

Research Article

Study on Functional Outcome of VDRO in Late-Presenting Perthes Disease in Paediatric

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Abstract

Background: Perthes disease is a pediatric hip disorder characterized by avascular necrosis of the femoral head, with late presentation (after age seven) often associated with poor prognosis and controversy over optimal management. This study aims to assess the functional outcomes of varus derotation osteotomy (VDRO) in children with late-presenting Perthes disease. **Aim of the study:** The aim of the study was to evaluate the functional outcomes of Varus Derotation Osteotomy (VDRO) in paediatric patients with late-presenting Perthes disease. **Methods:** This prospective study at the Department of Orthopaedics, Sylhet MAG Osmani Medical College Hospital (2023-24) evaluated VDRO in 14 children (8-12 years) with unilateral Perthes (Herring B/C). Patients underwent subtrochanteric osteotomy (15-20° varus correction, DCP fixation) followed by 6-week spica casting. Functional outcomes were assessed using Harris Hip Score over 6 months. Data were analyzed using SPSS v25. **Results:** This study included 14 paediatric patients with late-presenting Perthes disease treated by VDRO. Most were aged 8–10 years (64.29%) and male (71.00%), with right-side involvement in 57.14%. Based on the modified Elizabethtown classification, Stage I B was most common, and 57.14% were classified as Herring's Group B. Postoperatively, 57.14% had excellent to good outcomes per Harris Hip Score, while complications were minimal, with hypertrophic scar being the most frequent. **Conclusion:** VDRO is an effective treatment for late-presenting LCPD in adolescents, yielding favorable functional outcomes and manageable complications.

Keywords

LCPD, VDRO, Harris Hip Score, Modified Elizabethtown CLASSIFICATION, Herrings Classification

1. Introduction

Perthes disease is a juvenile hip disorder characterized by avascular necrosis of the capital epiphysis of the femur, with a variable clinical course [1]. Although the exact etiology of this childhood illness remains unclear, it typically resolves spontaneously [2]. However, by the age of 40, affected individuals may develop osteoarthritis and femoral head deformity [3]. Legg-Calvé-Perthes disease (LCPD) progresses

through distinct stages—avascular necrosis, subchondral fracture, fragmentation, revascularization, and remodeling—which contribute to its unpredictable prognosis [4]. The disease is typically mild in children younger than six years, in whom conservative management often yields good functional outcomes [5, 6].

The onset of symptoms after the age of seven is catego-

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rized as late presentation, and patients diagnosed at this age or older generally have a less favorable prognosis, which significantly affects treatment outcomes [7, 8]. Key prognostic factors include age at onset, disease severity, and the degree of femoral head sphericity preservation [3]. Non-operative treatments tend to be less effective in children over eight, with poorer outcomes reported in this group [9, 10].

All treatment approaches aim to maintain femoral head containment within the acetabulum, thereby minimizing deformity and preserving joint congruity. This can be achieved via surgical or non-surgical methods, with the most favorable results occurring when interventions are initiated before the revascularization phase [11]. Containment reduces mechanical stress, promotes normal growth of the femoral head and acetabulum, and maintains proper joint alignment [12]. Treatment goals also include restoring hip mobility and preventing future degenerative changes [3].

The principle of femoral head containment is central to most therapeutic strategies for Perthes disease. Available treatment options include acetabular shelf procedures, femoral osteotomy, innominate osteotomy, Petrie casting, bracing, and subtrochanteric varus derotation osteotomy (VDRO) [6]. However, the optimal approach remains a topic of ongoing debate in pediatric orthopaedics [13]. Conservative management is generally recommended for children under six years of age, employing traction, restricted weight-bearing, and observation. In children aged six to nine years, surgical stabilization is frequently indicated. In contrast, treatment strategies for patients over nine remain controversial [14, 15]. All interventions aim to contain the femoral head and preserve joint congruity, particularly when initiated before revascularization [10, 11].

VDRO has been shown to yield better outcomes than non-operative treatment in children aged 9 to 10 years [16]. First described over half a century ago, VDRO is now a widely accepted surgical option for Perthes disease. Multiple studies have demonstrated its efficacy in improving both clinical and radiological outcomes [17-19]. The procedure enhances femoral head coverage through varus angulation and rotational correction. By redirecting forces acting on the weight-bearing surface of the femoral head laterally and anteriorly, VDRO helps control lateral displacement and realign the epiphyseal plate.

