

ORIGINAL ARTICLE

Presentation Pattern and Early Surgical Outcomes of Developmental Dysplasia of the Hip among Bangladeshi Children

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ABSTRACT

Introduction: Developmental dysplasia of the hip (DDH) is an important pediatric orthopedic condition that can lead to persistent hip instability, deformity, gait abnormality, and early degenerative changes if diagnosis and treatment are delayed. Therefore, this study was conducted to assess the presentation pattern, clinical and radiological severity, surgical management, and early postoperative outcomes of DDH among Bangladeshi children.

Methods & Materials: This cross-sectional, descriptive observational study was conducted in the Department of Orthopaedic Surgery of National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh from January 2025 to December 2025. A total of 100 children were enrolled using consecutive purposive sampling. Data were analyzed using SPSS version 26.0. **Results:** Radiological acetabular dysplasia was present in 84.0%, while 47.0% had Tönnis grade III/IV dislocation. Open reduction was performed in 82.0%, with pelvic osteotomy required in 48.0% and femoral shortening in 20.0%. At 3-month follow-up, 92.0% achieved stable/concentric reduction and 74.0% had favorable functional outcomes; AVN occurred in 7.0% and redislocation/subluxation in 4.0%. Older age at presentation was significantly associated with poorer functional outcomes ($p=0.002$). **Conclusion:** The study demonstrated that DDH in Bangladeshi children was commonly diagnosed at a delayed age, with 65.0% diagnosed after 12 months and 60.0% presenting after walking age. Despite the late presentation and considerable radiological involvement, surgical management resulted in 92.0% stable/concentric reductions and 74.0% favorable early functional outcomes, with a relatively low incidence of postoperative complications. Notably, increasing age at presentation was significantly associated with less favorable functional outcomes ($p=0.002$), emphasizing the importance of early diagnosis and timely intervention.

Keywords: Surgical Outcomes, Developmental Dysplasia, Presentation Pattern.

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INTRODUCTION

Developmental dysplasia of the hip (DDH) represents a spectrum of abnormalities of hip development ranging from mild acetabular dysplasia and instability to subluxation and complete dislocation. Because the condition may be clinically silent in early infancy, delayed recognition will allow persistent malposition of the femoral head, progressive acetabular deformity and impaired hip development. Untreated or inadequately treated DDH will therefore be associated with abnormal gait, functional limitation and premature degenerative hip disease, making early detection and age-appropriate treatment particularly important in paediatric orthopaedic practice [1,2]. Contemporary evidence indicates that the reported frequency of DDH varies substantially

according to the diagnostic method and screening strategy. In a systematic review and meta-analysis including 16,901,079 infants, pooled early-detection rates were 8.4 per 1,000 newborns with clinical screening, 4.4 per 1,000 with selective ultrasonography and 23.0 per 1,000 with universal ultrasonography [3]. The clinical expression of DDH will vary with age. Newborns may present with hip instability detected by Barlow or Ortolani manoeuvres, whereas infants may develop limited hip abduction, leg-length discrepancy or asymmetry of the thigh and gluteal folds; after walking begins, limping and gait abnormalities may become the predominant manifestations [1,4]. Established risk factors will include breech presentation, female sex, and positive family history. A 2025 meta-analysis of 20 studies involving 64,543 infants found

