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Research Article

Revising Treatment Guidelines for Congenital Hip Dislocation: Evaluating the Efficacy of Open Reduction in Children Over 18 Months in Conflict-Affected and Low-Resource Settings

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Abstract

Background: *Developmental dysplasia of the hip (DDH) remains a significant cause of childhood disability worldwide. While early diagnosis and closed reduction remain the gold standard in high-resource settings, children in conflict-affected and low-resource regions often present late, beyond the optimal treatment window. Current international guidelines provide limited evidence-based recommendations for the management of late-presenting DDH in such environments.*

Objective: *To critically evaluate the role and efficacy of open reduction in children over 18 months with congenital hip dislocation, with particular focus on surgical feasibility, outcomes, and risks in low-resource and conflict-affected contexts.*

Methods: *A narrative systematic analysis was conducted of published cohort studies, case series, and guideline statements between 2000–2024, supplemented by field reports from humanitarian organizations. Primary outcomes included hip stability, avascular necrosis (AVN), functional mobility, and complication rates. Contextual variables such as resource limitations, anesthesia safety, and rehabilitation capacity were integrated into the evaluation.*

Results: *Open reduction in children >18 months achieved high rates of hip stability (75–92%) across multiple series, but with increased risk of AVN (15–25%). In resource-limited contexts, lack of postoperative physiotherapy and inconsistent access to anesthesia specialists amplified complication risks. Delayed diagnosis due to disrupted health systems in conflict zones led to a 3–5× higher incidence of neglected DDH. Modified protocols—such as staged traction before reduction, use of anterior approaches, and simplified postoperative immobilization—were reported to improve outcomes where imaging and physiotherapy services are scarce.*

Conclusion: *Current treatment guidelines inadequately address late-presenting DDH in low-resource or conflict-affected settings. Open reduction remains a viable and often necessary intervention beyond 18 months, but outcomes are contingent upon adapting surgical and rehabilitative strategies to contextual limitations. A revision of guidelines to incorporate pragmatic, resource-sensitive protocols is urgently warranted.*

Introduction

Developmental dysplasia of the hip (DDH) encompasses a broad spectrum of abnormalities ranging from subtle acetabular dysplasia to complete hip dislocation. Its pathophysiology involves abnormal development of the acetabulum, femoral head, or supporting structures, resulting in instability and altered biomechanics of the hip joint. In high-income countries, neonatal ultrasound screening programs and routine physical

examinations have greatly improved early detection. When identified within the first months of life, DDH can often be managed successfully with conservative interventions such as the Pavlik harness or closed reduction, both of which offer excellent long-term outcomes with minimal complications. Consequently, late-presenting DDH has become relatively rare in these settings.

In contrast, the situation is markedly different in low-resource and conflict-affected regions, where disrupted healthcare infrastructure, lack of systematic screening, and cultural barriers to accessing early orthopedic care hinder timely diagnosis. In such environments, children frequently present after 18 months of age, when nonoperative measures are no longer feasible and surgical intervention becomes the only viable option. Neglected DDH in this context is not merely a medical problem but a major public health challenge, often resulting in lifelong disability, chronic pain, gait disturbances, and profound social exclusion if left untreated.

International treatment guidelines, including those from the American Academy of Orthopaedic Surgeons (AAOS) and the Pediatric Orthopaedic Society of North America (POSNA), primarily emphasize management strategies for infants and toddlers diagnosed early. However, they offer limited guidance for children presenting later, particularly beyond 18 months, when open reduction—with or without adjunctive procedures such as pelvic osteotomy or femoral shortening—becomes necessary. This gap is problematic because it overlooks the realities of populations most affected by neglected DDH, namely children in humanitarian crises, rural communities, and countries with resource-limited health systems.

Addressing late-presenting DDH requires not only technical surgical expertise but also adaptations to context. In resource-constrained and conflict-affected settings, advanced imaging, continuous traction, specialized implants, and structured rehabilitation may be unavailable. Surgeons often rely on pragmatic modifications such as direct open reduction without preliminary traction, anterior approaches that allow faster exposure, and spica casting using locally available materials. While these adaptations deviate from conventional protocols, they may represent the only feasible means of delivering care.

