

Single institution clinical results in patients with Legg-Calvé-Perthes disease that undergo femoral varus osteotomy

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Abstract — Background: Legg-Calvé-Perthes disease is a significant topic in pediatric orthopedics due to its high incidence and often unclear prognosis. Both conservative and surgical treatments are widely practiced today, aiming primarily to contain the femoral head, reduce stress on the affected avascular zone, and minimize loss of sphericity of the femoral head.

The aim of this study is to evaluate the clinical results in early age patients with Perthes disease which undergo femur osteotomy in a single institution.

Materials and Methods: A retrospective study involving 81 hips in 79 patients was conducted at a single institution. Inclusion and exclusion criteria were set. Patients with a primary diagnosis of Legg-Calvé-Perthes disease were operated on – varus femoral osteotomy was done in all patients. The patients were classified using the Stulberg and Herring classifications, and were divided into three main groups depending on the disease severity preoperatively. Clinical and radiographic results were collected and analyzed.

Results: Poor clinical outcomes (Stulberg III, IV, V) were observed in 47% of the patients. There was a direct correlation between the degree of poor outcomes and the age at onset of the disease. The average limb length discrepancy was 0.9 cm (range: 0.0–2 cm), with 23 patients having a discrepancy greater than 1 cm. Twelve patients required contralateral epiphysiodesis in the knee area to equalize limb length.

Conclusions: Patients with Herring B and B/C, as well as Stulberg I and II stages over the age of six, have excellent outcomes following varus femoral osteotomy. Unsatisfactory and poor results are observed in patients with Herring and Stulberg IV and V grade hip joints. The early onset of the disease, as well as the lack of a unified treatment protocol, necessitate further and more in-depth studies in this area.

Keywords — Legg-Calvé-Perthes disease, surgical treatment, osteotomy

1 Background

Legg-Calvé-Perthes disease is a significant topic in pediatric orthopedics due to its high incidence and often unclear prognosis. First described by Legg in 1909, it is a self-limiting avascular necrosis of the epiphyseal complex of the hip joint of idiopathic

origin. Annually, 1 in 10,000 children develop avascular necrosis (AN) of the proximal femoral epiphysis, with a male predominance ratio of 5:1. The healing process is prolonged, averaging between 2 to 5 years, with treatment success directly related to the child's age and the extent of avascular changes at diagnosis. Early signs include pain, limp, and restricted range of motion particularly in abduction and internal rotation of the hip joint. It is hypothesized that changes in ossification centers and fragmentation of the epiphyseal growth plate underlie the development of hip pain in children with skeletal dysplasias.

The disease progresses through several stages, each characterized by distinct radiographic features.

Prognosis and treatment choices are guided by the age at disease onset, with Herring classification (degree of lateral column involvement) clarifying the extent of necrotic involvement of the femoral head. Stulberg classification assesses residual deformity of the femoral head and joint congruence. Both conservative and surgical treatments are widely practiced today, aiming primarily to contain the femoral head, reduce stress on the affected avascular zone, and minimize loss of sphericity of the femoral head.

Various surgical interventions focus on containing the femoral head within the acetabulum, categorized as femoral, pelvic, or combined osteotomies.

The aim of this study is to evaluate the clinical results in early age patients with Perthes disease which undergo femur osteotomy in a single institution.

2 Materials and Methods

A retrospective study was conducted in a single institution. Informed consent was taken from all the participants in the study (parental consent). From January 2008 to October 2020, 81 hips in 79 patients with Perthes disease were operated on at the Clinic of Pediatric Orthopedics at the University Orthopedic Hospital “Prof. B. Boichev” in Sofia, Bulgaria.

All patients underwent the same surgical procedure—varus and derotational proximal femoral osteotomy with a calculated angle, using Synthes LCP 3.5 and 5.0 plates.

All patients were diagnosed preoperatively with painful and limping gait. The average age was 7.3 years (range: 4-13 years). The average follow-up period was 44 months (minimum 12 months, maximum 87 months).

Patients were divided into three age groups: Group I (up to 6 years): 21 patients (26.58%); Group II (6-9 years): 51 patients (64.56%), and Group III (over 9 years): 7 patients (8.86%). The patients' main complaints were hip pain accompanied by a limp, associated knee pain. (Table 1)

Класификация на Herring предоперативно				
	A	B	B/C	C
Под 6 г.				
♂		5	10	2
♀		2		2
6-9 г.				
♂	1	22	13	2
♀		10	3	1
Над 9 г.				
♂		2	2	1
♀			1	1

Table 1. Preoperative staging by Herring classification.

Clinical assessments included the onset dates of complaints, and measurements of flexion, extension, abduction, adduction, and the range of internal and external rotation of the affected hip joints.

Radiological assessments involved full-length measurements and radiographs to detect discrepancies in the length of the lower limbs. Preoperative and postoperative radiographs in anteroposterior (AP), lateral, and maximum abduction views were used to evaluate outcomes. Two classification systems were used - Herring classification, and Stulberg classification.

