

ORIGINAL ARTICLE

Principles of Treating the Sequelae of Perthes Disease

MUHAMMAD ARSALAN¹, MIDRARULLAH KHAN², MAUZZMAH SHAHID³, ZEESHAN QAMAR², SANA AKHLAQ⁴, ASSAD ULLAH⁵¹Consultant Pediatrics Orthopedic Surgery, Hayatabad Medical Complex, Peshawar, Pakistan²Hayatabad Medical Complex, Peshawar, Pakistan³Department of Chemistry, University of Engineering and Technology Lahore, Pakistan⁴MD, M. Phil Physiology, Medical College Gujranwala, Pakistan⁵Civil Veterinary Hospital Gumbat, Kohat, KPK, PakistanCorresponding author: Muhammad Arsalan, Email: muhammad.arsalaan@gmail.com

ABSTRACT

Background: Perthes disease is a form of juvenile idiopathic osteonecrosis characterized by temporary bone mortality due to inadequate blood supply to the femoral head.**Objectives:** This cross-sectional study aimed to evaluate the treatment outcomes and sequelae of Perthes Disease and to identify the most effective treatment modalities for managing its sequelae.**Methods:** The research enrolled 59 Perthes Disease patients who had completed treatment at our institution between 2021 and 2022. The information pertaining to demographic characteristics, clinical presentations, radiological findings, specific treatments administered, and follow-up records were collected. Pain levels and hip functionality were secondary outcome measures. The Harris Hip Score (HHS) was used to assess the primary outcome of quality of life.**Practical Implication:** The practical implications for treating the sequelae of Perthes disease include early detection, a multidisciplinary approach, conservative management, surgical interventions when necessary, rehabilitation and physical therapy, long-term monitoring, and patient and family education. Timely diagnosis, collaboration among healthcare professionals, tailored treatment plans, and regular follow-up are important for optimizing outcomes and managing the condition effectively.**Results:** The average age of the study population was 4.76±1.10 years, with a higher proportion of males. Left-sided (59.32%) participation was more prevalent than right-sided (37.28%) participation ($p<0.05$). The disease's duration differed between patients. The majority of participants exhibited clinical symptoms such as hip or groin pain, limping, restricted hip movement, and deformities. The most prevalent treatment modality ($p<0.05$) was physical therapy (52.54%), followed by orthotic devices (30.50%) and surgical interventions (16.94%). Surgical procedures employed both extra-articular (70%) and intra-articular techniques (10%) ($p<0.05$).**Conclusion:** Multimodal, patient-specific approach is essential for managing Perthes disease sequelae. Physical therapy was the primary modality of care, while surgical interventions were employed selectively. Significant improvements were observed in pain reduction, functional outcomes, deformity correction, and ROM as a result of the treatment. These findings provided important insights into the management of Perthes disease and highlighted the need for individualized treatment strategies to achieve optimal patient outcomes.**Keywords:** Harris Hip Score; Perthes Disease; Orthopedic deformities; Orthotic devices; Radiological examination.

INTRODUCTION

Legg-Calvé-Perthes Disease, also known as Perthes Disease, is a pediatric orthopedic disorder characterized by a temporary interruption of blood supply to the femoral head¹⁻². This results in avascular necrosis, or the demise of bone cells, which primarily affects children ages 4 to 8, with males being more susceptible. Although its exact cause is unknown, it is believed to be a condition influenced by genetic, traumatic, and environmental variables. In 10% to 15% of instances, the disease remarkably affects both hips³⁻⁴.

The symptoms of Perthes disease include limping, pain in the hip, quadriceps, or knee, and limited hip mobility. These symptoms may develop gradually and range in severity from minor irritation to severe mobility difficulties⁵. Over time, the body can assimilate bone tissue that has died and stimulate the growth of new bone. Nonetheless, if the femoral head loses its rounded shape during this process, it can contribute to adult complications such as premature arthritis⁶⁻⁸.

Significant long-term effects can result from Perthes Disease, a condition that causes transient loss of blood supply to the femoral head¹. These complications include femoral head deformity, which can cause hip rigidity, discomfort, and possible gait abnormalities⁹. Changes in the hip joint's structure can also precipitate premature osteoarthritis, which causes pain and limits mobility. Moreover, alterations in the hip joint can limit its range of motion, and leg length disparities can cause additional complications¹⁰⁻¹¹. Importantly, the chronic nature of these effects can also result in psychosocial difficulties, necessitating a comprehensive, holistic approach to care¹².