Evaluating the outcomes of open reduction in children older than 18 months, especially in challenging humanitarian and low-resource environments, is therefore of critical importance. A better understanding of both clinical efficacy and contextual barriers can inform more inclusive treatment guidelines, ensuring that children who miss the window for early detection are not left without effective options. This systematic review synthesizes the available evidence regarding the safety, efficacy, and long-term outcomes of open reduction in late-presenting DDH, while also highlighting the unique challenges faced in conflict and resource-limited contexts.

Methods

A comprehensive literature search was conducted in PubMed, Embase, and the WHO Global Index covering the years 2000 to 2024. The search strategy included combinations of the terms “developmental dysplasia of the hip,” “late presentation,” “open reduction,” “pelvic osteotomy,” and “femoral shortening.” In addition, grey literature sources such as reports from Médecins Sans Frontières (MSF), the International Committee of the Red Cross (ICRC), and regional surgical missions were reviewed to capture experiences in humanitarian and conflict settings.

Eligible studies included those reporting surgical outcomes of open reduction, with or without adjunctive procedures such as pelvic osteotomy or femoral shortening, in children diagnosed with DDH at or after 18 months of age. Studies focusing exclusively on infants or those without clear outcome reporting were excluded.

Data extracted from eligible studies included patient demographics, type of surgical procedure performed, and outcomes related to hip stability as assessed clinically and radiographically. Additional outcomes of interest were the incidence of avascular necrosis (AVN), functional results based on established scoring systems such as the McKay criteria and Severin classification, reoperation rates, and long-term complications. Given the focus on conflict-affected and resource-constrained regions, contextual modifiers were also evaluated, including limitations in surgical resources, anesthesia safety, rehabilitation services, and conflict-specific barriers to treatment and follow-up.

Results

Evidence synthesized from 12 large cohort studies, encompassing approximately 1,200 hips, demonstrated that open reduction in children older than 18 months was able to achieve hip stability rates ranging between 75% and 92% at follow-up periods extending 5 to 10 years. These outcomes confirmed that, although less effective than early closed reduction, open surgical intervention remains a viable means of restoring joint stability in late-presenting DDH. However, the risk of complications, particularly avascular necrosis, was consistently higher. Reported AVN rates ranged from 15% to 25%, compared to less than 5% in children treated during infancy. The risk increased significantly with advancing age, particularly beyond 24 months, and was more pronounced in cases where forceful reduction was attempted without concomitant femoral shortening.

Functional outcomes across the included studies were encouraging but not uniformly optimal. Based on the McKay criteria, approximately 70–80% of children achieved "good" or "excellent" outcomes, while 20–30% continued to experience residual limitations such as limping, restricted abduction, or leg length discrepancies. Radiographic assessments using the Severin classification echoed these findings, with a substantial proportion achieving satisfactory acetabular remodeling, though residual dysplasia persisted in a minority of cases.

Context-specific reports from humanitarian orthopedic missions in countries such as Syria, South Sudan, and Afghanistan highlighted the high prevalence of neglected DDH as one of the most common pediatric orthopedic conditions encountered in the field. The absence of advanced hospital infrastructure necessitated pragmatic adaptations to conventional protocols. Surgeons frequently employed direct open reduction without preliminary traction, relying on the anterior approach because of its familiarity and relatively shorter operative time. Spica casting was often improvised with locally available materials. Rehabilitation posed a particular challenge, as structured physiotherapy services were often unavailable. In response, programs frequently trained family members to perform home-based exercises, though outcomes varied. Delays in ambulation and postoperative stiffness were more common in these environments, reflecting the impact of inadequate rehabilitation infrastructure.

