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Original Article

Lumbar Disc Herniation in Children and Elderly Patients

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Abstract

Introduction: Lumbar disc herniation is a common pathology of young and middle-aged patients. Fissures and tears in the annulus fibrosus become weak points that facilitate herniation of the nucleus pulposus, especially when extreme forces 'attack' the intervertebral disc. A significant biomechanical force applied to a healthy ('normal') disc can have the same effect. Disc protrusions and herniations to varying degrees penetrate the spinal canal.

Aim: This study aims to present features of lumbar disc herniation in pediatric and elderly patients and evaluate them with respect to data reported in the literature.

Materials and methods: Five hundred eighty-nine patients were assessed, 64 of whom were children (0-18 years), and 98 were elderly patients (>60 years). The operated patients were followed up for at least three years. All data were recorded at the regular follow-ups (at 1 and 3 months, and at 1 and 3 years after surgery). We used chi-square tests and directional measures to determine statistically significant data. Operative treatment in children and elderly patients was 28% (162) of our cohort's total number of patients.

Results: Analyzing postoperative MacNaB, our result showed that children have 23.4% excellent and 76.6 good self-assessment, while in elderly patients, on the one hand, MacNaB used to be excellent or good in 78.5%, and on the other hand, 21.5% had fair or poor self-assessment ($p<0.05$).

Conclusions: Long-term postoperative outcomes were worse in elderly patients than in children. This was mainly due to the poor status of the intervertebral discs according to the Phirman scale and the associated pathologies at other levels.

Keywords

aged-related LDH, operative results, incidence

INTRODUCTION

Lumbar disc herniation (LDH) is a common pathology of young and middle-aged patients. The intervertebral disc is a complex structure composed of collagen, proteoglycans, and 'rare' fibrochondrocyte cells, whose task is to buffer various forces on the human spine standing vertically in the three-dimensional space. Normal age-related changes lead to a decrease in the production of proteoglycans. This causes the disc to collapse, and overstresses the annular

fibrous ring surrounding the nucleus pulposus. Fissures and tears in the annulus fibrosus become weak points that facilitate herniation of the nucleus pulposus, especially when extreme forces 'attack' the intervertebral disc. A significant biomechanical force applied to a healthy ('normal') disc can have the same effect. Disc protrusions and herniations to varying degrees penetrate the spinal canal. Pain in the lumbosacral region combined with radicular pain is a direct consequence of root ischemia and neurochemical (aseptic) inflammation caused by inflammatory factors existing in the disc material itself. Sensory disorders in the genital area, together with loss of control of the pelvic reservoirs (the cauda equina syndrome) and loss of motor function in the legs, are indications for urgent diagnosis and, most often, surgical treatment. The naturally expected clinical outcomes of the treatment are the elimination of the underlying pain, the correction of motor and sensory deficits, and the restoration of working capacity.

AIM

The aim of this study was to present the characteristics of LDH in pediatric and adult patients and compare them to data from the literature.

MATERIALS AND METHODS

Between 2012 and 2017, 614 patients were studied at the Neurosurgery Clinic (Dr. Georgi Stranski University Hospital, Pleven). Twenty-five patients (4.7%) dropped out of the study. The reasons were insufficient and missing documentation, inability to communicate in the early postoperative period, and some technical issues.

Five hundred eighty-nine patients remained in the study, of whom 64 were children (0-18 years) and 98 were elderly patients (>60 years). The follow-up time of the operated patients was at least 3 years. All data were recorded on regular follow-ups (at 1 and 3 months, and at 1 and 3 years after surgery). We used chi-square tests and directional measures to determine statistically significant data.

RESULTS

Operative treatment in children and elderly patients was 28% (162) of the total number of patients in our cohort **(Table 1)**. The most common levels were L4-5 (47%) and L5-Ec1 (40%). It correlates with data from the literature.

