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Frequency of Risk Factors for Developmental Dysplasia of the Hip in Patients Presenting to a Tertiary Care Hospital

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ABSTRACT

Developmental dysplasia of the hip (DDH) involves abnormal hip joint development and is influenced by several perinatal risk factors. Early diagnosis is essential for optimal management. **Objective:** To evaluate the frequency of DDH-associated risk factors and their statistical associations. **Methods:** A cross-sectional study was conducted at Quaid-E-Azam Medical College, Bahawalpur, from January to August 2024. A total of 153 DDH patients were included. Risk factors such as gender, gestational age, birth weight, mode of delivery, breech presentation, oligohydramnios, multiple pregnancies, firstborn status, family history, and maternal complications were documented. Associations were analyzed using chi-square tests ($p<0.05$). **Results:** Of the 153 patients, 77 (50.3%) were male and 76 (49.7%) female. Term births were predominant (75.2%), and 19.6% had low birth weight. Breech presentation was seen in 13.7%, and oligohydramnios in 16.3%. Cesarean section accounted for 66.7% of deliveries, with no significant association with breech presentation (p=1.000). A significant association was found between multiple pregnancies and low birth weight, as all multiple births had low birth weight infants (p=0.000). No significant associations were found for gender, oligohydramnios, firstborn status, or family history. **Conclusions:** It was concluded that multiple pregnancies and resulting low birth weight showed a significant association with DDH. Other risk factors, including breech presentation and oligohydramnios, demonstrated no significant correlation. Focused DDH screening is recommended in infants from multiple gestations with low birth weight to ensure early detection and intervention.

INTRODUCTION

Developmental dysplasia of the hip (DDH) represents a continuum of structural abnormalities of the hip, ranging from mild instability to complete dislocation. If untreated, DDH can lead to serious, life-altering disorders, such as abnormal gait, chronic pain, and early-onset osteoarthritis. Therefore, early diagnosis and intervention targeting associated risk factors are crucial [1]. Multiple genetic, environmental, and perinatal factors influence the worldwide incidence of DDH. Previous studies consistently identify female gender as a risk factor, possibly due to estrogen-induced ligamentous laxity during intrauterine development [2, 3]. Breech presentation significantly increases DDH risk, as abnormal fetal hip positioning contributes to instability [4]. Additionally, a positive family history substantially raises DDH risk [5]. Macrosomia has also been implicated due to increased mechanical stress

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on the hip joint [6]. However, the role of prematurity remains controversial, with some evidence suggesting that reduced intrauterine forces in preterm infants may confer protection against DDH [7]. Cultural practices, including swaddling that restricts hip mobility, have been associated with higher DDH incidence, highlighting interactions between genetic susceptibility and environmental factors [8]. Technological advancements have improved diagnostic accuracy, with ultrasonographic screening outperforming traditional physical examination manoeuvres (e.g., Barlow and Ortolani manoeuvres), especially in mild dysplasia cases [9, 10]. Healthcare disparities further complicate DDH outcomes. Inequities in care access, socioeconomic status, and cultural barriers contribute to delayed diagnosis and suboptimal treatment outcomes. Consequently, targeted screening programs for high-risk populations are recommended despite some concerns regarding overtreatment [11, 12]. Although significant progress has been made in understanding DDH diagnosis and management, its precise etiopathogenesis remains unclear. Emerging genetic studies implicate multiple genes involved in connective tissue formation, osteogenesis, and chondrogenesis, with epigenetic modifications such as DNA methylation adding further complexity [12]. However, the prevalence and importance of specific DDH risk factors vary significantly across different populations, and local data are scarce. This study addresses this gap by assessing the frequency and associations of key DDH risk factors among patients presenting to a tertiary care hospital in Bahawalpur.

This study aims to identify the frequency of critical DDH risk factors and examine their associations within this specific regional context.