Despite the variety of treatment options available, the optimal management strategy for late-presenting LCPD remains uncertain. This study evaluates the functional outcomes of VDRO in treating children with late-presenting Perthes disease. Specifically, we aimed to determine whether surgical intervention alters the natural history of the disease, improves femoral head morphology at presentation, and promotes favorable acetabular remodeling.

2. Objective

The aim of the study was to evaluate the functional out-

comes of Varus Derotation Osteotomy (VDRO) in paediatric patients with late-presenting Perthes disease.

3. Methodology & Materials

This prospective observational study was conducted at the Department of Orthopaedics, Sylhet MAG Osmani Medical College Hospital, Sylhet, Bangladesh, between July 2023 and June 2024. A total of 14 patients were included based on specific inclusion criteria to evaluate the functional outcomes of subtrochanteric varus derotation osteotomy (VDRO) in late-presenting Legg-Calvé-Perthes Disease.

Inclusion Criteria:

- 1) Patients aged between 8 and 12 years.
- 2) Unilateral involvement with Herring's Lateral Pillar classification B or C.

Exclusion Criteria:

- 1) Bilateral hip involvement.
- 2) Presence of hinged abduction deformity.

All patients underwent subtrochanteric open wedge varus derotation osteotomy (VDRO) using a lateral approach in the supine position, guided by imaging. A varus correction of 15°–20° was performed, with a target postoperative neck-shaft angle of 120°–125°. Fixation was achieved using a 4.5 mm narrow dynamic compression plate and screws, with the proximal-most screw inserted through the greater trochanter for trochanteric epiphysiodesis. Postoperatively, patients were immobilized in a hip spica cast for six weeks, followed by a gradual rehabilitation program involving hip range of motion exercises and restricted weight-bearing until complete healing of the osteotomy site. Follow-up evaluations were conducted at two weeks, six weeks, three months, and six months post-surgery. Functional outcomes were assessed using the Harris Hip Score. Informed written consent was obtained from all participants or their guardians prior to enrollment. Data were analyzed using SPSS version 25.0.

4. Results

Table 1. Demographic Characteristics of the Study Population (n=14).

Variable		Frequency (n)	Percentage (%)
Age Groups (years)	8–10	9	64.29%
	10–12	5	35.71%
	Total	14	100.00%
Gender	Male	10	71.00%
	Female	4	29.00%
Side of	Right	8	57.14%

Variable	Frequency (n)	Percentage (%)
Involvement Left	6	42.86%

Table 1 presents the demographic characteristics of 14 patients included in the study. Of the total 14 patients, 9 were in the 8–10 years age group (64.29%), and 5 were in the 10–12 years age group (35.71%). In terms of gender, 10 patients (71.00%) were male, and 4 patients (29.00%) were female. Regarding the side of involvement, 8 patients (57.14%) had the right hip affected, while 6 patients (42.86%) had the left hip affected.

Table 2. Severity Group Based on Modified Elizabethtown Classification (n=14).

Age (years)	Stage I B	Stage II A	Stage II B	Total
< 10	4	4	2	10
≥ 10	2	1	1	4
Total	6	5	3	14

Table 2 presents the distribution of severity stages in relation to age groups based on the modified Elizabethtown classification. Among the 14 patients, 10 were under 10 years of age, with 4 in Stage I B, 4 in Stage II A, and 2 in Stage II B. For patients aged 10 years and older, 2 were in Stage I B, 1 in Stage II A, and 1 in Stage II B. In total, 6 patients were classified as Stage I B, 5 as Stage II A, and 3 as Stage II B.

Table 3. Lateral Pillar Classification by Herring's Group (n=14).

Herring's Group	Frequency (n)	Percentage (%)
B	8	57.14%
C	6	42.86%
Total	14	100.00%

Table 3 shows the distribution of patients based on the Herring's lateral pillar classification. Out of 14 patients, 8 (57.14%) were categorized as Group B, and 6 (42.86%) as Group C. This classification helps in assessing the extent of lateral pillar height preservation and predicting the prognosis of Perthes disease.

Table 4. Postoperative Functional Outcome Based on Harris Hip Score (n=14).

Harris Hip Score	Frequency (n)	Percentage (%)
Excellent & Good	8	57.14
Fair	5	35.71
Poor	1	7.14
Total	14	100.00

Table 4 summarizes the postoperative functional outcomes of patients as evaluated by the Harris Hip Score. A majority of the patients (8, 57.14%) had excellent to good outcomes. Fair outcomes were observed in 5 patients (35.71%), while only 1 patient (7.14%) had a poor outcome, indicating that VDRO provided satisfactory functional recovery in most cases.