significantly increased odds of DDH with breech presentation (OR 4.15), family history (OR 3.83), oligohydramnios (OR 3.76), female sex (OR 2.50), and high birth weight (OR 2.00) [5]. Early diagnosis will directly influence treatment intensity and surgical requirement. In infants younger than six months, abduction treatment with a Pavlik harness will remain the principal initial treatment, with reported success rates generally between 70% and 95% [4]. However, treatment effectiveness will decline with increasing age and severity. In a cohort of 130 infants treated with a Pavlik harness, success was 93% among children younger than three months but only 37% among those older than five months [6]. A systematic review further reported that Pavlik-harness success commonly exceeded 75%, while failure was associated particularly with greater initial severity and older age at treatment initiation [7]. Current evidence-based guidance consequently emphasizes careful clinical examination, appropriate ultrasonography in selected infants, and prompt initiation of treatment when instability or dysplasia is confirmed [8]. The consequences of delayed presentation will be particularly important in resource-constrained settings where systematic newborn screening may not be uniformly available. Meta-analytic evidence has demonstrated that universal ultrasonography increases early detection but may not substantially reduce late detection or operative treatment compared with selective or clinical screening, indicating that local patterns of presentation remain important when planning services [3,9]. Once DDH presents later in childhood, closed reduction may no longer be sufficient and open reduction, pelvic osteotomy, or combined reconstructive procedures may be required. In a series of 645 children undergoing surgery for late-presenting DDH, 80% of hips achieved good radiographic outcomes and 87% achieved a Children's Hospital Oakland Hip Evaluation Score above 90; however, avascular necrosis occurred in 14%, and reoperation was required in 2% [10]. This study aimed to describe the presentation pattern and evaluate early surgical outcomes of DDH among Bangladeshi children,

METHODS & MATERIALS

This cross-sectional, descriptive observational study was conducted in the Department of Orthopaedic Surgery of National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh from January 2025 to December 2025 to assess the presentation pattern and early surgical outcomes of developmental dysplasia of the hip (DDH) among children. The study population comprised children diagnosed with DDH who underwent surgical treatment during the study period. A total of 100 children were enrolled using consecutive purposive sampling. Children below 5 years of age with clinically and/or radiologically diagnosed DDH who underwent surgical treatment and had adequate clinical, radiological, operative, and postoperative records were included. Children with neuromuscular, syndromic or

teratological hip dislocation, previous hip surgery, associated major congenital musculoskeletal abnormalities, incomplete records, or inadequate postoperative follow-up were excluded. Data were collected using a structured, pretested data collection form covering sociodemographic characteristics, age at presentation and diagnosis, sex, residence, family history, laterality, age relative to walking, clinical manifestations, imaging findings, Tönnis grade, radiological acetabular dysplasia, surgical procedure, and early postoperative outcomes. Clinical assessment included limited hip abduction, limb-length discrepancy, asymmetry of thigh/gluteal folds, limp or abnormal gait, pain or discomfort, and incidental detection. Ultrasonography and/or plain radiography were used according to age and clinical indication, and dislocation severity was categorized according to the Tönnis classification (Grades I–IV). Surgical procedures included closed reduction with hip-spica immobilization, open reduction alone, open reduction with pelvic osteotomy, and open reduction with pelvic osteotomy and femoral shortening. Early postoperative outcomes were assessed clinically and radiologically, with reduction categorized as concentric/stable or incongruent/unstable and functional outcomes classified as excellent, good, fair, or poor; excellent and good outcomes were considered favorable, while fair and poor outcomes were considered unfavorable. Patients were followed up for 3 months after surgery to assess early radiological reduction, functional outcome, and postoperative complications. Early complications including avascular necrosis, joint stiffness, redislocation/subluxation, and wound infection were also recorded. Data were entered, cleaned, and analyzed using SPSS version 26.0. Descriptive statistics were used to summarize the study variables as frequencies and percentages. The association between age at presentation and early functional outcome was assessed using the Chi-square test, with a p-value of <0.05 considered statistically significant. Ethical approval was obtained from the appropriate institutional authority before commencement of the study, and informed consent was obtained from the parents or legal guardians of participating children.

RESULTS

Among the 100 children, 33 (33.0%) were older than 24 months at presentation, while 27 (27.0%) were aged 13–24 months, 22 (22.0%) were 6–12 months, and 18 (18.0%) were younger than 6 months. The mean age was 22.8 ± 14.6 months. Female children were substantially more common than males, accounting for 72 (72.0%) compared with 28 (28.0%). Most participants were from urban areas (61.0%). Only 35 (35.0%) children were diagnosed within the first year of life, whereas 65 (65.0%) were diagnosed after 12 months. A positive family history of DDH was reported in 18 (18.0%) children (*Table 1*).

Table I: Sociodemographic and clinical characteristics of the study participants (n=100).

