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RE-EVALUATION OF DDH RISK FACTORS IN HELENA REHABILITATION CENTER-ERBIL, KURDISTAN REGION OF IRAQ

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ABSTRACT

***Purpose**: Developmental dysplasia of the hip (DDH) comprises a spectrum of abnormalities from hip instability to frank dislocation, Hip ultrasonography prior to femoral head ossification, is recognized as an early diagnostic tool for DDH. It is safe and non-invasive procedure, keeping those babies less than 6 months of age away from radiation hazard.*

***Subjects and Methods:** From august 2021 until august 2022, we investigated 534 babies [1068 hips] by ultrasound depending on Graf method to identify DDH types. All included infants were in between 6 weeks- 6 months of age and referred due to have high risk factors. The data was analyzed by using the SPSS, version 28 and Chi- square test of association was used to compare the proportions.*

***Results:** On the bases of examining 534 babies [with high-risk groups] by ultrasound of hip, about 50.94 % of them were shown to have different types of DDH while 48.06% were normal, bilateral cases were > unilateral cases and Lt. hip >Rt. Hip were affected. Significant association was found between DDH family history (86%), breech presentation (52%)and swaddling (12%).*

***Conclusions:** It is crucial to establish the principle of selected screening programs for early detection of DDH in our society and to identify the incidence and associated risk factors for DDH in high-risk group babies between the ages of six weeks and six months in Erbil city of Kurdistan region-Iraq.*

INTRODUCTION

DDH is a hip disorder, the acetabulum, proximal femur, labrum, capsule, and various soft tissues are abnormal (Munkhuu et al., 2013). The spectrum includes dysplasia, subluxation, dislocatable and dislocated hips. DDH can lead to premature degenerative joint disease, impaired walking, and chronic pain Variations exist due to genetic predisposition and cultural practices (Shipman et al., 2006). The reported incidence has increased significantly since the advent of clinical and sonographic screening, which suggests possible over diagnosis. The incidence of DDH ranges from 1-7% in newborns across several populations (Pollet et al., 2017). Depending on some estimates, the rate of incidence is 0.1 among Africans who live in Africa, whereas it is 76.1 in Native Americans for every 1000 births. As an example, the incidence of DDH is 1.1 cases per 1000 births in North America, 3.6 cases in the United

Kingdom, and 6.8 cases in Australia (Loder & Skopelja, 2011). The considerable heterogeneity in incidence in the ultra-sonographic period is better described once two types of newborn instability are considered. The first kind is neonatal, sonographic DDH, which recovers by itself. The second condition is neonatal instability, which, if unaddressed, may proceed to real DDH, which can range from acetabular dysplasia to total dislocated. Health issues including a family background of DDH, breech presentation, intrauterine packing, first-born girl, oligohydramnios, and postnatal swaddling have been linked to the development of DDH (Weinstein et al., 2004). This is why early detection of developmental dysplasia of the hip (DDH) is of value since most of them has an asymptomatic stage in early post-natal period which can be effectively managed if diagnosed Early and to overcome serious implications of late diagnosis including chronic lifelong pain and disability.

Ultrasound screening is the most dependable imaging tool for the detection of DDH before primary ossification center of the femoral head appearance. Among them Graf lateral ultrasound scanning is widely used for initial screening of suspected DDH newborns and for follow-up (Graf, 1984; Graf, 2017). Effective screening programmers have been reported to have significantly reduced the rates of all types of surgery for DDH (tenotomy, closed reduction, open reduction and osteotomies) (Vane et al., 2005; Boeree & Clarke, 1994; Paton et al., 2002). The evaluation of the hip joint is currently performed as part of the standard checkup performed on all newborns. Despite the fact that screening using clinical examination (including the Barlow and Ortolani tests) has been conducted in the UK for over three decades and has a high specificity, the sensitivity of clinical examination is poor (Marshall, 1996). False - positive result to diagnostic errors and overtreatment, whereas excessive false negatives might result in DDH identification being delayed (Dezateux et al., 2003). The purpose of our study is to determine incidences of DDH in Erbil governorate and to re assess those risk factors leading to DDH among Kurdish nationality as well as diagnostic value of Graf ultrasound .and we intended to use information from our study to inform authority to re adjust the current screening practices in our locality we feel that's crucial to establish the principle of selected screening programs for early detection of DDH in our society (as we do not have an official screening program yet).