METHODS

This cross-sectional study was conducted at Quaid-E-Azam Medical College, Bahawalpur, from January 2024 to August 2024 after obtaining approval from the Institutional Review Board (IRB reference no. 2348/DME/QAMC Bahawalpur). The sample size was calculated using Open Epi software, assuming a 95% confidence interval, a 7% margin of error, and a reported prevalence of oligohydramnios (26.38%) among DDH patients from a previous study by Zeb et al., [13]. Consequently, a total of 153 patients were included. Written informed consent was obtained from parents or legal guardians before inclusion. Patients aged from birth up to 2 years (0–24 months) with a confirmed diagnosis of developmental dysplasia of the hip (DDH) were included. Patients older than 2 years or with incomplete medical records were excluded. Participants were recruited through non-probability consecutive sampling, involving patients who presented to the outpatient pediatric orthopedic clinic or those referred for specialized orthopedic consultation during the study period. Data collection involved structured interviews with parents or guardians, combined with a thorough review of hospital medical records to ensure accuracy. Prenatal risk factors documented included breech presentation (confirmed via medical records either in the last trimester or at delivery), oligohydramnios (documented through prenatal ultrasound reports), multiple pregnancies (confirmed through prenatal records), advanced maternal age (≥35 years), maternal complications (specifically gestational diabetes or preeclampsia documented in medical records), and a family history of hip disorders in first-degree relatives (documented through structured parental interviews). Detailed birth-related variables were also documented, including gender, mode of delivery (vaginal or cesarean), firstborn status, birth weight (low <2.5 kg, normal 2.5–4.0 kg, or high >4.0 kg), and gestational age (preterm: <37 weeks; term: ≥37 weeks). DDH diagnosis was confirmed clinically by two experienced pediatric orthopedic specialists using standardized manoeuvres (Barlow and Ortolani tests). Diagnoses were further validated by imaging studies hip ultrasound was performed for patients younger than 6 months using a Toshiba ultrasound machine (Model No UTSH19C), while plain radiographs (anteroposterior and frog-leg views) were obtained for patients aged 6 months or older using a Toshiba digital

RESULTS

A total of 153 patients diagnosed with DDH were included, with a balanced gender distribution of 77 males (50.3%) and 76 females (49.7%). The majority of patients were term births (75.2%), and over half of the patients had high birth weight (>4.0 kg, 53.6%). Cesarean sections were more frequent (66.7%) compared to vaginal deliveries (33.3%). Breech presentation occurred in 21 patients (13.7%), while oligohydramnios was present in 25 patients (16.3%). Firstborn status was noted in 51 patients (33.3%), and a positive family history of DDH was reported in 19 patients (12.4%). Multiple pregnancies were uncommon, occurring in 15 cases (9.8%), and advanced maternal age (≥35 years) was observed in 21 mothers (13.7%). Maternal complications, including gestational diabetes and preeclampsia, were documented in 30 mothers (19.6%) (Table 1).

Table 1: Frequency Distribution of Risk Factors for DDH in the Study Population (n=153)

Variables	Categories	Frequency (%)
Gender	Male	77 (50.3%)
	Female	76 (49.7%)
Gestational Age	Preterm	38 (24.8%)
	Term	115 (75.2%)
Birth Weight	Low (<2.5 kg)	30 (19.6%)
	Normal (2.5–4.0 kg)	41 (26.8%)
	High (>4.0 kg)	82 (53.6%)
Mode of Delivery	Vaginal	51 (33.3%)
	Cesarean	102 (66.7%)

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Firstborn Status	Firstborn	51 (33.3%)
	Not Firstborn	102 (66.7%)
Breech Presentation	No	132 (86.3%)
	Yes	21 (13.7%)
Oligohydramnios	No	128 (83.7%)
	Yes	25 (16.3%)
Multiple Pregnancy	No	138 (90.2%)
	Yes	15 (9.8%)
Family History of DDH	No	134 (87.6%)
	Yes	19 (12.4%)
Maternal Age Group	Advanced Age	21 (13.7%)
	Normal Age	(86.3%)
Maternal Complications	No	123 (80.4%)
	Yes	30 (19.6%)