Characteristic	Number (n)	Percentage (%)
Age at presentation		
<6 months	18	18.0
6–12 months	22	22.0
13–24 months	27	27.0
>24 months	33	33.0
Sex		
Female	72	72.0
Male	28	28.0
Residence		
Urban	61	61.0
Rural	39	39.0
Age at diagnosis		
≤12 months	35	35.0
>12 months	65	65.0
Family history of DDH		
Present	18	18.0
Absent	82	82.0

Bilateral hip involvement was the most frequent pattern, observed in 38 (38.0%) children, followed by right-sided involvement in 35 (35.0%) and left-sided involvement in 27 (27.0%). Among the presenting clinical features, limited hip abduction was the most common finding, occurring in 44 (44.0%) children, followed by limb-length discrepancy in 38 (38.0%), asymmetry of the thigh or gluteal folds in 34 (34.0%),

and limp or abnormal gait in 29 (29.0%). Pain or discomfort was reported in 12 (12.0%), while 10 (10.0%) children were detected incidentally. Regarding age-related presentation, 60 (60.0%) children presented after walking age, whereas 40 (40.0%) presented before walking age (*Table II*).

Table II: Pattern of presentation and clinical manifestations of DDH (n=100).

Variable	Number (n)	Percentage (%)
Laterality of hip involvement		
Left hip	27	27.0
Right hip	35	35.0
Bilateral	38	38.0
Presenting clinical features*		
Limited hip abduction	44	44.0
Limb-length discrepancy	38	38.0
Asymmetry of thigh/gluteal folds	34	34.0
Limp or abnormal gait	29	29.0
Pain/discomfort	12	12.0
Incidentally detected abnormality	10	10.0
Age-related pattern of presentation		
Presentation before walking age	40	40.0
Presentation after walking age	60	60.0

*Multiple responses were possible.

Clinically, 46 (46.0%) children had evidence of hip instability or suspected dislocation, while 41 (41.0%) had a fixed dislocation at presentation. Isolated acetabular dysplasia without clinically obvious dislocation was present in 13 (13.0%) children. Ultrasonography was used in 43 (43.0%), mainly among younger children, whereas plain radiography was used in 57 (57.0%). According to the Tönnis classification,

32 (32.0%) children had grade II and 30 (30.0%) had grade III dislocation; grade I was observed in 21 (21.0%), while 17 (17.0%) had severe grade IV displacement. Overall, radiological evidence of acetabular dysplasia was present in 84 (84.0%) children (*Table III*).

Table III: Clinical and radiological severity of DDH at presentation (n=100).

Parameter	Number (n)	Percentage (%)
Clinical diagnosis		
Hip instability/dislocation suspected clinically	46	46.0
Fixed dislocation	41	41.0
Acetabular dysplasia without obvious dislocation	13	13.0
Imaging modality used for assessment.		
Ultrasonography	43	43.0
Plain radiograph	57	57.0
Tönnis grade of dislocation		
Grade I	21	21.0
Grade II	32	32.0
Grade III	30	30.0
Grade IV	17	17.0
Radiological acetabular dysplasia		
Present	84	84.0
Absent	16	16.0

Closed reduction followed by hip-spica immobilization was performed in 18 (18.0%) children. Open reduction alone was required in 34 (34.0%), while 28 (28.0%) underwent combined open reduction and pelvic osteotomy. A further 20 (20.0%) children required open reduction with pelvic osteotomy and femoral shortening because of more advanced displacement and difficulty obtaining a stable reduction. Overall, 48 (48.0%)

children required a pelvic reconstructive procedure, and femoral shortening was necessary in 20 (20.0%). Thus, almost half of the children required reconstructive surgery beyond reduction alone, reflecting the substantial proportion presenting with established DDH (*Table IV*).

Table IV: Surgical procedures performed for DDH (n=100).