This study aimed to cast light on therapeutic approaches for managing this condition's long-term effects. Even though Perthes Disease is self-limiting, intervention may be necessary to assure

optimal hip function in adulthood. In severe cases, physical therapy, immobilization, and even surgery may be used to maintain hip mobility and alleviate pain¹³. In addition, the purpose of this study was to investigate recent advances in surgical techniques and innovative treatment modalities, highlighting the significance of early intervention and continuous care for enhancing long-term patient outcomes. We advocated for holistic, patient-centered care that goes beyond addressing physical symptoms, highlighting the importance of psychological support, occupational therapy, and social integration strategies for children and adolescents affected by Perthes disease. Our mission is to aid clinicians, researchers, and therapists in making informed decisions to enhance the health and well-being of those affected by Perthes Disease complications.

MATERIAL AND METHODS

This cross-sectional study was carried out on 59 patients diagnosed with Perthes Disease, at Hayatabad Medical Complex, Peshawar, designed to evaluate the treatment outcomes and long-term effects of Perthes Disease.

We recruited Perthes Disease patients who were treated at our institution between 2021 and 2022. Patients were included regardless of age, gender, or specific treatment received, as long as they had completed treatment and were not presently receiving Perthes Disease interventions. Excluded were patients with other significant comorbidities that could affect hip function such as other hip dysplasia, unrelated arthritis, neuromuscular disorders, or any severe systemic disease. Patients who had not concluded their Perthes Disease treatment and any patient who has received a hip replacement were excluded from this investigation.

We gathered information from the patients and noted on Excel spreadsheets pertaining to their health records, including demographic information, clinical presentations, radiological

findings, specific treatments administered, and follow-up records. Included in the details of physical wellness were pain levels and joint functionality. Analyses were conducted on radiological parameters, including the morphology of femoral head and joint space. The presence and severity of osteoarthritis were also documented for patients who had reached skeletal maturity.

Using validated instruments such as Harris Hip Score (HHS), quality of life was the primary outcome measured. Pain, measurement hip functionality, assessed by range of motion (ROM) and any restrictions on daily activities, were secondary outcome measures.

The HHS is a commonly used clinical instrument designed to evaluate the outcomes of hip surgery. It is also frequently used to assess the severity of hip conditions, such as Perthes Disease. It measures pain, function, deformity absence, and ROM (Figure 1). Each section is assessed, with a maximum possible score of 100. Higher scores indicate healthier and more functional hips. Scores can be categorized as follows: 70 (poor), 70–80 (fair), 80–90 (good), and 90–100 (excellent). It is the patient-reported outcome measure that has been validated extensively in orthopedic research.

Using descriptive statistics, the demographic data were analyzed. Adjusting for potentially confounding variables such as age at diagnosis and disease severity, statistical models were used to examine the associations between distinct treatment modalities and outcome measures. All statistical analyses were conducted using the SPSS program, version 24.0 and p-value of less than 0.05 was regarded as statistically significant.

Our hospital's institutional review board approved this study, and all procedures were performed per Declaration of Helsinki. Before analysis, however, all patient data were anonymized to protect patient confidentiality and patients also provided informed written consent.

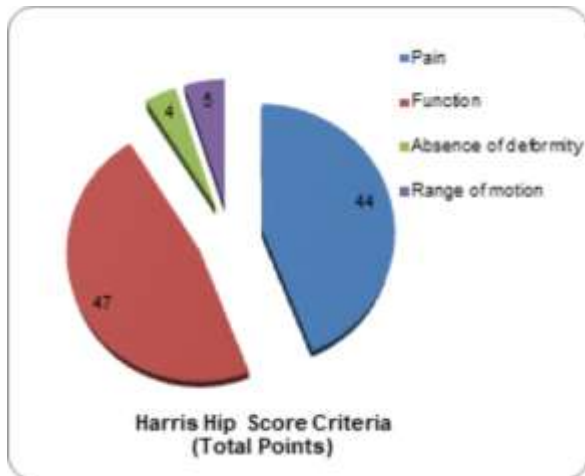


Figure 1: The assessment criteria for Harris Hip Score

RESULTS

Demographic characteristics of 59 study's participants revealed mean age of 4.76±1.10 years. There were 39 male participants and 20 female participants, accounting for 66.10% and 33.89% of the total, respectively, based on their gender. The p-value of 0.0422* indicated that there was statistically significant difference between the gender distribution of the participants. Regarding the afflicted side, 35 participants had the disease on the left and 22 on the right. Two participants exhibited bilateral Perthes disease. This distribution corresponds to 59.32 percent for the left side, 37.28 percent for the right side, and 3.39 percent for both sides. The frequencies of duration of disease category were as follows: 26 (44.06%), 19 (32.20%), and 14 (23.72%). The p-value of 0.00001* indicates that there was statistically significant difference between the categories regarding the duration of the disease (Table 1).

