

Results of spica cast in treatment of developmental dysplasia of the hip in children between 6-18 Months

Dr.Alhadi Alsaghaier ¹, Dr.Mustafa Elsagier ², Dr. Nuraldeen Algasaier ³ Dr.Milad eltanashi ⁴

1. MBBCh FRCS MSc Orth, Department of Orthopaedics, Misurata Medical Centre, Libya
2. MBBS, MBChB, Professor and Head, Division of orthopaedic Surgery, Faculty of Medicine, Misurata University and Misurata Medical Center, Misurata, Libya.
3. MBBCh FRCS MSc Orth, Department of Orthopaedics, Misurata Medical Centre, Libya
4. MBBCh FRCS MSc Orth, Department of Orthopaedics, Misurata Medical Centre, Libya

Article information	Abstract
<p>Key words:</p> <p>DDH, Closed Reduction, Spica Cast, AVN, McKay Criteria, Severin Classification</p> <hr/> <p>Received: 12-06-2025</p> <p>Accepted: 28-07-2025</p> <p>Available: 10-08-2025</p>	<p>Background: Developmental dysplasia of the hip (DDH) includes a spectrum from mild dysplasia to complete dislocation. Early treatment improves outcomes and reduces complications.</p> <p>Objective: To assess clinical and radiological outcomes of closed reduction and static long leg spica casting in children aged 6–18 months with DDH.</p> <p>Methods: This retrospective study included 29 patients (38 hips) treated at Misurata Medical Center in 2018. All underwent adductor tenotomy, closed reduction, and hip spica casting. Outcomes were assessed using McKay's criteria and Severin classification. AVN was evaluated by Salter's criteria.</p> <p>Results: 70% of hips had good radiological outcomes; 89% showed good clinical outcomes. AVN occurred in 7.89% of cases. Mean casting duration was 90 days.</p> <p>Conclusion: Closed reduction and spica casting is effective and safe for managing DDH in children 6–18 months, with high success rates and low complication risk when properly applied.</p>

I. Introduction

The treatment approach for pediatric patients aged 6 to 18 months with developmental dysplasia of the hip (DDH) remains a topic of debate. While many surgeons increasingly support early surgical intervention,¹ there are limited reports on the long-term outcomes of conservative treatment for children older than 12 months.² Conservative methods, being non-invasive, generally cause less trauma and are easier for families to accept, but the ideal age for their application is still uncertain.³ Various conservative techniques have been used, including frog-leg and human position fixation.⁴ Traditionally, hips were immobilized in abduction and flexion,⁴ although some surgeons have developed modified versions of these approaches.³ This study aims to evaluate the results of adductor tenotomy, closed reduction, and static long leg casting in infants diagnosed with DDH between 6 and 18 months of age.

Some infants may have a normal femoro-acetabular joint at birth but develop hip dysplasia later.³⁷ Conversely, certain hips that appear abnormal at birth can normalize without treatment.⁴¹

In a dislocated hip, the femoral head has no contact with the acetabulum and may be reducible or irreducible. In subluxation, the femoral head is partially displaced but retains some contact with the acetabulum.

A hip is termed dislocatable if applying a posterior force on the adducted hip results in complete displacement of the femoral head. It is subluxable if only partial sliding of the femoral head is detected.

Acetabular dysplasia refers to abnormalities in acetabular development, including changes in size, shape, and structure.^{35–36} Dislocations fall into two categories:

- A) **Typical dislocations**, which occur in otherwise healthy infants and can be pre- or postnatal.
- B) **Teratologic dislocations**, which are linked to neuromuscular conditions and occur prenatally.

^{34–37}

Proper development of the hip depends on stable, congruent positioning of the femoral head within the acetabulum. If instability persists, the hip will not develop normally by the time the child begins to walk.^{36–38}

The true incidence of DDH varies widely due to differences in clinical assessment skills, ranging from 1 to 34 per 1,000 births. The use of ultrasonography alongside clinical exams generally results in higher detection rates.³⁹ Risk factors include first-born status, female sex, family history, breech birth, and oligohydramnios.⁴⁰ Additional associated factors are birth weight over 4,000 g and foot deformities such as metatarsus adductus and clubfoot.

Notably, over 60% of infants with DDH do not have identifiable risk factors. The condition is more common in identical twins than fraternal twins. Therefore, thorough clinical screening is essential for all newborns, especially those with risk factors.

Routine hip examinations should include the Ortolani and Barlow tests, assessing each hip individually. These exams should be conducted with the infant relaxed, placed on a smooth, warm, and comfortable surface in a calm environment.