METHODOLOGY

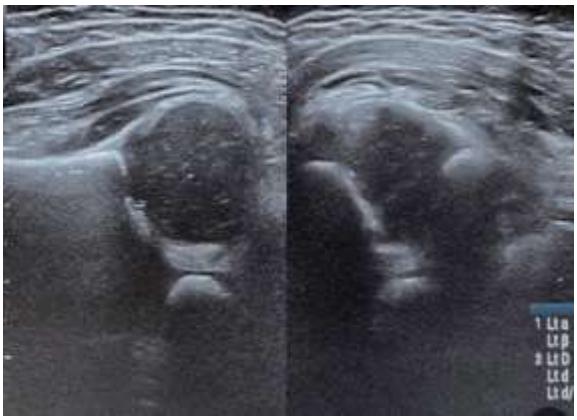
From August 2021 to August 2022, we enrolled 534 infants at our centre, Helena Governmental Specialized Rehabilitation Centre of Children with Special Needs/ Iraq Government/Kurdistan Region/ Erbil City. Age range was restricted to 6 weeks - 6 months. Our orthopaedic specialists and outpatient paediatricians made the referral. Regardless of whether the clinical evaluation was positive or negative, the presence of high-risk factors of DDH was the cause for the referral. Prior to ultrasound examination, our engaged radiologists collected information from parents on sex, family history (defined as first-degree relatives, parents and siblings), firstborn child, mode of delivery, and breech presentation (during the last trimester and birth). In our analysis, these variables were considered to be the top 5 risk factors. Traditional swaddling, is included as additional risk factors.

We also asked mothers about history of oligohydramnios, club foot, limb length discrepancy, torticollis, preterm, and multiple gestations. Because clinical examination is unreliable after the age of two months, we relied solely on ultrasonography as the modality of choice for early detection of DDH in this age group, hence the results of clinical examination were not included in this study. Each patient was checked bilaterally by ultrasound in both static and dynamic scans by an experienced radiologist utilizing an Aquila pie medical ultrasound equipment, linear probe 10.0 L40. The ACR Standard Minimum is applied. The general

strategy was coronal neutral, coronal flexion [at rest and stress], with transverse abduction scan for reducibility [which is limited to advance cases of DDH [type III and IV].

• Depending on Graf method, U/S classification of the hip joint was done, types were obtained in coronal section at rest and as follows:
• Graf type I: α >60, B angle<55 [normal hip joint].
• Graf type IIa: α 50-59, B >55, age <3 m [representing physiological immaturity].
• Graf type IIb: α 50-59, B >55, age >3 m [representing delayed maturity].
• Graf type IIc: α 43-49, B <77 [representing dysplastic hip].
• Graf type IId: α 43-49, B >77 [representing dysplastic hip].
• Graf type III: α <43, B >77, everted labrum[dysplastic partially dislocated hip].
• Graf type IV: α <43, B >77, inverted labrum[representing massive total hip dislocation].
• *Alpha [α] angle [measures osseous convexity]. Normally >60
• *Beta [B] angle is a measurement of the acetabulum's cartilaginous growth. N<55
The Kurdistan Board of Medical Specialties KBMS/research protocol ethics committee gave its clearance for this study.

The statistical package for social science [SPSS, version 28] was used to analyze the data and the Chi square test of associations was used to compare proportion. Fishers exact test was used in certain circumstances. To compare the mean of two samples, Students t-test of two independent samples was used. A p-value of ≤ 0.05 is considered statically significant.



RESULTS AND DISCUSSION

We enrolled 534 children in this study. Table 1 shows that more than half (54.3%) of participants were female, 55.6% of them had a DDH case in their first degree family member, most (63.1%) of the study sample were delivered through caesarean section, most (60.3%) of them did not have breech position while 39.7% of cases were in breech presentation status, 72.1% of samples were not first-born children while only 27.9% of them were firstborns, the majority 82.1% of them were not swaddled tightly, while 17.9% of the babies were swaddled unsafely (traditional tight swaddling).

Table 1: Risk factors of DDH among the children.

