson with adults[9-13].

MATERIALS AND METHOD

We present a single-center cohort of 78 pediatric patients admitted over the course of 5 years (2016-2021) for low back pain in the Neurosurgical department at the Grigore Alexandrescu Emergency Children's Hospital, in Bucharest, Romania. Our database consists of 51 females and 27 males , with an 1.8:1 ratio. Patient ages were in the interval between 6 (youngest patient) and 17, with an average age of 14.71 years. Follow-up periods range from 4 to 48 months. The 78 cases represent 2.88% of all admitted cases over the same period (2702 total admissions).

All the included patients were admitted for low back pain (pain in the lumbar region of the spine) with irradiation to the lower limbs. Following informed consent the patients underwent MRI scanning of the thoraco-lumbo-sacral spine as standard. In select cases (a history for trauma) computer assisted tomography was also used to better assess the bone structures of the spine. MRI studies were randomly performed on 1.5T and 3T machines with no notable difference in diagnosis image quality. The results are summarized in Table 1.

Table 1. Summarized MRI findings in our study

Level of protrusion	Number of cases	Surgery recommended (prolapse and defficit)
T11-T12	1	0
L1-L2	2	0
L3-L4	1	0
L4-L5	14	4 cases
L5-S1	26	10 cases (1 case was operated elsewhere)
S1-S2	1	0
Multiple levels	2	0
Nonspecific images	31	0

Following neuroimaging studies, we then applied the quantitative prolapse criteria (Mysliwiec et al. classification system)[14] and the study group was divided into surgical cases (14 patients, 17.95%) and non-surgical cases (64 cases, 82.05%).

Table 1. Summarized MRI findings in our study

Two patients were excluded from our study: one patient was diagnosed with congenital horseshoe kidney (ren arcuatus) and was reffered to a pediatric nephrology unit while one patient, despite being diagnosed with a lumbar disc prolapse mandating surgery, chose to undergo surgery in another hospital. Other relevant imaging findings include the following (Table 2).

Table 2. Other relevant imaging findings

Degenerative spondylolisthesis	2 cases	2.5% (of all cases)
Lumbar canal stenosis	4 cases	5%
Foraminal stenosis	3 cases	3.8%
Spondilodiscitis	2 cases	2.5%
Lumbar hyperlordosis	1 case	1.2%
Scoliosis	4 cases	5%
Spina bifida occulta	2 cases	2.5%
Polydiscopathy	26 cases	33.3%

We highlight the fact that a third of our patients (26 patients) had multiple disc degeneration illustrated on MRI. Other interesting situations include patients with lumbar and foraminal stenosis (which usually take years to develop) as well as patients with spondilolysthesis but with no history of trauma. Another important situation we want to highlight is that of patients with scoliosis in which secondary nerve root tensioning occurs. In such situations we recommend attempting postural correction prior to nerve decompression.

While taking the patient's history we discovered that 17 patients (12 males and 5 females) (out of the 78 patients included) had been dealing with daily chores requiring physical labor. These patients were all identified as coming from a rural environment. There were 52 patients coming from an urban environment, with 39 children having a history of sustained physical activity (sports, ballet, dancing). It is our oppinion therefore, that incorrect sustained physical activity might be a risk factor for early lumbar degeneration. Surprisingly, in what regards risk factors, obesity was diagnosed in only 12 children, while trauma (even though not severe) was identified in 29 cases. Post-traumatic disc herniations were described in 4 cases.

From a technical point of view, all the 13 patients in our surgical group, underwent minimally invasive microdiscectomy (2.5-4X) via a unilateral interlaminar approach. To create a surgical corridor, the surgical level was determined using C-ARM intraoperative radiology.

We usually incise the skin for 5 cm, enough to allow usage of a low-profile autostatic retractor. (Figure 1). We then expose the posterior layer of the thoracolumbar fascia (Figure 2), which is incised using an 11 blade, at 2 centimeters, from the midline to create a „trapdoor" as to allow for interspinous and supraspinous ligament integrity. This also enables a perfect fascial suture (Figures 3 and 4).