The percentage of patients exhibiting particular clinical symptoms associated with Perthes disease was also recorded. 83% of participants reported hip or groin discomfort was the prevalent symptom of the condition. 65% of the patients reported limping. 35% of the participants reported nighttime pain. Forty-eight percent of the patients reported morning stiffness, and 92% of participants reported restricted hip movement, highlighting its high prevalence and significant impact on mobility. 65 percent of patients reported a shortening of the affected limb, 55% of participants reported quadriceps muscle atrophy, 33% of the patients reported a Trendelenburg gait, which is characterized by a pelvic displacement during walking and 75 percent of participants reported joint stiffness (Figure 2).

Physical therapy (52.54%) was the most prevalent approach to managing Perthes disease (p<0.05), followed by orthotic devices (30.50%) and surgical interventions (16.94%), as described in the study. These results shed light on current practices for treating patients with Perthes disease and highlighted the significance of a multimodal, patient-specific approach (Table 2). Extra-articular and intra-articular approaches classified the various surgical treatments for Perthes disease. Among the extra-articular techniques, valgus extension was performed in 5 cases, indicating that this procedure was used to correct limb deformity and potentially address anterior impingement. Shelf-acetabuloplasty was utilized in two cases, indicating its application in the treatment of increased trochanteric abutment. One instance of osteochondroplasty of the head and neck was performed intra-articularly. To treat any remaining dysplasia, the head and neck of the femur are reshaped during this procedure. In 1 case, labral repair, an intra-articular technique, was used to enhance hip joint stability by surgically repairing the labrum. In 1 case, osteochondritis dissecans was also excised, indicating the removal of diseased or damaged cartilage and underlying bone fragments. These findings illustrated the variety of extra-articular and intra-articular surgical techniques used to treat the complications of Perthes disease (Figure 3).

The clinical outcomes of patients with Perthes Disease sequelae before and after treatment, indicated that prior to receiving treatment, 90% of patients reported experiencing pain. After undergoing treatment, however, the percentage decreased significantly to 25% (p<0.05). Prior to treatment, 45% of patients reported impaired function in terms of functional outcomes. After undergoing treatment, however, the percentage of patients with improved function increased significantly to 85 percent (p<0.05). Likewise, before treatment, 80% and 45% of patients had deformities and limited ROM, respectively. However, the percentages decreased to 30% for deformities and increased to 80% for ROM improvement after treatment (p<0.05). These outcomes demonstrate the treatment's efficacy in correcting deformities and increasing range of motion. These therapeutic strategies for Perthes Disease sequelae resulted in significant enhancements in pain alleviation, functional outcomes, deformity correction, and ROM and revealed the efficacy of the treatment approach (Table 3).

Table 1: Demographic features of participants

S. No	Demographic features	No. of patients (n=59)	Frequency (%)	p-value
1	Age (Mean±SD) years	4.76±1.10		0.7834
2	Gender Male/Female	39/20	66.10/33.89	0.0422*
3	Side Left/Right Both sides	35/22 02	59.32/37.28 3.389	0.2090
4	Duration of Perthes Disease <6 months 7-12 months >12 months	26 19 14	44.06 32.20 23.72	0.00001*

*indicated that the value is significant (p<0.05)

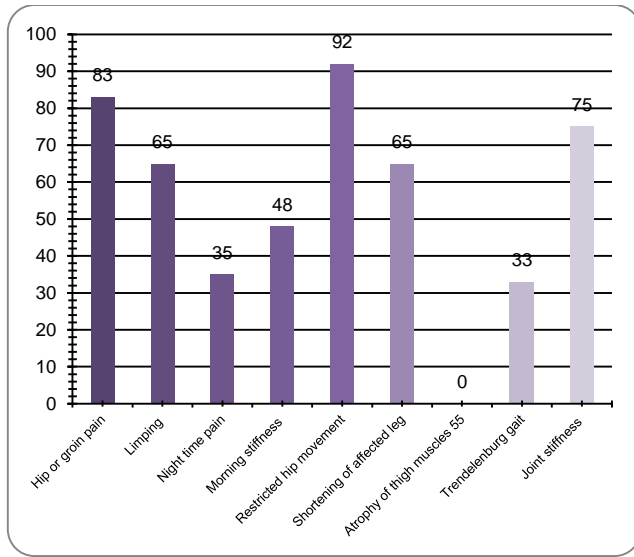


Figure 2: Clinical manifestations of Perthes Disease patients

Table 2: Treatment modalities of the affected patients

S. No	Treatment modality	Number of patients (n)	Frequency (%)	p-value
1	Physical therapy	31	52.54	0.00001*
2	Orthotic devices	18	30.50	
3	Surgical interventions	10	16.94	

