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Original Research

Varus derotation osteotomy in perthes disease: a long term radiological and clinical follow up of 5 years

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ABSTRACT

Aim: The aim of the present study was to assess the long term radiological and clinical follow-up of 5 years in varus derotation osteotomy in perthes disease.

Methods: This retrospective study was conducted in the orthopedic department and 30 patients with Perthes` disease were enrolled over the period of 5 years, patients aged 6-12 years.

Results: The age range was between 6 and 12 years, with an average ± standard deviation of 9.51 ± 1.80 years. Based on the clinical parameters, it was observed that 53.33% of the patients were below the age of 8. Among the total of 30 patients, 23 were male. The right hip was the most affected, followed by the left hip then both sides simultaneously. The lateral pillar classification revealed that 50% of patients exhibited grade C and 36.66% exhibited grade B & C. Conversely, 13.34% possessed B. The majority of femur head radiographs showed subluxation and metaphyseal resorption, accounting for 36.66% and 30% of cases, respectively. Only 3 radiographs (10%) demonstrated Gage's sign as the only finding. The patients' radiological stages were primarily characterized by early, late, and early healing periods.

Conclusion: The research found that the Stulberg classification, along with age, lateral pillar classification, and pre-operative radiological stages of the illness, is the most influential factor in predicting outcomes.

Keywords:long term, radiological, clinical, follow-up, varus derotation osteotomy, perthes disease

INTRODUCTION

Legg-Calve-Perthes (LCP) disease is a rare and distressing ailment that affects youngsters. Osteonecrosis is defined as the necrosis of bone tissue in the femoral head caused by insufficient blood flow.[1] However, if not well managed during its first phases, it may cause deformation of the femoral head, which can then contribute to the early development of osteoarthritis, flattening, and dislocation of the hip joint in later years. Key factors that impact the prognosis include the individual's age, the severity of LCP (Legg-Calvé-Perthes) disease, the roundness of the femoral head, the specific pattern of damage as classified by Herring, and the presence of lateral pillar type C.[2] The main objective of the therapy is to prevent any deformity of the femoral head before the revascularization phase.[3]

By keeping the femoral head inside the acetabular cavity, the mechanical stress is reduced and the proper growth of both the head and cavity is facilitated, while ensuring that the joint remains congruent. This may be achieved by conservative approaches such as traction,

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weight reduction, and the use of braces, or through surgical interventions. Previous research suggests that both varus derotation osteotomy (VDRO) and Salter innominate osteotomy have comparable outcomes in terms of surgical containment. Nevertheless, the Salter innominate osteotomy has the potential for neurovascular injury.[4] Legg-Calve-Perthes disease (LCPD) is a pediatric disorder that specifically affects the hip joint. It is distinguished by the emergence of pain and first indications of joint degeneration in subsequent phases.[5] The prevalence of this illness varies from 0.5 to 21 cases per 100,000 persons. The condition is shown to be 4 to 5 times more common in men than females, and it mostly affects youngsters aged 4 to 8 years.[6]

Although the precise source of the illness is not well understood, other elements have been suggested as possible reasons. The factors contributing to this condition include trauma, irregularities in blood coagulation, the existence of the factor V Leiden mutation, hyperactivity, disadvantaged socio-economic level, exposure to cigarette smoke, low birthweight, genetic vulnerability, and delayed bone growth. Patients presenting with complaints of limping, hip discomfort, and anterior knee pain undergo direct pelvic anterior-posterior radiography for examination. The main goal of treatment is to provide sufficient acetabular coverage of the femoral head, which is experiencing impaired blood flow. This is accomplished by decreasing the pressure inside the joint, which enhances blood circulation and restores the round shape of the femoral head to align with the acetabulum.[7]

The current main surgical procedures are Salter osteotomy, combined osteotomy (femoral and pelvic osteotomy), chiari osteotomy, shelf acetabular augmentation of Staheli and femoral varus derotation osteotomy (FVDO). Although there is a substantial body of literature on the immediate and intermediate results of surgical treatment for LCPD, there is a lack of research that has investigated the long-term effects of this therapy.[8-10]

The aim of this study was to assess the long-term radiological and clinical surveillance of patients who had varus derotation osteotomy for perthes disease, spanning a duration of 5 years.

MATERIALS AND METHODS

The study was conducted in the orthopedic department and included a cohort of 30 children who were diagnosed with Perthes' disease over a period of 5 years. The age of the patients varied between 6 and 12 years. The study excluded those below the age of 6 and over the age of 12, those with notable hip mobility rigidity, and those with ongoing hip and femur infections. Every patient had an antalgic gait as their main symptom, and the Tendelenburg test showed positive findings for all except three of them.