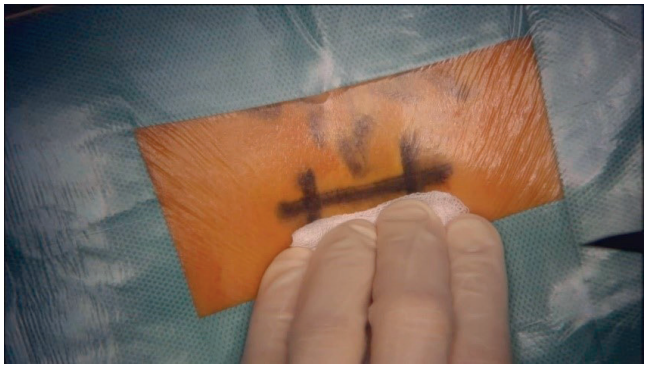

Figure 1. Minimal skin incision. Note the use of incision foil.

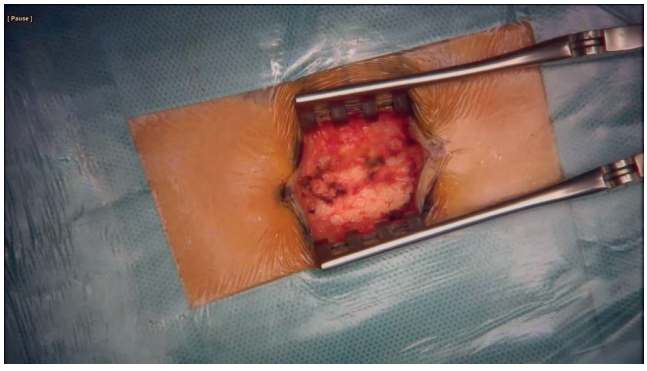

Figure 2. Exposure of the posterior layer of the thoracolumbar fascia

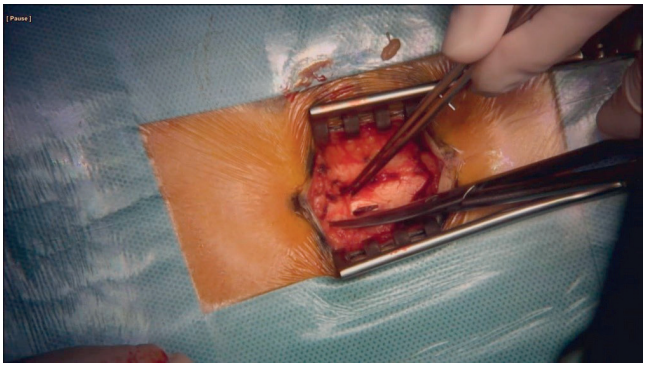

Figure 3. Incision of the thoracolumbar fascia at 2cm from the midline

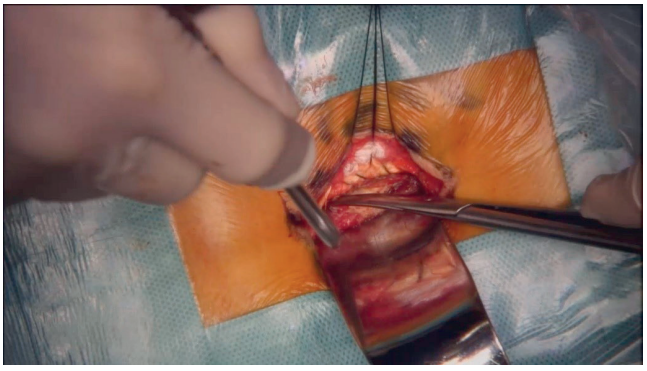

Figure 4. Exposure of the incised thoracolumbar fascia using 2-0 silk sutures and „trapdoor" construction

Once the deep muscle layer is reached, we advocate for blunt dissection avoiding use of monopolar cauterization. Once the bony landmarks are identified, a retractor (Caspar/Scoville/Tentacle) is positioned. We usually perform a 2/2 cm osteotomy of the laminas using size 2 and 3 Kerrison bone punches (with extreme care not to violate the articular processes and articular capsule fibers) and a small diamond drill. The ligamentum flavum is sharply incized and access to the spinal canal is thus achieved. The goal of the surgery is to remove the protruded fragment and any loose fragments in the disc space. In select cases microdiscectomy was doubled by endoscopic inspection of the disc space. Do note that disc material in children is usually well hydrated and gellatinous in texture by comparisson with adult disc material which is more fibrous. Therefore, discectomy should be performed cautiously using pre-measured instruments. In our department we use the more recent Tentacle spine retractor (Karl Storz Gmbh.) which, besides providing excellent atraumatic retraction, also has an aditional fiber-optic light source carrier which offers improved visualization (Figures 5 and 6).