Surgical procedure	Number (n)	Percentage (%)
Closed reduction with hip spica	18	18.0
Open reduction alone	34	34.0
Open reduction + pelvic osteotomy	28	28.0
Open reduction + pelvic osteotomy + femoral shortening	20	20.0
Total	100	100.0
Operative approach		
Reduction without pelvic procedure	52	52.0
Reduction with pelvic procedure	48	48.0
Femoral shortening required	20	20.0

At early postoperative assessment, a stable or concentric reduction was achieved in 92 (92.0%) children, while 8 (8.0%) had an incongruent or unstable reduction. Functional assessment showed an excellent outcome in 36 (36.0%) and a good outcome in 38 (38.0%), giving an overall favorable outcome in 74 (74.0%) children. Fair and poor outcomes were

observed in 18 (18.0%) and 8 (8.0%), respectively. Most children (80.0%) experienced no early postoperative complications. Avascular necrosis was identified in 7 (7.0%), joint stiffness in 6 (6.0%), redislocation or subluxation in 4 (4.0%), and superficial wound infection in 3 (3.0%) (*Table V*).

Table V: Early postoperative outcomes following surgical treatment (n=100).

Outcome parameter	Number (n)	Percentage (%)
Early radiological reduction		
Concentric/stable reduction achieved	92	92.0
Incongruent/unstable reduction	8	8.0
Functional outcome at early follow-up		
Excellent	36	36.0
Good	38	38.0
Fair	18	18.0
Poor	8	8.0
Overall favorable outcome (excellent + good)	74	74.0
Postoperative complications*		
No complication	80	80.0
Joint stiffness/limited movement	6	6.0
Avascular necrosis	7	7.0
Redislocation/subluxation	4	4.0
Superficial wound infection	3	3.0

*Multiple complications could occur in the same patient.

A clear relationship was observed between age at presentation and early functional outcome. A favorable outcome was achieved in 17 of 18 (94.4%) children presenting before 6 months, compared with 19 (86.4%) among those aged 6–12 months and 22 (81.5%) among those aged 13–24 months. In contrast, only 16 (48.5%) children presenting after 24 months achieved an excellent or good outcome, while 17 (51.5%) had a

fair or poor outcome. The association between age at presentation and early functional outcome was statistically significant ($p=0.002$), demonstrating that older age at presentation was associated with less favorable early surgical results (Table VI).

Table VI: Association of age at presentation with functional outcome at 3 months after surgery ($n=100$).

Age at presentation	Excellent/Good n (%)	Fair/Poor n (%)	Total	p-value*
<6 months	17 (94.4)	1 (5.6)	18	0.002
6–12 months	19 (86.4)	3 (13.6)	22	
13–24 months	22 (81.5)	5 (18.5)	27	
>24 months	16 (48.5)	17 (51.5)	33	
Total	74 (74.0)	26 (26.0)	100	

*Chi-square test.

DISCUSSION

The present study of 100 surgically treated children demonstrated a predominantly delayed presentation of DDH, with a mean age of 22.8 ± 14.6 months and 65.0% diagnosed after 12 months. Females constituted 72.0% of the cohort. These findings are consistent with the large late-presenting series of Castañeda et al., in which 561 of 645 children (87.0%) were girls, and the mean age at surgery was 2.1 years [10]. Their cohort therefore had an even stronger female predominance than the present study, while the age distribution was broadly alike, supporting the observation that surgically treated DDH frequently represents children who present beyond infancy. Talbot et al. also documented persistent late presentation despite screening, with 18 infants developing late irreducible dislocation among 64,670 live births; 13 (72%) had no recognized risk factor, emphasizing that absence of recognized risk factors does not exclude delayed DDH [11]. In the present study, bilateral involvement was found in 38.0%, right-sided disease in 35.0%, and left-sided disease in 27.0%. Limited hip abduction was the most common clinical manifestation (44.0%), followed by limb-length discrepancy (38.0%), asymmetry of thigh/gluteal folds (34.0%), and abnormal gait (29.0%). Castañeda et al. reported 134 bilateral cases among 645 children (20.8%), while 355 (55.0%) had left-sided and 89 (13.8%) right-sided unilateral involvement [10]. Thus, bilateral disease was substantially more frequent in the present cohort (38.0% vs 20.8%), whereas left-sided involvement was less frequent (27.0% vs 55.0%). Importantly, Talbot et al. found that leg-length discrepancy and limited hip abduction were the commonest reasons for referral among late-presenting cases [11]. Their findings closely support the current results, in which these two manifestations ranked first and second. The prominence of limited abduction is also supported by Mulpuri et al., who demonstrated increasing diagnostic value of limited abduction after eight weeks, with sensitivity of 78.3% for more severe DDH [8]. The present study showed substantial structural severity: 84.0% had radiological acetabular dysplasia, while 32.0% had Tönnis grade II, 30.0% grade III, and 17.0% grade IV disease. Castañeda et al. studied 712 dislocated hips, of which 360 (50.6%) were Tönnis/IHDI grade III and 352 (49.4%) grade IV [10]. Compared with their exclusively dislocated cohort, the present study included a broader spectrum, with 47.0% of children having grade III/IV disease. This difference is expected because the present cohort included children with less advanced dysplasia and instability as well as established dislocation. The high proportion of radiological dysplasia nevertheless indicates that structural acetabular abnormality had already developed in most children by the time of surgery. In the present series, 18.0%

