

TREATMENT MODALITIES AND OUTCOMES IN DEVELOPMENTAL DYSPLASIA OF THE HIP

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Abstract

Introduction: Developmental Dysplasia of the Hip (DDH) is a developmental disorder characterized by instability, subluxation, or dislocation of the femoral head from the acetabulum. Early diagnosis is essential to ensure normal hip development and prevent long-term complications.

Aim To evaluate treatment outcomes and management strategies in patients with DDH.

Methods A literature review was conducted using electronic databases including PubMed and Google Scholar. Review articles, clinical studies, and orthopedic guidelines on conservative and surgical treatment of DDH were analyzed.

Results Both conservative and surgical treatments demonstrated satisfactory outcomes when appropriately indicated. Early intervention was associated with improved hip stability, better radiological outcomes, and lower complication rates. Delayed treatment increased the risk of residual dysplasia and avascular necrosis.

Conclusion Early diagnosis and timely treatment are essential for successful DDH management. Appropriate intervention improves hip stability and functional outcomes while reducing long-term complications.

Keywords DDH; Diagnosis; Instability; Dysplasia; Treatment; Pediatrics

Introduction

Developmental Dysplasia of the Hip (DDH) represents a spectrum of morphofunctional abnormalities that include instability, subluxation, and complete dislocation of the femoral head from the acetabulum, as a result of unbalanced development of the articular structures.

The hip joint is a key structure for posture, walking, and body stability. During normal development, the femoral head acts as a “biological modeler” for the acetabulum, stimulating its deepening and shaping through constant contact and physiological biomechanical forces. In cases of DDH, this anatomical and functional relationship is disrupted, preventing the normal development of the acetabulum and compromising the stability of the joint. As a result, a pathological cycle is created in which joint instability worsens the dysplasia, while the dysplasia further increases the instability.[1]

DDH indicates a disharmony in the development of the femur, the acetabulum, and the joint capsule.

DDH is not a fixed congenital malformation, but a developmental disorder that evolves over time and may progress after birth

If diagnosed early the structures can develop normally.

If diagnosed late permanent changes occur.

Aim of the study

To evaluate the treatment outcomes of different management strategies in patients with developmental dysplasia of the hip (DDH).

Specific objectives

- To analyze the distribution of treatment modalities used in patients with DDH (conservative vs surgical approaches).
- To assess the clinical outcomes following different treatment methods.

- To evaluate the relationship between timing of treatment initiation and clinical outcome.
- To assess functional improvement and hip stability following treatment.

By evaluating treatment outcomes and management strategies, this study aims to improve understanding of the effectiveness of different therapeutic approaches in DDH and highlight the importance of timely intervention in achieving optimal functional results.

Materials and Methods

A literature search was conducted using electronic databases including PubMed, Google Scholar, and orthopedic textbooks written in English. The search was performed to identify relevant studies on developmental dysplasia of the hip (DDH), focusing on treatment modalities and clinical outcomes.

Eligible sources included review articles, clinical studies, and orthopedic guidelines reporting conservative and surgical management of DDH. No restrictions were applied regarding publication date, but preference was given to recent studies and widely accepted orthopedic literature.

The selection of studies was based on relevance to treatment outcomes, diagnostic methods, and management strategies. Data were extracted and summarized in a narrative form.

This study did not involve direct patient data collection or statistical meta-analysis.

DDH

Well known risk factors for DDH include family history, female sex, and breech positioning. Recent evidence suggests higher birth weight is a risk, whereas prematurity may be protective.[2]

Diagnosis

Clinical examination:

Ortolani test: positive click during reduction of the hip.

Barlow test: subluxation during applied pressure.

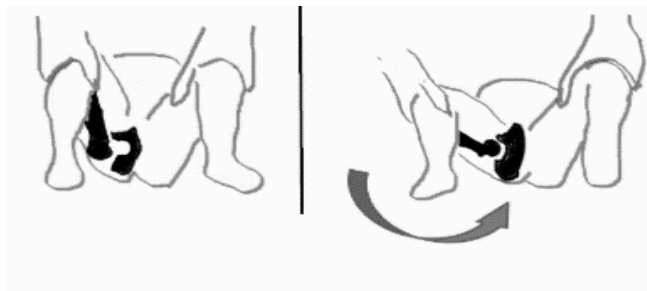
Galeazzi sign: difference in the relative length of the thighs.