Preoperative radiological signs indicating a femoral head at risk included lateral calcification of the epiphysis, lateral subluxation of the epiphyseal nucleus, metaphyseal cysts, and Gage's sign.

Statistical analysis included descriptive statistics, and the results were analyzed using Statistical tool in Microsoft Excel.

3. Results

The average follow-up period for patients in the group was 44 months (minimum 12 months, maximum 87 months). A total of 81 cases were followed. Poor clinical outcomes (Stulberg III, IV, V) were observed in 47% of the patients. There was a direct correlation between the degree of poor outcomes and the age at onset of the disease.

In the group over 9 years old 62.5% had poor outcomes, compared to 28.5% in the group under 6 years old. Poor outcomes also correlated with the Herring classification. (Figure 1)

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Figure 1. Example of a 9-year old patient. Preoperative, intraoperative, and 4-year-postoperative radiographs.

Postoperatively, in group B, 28% of patients had poor outcomes; in group B/C, 47.5%; and in group C, 78%. (Table 2)

Резултати						
	ТБС бр. Herring		Stulberg III, IV,V %		Общо %	Лоши резултати по Herring
I.гр (21)	7 ТБС	В група	2 ТБС	9%	28,5%	Група В 28%
	10 ТБС	В/С група	3 ТБС	14%		
	4 ТБС	С група	1ТБС	5,5%		
II.гр. (52)	32 ТБС	В група	9 ТБС	17%	50%	Група В/С 47,5%
	27 ТБС	В/С група	14 ТБС	27%		
	3 ТБС	С група	3 ТБС	6%		
III гр (8)	3 ТБС	В група	1 ТБС	12,5%	62,5%	Група С 78%
	3 ТБС	В/С група	2 ТБС	25%		
	2 ТБС	С група	3 ТБС	25%		

Table 2. Postoperative results in the different groups.

The average limb length discrepancy was 0.9 cm (range: 0.0–2 cm), with 23 patients having a discrepancy greater than 1 cm. There was no progressive change in this parameter during the follow-up period, especially after the removal of osteosynthesis material and in younger patients. Changes in gait due to limb length discrepancy and gluteal weakness were observed in all patients, but there was a significant improvement following the rehabilitation program, gradually improving over 8 months post-surgery.

To monitor the degree of shortening, control full-standing radiographs were performed every 6 months. Twelve patients required contralateral epiphysiodesis in the knee area to equalize limb length.

4. Discussion

The Optimal Treatment for Severe Forms of Perthes Disease Remains Uncertain. Most authors agree that some form of surgical containment is indicated for severely affected hip joints with lateral subluxation and poor coverage of the femoral head, although the methods vary.

In 1981, Catterall presented results from the treatment of LCPD (Legg-Calvé-Perthes Disease) in 97 hip joints, correlating the final outcome with the degree of preoperative involvement of the femoral head. Based on these findings, Catterall developed his classification for the severity of the disease and found that 92% of patients in groups I and II had good results, while 91% of patients in groups III and IV had predominantly poor results. Other studies with a follow-up period of over 40 years show that although most patients with LCPD treated surgically have good short-term functional results, residual deformity of the femoral head often leads to a high incidence of osteoarthritis, frequently requiring total hip arthroplasty.

Postoperative results of proximal varus osteotomies presented by other authors vary widely. Lloyd-Roberts et al. reviewed a controlled study of 48 patients with LCPD treated by varus and derotation osteotomy, concluding that the treatment is the method of choice for patients with signs of "risk," provided severe deformation has not yet occurred. Of the 48 patients with LCPD, the results were 58% good, 23% satisfactory, and 19% poor. Friedlander and Weiner presented a large series of 116 patients with LCPD, concluding that proximal osteotomies are a reliable treatment method, regardless of age. They reported 51% excellent results, 40% good, and 9% poor results, with all patients classified as poor results (Stulberg V) falling into the preoperative Herinc C group and age over 9 years, which correlates with our study results.

Hoikka et al. reported on 112 patients treated surgically by the same method, with 52% excellent results, 24% satisfactory, and 24% poor results. In their series, results worsened with increasing patient age.

There are several articles in the literature reporting medium- or long-term results of FVO (femoral varus osteotomy) in the Korean population. Kim et al. reported their experience with 13 FVOs, with medium-term follow-up results of 31% good, 61% satisfactory, and 8% poor. Park and Choi reported medium-term follow-up results of 23 FVOs, with 44% good, 52% satisfactory, and 4% poor.

Our results, showing 39.5% excellent results, 45.5% satisfactory, and 15% poor results, were better than previous reports. We believe our better results are due to careful patient selection, who were in the fragmentation stage at the time of surgery. Additionally, differences in final results between documents may be caused by the condition of the operated patients, including the age of onset, severity of the disease, and stage of the disease.

5. Conclusions

Patients with Hering B and B/C, as well as Stulberg I and II stages over the age of six, have excellent outcomes following varus femoral osteotomy. Unsatisfactory and poor results are observed in patients with Hering and Stulberg IV and V grade hip joints. The early onset of the disease, as well as the lack of a unified treatment protocol, necessitate further and more in-depth studies in this area.

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