Table 5. Postoperative Complications Observed in the Study Population (n=14).

Complications	Frequency (n)
Hypertrophic Scar	3
Wound Infection	2
Limb Length Shortening	1
Total	6

Table 5 outlines the postoperative complications encountered among the 14 patients who underwent VDRO. A total of 6 complications were reported: hypertrophic scar was the most common (3 cases), followed by wound infection (2 cases), and limb length shortening in 1 case.



Figure 1. Pre Operati.

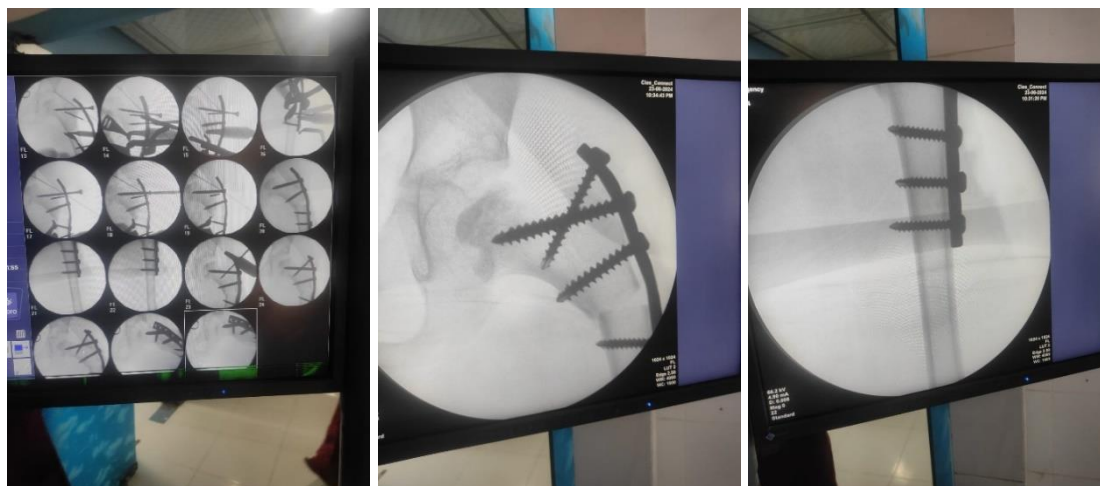


Figure 2. Per Operative.



Figure 3. 6 Weeks after operation.



Figure 5. 6 months after operation.



Figure 4. 3 Months after operations.

5. Discussion

This study assesses the functional outcomes of varus derotation osteotomy (VDRO) in children with late-presenting Legg-Calvé-Perthes disease (LCPD) treated at a tertiary care center in Bangladesh. LCPD is an idiopathic condition with a highly variable course, and its prognosis is primarily influenced by the patient's age at diagnosis and the extent of femoral head involvement. Late-onset Perthes disease, often associated with a less favorable prognosis due to limited remodeling potential, poses a significant challenge in pediatric orthopaedics. Subtrochanteric VDRO is a well-documented and widely practiced surgical procedure for the treatment of LCPD. Through surgical containment via VDRO, this study aimed to assess whether early intervention could enhance

joint function and influence disease progression. The results indicate that VDRO provides favorable functional outcomes in selected patients, especially when performed prior to significant femoral head collapse.

In our study, the mean age of the patients was 10.4 years, ranging from 8 to 12 years, with the majority (64.29%) falling within the 8–10-year age group. This age distribution reflects the typical presentation window for late-onset LCPD, which is known to have a less favorable natural history compared to early-onset cases. Our findings align with those reported by Joseph et al. [20], who documented a mean age of onset of 9.4 years among their study population, emphasizing the relevance of age as a prognostic indicator. Age at diagnosis plays a pivotal role in determining the disease outcome, as the remodeling potential of the femoral head decreases with advancing age. Children under 6 years of age generally have better outcomes due to their enhanced ability for revascularization and bone regeneration. In contrast, older children, especially those over 8 years, are at greater risk for persistent deformity and long-term joint dysfunction. Therefore, timely surgical intervention in this age group is crucial to improve containment of the femoral head within the acetabulum, optimize hip mechanics, and prevent future complications such as early-onset osteoarthritis.