Variables	Categories	Frequency	Percent
Gender	female	290	54.3
	male	244	45.7
Family history of DDH	yes	297	55.6
	no	237	44.4
Mode of delivery	normal vaginal delivery	197	36.9
	Caesarean section	337	63.1

Breech	yes	212	39.7
	no	322	60.3
First born	yes	149	27.9
	no	385	72.1
Swaddling	yes	42	17.9
	no	492	82.1
Total		534	100

Table 2 and Figure 1 show ultra sound assessment of the hips, therefore half (50.9%) of children had DDH, at the same time nearly half (49.1%) of them were normal through using ultra sound diagnosis, one third (33.3%) of them affected both sides of the hips, while 17.6% of the cases were unilateral-left hip more affected (11.2%) than right hip (6.4%)- finally 49.1% of them were normal, 49.1% of samples was type 1 followed by 22.5% of cases represented 2a Graf type, and only (1.3%) of them were type 3.

Table 2: Ultra sound assessment (findings) of the hips.

Variables	Categories	Frequency	Percent
Ultra sound diagnosis	DDH	272	50.9
	normal hip	262	49.1
Side of DDH (affected hip)	none	262	49.1
	right hip	34	6.4
	left hip	60	11.2
	both hips	178	33.3
Graf type	type 1	262	49.1
	type 2a	120	22.5
	type 2b	101	18.9
	type 2c	32	6
	type 2d	3	0.6
	type 3	7	1.3
	type 4	9	1.7
Total		534	100

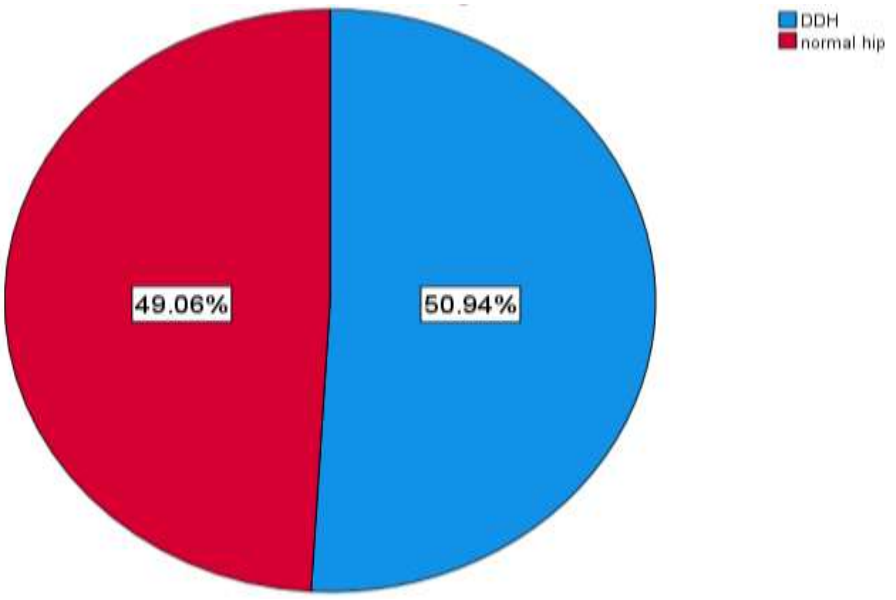


Figure 1: Ultrasound diagnosis.

Findings of Table 4 determine that, there was significant statistical association between DDH diagnosis and family history, the majority (86%) of diagnosed cases with DDH had the same condition in their family member while only 24% of normal (non-DDH) cases had DDH family history. There was significant statistical association between diagnosis and breech, more than half (52.6%) of DDH children were in breech position while most (73.7%) of normal hip sample sizes were in head-first position. There was significant statistical association between diagnosis and unsafe swaddling, 33 out of 42 cases of swaddled babies diagnosed as DDH (12.1%) while only 9 cases were normal (3.4%). Chi square test was highly significant and p-value was < 0.001.

Table 4: Association between DDH and the risk factors.

Variable	Categories	Diagnosis		p-value
		DDH	normal hip	
family history	yes	234 (86%)	63 (24%)	< 0.001
	no	38 (14%)	199 (76%)	
Breech	yes	143 (52.6%)	69 (26.3%)	< 0.001
	no	129 (47.4%)	193 (73.7%)	
Swaddling	no	239 (87.9%)	253 (96.6%)	< 0.001
	yes	33 (12.1%)	9 (3.4%)	
Total		272	262	
		100%	100%	

Results of Table 5 reveal that, there was non-significant statistical association between diagnosis and gender, mode of delivery and firstborn, p-values were 0.074, 0.809 and 0.345 respectively. There was significant statistical association between diagnosis and graph type, all the normal hip cases were type 1 graph while the maximum amount (44.1%) of DDH children were type 2a while in reverse normal hip cases were zero, followed by 37.1% of diagnosed DDH cases were type 2b, 11.8% type 2c, 1.1% type 2d, 2.6% type 3 and 3.3% type 4. Graf vice versa normal cases were zero. Chi square was done and p-value was < 0.001.