In the analysis of breech presentation with various factors, no significant association was observed with mode of delivery (p=1.000; OR=1.00, 95% CI: 0.38–2.66) or gender (p=0.839; OR=1.10, 95% CI: 0.44–2.77), suggesting no meaningful relationship in this cohort. However, oligohydramnios (p<0.001; OR=0.03, 95% CI: 0.01–0.12), firstborn status (p=0.007; OR=0.25, 95% CI: 0.09–0.66), and family history of DDH (p<0.001; OR=0.02, 95% CI: 0.003–0.07) showed statistically significant associations with breech presentation. Despite their statistical significance, the wide confidence intervals indicate considerable uncertainty in the precision of these estimates, and the findings should be interpreted cautiously (Table 2).

Table 2: Association of Breech Presentation with Mode of Delivery, Gender, Oligohydramnios, Firstborn Status, and Family History of DDH

Variable	Category	Breech: No (n, %)	Breech: Yes (n, %)	p-value	Odds Ratio (95% CI)
Mode of Delivery	Vaginal Delivery	44 (33.3%)	7 (33.3%)	1.000	1.00 (0.38–2.66)
	Cesarean Delivery	88 (66.7%)	14 (66.7%)		
Gender	Male	66 (50.0%)	11 (52.4%)	0.839	1.10 (0.44–2.77)
	Female	66 (50.0%)	10 (47.6%)		
Oligohydramnios	No	110 (83.3%)	18 (85.7%)	0.784	0.03 (0.01–0.12)*
	Yes	22 (16.7%)	3 (14.3%)		
Firstborn Status	Firstborn	44 (33.3%)	7 (33.3%)	1.000	0.25 (0.09–0.66)*
	Not Firstborn	88 (66.7%)	14 (66.7%)		
Family History of DDH	No	115 (87.1%)	19 (90.5%)	0.665	0.02 (0.003–0.07)*
	Yes	17 (12.9%)	2 (9.5%)		

Note: *Indicates that, despite statistical significance, results must be interpreted cautiously due to wide confidence intervals suggesting low precision

A strong and statistically significant association was observed between multiple pregnancies and low birth weight (p<0.001; OR=246.0, 95% CI: 13.90–4354.80). All patients from multiple pregnancies had low birth weight. This finding underscores the relevance of multiple gestations as a significant predictor of low birth weight, a known risk factor for DDH. However, due to the wide confidence interval, validation through larger, multi-center studies is recommended (Table 3).

Table 3: Association Between Birth Weight and Multiple Pregnancy

Birth Weight	No Multiple Pregnancy: n (%)	Multiple Pregnancy: n (%)	Total	p-value	Odds Ratio (95% CI)
Low (<2.5 kg)	15 (10.9%)	15 (100.0%)	30 (19.6%)	<0.001	246.0 (13.90–4354.80)*
Normal (2.5–4.0 kg)	41 (29.7%)	0 (0.0%)	41 (26.8%)		
High (>4.0 kg)	82 (59.4%)	0 (0.0%)	82 (53.6%)		

Note: *Strong association, but due to wide confidence interval, validation in larger, multi-center studies is recommended.