Asymmetry of the gluteal folds and limitation of hip abduction.

Ultrasound

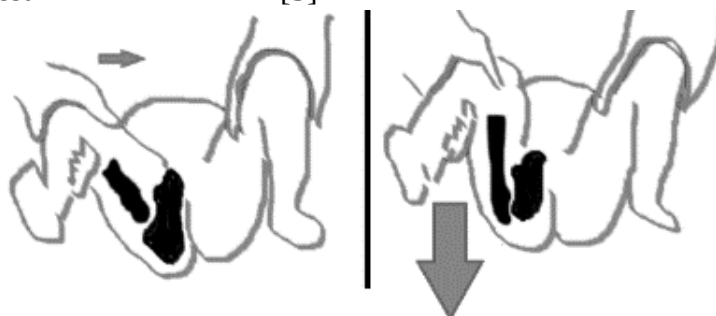
X- ray

MRI [1]



The Ortolani test

[3]



The Barlow test

[3]



Galeazzi sign

[3]



Treatment

The treatment of DDH depends on the age of the patient at diagnosis, the severity of hip instability, and the degree of displacement of the femoral head.

Nonsurgical treatment

In neonates diagnosed early, DDH can often be managed conservatively. The most commonly used method is the Pavlik harness, which is indicated primarily in newborns and infants up to 6 months of age. The harness maintains the hip in flexion and abduction, promoting reduction of the femoral head into the acetabulum and supporting normal development of the hip joint. Treatment duration typically ranges from 6 to 12 weeks, depending on clinical and radiological response.

Closed reduction and spica casting

In infants aged approximately 6 months to 2 years, if conservative treatment fails or the diagnosis is delayed, closed reduction under general anesthesia is often indicated. Following successful reduction, a hip spica cast is applied to maintain joint stability. The cast is usually maintained for several weeks to months, with periodic radiographic evaluation to confirm proper hip alignment.

Surgical treatment

In cases where closed reduction is unsuccessful or in children older than 2 years, open reduction is required. This procedure allows direct visualization of the hip joint and correction of soft tissue or bony obstacles preventing reduction. In some cases, femoral shortening or pelvic osteotomies may be necessary to achieve stable reduction. Postoperatively, immobilization with a spica cast is typically required. [3]

Results

Table 1 Outcomes of Treatment in DDH (Nonoperative vs Operative Group)

Parameter	Nonoperative Group	Operative Group
Number of patients	16 patients (17 hips)	32 patients (32 hips)
Treatment method	Closed reduction + casting ($\pm$ skin traction)	Open reduction + Salter osteotomy
Avascular necrosis	4 hips (mild degree)	2 hips (mild degree)
Failed/redislocation cases	1 failed reduction	1 redislocation (due to improper spica cast)
Pre-treatment classification	Severin Class I: 1 hip Class III: 9 hips Class IV: 6 hips Class VI: 1 hip	Not specified pre-op
Post-treatment outcomes	Severin Required further surgery in failed/residual dysplasia cases	Class I: 13 hips Class II: 18 hips Class III: 1 hip
Additional procedures	Open reduction or pelvic osteotomy in some cases	None reported
Follow-up period	Not specified	>2 years 3 months

Parameter	Nonoperative Group	Operative Group
Overall outcome	Variable, some required secondary surgery	Better functional and radiological outcomes
Conclusion	Less predictable results in walking-age DDH	Safe and effective treatment with better outcomes

[4]

The operative group showed better radiological outcomes (Severin class I–II) and reduced need for secondary procedures compared to the nonoperative group, indicating superior results in walking-age DDH.