Table 5: Association between DDH condition and general background of the participants.

Variable	Categories	Diagnosis		p-value
		DDH	normal hip	
Gender	male	158 (58.1%)	132 (50.4%)	0.074
	female	114 (41.9%)	130 (49.6%)	
Mode of delivery	normal vaginal delivery	99 (36.4%)	98 (37.4%)	0.809
	Caesarean section	173 (63.6%)	164 (62.6%)	
First born	Yes	71 (26.1%)	78 (29.8%)	0.345
	No	201 (73.9%)	148 (70.2%)	
Graf type	type 1	0 (0%)	262 (100%)	< 0.001
	type 2a	120 (44.1%)	0 (0%)	
	type 2b	101 (37.1%)	0 (0%)	
	type 2c	32 (11.8%)	0 (0%)	
	type 2d	3 (1.1%)	0 (0%)	
	type 3	7 (2.6%)	0 (0%)	
	type 4	9 (3.3%)	0 (0%)	
Total		272 (100%)	262 (100%)	

Discussion

In this study 534 children sent for ultrasound examination of DDH. 290 (54.3%) of them was female& 244 (45.7%) was male. This is consistent with research conducted in Turkey in 2015 by Cekic et al., which found that of the 1162 new-borns referred, 523 (45%) were male and 639 (55%) were female (Çekiç et al., 2015). In our study, 50.9% of the 534 children whose ultrasounds were requested had DDH whereas 49.1% were found to be normal. 4.4%-51.8% are the generally accepted estimates for the incidence of DDH, with Africans having the lowest rates at 7.15%. (Randall et al., 2011). The epidemiologic literature on DDH is vast and confusing because there are numerous definitions of hip dysplasia, different ways to diagnose it (such as physical examination, plain radiographs, and ultrasound), different ages of the population studied (such as new-born, 1 month old, 3 months old, etc.), clinical experience of the examiner (Krikler & Dwyer, 1992), different racial/ethnic groups in the population being studied, and different geographic areas within similar ethnic groups (Larchet et al., 1994; Masse, 1990). The incidence of sonographic DDH at 6 weeks in Turkey was 47.1, which is comparable to the outcome of our investigation. (Dogruel et al., 2008).

In our study, according to graph classification of the DDH cases, 49.1% were graph type I, 22.5% type 2a, 18.9% type 2b, 6% type 2c, only 0.6% type 2d. While type 3 were only 1.3%& type 4 were 1.7%. A study done in Turkey show ultrasonographic evaluation of the right hip joints of 1162 infants revealed type 1a (n=1026,88.3%), type 2a (n=116,10%), type 2b (n=16,1.4%), type 2c (n=3,0.3%), and type 3a (n=1, 0.1%) DDHs. While 1162 new-borns with left hip joints that underwent ultrasonographic examination for DDHs were found to have type 1a (n=900; 77.5%), type 2a (n=210; 18.1%), type 2b (n=10;3.4%), type 2c (n=4; 0.9%), and type 3a (n=1; 0.1%) DDHs (Çekiç et al., 2015).

A cohort study in Mongolia show14,873 mature hips (89.0%), along with 1,715 physiologically immature hips (10.3%), 36 dysplastic cantered hips (0.2%), 70 dysplastic decentred hips (0.4%), 14 luxated hips (0.08%), and 4 luxated hips with trapped cartilage (0.02%) (Munkhuu et al., 2011). The incidence of DDH in the last theses are quite less than our research including all graph types, many factors may affect the incidence but the main reason for this relatively big difference is that: these two theses did screening& examined all cases while in our study the examination performed in Helena centre which is a specialized centre for DDH management& only high-risk cases were referred to this centre. Along with genetic, ethnic, and cultural traits, swaddling babies and attempting to keep their hips and knees extended are cultural practices.

Typical risk factors for DDH are recognized to be female, first born, breech position, favourable family history, left hip, and unilateral involvement (Randall & Elaine, 2011). However, in this study no statistically significant correlation between diagnosis& gender, mode of delivery and firstborn babies seen. For gender we can't find explanation, and mode of delivery is not generally seen as a risk factor on its own. For first born kids; we can explain it by the widespread usage of caesarean sections for delivering primigravida cases at earlier gestational age.