Table 1. Investigated cohort (children and elderly patients, total 28%)

Patients group (by age)	Number of patients	Percentage
0–18 years	64	11%
19–60 years	427	72%
>60 years	98	17%

Thirty-one percent of all patients associated the onset of complaints with an acute moment, commonly weight lifting, sports, and spine trauma. That was most familiar in young patients (1-44 years). The relationship between the acute moment – 'weight lifting' and the severity of the clinical picture (VAS input, ODI) is impressive, but not statistically significant **(Table 2)**.

Twenty-nine percent of all patients had accompanying diseases distributed as follows: 54% with arterial hypertension; 34% with diabetes mellitus; 5% with carcinoma, and 7% with coxarthrosis. Thirty-six patients had more than one accompanying disease, most often a combination between arterial hypertension and diabetes mellitus. This data was most familiar to the elderly than children ($p<0.05$).

In a sample of 20 patients, we evaluated the MRI findings in the lumbar region according to Phirman scale, the VAS score for lumbar and leg pain (at discharge), and the self-assessment of the patient's condition at discharge according to the MacNab criteria **(Table 3)**.

Categorically, in younger patients with low grades (*I, II*) of the Phirman criteria at levels other than the level of disc prolapse, the final postoperative VAS & MacNab scores were significantly more favorable. Conversely, as a rule, in elderly patients with 'worse' scores according to the Phirman criteria, the postoperative VAS & MacNab scores were in the less favorable spectrum. **(Fig. 1 and 2)**

The analysis of the postoperative MacNaB scores revealed that 23.4% of the children had an excellent self-assessment and 76.6% of them had a good self-assessment. In contrast, for elderly patients, on the one hand, the MacNaB scores were either excellent or good in 78.5% of the cases, and on the other hand, 21.5% of them had a self-assessment score of either fair or poor ($p<0.05$) **(Table 4)**.

Table 2. Relationship between the acute moment - 'weight lifting' and the severity of the clinical picture

	LDH (other) n = 468	LDH due to 'weight lifting' n = 121	*p* value
Oswestry disability index (0-100)	50±21	61±17	0.10
Visual analog scale leg pain (0-10)	6.9±2.4	7.8±2.3	0.19
Visual analog scale back pain (0-10)	5.1±3.3	5.6±3.8	0.54

Table 3. Phirman associated values

Phirman scale	Sample / Age	L1-2	L2-3	L3-4	L4-5	L5-S1	VAS at discharge Low back pain	VAS at discharge Leg pain	MacNab
Patient 1	28	I	II	I	I	V	1	1	Excellent
Patient 2	17	I	I	I	I	V	1	1	Excellent
Patient 3	47	III	IV-a	V	III	II	2	2	Good
Patient 4	44	I	II	III	V	II	1	1	Excellent
Patient 5	58	III	IV-b	III	IV-a	II	2	2	Good
Patient 6	37	I	I	I	V	I	1	1	Excellent
Patient 7	70	IV-a	III	III	III	V	3	1	Fair
Patient 8	33	I	I	I	IV-b	I	1	1	Excellent
Patient 9	43	II	I	II	I	IV-b	2	1	Good
Patient 10	55	II	II	III	III	IV-b	2	2	Good
Patient 11	63	IV-b	IV-b	V	V	IV-b	3	2	Fair
Patient 12	63	II	III	IV-b	IV-a	II	2	2	Good
Patient 13	50	I	II	II	II	V	1	1	Excellent
Patient 14	65	II	II	III	IV-a	V	2	2	Good
Patient 15	51	II	II	II	IV-b	II	1	1	Excellent
Patient 16	48	I	II	II	III	IV-a	2	1	Good
Patient 17	54	III	III	IV-a	IV-a	V	3	3	Fair
Patient 18	15	I	I	I	V	I	1	1	Excellent
Patient 19	52	I	II	II	I	IV-b	1	1	Excellent
Patient 20	40	I	I	II	II	V	1	1	Excellent