This study utilizes the lateral pillar classification system, which is based on radiographical changes in the lateral area of the femoral head throughout the fragmentation stage, as seen in the antero-posterior view.11 Radiological signs function as a diagnostic tool that impacts the treatment and prognosis of all the patients included in the study. These indications include the metaphysical absorption and partial dislocation of the femoral head.

A Gage sign is a term used to describe a V-shaped region of heightened brightness seen on the outside section of the epiphysis and/or the adjacent metaphysis. It is a distinctive indication of Legg-CalvePerthes disease.[12] A Varus derotational osteotomy was performed on all 30 hips affected by Perthes disease, following the specific radiological stages identified by the Waldenstrom classification[13]:

Preoperatively, radiographs were obtained for all 30 hip joints. The lower limbs were aligned in internal rotation and in parallel with each other. In addition, the limbs were abducted to achieve the required confinement of the femoral head. The level of abduction was measured by the angle formed between the shaft of the femur and a vertical line that runs parallel to the midline of the pelvis. This angle represents the desired angle of the osteotomy.[14]

Every patient had open wedge varus derotational osteotomy of the proximal femur, with or without the additional procedure of soft tissue release (Adductor tenotomy).[15] Following the surgical procedure, it was mandatory for the youngsters to maintain bed rest for a minimum duration of 6 weeks. At that time, Plaster of Paris (PoP) spica was not used and individuals were prohibited from bearing any weight on their legs. Following the first phase, individuals were advised to commence ambulation using a pair of crutches and progressively increase their level of physical exertion. Afterwards, they were subsequently seen at two-month intervals throughout the first year and then once a year after that. Orthopedic specialists use the Stulberg radiographic grading system to monitor patients over an extended period of time. The Stulberg radiological grading system has five grades, ranging from grade 1, indicating a positive outlook, to grade V, indicating a very negative prognosis.[16]

The data was inputted into an Excel spreadsheet, where it was then filtered and cleansed. Subsequently, the data was uploaded to SPSS version 22 for statistical analysis. Frequencies, percentages, and the Chi-square test were used to determine the relationship between various variables. A P value of ≤ 0.05 was considered statistically significant.

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RESULTS

Table 1: Clinical preoperative profile of the patients

Variables	Clinical profile No. & (%)			Total
	Limitation of all hip movements with TDB +ve	Partial limitation of hip movements with TDB +ve	Partial limitation of hip movements with TDB -ve	
Agegroups				
<8years	4	9	3	16
8-12years	6	7	1	14
Gender				
Males	8	11	4	23
Females	2	5	0	7
Side of the affected limb				
Right	6	6	4	16
Left	3	10	0	13
Both	1	0	0	1
Total	**10(33.3)**	**16(53.33)**	**4(13.4)**	**30 (100)**

The age range was between 6 and 12 years, with an average ± standard deviation of 9.51 ± 1.80 years. Based on the clinical parameters, it was found that 53.33% of the patients were below the age of 8. Among the total of 30 patients, 23 were male. The right hip was the most affected, followed by the left hip then both sides simultaneously.

Table 2: Preoperative radiological profile of the hips

Radiological findings	No. (%)
Lateral pillar	
B	4(13.34)
C	15(50)
B & C	11(36.66)
Head atrisk	
Subluxation	11(36.66)
Metaphyseal resorption	9(30)
Subluxation and metaphyseal resorption	6(20)
Gage's sign	3(10)
Subluxation, metaphyseal resorption & Gage's sign	1(3.33)
Stages	
Sclerotic stage/ Stage of increased density	4(13.34)
Early fragmentation/ Stage of revascularisation	8(26.66)
Late fragmentation	8(26.66)
Early healing stage/ Stage of reossification	7(23.33)
Late healing stage/ Remodelling phase	3(10)
Total	**30(100)**

According to the lateral pillar classification, 50% of patients had stage C and 36.66% had a combination of stages B and C. Conversely, 13.34% possessed B. The majority of femur head radiographs showed subluxation and metaphyseal resorption, accounting for 36.66% and 30% of cases, respectively. Only 3 cases (10%) had Gages sing as the only finding. The patients' radiological stages were primarily characterized by early, late, and early healing periods.