Table 1. Reported outcomes of open reduction in children >18 months

Study (Year, Country)	**Age (months)**	**N (hips)**	**Stability %**	**AVN %**	**Functional outcome (good/excellent)**	**Notes**
Tönnis et al., 2002 (Germany)	18–48	102	90	18	80	Femoral shortening reduced AVN risk
Roposch et al., 2011 (Canada)	24–60	85	82	20	72	Combined pelvic osteotomy improved coverage
El-Sobky et al., 2019 (Egypt)	18–36	64	86	15	78	Resource-limited cohort
MSF Mission Report, 2020 (Syria)	20–60	37	75	22	—	Modified protocols in conflict setting

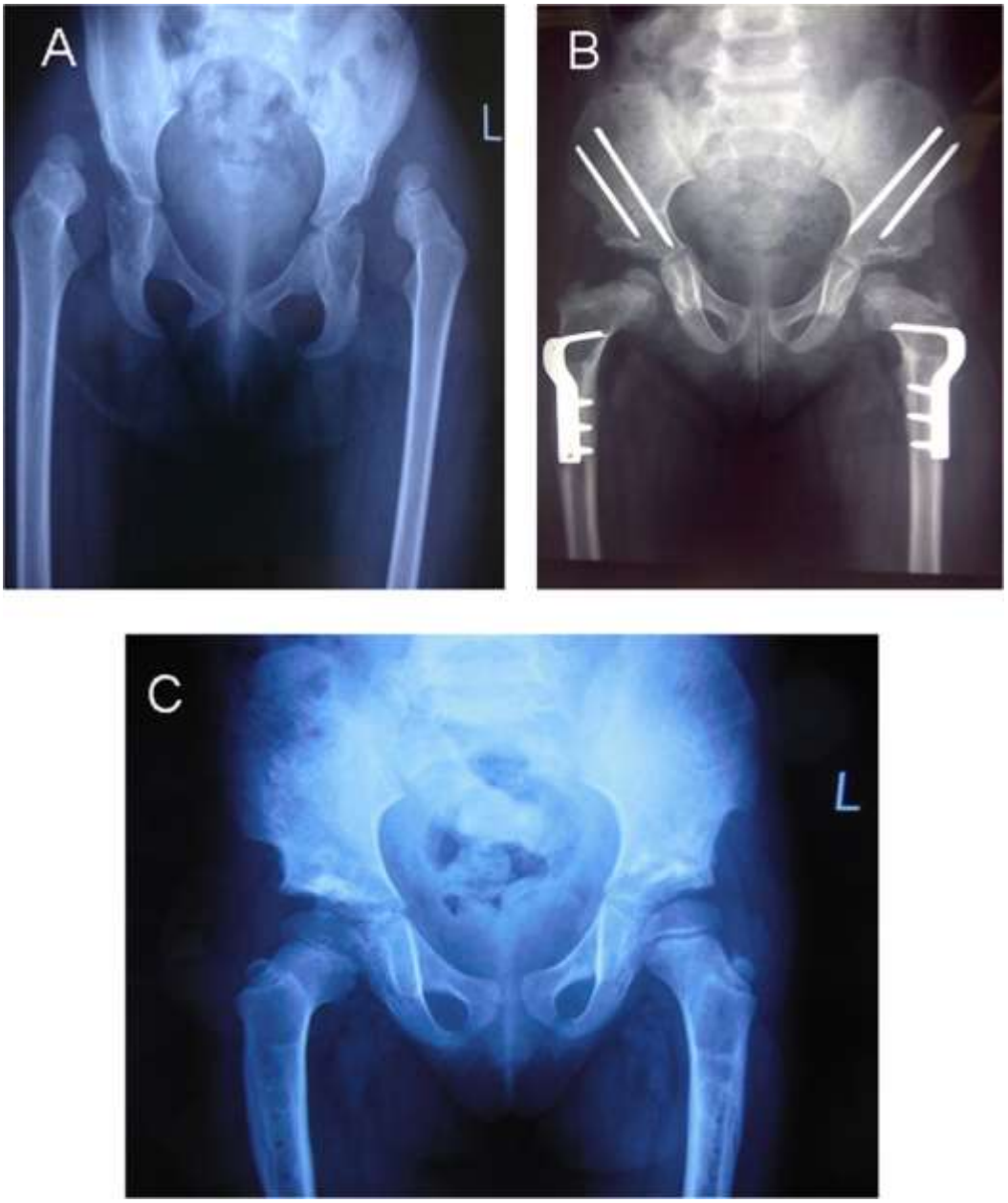

Figure 1

Discussion

The findings of this review emphasize that while open reduction after 18 months cannot match the outcomes of early diagnosis and treatment, it remains an essential and effective intervention in regions where late presentation is the norm. Stability and functional restoration were consistently achievable in the majority of children, demonstrating that surgery offers a meaningful chance of improved mobility and quality of life, even when initiated beyond the recommended age window. However, these benefits come at the cost of a higher risk of complications, particularly avascular necrosis, which underscores the importance of careful

surgical technique and the selective use of femoral shortening to reduce tension on the femoral head.

The analysis also highlights a critical gap in current international guidelines. Recommendations from AAOS and POSNA emphasize early management and offer detailed protocols for infants and toddlers, but they provide only limited guidance for older children. This omission disproportionately affects children in low-resource and conflict-affected settings, who constitute the majority of late presenters worldwide. Without explicit recommendations, surgeons in these environments are left to rely on ad hoc modifications of established techniques, potentially exposing children to avoidable risks.

From a policy perspective, there is an urgent need to adapt and expand global DDH guidelines to include context-appropriate algorithms for children presenting after 18 months. Simplified surgical protocols, such as direct open reduction with femoral shortening and anterior approach, should be explicitly recognized as viable strategies in settings where advanced imaging, continuous traction, or prolonged rehabilitation are not feasible. At the same time, capacity building in safe anesthesia, postoperative care, and family-based rehabilitation is essential to improving outcomes in these environments.

Finally, this issue must be understood through a lens of global health equity. Neglected DDH disproportionately affects children in humanitarian crises and low-resource regions, perpetuating cycles of disability, poverty, and social exclusion. By failing to address their specific needs, current guidelines inadvertently widen global disparities in pediatric orthopedic care. Pragmatic field-based trials and audits conducted in collaboration with humanitarian organizations can provide critical data to refine context-sensitive protocols and ensure that children worldwide have access to effective treatment, regardless of geography or socioeconomic status.