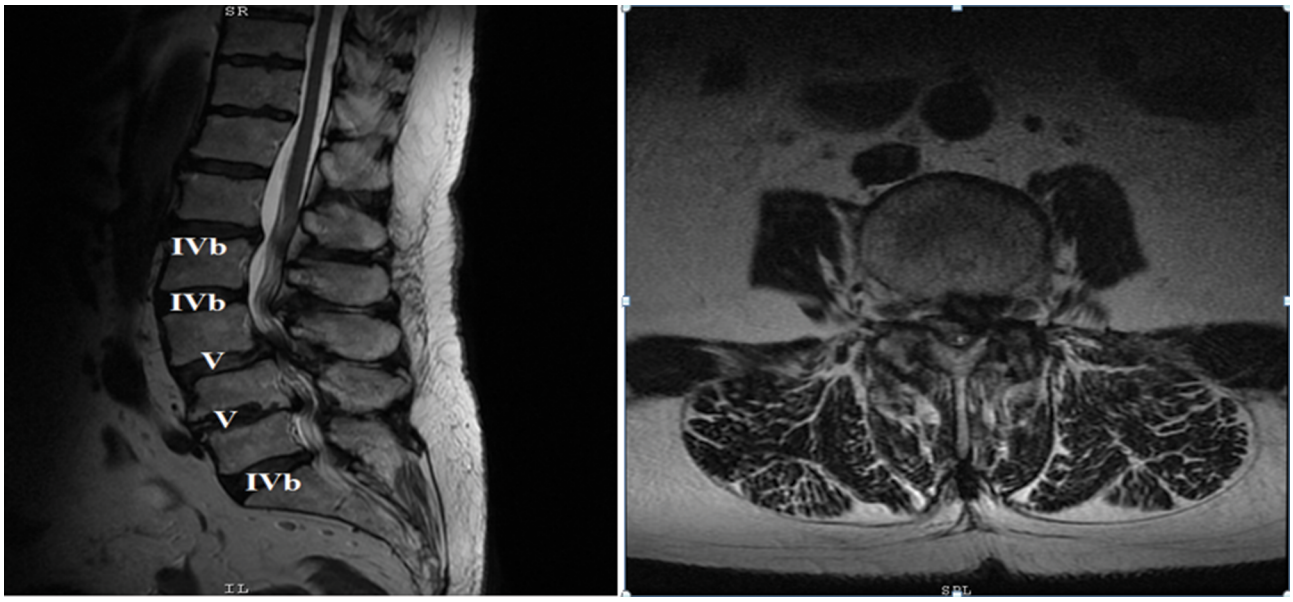

Figure 1. A 63-year-old patient with L4-5 lumbar stenosis and L3-4 lumbar disc herniation with poor MacNab self-assessment. Note: Multilevel decompression followed by fusion could be performed in such patients.

Analysis of the parameters - mean VAS values of lumbar pain/leg pain (for both groups– children and elderly patients) postoperatively and within 1 month after surgery shows statistically significant differences ($p<0.05$) between standard (SD) and microdiscectomy (MD) in both age groups. Lumbar and leg pain was prolonged in SD, probably due to operative wound extent, the tissue healing process, and iatrogenic nerve root irritation, respectively **(Tables 5, 6)**.