In this study 55.6% had positive family history of DDH in first degree relatives showing statistically significant correlation. According to a study conducted in Mongolia; new-borns who had a parent or sibling with DDH presented 12 times more frequently with a DDH than new-borns without DDH in their parents or siblings (Munkhuu et al., 2011). Positive family history was confirmed in 86 (8%) neonates (epidemiology & demographics) (Randall & Elaine, 2011). In DDH group in Iran, only 24% reported to have a positive family history (P=0.165). (Amir R et al., 2017). A positive family history increases the risk of DDH in many researches (18, 21-22); it was 21% in Saudia Arabia (Mirdad, 2002), and 35% in Greece (Giannakopoulou et al., 2002).

A positive family history increases the relative risk by 1.7 times, while breech presentation increases the relative risk by 6.3 times in comparison to vertex (for an incidence of 29 for males and 133 for girls) (Randall & Elaine, 2011). In our study, breech presentation was present in 143 children (52.6%) of the 272 DDH cases, but only 26.3% of the 262 normal hip children did. This result shows a statistically significant correlation between breech presentation and the diagnosis of DDH. According to Munkhuu et al. (2011) breech births raised the risk by 4.8 times compared to those who were not (Munkhuu et al. 2011). Many studies claim that Breech presentation increases the incidence of DDH (Mirdad, 2002; Partenheimer et al., 2006; Abdinejad et al., 1996; Ang et al., 1997; Patterson et al., 1995; Poul et al., 1992; Szepesi et al., 1993; Ruhmann et al., 1999; Diaz et al., 1997). According to a study conducted at Imam Khomieny Hospital in Tehran, the bilaterality and occurrence of DDH were both significantly related to breech presentation. (Amir et al., 2014) In our study,178 out of the 272 DDH cases (65.4%) both hips affected, left hip involved alone in 60 cases (22.05%) while right hip involved in 34 cases (12.5%). Many other studies in the region (Iran, Turkey &Saudi arabia) show close results (Dogruel et al., 2008; Mirdad 2002; Mamouri et al., 2004; Pashapour and Golmahammadlou, 2007).

Among the 534 kids enrolled in our study, 42 (17.9%) were improperly (unsafe) swaddled while 492 were not. The incidence of DDH among unsafe traditional swaddled kids was 78% (33 out of 42 kids), indicating statistically significant association. Swaddling new-borns is a common practice across cultures, and many experts believe it to be a substantial contributor to the development of DDH. In Turkey (Kutlu et al., 1992), 98% of new-borns with DDH were swaddled compared to 87.1%who were not swaddled; the OR of DDH in swaddled children was 6.1 (34). A study in turkey (Dogruel et al., 2008), showed swaddling was utilized in 21.2% of those children with DDH ≥ Graf IIb ($P < 0.0001$), which was the biggest risk factor associated with DDH. Swaddling is also thought to be the cause of the high prevalence of DDH among Arabs in Western Galilee (Alkalay, 1980) and immigrants from Iraq in Israel (Randall & Elaine, 2011). Unsafe swaddling is the most significant contributing factor to DDH after birth. In Native Americans, Japan, and Turkey, making the practice of traditional swaddling a safe one has been demonstrated to minimize the incidence by six times (Chwend et al., 2014). Finally, many studies came to the conclusion that any new-born who had one or more risk indicators should be taken into consideration as a potential candidate for sonographic screening (Randall & Elaine, 2011; Ortiz-Neira et al., 2012; De-Hundt et al., 2012; Kotlarsky et al., 2015; Imrie et al., 2010).

CONCLUSION

Due to the high prevalence of DDH in the study group's infants, it's possible that the key risk factors for our screening program should be revaluated in the future. In our study, the three main risk factors that were closely associated were a favourable family history, breech presentation, and dangerous traditional swaddling. All high-risk new-borns should have a DDH ultrasound performed, and it is best to have the ultrasound examination starting at 6 weeks old because younger ages frequently show milder dysplasia that cure on their own and don't require therapy. The rate of late identified and surgically treated DDH cases has proved to be considerably reduced as a result of the universal or selective neonatal hip screening programs using ultrasonography. On the other hand, in order to combat the high incidence of DDH in our society, we should launch a government awareness campaign to discourage hazardous swaddling.

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