Treatment decisions for DDH are based on the child's age and severity of the condition.

I) Methods and Study Design

This retrospective descriptive case series was conducted in the Department of Pediatric Orthopaedics at Misurata Medical Center, Libya. The study period spanned from January 1 to December 31, 2018.

A total of 29 pediatric patients with developmental dysplasia of the hip (DDH), aged 6 to 18 months at the time of intervention, were included. All patients had simple hip dislocations without associated congenital malformations and had not received prior treatment. Exclusion criteria were dislocations secondary to inflammation, spasticity, spinal bifida, arthroereisis, Down's syndrome, or other associated congenital abnormalities.

Patients were categorized based on acetabular index (AI) into three groups: 30°–35°, 36°–40°, and >40°. Radiological grading was performed according to Tönnis classification:

- Type I: Femoral head medial to Perkin's line and below Hilgenreiner's line
- Type II: Head lateral to Perkin's line but still below Hilgenreiner's line
- Type III: Head lateral to Perkin's line and at the level of the acetabular margin
- Type IV: Head lateral to Perkin's line and above the acetabular rim

Functional outcomes were assessed using McKay's criteria (excellent, good, poor), and radiographic outcomes were classified using Severin's system (Types I–VI).

Pre-reduction traction was applied to all patients. For Tönnis Types I and II, skin traction with double lower limb suspension was used. For Tönnis Types III and IV, femoral condyle pin traction plus skin traction (0.5 kg per 6 months of age) was applied for one week.

Under general anesthesia, adductor tenotomy and closed reduction were performed. A percutaneous incision over the pubic region was made to release the adductor tendon. With the pelvis stabilized, the hip and knee were flexed to 90°, and gentle traction was applied to relocate the femoral head into the acetabulum. Intraoperative fluoroscopy confirmed reduction. Hips were immobilized in static long leg casting with 90° abduction, 110° flexion, and external rotation, preserving joint mobility.

After discharge, patients were permitted limited mobility. At 3 months, casts were removed and replaced by adjustable abduction orthoses for an additional 3 months. Follow-up included pelvic radiographs every 6 months to monitor femoral head and acetabular development.

Data analysis was conducted using SPSS version 15.0. Outcomes were evaluated using McKay's clinical criteria and Severin's radiographic classification. AVN was assessed according to Salter's classification. Comparisons were made based on AI groups and Tönnis types.

II) Results:

A total of 29 patients with 38 affected hips were included in the study. The majority were female (28 females, 1 male), representing 96.55% of the cases, with a female-to-male ratio of 28:1.

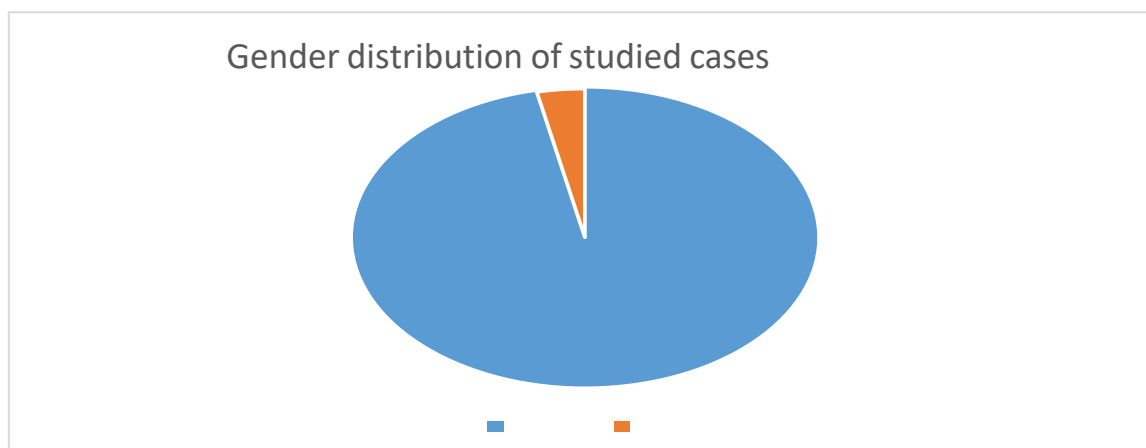


Figure (1): Gender distribution of studied cases.

Among the patients, 20 had unilateral DDH (69%) and 9 had bilateral DDH (31%), resulting in a unilateral-to-bilateral ratio of approximately 2.3:1.

When classified by Tönnis grading system, the 38 hips were distributed across all four types, with the majority in Types II and III. The age distribution of the patients ranged from 6 to 18 months, with most cases clustering around 9–12 months of age.