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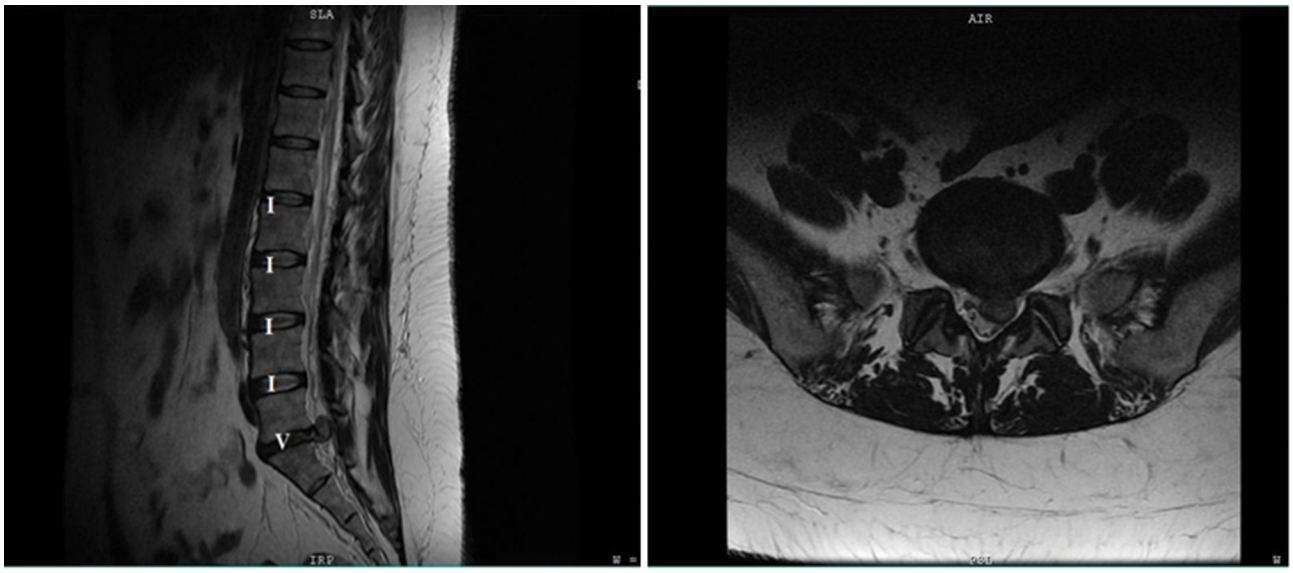

Figure 2. A 17-year-old patient with one 'pathologic' level and excellent self-assessment according to MacNab.

Table 4. Analysis of postoperative MacNab

			Age group			Total
			1-18	**19-60**	**>60**	
MACNAB	**1**	N	15	272	33	320
		%	23.4%	63.7%	33.6%	54.4%
	2	N	49	155	44	248
		%	76.6%	36.3%	44.9%	42.1%
	3	N	0	0	21	21
		%	0%	0%	21.5%	3.5%
Total		N	64	427	98	589
%		100%	100%	100%	100%	

Chi-square tests

	Value	**df**	**Asymptotic significance (2-sided)**
Pearson chi-square	42.557	4	0.000
Likelihood ratio	41.476	4	0.000
Linear-by-linear association	7.652	1	0.006
N of valid cases	589		

Table 5. ANOVA analysis of lumbar pain

ANOVA analysis (lumbar pain)	**SD (N=91)**	**MD (N=71)**	***P***
Postoperative	1.22±0.64	0.97±0.52	<0.05
1 month after operation	0.51±0.50	0.25±0.43	<0.05

Table 6. ANOVA analysis of leg pain

ANOVA analysis (leg pain)	**SD (N=91)**	**MD (N=71)**	***P***
Postoperative	1.20±0.64	0.96±0.51	<0.05
1 month after operation	0.43±0.49	0.22±0.41	<0.05

The analysis of mean VAS scores of lumbar/leg pain postoperatively and within one month after surgery showed that there was a statistically significant difference ($p<0.05$) between young and elderly patients. Children (1–18 years) responded more difficultly and postoperatively reached the optimal surgical outcome later, most likely as a result of the activity of inflammatory and neuromodulatory agents **(Fig. 3)**.

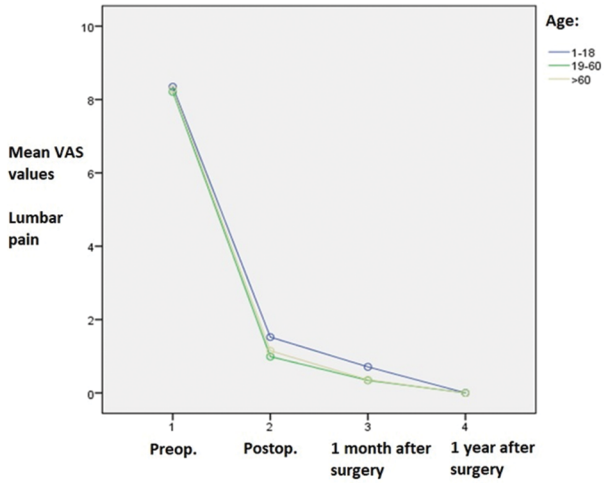

Figure 3. Graphic expression by age groups and lumbar pain (Kaplan-Meier analysis).
Note: Children (1-18 years) responded more difficultly and postoperatively reached later the optimal surgical outcome.