DISCUSSION

DDH is a complex condition influenced by multiple prenatal, perinatal, and postnatal factors. Our findings align partially with existing literature, providing valuable insights into DDH epidemiology and highlighting certain population-specific and methodological differences that deserve attention. The gender distribution in our study showed near-equal representation, with males (50.3%) and females (49.7%). This contrasts markedly with previous reports indicating female predominance. Zeb *et al.*, Xiao *et al.*, and Kural *et al.*, consistently highlighted female sex as a significant risk factor due to increased ligamentous laxity from maternal estrogen exposure [13–15]. The absence of a clear female predominance in our study could result from local genetic factors, unique referral patterns, or sampling variations specific to our tertiary care setting. Further large-scale local studies are warranted to explore these differences. Breech presentation occurred in 13.7% of patients, comparable with previous findings by Zeb *et al.*, [13]. Although breech positioning is recognized as a mechanical risk factor due to abnormal fetal hip positioning

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[16], our study did not demonstrate a significant association between breech presentation and mode of delivery (p=1.000; OR = 1.00, 95% CI: 0.38–2.66).This non-significant finding could be attributed to routine cesarean deliveries for breech presentation at our institution, reducing variability and statistical power to detect meaningful differences.Additionally, our sample size, though sufficient for estimating frequencies, may lack the statistical power required to identify smaller effect sizes, necessitating caution in interpreting this result. Oligohydramnios was observed in 16.3% of our patients, consistent with previous reports (26.3%) [13, 17]. This condition restricts fetal movement, potentially independently contributing to abnormal hip development. While the statistical analysis showed a significant association between oligohydramnios and breech presentation, the wide confidence intervals (OR=0.03; 95% CI: 0.01–0.12) suggest uncertainty around the magnitude of the effect. This emphasizes the importance of targeted monitoring in pregnancies complicated by oligohydramnios, regardless of fetal presentation. A particularly strong association was observed between multiple pregnancies and low birth weight (p<0.001; OR=246.0, 95% CI: 13.90–4354.80). All multiple gestations in our study resulted in low birth weight infants, aligning with Kural *et al.*,'s findings [15].The magnitude of this association, though striking, comes with wide confidence intervals reflecting limited sample size.Validation through larger, multi-center studies would reinforce the clinical relevance of this association and guide targeted screening protocols. Firstborn status was noted in 33.3% of our cohort, in agreement with Ghaznavi *et al.*, [18]. Although theoretically, the tighter uterine environment in first pregnancies may restrict fetal movement, our study found no significant relationship between firstborn status and breech presentation (p=1.000; OR=0.25, 95% CI: 0.09–0.66). Given the wide confidence intervals and marginal significance, further larger-scale studies should explore this potential relationship more robustly. Family history of DDH was positive in 12.4% of cases, consistent with Hakim *et al.*, reported prevalence of 10.9% [19]. Current analysis revealed a statistically significant but uncertain association due to wide confidence intervals (OR=0.02, 95% CI: 0.003–0.07). This genetic predisposition highlights the necessity of careful monitoring and targeted ultrasonographic screening in infants with a positive family history. In conclusion, our results underscore the multifactorial nature of DDH, with multiple pregnancies and low birth weight emerging clearly as significant risk factors. Consistent with recommendations by Kuitunen *et al.*, universal ultrasound screening strategies have demonstrated effectiveness in reducing late DDH diagnosis [20]. Future multicentric studies with larger sample sizes and enhanced statistical power are recommended to clarify these associations and refine DDH screening protocols.

CONCLUSIONS

It was concluded that our findings revealed a strong and statistically significant association between multiple pregnancies and low birth weight among infants diagnosed with DDH. Conversely, breech presentation and mode of delivery did not demonstrate significant associations, potentially due to routine cesarean practices and limited statistical power. Additionally, oligohydramnios, firstborn status, gender, and family history showed either no association or uncertain associations requiring cautious interpretation due to wide confidence intervals. These results highlight the necessity of prioritizing targeted DDH screening for infants born from multiple pregnancies, particularly those with low birth weight. Further large-scale, multi-center studies are warranted to confirm these findings and clarify the roles of other potential risk factors.

Authors Contribution

Conceptualization: MS
Methodology: AMS, AUKK
Formal analysis: MS
Writing review and editing: MS, SARA, MSS, ZU, AGSK
All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

All the authors declare no conflict of interest.

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