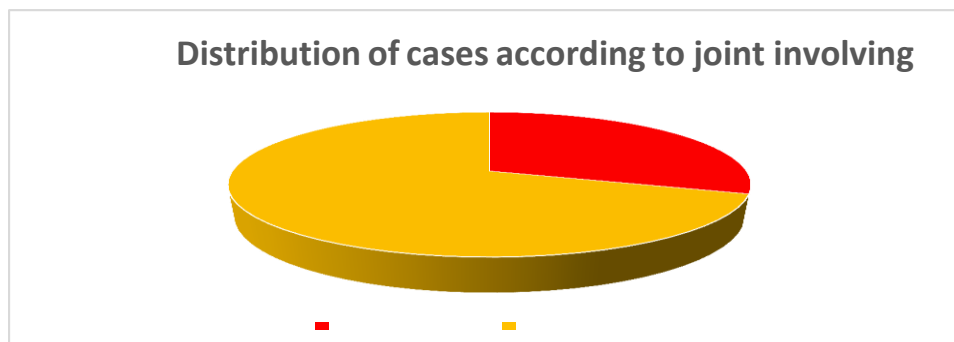


Figure (2) Distribution of cases according to joint involving

Based on acetabular index measurements before treatment, hips were grouped into the following categories: 30° – 35° , 36° – 40° , and $>40^{\circ}$. Radiographic outcomes according to Severin's classification showed that most hips achieved either Type I or Type II status at final follow-up, indicating satisfactory results.

For the bilateral cases, Severin classification demonstrated that many hips fell into Type I and II categories. Similarly, in the 20 unilateral hips, most were classified as Severin Type I or II, with a few falling into Type III or IV.

Clinical assessments based on McKay's criteria revealed that many hips in both unilateral and bilateral groups had excellent or good functional outcomes, with a small proportion classified as poor.

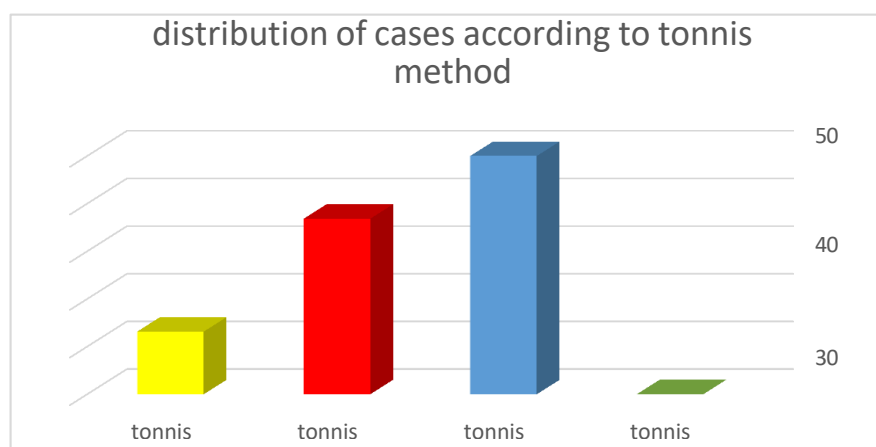


Figure (3) Distribution of cases according to method described by tonnis in 38 cases:

Avascular necrosis (AVN) of the femoral head was observed in 3 of the 38 hips (7.89%) based on Salter's criteria. These cases were managed conservatively, and most showed improvement over time.

Overall, 89% of patients achieved satisfactory functional outcomes per McKay's criteria, and 70% showed satisfactory radiological results per Severin classification.

III) Discussion

The management of developmental dysplasia of the hip (DDH) in children aged 6 to 18 months remains challenging. This study aimed to evaluate the effectiveness of closed reduction and static long leg casting following adductor tenotomy. Despite a wide range of treatment approaches documented in the literature, achieving a balance between anatomical correction and functional recovery continues to be a matter of clinical concern.

In the present study, many patients achieved satisfactory outcomes according to both clinical and radiological assessments. McKay's criteria demonstrated that 89% of hips had excellent or good functional results, while 70% met Severin classification standards for satisfactory radiographic outcomes. These findings align with previous reports indicating that closed reduction, when appropriately performed and followed by stable immobilization, can yield favorable results even in children older than 12 months.

Radiological results often serve as a more reliable predictor of long-term joint prognosis than clinical findings alone. A common observation across many studies is the discrepancy between excellent clinical performance and suboptimal radiographic appearance, particularly in younger children. This may be due to the compensatory adaptation of immature bone and soft tissues to altered joint mechanics, which temporarily mask anatomical abnormalities.