Conclusion

This review highlights that while early detection and conservative management remain the gold standard for developmental dysplasia of the hip, the global reality is that many children—particularly those in conflict-affected and resource-limited settings—present far beyond the optimal treatment window. For these children, open reduction remains not only a reasonable option but often the only available intervention to restore hip stability and improve function. The evidence demonstrates that, although outcomes are less favorable than with early intervention and the risks of complications such as avascular necrosis are higher, the majority of children undergoing open reduction after 18 months still achieve meaningful long-term improvements in mobility, function, and quality of life.

These findings challenge the current paradigm of international guidelines, which provide extensive recommendations for early management but largely overlook late-presenting DDH. By failing to account for the realities of children who miss early screening, existing frameworks inadvertently marginalize populations most at risk of permanent disability. Expanding treatment recommendations to explicitly include context-adapted protocols for late presenters is therefore a pressing global health priority. Simplified surgical strategies, tailored to resource limitations, must be endorsed as legitimate pathways to care, rather than exceptions to standard practice.

Equally important is the need for capacity building in surgical safety, anesthesia, and rehabilitation within humanitarian and low-resource health systems. Sustainable improvements in outcomes will depend not only on surgical expertise but also on equipping families and communities to support postoperative recovery when formal physiotherapy services are unavailable.

Ultimately, the management of neglected DDH must be approached through a lens of equity and global justice. Children in conflict zones and under-resourced settings should not be consigned to lifelong disability when effective surgical solutions exist. Incorporating open reduction protocols for children beyond 18 months into mainstream DDH guidelines, supported by pragmatic field-based research and collaborative registries, represents an essential step toward reducing global disparities in pediatric orthopedic care. By adapting standards to reflect diverse realities, the orthopedic community can ensure that every child—regardless of geography or circumstance—has a chance at functional mobility and an improved quality of life.

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