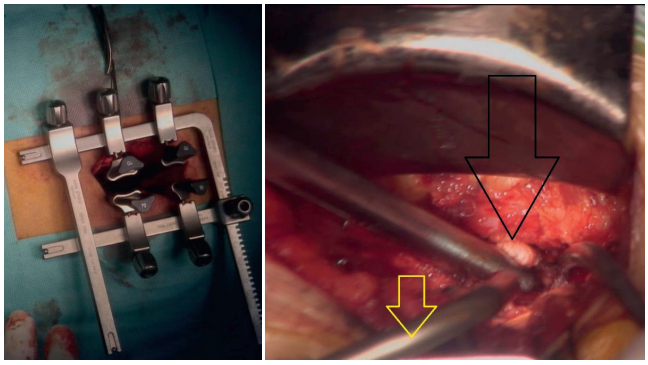

Figure 5. (left) **and 6** (right): The tentacle retractor (left) and the auxiliary light source (yellow arrow, right). The black arrow indicates disc material. Note that on the right we are using a Scoville retractor.

In our oppinion any nerve root decompression in a degenerative context should be performed using the already established technique of microdiscectomy (Figures 7 and 8) as endoscopic approaches may fail to provide adequate visualization and may over-complicate surgery.

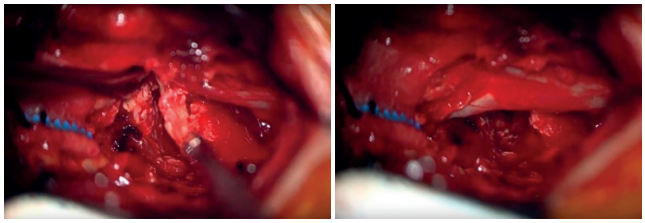

Figure 7. (left) **and 8** (right): The surgeon's view through the surgical microscope. The image on the left illustrates disc fragment removal. The image on the right illustrates the dural sac.

Post-operative care usually refers to wound dressing change, epidural drain removal and mobilization at 24 hours after the operation. Physiotherapy is started at 36 hours following surgery. We usually discharge patients at 72 hours following surgery. The first check-up is at 7 days (with suture removal), one month and 3 months. We advocate for early physiotherapy and following wound healing we reccomend our patients take up swimming.

The results were positive with pain and defficit dissappearing in all cases. There were no secondary complications such as would infection, CSF fistulas or microinstability. Postoperative pain dissapeared within 48 hours.

CONCLUSION

Pediatric disc degeneration is a phenomenon which is more frequently encountered than previously reported in the literature. This fact could be the consequence of several issues: a) more thorough research is performed by physicians, b) more pediatric patients have access to neurosurgeons and neuroimaging (as standard of care improves) c) we are dealing with a situation in which lumbar disc disease is becoming a multifactorial problem concerning younger and younger patients. It goes without saying that further multicentric studies are required to determine what the real situation is.

Disc degeneration and disc prolapses in the pediatric age are not exceptional situations. They should rather be considered and eliminated from the diferential diagnosis of axial pain more frequently and imaging should be performed routinely if we are to fully understand the pathologic processes occuring in these cases. Prevention and adequate physical activity still remain key topics when discussing degenerative disease of the spine, both in adults and in children.

From our experience, even if disc degeneration and prolapses are encountered, surgery isn't required for most of them, as they will respond to conservative treatment better then adults do. On the other hand, when the semiotics suggest decompression is needed (radiating pain with motor defficit) it should be performed without hesitation.

As with any surgical intervention, careful selection of patients is crucial in avoiding unwanted complications. Furthermore, logistics play a tremendous role in the surgical theatre as microdiscectomy requires the use of a versatile microscope, optimal retraction should be atraumatic and adequate visualisation may require the use of auxiliary light sources and occasionaly the use of an endoscope.

Further in depth studies are required to accurately identify risk factors for degenerative disc disease in the pediatric population. Last but not least, we emphasize that a national database concerning pediatric cases of lumbar disc prolapse is crucial for the development of further studies with statistical significance.

Compliance with ethics requirements: The authors declare no conflict of interest regarding this article. The authors declare that all the procedures and experiments of this study respect the ethical standards in the Helsinki Declaration of 1975, as revised in 2008(5), as well as the national law. Informed consent was obtained from all the patients included in the study.

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