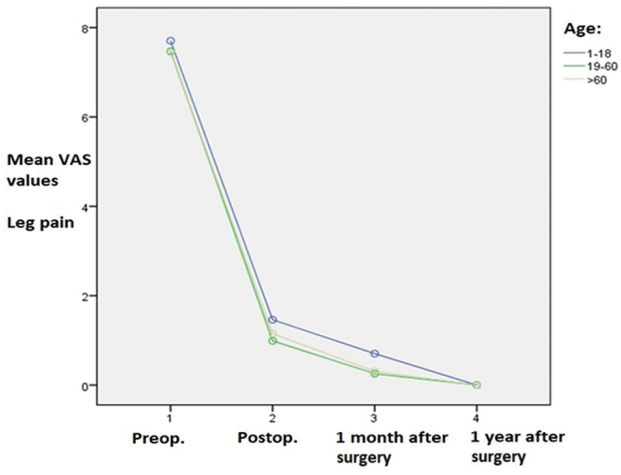

Figure 4. Graphic expression by age groups and leg pain (Kaplan-Meier analysis).
Note: Identical graphic expression for leg pain.

DISCUSSION

The role of trauma in causing lumbar disc herniation in children is more significant than in adults.[1-3] Children are unlikely to have disc degeneration or a previous period of low back pain. Clinical signs and symptoms are similar to those in elderly patients but are much more acute at the onset. Clinical and imaging evaluation is similar to that in the elderly. Reports of fusion in pediatric patients are in a small percentage. There are no well-defined selection criteria. The congenital anomalies were not considered in this study. There appears to be no relationship between anomaly and a herniated disc. It is important to recognize anomalies like spina bifida during routine preoperative planning to avoid iatrogenic neurological damage.[4]

The literature on discectomy in children reveals mixed results over time. Initial results are excellent. At a one-year follow-up, Papagenlopoulos et al.[5] reported 93% good or excellent results. At the last follow-up, ranging from 12 to 45 years, 92% were good or excellent but there were 28% re-operated. Parisini et al.[6] documented 95% success at a short-term follow-up, while at long-term follow-up (mean 12.4 years) good or excellent results were documented in 87% of cases. These researchers found a 10% reoperation rate at 10 years. DeOrio and Bianco[7] showed 96% good or excellent results at initial follow-up, decreasing to 74% at the final review. Many other series document similar results.[1,8,9] In our 3-year follow-up of patients with LDH operated by two methods (MD and SOD), 11% of patients with this pathology in the age group (0-18 years) were observed. Our data correlate with these literature data – 23.4% excellent and 76.6 good MacNaB status and 7.5% reoperations.

On the one hand, LDH is much less common in elderly patients than in active-age patients (17 vs. 71%), but on the other hand, LDH is less common in children than in elderly patients (11% vs. 17%). The nucleus pulposus dehydrates with age and is less likely to herniate. Lumbar stenosis and joint hypertrophy are frequent problems.[10] Nevertheless, LDH can occur with or without the presence of stenosis. The results of discectomy in this population are comparable to younger patients, assuming they have the correct diagnosis. Maistrelli et al.[11] reported results of discectomy in 32 patients over 60 years of age. Clinical findings were similar, with 81% of patients having radicular pain as well as a positive Laseque test. At an average follow-up of 50 months, good or excellent results were found in 87% of cases. None of the patients had evidence of neurogenic claudication, which is an important distinguishing feature in making the diagnosis of disc herniation versus stenosis. Jonsson and Stromqvist[12] also found that discectomy in patients over 70 years of age had good results documented at a 2-year follow-up. In our 3-year follow-up of patients with LDH operated by both methods (MD and SOD), we report that 17% of patients with this pathology are in the age group of >60 years. Our long-term postoperative outcome data are worse than those of the pediatric patients and are mainly related to the poor status of the intervertebral discs according to the Phirman scale (78% excellent or good MacNaB status and 7.5% reoperations).