*indicated that the value is significant (p<0.05)

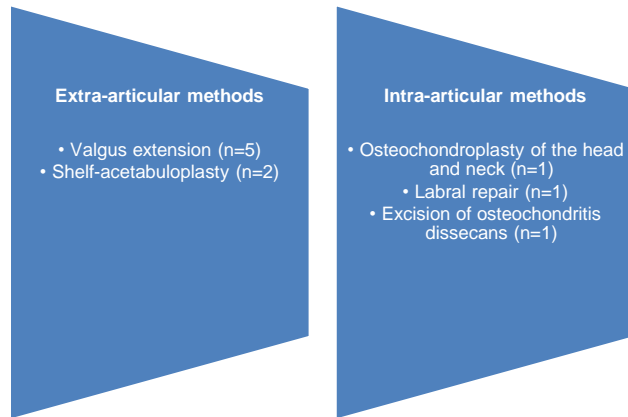


Figure 3: Surgical interventions used by the participants

Table 3: Clinical outcomes after treating the sequelae of Perthes Disease patients (HHS)

S. No	Category	Before treatment	After treatment	Chi-square value	p-value
1	Pain (%)	90	25	23.19	0.00001*
2	Function (%)	45	85	6.958	0.00834*
3	Deformity (%)	80	30	14.13	0.00017*
4	ROM (%)	45	80	5.548	0.01850*

*indicated that the value is significant (p<0.05)

DISCUSSION

The investigation assessed the treatment outcomes and long-term effects of Perthes Disease in 59 patients. The preponderance of patients had the disease on the left side (59.32%) and was male (66.10%). Among the clinical symptoms were hip or groin pain (83%), hobbling (65%), and hip movement restriction (92%) among

others. The most prevalent treatment modality was physical therapy (52,54%), followed by orthotic devices (30.50%) and surgical interventions (16.94%). There were both extra-articular and intra-articular surgical interventions. Significant improvements were observed following treatment, including reduction in pain (from 90% to 25%), improvement in function (from 45% to 85%), and reduction in deformity (from 80% to 30%). These results demonstrate the effectiveness of the treatment strategy for managing Perthes disease complications.

It was reported that femoral osteotomies are the standard surgical intervention for Perthes disease, supported by the existing literature. However, there are complications and inconveniences associated with these procedures. In correlation with the advent of symptoms, the lateral pillar classification demonstrated its utility in assessing the severity of the disease. It was suggested that shelf acetabuloplasty was as effective as pelvic or femoral osteotomies in the medium term for children of any age and disease severity, with fewer complications and less patient inconvenience¹⁴. Alternative joint preservation methods were available for older children and adolescents with more severe femoral head involvement in Perthes disease, according to a separate study. Extraarticular and intraarticular techniques included proximal femoral osteotomy, frequently in a valgus direction, osteochondroplasty of the femoral head and neck, and femoral head reduction with the possibility of acetabular reorientation in certain cases¹⁵.

In Perthes' disease, femoral head deformation is recognized as the primary complication. Two significant factors were associated with the development and timing of this complication, according to the research. First, femoral head extrusion was identified as significant contributor to its deformation. Second, femoral head deformation typically takes place during the final stage of fragmentation. It has been observed that the likelihood of preventing femoral head deformation is substantially greater if extrusion is addressed or prevented at an earlier stage of fragmentation than at a later stage². Another study concluded that Intertrochanteric osteotomy led to pain relief, a reduction in hobbling, and increased ROM. Subluxation before surgery was considered significant factor that can affect the prognosis. Changes in the acetabulum and femoral neck shortening were two significant factors that can significantly impact hip ROM¹⁶. The primary objective of treatment is to stabilize the child's movement while standing and walking. This is accomplished via an extension or valgus upper femoral osteotomy. This procedure alleviates pain, improves leg length, restores the normal abductor lever arm, and consequently improves the patient's gait, which is a major concern for the patient¹⁷.

CONCLUSION

Our research offered important insights into the treatment outcomes and sequelae of Perthes Disease. The findings emphasized the importance of a multimodal, patient-specific treatment strategy, with physical therapy being the most prevalent treatment modality. Specific complications were also treated with extra-articular and intra-articular surgical procedures. After treatment, the results indicated significant enhancements in pain reduction, functional outcomes, deformity correction, and ROM. These results contributed to comprehension and management of Perthes Disease sequelae, highlighting the importance of early intervention and individualized treatment strategies for optimal patient outcomes. To enhance our understanding of this condition and optimize treatment, additional research and long-term follow-up studies are necessary.

Conflict of Interest: None.

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