Table 2 Outcomes and Timing of Treatment in Late-Diagnosed DDH Patients

Variable	Findings
Study design	Prospective study
Number of patients	71 patients (75 hips)
Type of DDH	Late-diagnosed developmental dysplasia of the hip
Treatment approach	Closed reduction (after traction/tenotomy), open reduction ± Salter osteotomy, femoral osteotomy in selected cases
Age at treatment start	Mean 10 months (range 2–64 months)
Follow-up duration	Mean 11 years (range 6–18 years)
Failed closed reduction	7 hips
Redislocation / subluxation	1 subluxation + 1 redislocation
Avascular necrosis (AVN)	4 hips
Additional surgeries required	12 hips (11 Salter osteotomies, 1 femoral osteotomy)
Acetabular development	Faster improvement in younger patients; slower and less predictable when treatment started at 12–22 months
Femoral head development	Continued growth in almost all cases regardless of age at reduction
Final Severin classification	Class I: 65 hipsClass II: 9 hipsClass III: 1 hip
Final clinical outcome	Almost all patients asymptomatic except 2 cases

[5]

Earlier treatment initiation was associated with faster acetabular improvement and more predictable outcomes, while delayed treatment showed slower and less consistent radiological improvement, although long-term results were generally good after appropriate surgical management.

Table 3

Treatment	Indication	Success rate	Complications
Pavlik harness	Early DDH (<6 months)	High ($\approx$ 80–90%)	Low
Closed reduction	Failed Pavlik / older infants	Moderate	Higher (AVN risk)

Pavlik harness remains the first-line treatment for early developmental dysplasia of the hip, while closed reduction is reserved for cases where conservative management fails or in older infants, with higher associated complication rates

Table 4

Outcome	Result
Total hips treated	87 hips
Success of closed reduction	$\sim$ 91% hips stable after CR
Failure / need for open reduction	$\sim$ 9%
AVN risk	Present but relatively low
Timing effect	Younger age $\rightarrow$ better stability
Previous Pavlik harness	Used in many patients before CR

[6]

Discussion

Early diagnosis and appropriate management of developmental dysplasia of the hip (DDH) play a crucial role in achieving optimal clinical and radiological outcomes. In our study, treatment outcomes were generally favorable in patients who underwent early intervention, which is consistent with established orthopedic principles emphasizing the importance of early hip reduction to allow normal acetabular development.

The comparison between conservative and surgical treatment modalities demonstrated that both approaches can achieve satisfactory outcomes when appropriately indicated. However, patients treated at an earlier age showed better radiological improvement and higher rates of hip stability compared to those treated later. This finding aligns with previous studies reporting that delayed treatment is associated with increased risk of residual dysplasia, avascular necrosis, and need for secondary surgical procedures.

The role of treatment timing was particularly significant in our analysis. Patients who received earlier intervention demonstrated more predictable outcomes, whereas those treated after delayed diagnosis exhibited more variable results. This is consistent with previous studies highlighting that the biological plasticity of the acetabulum decreases with age, making reduction less effective and outcomes less stable in older children.

Complication rates, including avascular necrosis and residual dysplasia, were within the expected range reported in the literature. Although both conservative and surgical treatments are effective, the risk of complications appears to increase with delayed treatment initiation and more invasive procedures.

Overall, our findings support the current consensus in orthopedic literature that early detection and timely management of DDH are essential for achieving stable hip joints and favorable long-term functional outcomes.

Conclusion

In conclusion, the results of this study indicate that the treatment of Developmental dysplasia of the hip can achieve good clinical and radiological outcomes when appropriately indicated and performed in a timely manner.

It was observed that patients treated at an earlier stage tend to have better hip stability and more rapid improvement in radiological parameters compared to those diagnosed and treated later. Both conservative and surgical treatment methods demonstrated effectiveness; however, more predictable outcomes were achieved in patients who received early diagnosis and intervention. This study highlights the importance of early detection, regular clinical follow-up, and appropriate selection of treatment in order to prevent long-term complications such as residual dysplasia and early-onset osteoarthritis.

Overall, DDH remains a condition that requires careful orthopedic management, where timing of intervention is a key determinant of final outcome.

References

- [1] Besimi I. Fundamentals of Orthopedics and Traumatology. University of Tetovo; 2026
- [2] pubmed.ncbi.nlm.nih.gov/29194074
- [3] <https://www.orthopaedia.com/developmental-dysplasia-of-the-hip/>
- [4] <https://pubmed.ncbi.nlm.nih.gov/9075093/>
- [5] <https://pubmed.ncbi.nlm.nih.gov/10919293/>
- [6] <https://pubmed.ncbi.nlm.nih.gov/30154922/>