Recurrent lumbar disc herniation (rLDH) is the most unsatisfactory and undesirable result for surgeons, patients and health-insurance organizations.[13] Many studies report rLDH rates approximately between 5% and

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25%. [14-16] On the one hand, age difference and body mass index have not been reported as significant risk factors for recurrent lumbar disc herniation in other studies. On the other hand, smoking and physical activity levels in younger patients may increase the risk for lumbar disc re-herniation.[17] Other studies suggest different factors, such as alcohol consumption, compliance with doctors' postoperative recommendations, level of daily physical activities, type of occupation, return to work, education, surgeon's' choice, etc.[18-20] Kim et al. report other predictions for re-herniation after percutaneous endoscopic discectomy: high body mass index, age, protrusion type of lumbar disc herniation, and positive Modic changes.[19,20] However, Swartz and Trost do not consider smoking, herniation level, and duration of symptoms to be sufficient risk factors for recurrent lumbar disc herniation.[21] Wilke et al. have presented an in-vitro model and shown that at a younger age, a highly hydrated nucleus pulposus is more likely to re-herniate under mechanical stress.[22] They have also pointed out that re-herniation is less likely to occur in patients older than 55. In our study, disc degeneration with ageing also acted as a protection against re-herniation.

CONCLUSIONS

The long-term postoperative outcome in elderly patients is worse than in children and is mainly due to the poor status of the intervertebral discs according to the Phirman scale and associated pathologies at other levels.

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Competing Interests

The authors have declared that no competing interests exist.

Author contribution

All listed authors have contributed to the preparation of this manuscript and have permitted their names to be included as co-authors.

The research was conducted in accordance with the updated Declaration of Helsinki and all patients, whose data are used for analysis, signed informed consent.

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Грыжа диска поясничного отдела позвоночника у детей и пациентов пожилого возраста

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Резюме

Введение: Грыжа диска поясничного отдела позвоночника является частой патологией пациентов молодого и среднего возраста. Трещины и разрывы в фиброзном кольце становятся слабыми местами, которые способствуют грыже студенистого ядра, особенно когда экстремальные силы «атакуют» межпозвонковый диск. Значительная биомеханическая сила, приложенная к здоровому («нормальному») диску, может иметь тот же эффект. Протрузии и грыжи дисков в разной степени проникают в позвоночный канал.

Цель: Это исследование направлено на то, чтобы представить особенности грыжи поясничного отдела позвоночника у детей и пожилых пациентов и оценить их по сравнению с данными, представленными в литературе.

Материалы и методы: Было обследовано 589 пациентов, 64 из которых были детьми (0-18 лет) и 98 пациентов пожилого возраста (> 60 лет). Оперированные больные наблюдались не менее трёх лет. Все данные были зарегистрированы при регулярных наблюдениях (через 1 и 3 месяца, а также через 1 и 3 года после операции). Мы использовали тест хи-квадрат и меры направленности (directional measures) для определения статистически значимых данных. Оперативное лечение детей и пожилых пациентов составило 28% (162) от общего числа пациентов нашей когорты.

Результаты: Анализируя послеоперационный MacNaB, наш результат показал, что у детей 23.4 % имеют отличную и 76.6 хорошую самооценку, в то время как у пациентов пожилого возраста, с одной стороны, MacNaB раньше была отличной или хорошей у 78.5 %, а с другой стороны, 21.5 % имели удовлетворительную или плохую самооценку ($p<0.05$).

Заключение: Отдалённые послеоперационные исходы у пожилых пациентов были хуже, чем у детей. В основном это было связано с неудовлетворительным состоянием межпозвонковых дисков по шкале Phirman и сопутствующими патологиями на других уровнях.

Ключевые слова

возрастная LDH, результаты операций, заболеваемость