According to Herring's lateral pillar classification, 8 patients (57.14%) in our study were categorized as Group B, while 6 patients (42.86%) fell into Group C. This distribution highlights the presence of both moderate and more severe forms of femoral head involvement in our cohort. Our findings are consistent with the outcomes reported by Saini et al. [3], who observed that among 23 children in Group B, 73.9% achieved good outcomes, and 26.08% had moderate results, with no poor outcomes reported. In contrast, Group C had only 27% good outcomes, while the majority experienced fair (63.63%) or poor (9.09%) results. These observations reinforce the prognostic significance of the lateral pillar classification, suggesting that patients in Group B generally respond better to surgical containment procedures like VDRO compared to those in Group C. The relatively better preservation of the lateral pillar in Group B likely contributes to more favorable femoral head remodeling and improved functional outcomes.

All patients in this study underwent subtrochanteric VDRO with trochanteric epiphysiodesis to reduce the risk of trochanteric overgrowth. This preventive measure is particularly important in pediatric patients, where premature trochanteric growth can lead to altered hip biomechanics and compromised abductor function. The use of this technique is supported by the findings of Langenskiöld et al. [21] and Matan et al. [22], who advocated trochanteric epiphysiodesis as an effective prophylactic intervention. By controlling proximal femoral growth, this approach helps preserve hip stability and function during the critical period of skeletal development.

To assess disease severity, we utilized the modified Eliza-

bethtown classification, a system that categorizes Perthes disease based on radiographic stages of progression. This classification has been widely used in previous studies, including those by Joseph et al. [20]. In our study, the majority of patients were classified in the earlier stages (I B and II A), which typically indicates a less advanced disease state. These stages are often associated with a more favorable prognosis and, when managed appropriately, can lead to better postoperative outcomes. Early intervention in these cases may have contributed to the positive functional results observed in our cohort.

Postoperative functional status was evaluated using the Harris Hip Score, a widely recognized tool for assessing hip function. In our cohort, 8 patients (57.14%) achieved excellent to good results, 5 patients (35.71%) had fair outcomes, and only 1 patient (7.14%) had a poor result. These findings underscore the efficacy of VDRO in improving hip function, particularly in patients with late-presenting Perthes disease. Our findings align with those published by Herring et al. [10], who found that 62% of patients undergoing VDRO after the age of 8 attained favorable Stulberg class I or II hips at skeletal maturity, indicating a positive long-term outcome. Furthermore, McElwain et al. [19] demonstrated that VDRO yields significantly better outcomes in children under the age of 10 compared to both noncontainment treatment and the natural progression of the disease. These studies, along with our findings, highlight the potential of VDRO to provide substantial functional improvement in young patients with Perthes disease.

Regarding complications, 3 patients developed hypertrophic scars, 2 experienced wound infections, and 1 had limb length discrepancy of approximately 1 cm. Saini et al. [3] observed a mean limb length reduction of 11 mm (range: 6–15 mm) in their study, with some patients demonstrating altered gait mechanics. While complications were present, they were generally manageable and did not significantly impair functional recovery in most cases.

Limitations of the Study

This study had some limitations:

- 1) Small sample size, limiting generalizability.
- 2) Short follow-up duration, which may not capture long-term outcomes.
- 3) Absence of a control group for comparison.

6. Conclusion

Subtrochanteric varus derotation osteotomy (VDRO) is an effective surgical intervention for managing late-presenting Legg-Calvé-Perthes Disease (LCPD) in adolescents aged 8 to 12 years. The Harris Hip Score indicated that the majority of patients in this study achieved favorable functional outcomes, particularly those classified under Herring's group B. The most common complications were hypertrophic scars and incision infections, both of which were minimal and manageable. Trochanteric epiphysiodesis effectively pre-

vented overgrowth. Although the results are encouraging, the absence of a control group, short follow-up duration, and small sample size highlight the need for further research with larger cohorts and extended follow-up to validate these findings and refine treatment protocols for late-onset LCPD.

Abbreviations

VDRO	Varus Derotation Osteotomy
LCPD	Legg-Calvé-Perthes Disease
DCP	Dynamic Compression Plate
SPSS	Statistical Package for the Social Sciences
ORCID	Open Researcher and Contributor ID
Mm	Millimeter (Used for Screw Size)

Author Contributions

Mohammad Asaduzzaman: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing

Quazi Shahid-ul Alam: Resources, Software, Writing – review & editing

Conflicts of Interest

The authors declare no conflicts of interest.

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