Avascular necrosis (AVN) of the femoral head is one of the most concerning complications of DDH treatment. In this series, AVN occurred in only 7.89% of hips, which is within the acceptable range reported in the literature. Factors influencing the development of AVN include excessive abduction, forceful manipulation during reduction, and prolonged immobilization. Our traction and reduction protocol minimized these risks, likely contributing to the low AVN incidence observed.

Additionally, the pre-treatment position of the femoral head and the acetabular index were found to significantly affect the final outcome. Hips with higher degrees of initial dislocation or steep acetabular angles had relatively less favorable results, underscoring the importance of early diagnosis and prompt intervention.

Overall, this study supports the safety and effectiveness of non-operative management using adductor tenotomy, closed reduction, and static casting in selected DDH cases. Careful patient selection, adherence to technique, and structured follow-up are key to achieving optimal outcomes.

IV) Conclusion

This retrospective descriptive case series investigated the outcomes of adductor tenotomy, closed reduction, and static long leg hip spica casting in infants aged 6 to 18 months diagnosed with developmental dysplasia of the hip (DDH). The study included 29 patients with 38 affected hips, treated at Misurata Medical Center over a one-year period. The results demonstrated that this treatment protocol is a safe and effective method for managing DDH in children within this age group when performed under appropriate clinical indications and with standardized follow-up care.

Many patients in our study achieved favorable clinical outcomes, as evidenced by 89% of cases rated satisfactory according to modified McKay's criteria. Radiological assessments using Severin classification showed that approximately 70% of the hips achieved good or excellent structural outcomes at short-term follow-up. The incidence of avascular necrosis (AVN) of the femoral head was observed in only 7.89% of cases, which aligns with, or is lower than, complication rates reported in comparable studies.

Key determinants of treatment success included the severity of hip dislocation at presentation (Tönnis classification), the acetabular index prior to intervention, and the presence or absence of AVN. These parameters underline the critical need for early detection and accurate classification of DDH prior to the initiation of treatment. The success of the closed reduction approach further highlights the importance of surgical technique, the application of appropriate traction protocols prior to reduction, and meticulous post-reduction immobilization.

The low rate of complications, coupled with high functional and radiological success, supports the continued use of this non-invasive method in resource-limited settings or when early intervention is possible. Although the follow-up duration in this study was relatively short, the results suggest that closed reduction combined with hip spica casting can restore near-normal hip anatomy and function in a significant proportion of patients when managed according to standardized guidelines. Longer-term follow-up studies will be essential to assess outcomes related to joint congruency, growth disturbance, and the development of early degenerative changes.

V) RECOMMENDATIONS

Based on the findings and clinical insights derived from this study, the following recommendations are proposed to enhance the early detection, timely intervention, and optimal management of developmental dysplasia of the hip (DDH):

- A)** Early diagnosis remains the cornerstone of successful treatment. All neonates, regardless of the presence of clinical signs, should undergo thorough hip examinations by trained pediatric practitioners during routine postnatal checkups. Both Ortolani and Barlow maneuvers should be routinely employed.
- B)** Given that over 60% of DDH cases may present without identifiable risk factors, we strongly advocate for the implementation of universal screening protocols for all newborns. This could include physical examination complemented by hip ultrasonography, particularly within the first 6 weeks of life.
- C)** Infants who present with risk factors such as breech presentation, positive family history of DDH, oligohydramnios, first-born status, or associated musculoskeletal abnormalities (e.g., metatarsus adductus or talipes) should be prioritized for early orthopedic referral and imaging.
- D)** Pediatricians and general healthcare providers should be trained to recognize subtle signs of DDH and understand when timely referral is necessary. Increased awareness and clinical suspicion can facilitate early diagnosis and reduce the incidence of delayed presentation.
- E)** Adductor tenotomy followed by closed reduction and long leg hip spica casting should be considered a primary treatment option in children aged 6 to 18 months, especially in healthcare settings with limited access to open surgical interventions.
- F)** Post-treatment follow-up should be standardized, with serial pelvic radiographs obtained at 6-month intervals for at least two years to monitor acetabular development, identify early complications (e.g., AVN), and ensure maintenance of concentric reduction.
- G)** National health authorities and pediatric orthopedic societies should work toward developing clear, evidence-based clinical pathways for the diagnosis and management of DDH, including guidelines for screening, referral timelines, and treatment protocols.
- H)** Further multicenter prospective studies with longer follow-up periods are essential to evaluate the durability of results obtained through conservative treatment, the long-term joint function, and the rate of osteoarthritic changes in adulthood.

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