Table 3: Postoperative radiological findings of the patients

Radiological findings	N (%)
Stulberg grades	
Good prognosis	18(60)
Fair prognosis	9(30)

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Bad prognosis	3 (10)
Central edge	
≤ 25º	10(33.34)
26-40º	18(60)
>40º	2(6.66)
Others abnormalities	
No abnormalities	16(53.34)
Short neck	3 (10)
Overriding of greater trochanter and short neck	10 (33.34)
Abduction hinge	1 (3.33)
Total	30 (100)

Pre operative Radiograph of a case of Perthes disease of Left Hip of a 8 year old male patient (AP and Lateral view)- Herring group-B

Immediate post-operative radiograph after varus derotation osteotomy of left proximal femur

Post operative 6month follow up radiographs (AP and Lateral)

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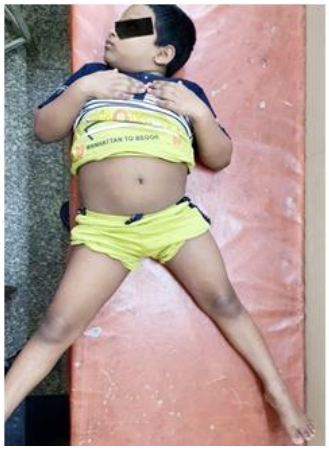
Post operative 2 years follow up with excellent remodeling of left femoral head- Stulberg Class- III

Range of motion of operated hip joint during 6 month follow up

Hip flexion

Hip extension



Hip abduction

Hip adduction

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Hip internal and external rotation in flexion

Standing clinical photograph at 6 month post op follow up

DISCUSSION

Legg-Calve-Perthes syndrome is a pediatric disorder that specifically affects the hip joint. The description of it was independently supplied in 1910 by Legg, Calve, Perthes, and Waldenstrom. Over a hundred years have passed since the first publication of the first three studies on Legg-Calvé-Perthes disease (LCPD). This ailment mostly affects children between the ages of 4 and 12. The etiology of this condition remains unclear, and there is no consensus on the most effective treatment.[18,19]

The participants' ages ranged from 6 to 12 years, with an average age of 9.51 years and a standard deviation of 1.80 years. The analysis of the patients' clinical features indicated that the majority (53.33%) of the patients were less than 8 years old. Among the 30 cases, 23 were male. The right hip was the most severely affected, followed by the left hip, and then both sides simultaneously. The study revealed that a significant proportion of the patients were male, and the right side of the hip was the most often affected side. A study done in Iraq revealed that males had a greater degree of distress, particularly affecting the left side of the hip.[20,21] An independent study done in the United States found that the disease mostly affects one side of the body (89.2%), with a larger incidence in men (81.4%) compared to females (18.6%). Furthermore, the involvement of both the right and left hip is similar.[22]

Upon analyzing the patients using the lateral pillar classification, it was found that 50% of them had C,

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while 36.66% were classified as B & C. In comparison, just 13.34% had B. A study done in China revealed that 23.5% of the patients were categorized as grade B, 47.1% were categorized as grade B & C, and 29.4% were categorized as grade C.[23] A distinct study carried out in France found that 61.9% of the patients were categorized as grade B, whilst 19.0% were classified as grade B & C and an additional 19.0% fell into the grade C group.[24] The main radiographic observations of the femoral head were partial dislocation and erosion of the metaphysis, with respective rates of 36.66% and 30%. Only three cases, accounting for 10% of the total, had Gage's sign as the only symptom. The radiological phases seen in the patients mostly consisted of early fragmentation, late fragmentation, and early healing stages. An examination of the patients after surgery revealed that 60% of them had a positive outlook (Stulberg grades 1 & 2), while 30% had a moderate outlook (Stulberg grade 3), and just two cases had a negative outlook (Stulberg grades 4 & 5). According to a study conducted in Japan, out of 130 patients, 82 hips (63%) had a positive radiological result at the last follow-up, 40 hips (31%) had a moderate outcome, and 8 hips (6%) had a negative prognosis.[25]

Around 60% of the cases had a central edge angle between 26º and 40º, whereas a lesser percentage had an angle below 25º and a greater percentage had an angle beyond 40º. Out of all the patients, the majority (53.34%) did not have any abnormalities after the surgery. However, 33.34% experienced the overlapping of the great trochanter and short neck, while 10% had a short neck alone. Research indicates that doing a varus derotation osteotomy during the avascular necrosis phase & various stages of fragmentation are an excellent method for reducing the duration of the sickness by avoiding the fragmentation stage.[19]

CONCLUSION

According to this research, open wedge proximal femoral varus derotation osteotomy is effective for children under 8 years old, somewhat effective for those over 8 years old, and particularly beneficial for those with lateral pillar B & B & C and the first three radiological phases (sclerosis, early and late fragmentation). The study demonstrated that the Stulberg classification, which takes into account age, lateral pillar classification, and pre-operative radiological phases of the disease, is the most accurate predictor of outcomes.

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