underwent closed reduction with hip spica, 34.0% open reduction alone, 28.0% open reduction with pelvic osteotomy, and 20.0% open reduction with pelvic osteotomy plus femoral shortening. Therefore, 48.0% required pelvic osteotomy and 20.0% required femoral shortening. Castañeda et al. reported that only 91 of 712 hips (12.8%) were treated with open reduction alone, whereas 621 (87.2%) required open reduction combined with pelvic osteotomy and 221 (31.0%) required femoral shortening [10]. The present study therefore used considerably less extensive reconstruction, probably because it included younger and less severely displaced hips; nevertheless, the substantial requirement for pelvic osteotomy confirms the operative burden created by delayed presentation. Their study also found better radiographic outcomes and lower reoperation rates when pelvic osteotomy was combined with open reduction [10]. A stable or concentric reduction was achieved in 92.0% of the present children, and 74.0% achieved excellent or good early functional outcomes. Early complications included avascular necrosis (7.0%), joint stiffness (6.0%), redislocation/subluxation (4.0%), and wound infection (3.0%). Castañeda et al. reported 80% good radiographic outcomes and 87% CHOHES scores >90 after a much longer follow-up, with 14% AVN and 2% redislocation [10]. Thus, the present AVN rate was lower (7.0% vs 14.0%), whereas redislocation was slightly higher (4.0% vs 2.0%). The lower AVN rate may partly reflect the younger and less severely displaced composition of the present cohort. Castañeda et al. further demonstrated that AVN occurred in 18% of Tönnis IV hips compared with 10.3% of Tönnis III hips, illustrating the effect of increasing severity [10]. Age at presentation was significantly associated with early functional outcome ($p=0.002$), with favorable outcomes declining from 94.4% in children presenting before 6 months to 48.5% in those presenting after 24 months. Ömeroğlu et al. reported treatment success of 93% in children younger than 3 months compared with 37% in those older than 5 months [6]. Castañeda et al. also observed poorer outcomes with increasing age [10]. Dumont et al. reported that outcomes were influenced by dislocation severity and the extent of reconstruction, while Zamzam et al. identified AVN and postoperative complications as important determinants of unfavorable outcomes [12,13].

LIMITATIONS

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community. The follow-up period was relatively short; therefore, long-term complications and functional and radiological outcomes could not be assessed.

CONCLUSION

The study concluded that DDH among Bangladeshi children frequently presented late, with 65.0% diagnosed after 12 months and 60.0% presenting after walking age. Despite the delayed presentation and substantial radiological severity, surgical treatment achieved 92.0% stable/concentric reduction and 74.0% favorable early functional outcomes, with relatively low rates of postoperative complications. However, older age at presentation was significantly associated with poorer functional outcomes ($p=0.002$).

RECOMMENDATION

Early screening and timely referral of children suspected of DDH should be strengthened to reduce delayed presentation and improve surgical outcomes. Greater awareness among parents and primary healthcare providers regarding early clinical signs, appropriate imaging, and the importance of prompt specialist assessment should be promoted. Further prospective, multicenter studies with larger sample sizes and longer follow-up periods should be conducted to evaluate the long-term functional and radiological outcomes.

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CONFLICT OF INTEREST

None declared.

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