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Evaluation The Efficacy of Barlow and Ortalani Test in The Diagnosis of Developmental Dysplasia of The Hip in Infant in Salah Al-deen General Hospital

Qabas Adil Ahmed*, Ahmed Hashim Alanee**

***Kirkuk Health Directorate.**

**Pediatrics Departments /College of Medicine/Tikrit University.

**Corresponding author*: E-mail: ah70.tucam@tu.edu.iq

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ABSTRACT

This cross sectional study aimed to assess the effectiveness of clinical examination using the Barlow and Ortolani tests compared to ultrasound diagnosis for identifying developmental dysplasia of the hip (DDH) in infants. The study involved 100 babies aged 1 week to 12 weeks, randomly selected from Salah Al-deen General Hospital between January and June 2020. The infants were examined using the Barlow and Ortolani tests, followed by ultrasound confirmation of DDH diagnosis.

Results showed that 9% of the infants had DDH. Infants with abnormal ultrasound findings had a higher birth weight, and significant associations were found with breech presentation, vaginal bleeding during pregnancy, and a family history of the same condition. Senior specialists were more accurate in diagnosing DDH compared to residents.

The sensitivity of the Barlow and Ortolani maneuvers was low for both residents and seniors, while specificities were high. Positive predictive values were better for residents, but negative predictive values were better for seniors. False-negative rates were lower for seniors, and false-positive rates were generally low.

In conclusion, clinical examination alone may not always accurately identify DDH in infants, as some babies with normal hips may show abnormalities on ultrasound. Conversely, ultrasound scans may indicate clinical dysfunction in babies with normal hips. Female infants had a higher incidence of DDH, and certain risk factors were associated with the condition. The sensitivity of the Barlow and Ortolani tests was limited, but specificities were high, and the choice of examiner impacted predictive values

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INTRODUCTION

Developmental dysplasia of the hip (DDH) is a condition involving the immature hip joint's abnormal development. It encompasses a range of presentations from mild dysplasia to complete dislocation. The term "DDH" replaced the previous term "congenital dysplasia of the hip" to better reflect the developmental nature of the disorder.(1,2)

DDH can be classified into acetabular dysplasia, hip subluxation, and hip dislocation, with two major groups: typical and teratologic.(3) The exact cause is unknown, but it likely results from a combination of hormonal, mechanical, and genetic factors. Conditions leading to reduced fetal motion, such as oligohydramnios, large birth weight, and first pregnancies, may be associated with DDH, with female gender being a potential risk factor.(4)

Clinical findings vary by age:

•In neonates, DDH is asymptomatic and requires specific screening maneuvers, including the Barlow and Ortolani tests, to assess hip stability.(5)

•By three months of age, these tests become less reliable, and limitations in hip abduction and other physical signs become more indicative of DDH.(6)

•In older children, limping, waddling gait, leg-length discrepancies, and positive Trendelenburg signs may be observed.(7)

Diagnostic testing includes ultrasonography before the femoral head's ossification (typically 4-6 months) and radiographs once the proximal femoral epiphysis has ossified.(8)

Treatment options depend on age:

•Neonates and infants under six months may use a Pavlik harness on a full-time basis.

•Children aged 6 months to 2 years may undergo closed reduction.

•Children older than 2 years may require open reduction for treatment.

Overall, early detection and appropriate management are crucial in addressing DDH and preventing long-term hip joint issues.(9)

PATIENT AND METHOD

This study is a cross-sectional hospital-based investigation conducted on 100 babies aged 1 week to 12 weeks who were randomly selected from the pediatric and neonatology department at Salah Al-deen General Hospital over a 6-month period from January to June 2020. Prior oral consent from the neonates' relatives was obtained. The study collected demographic information through a questionnaire covering age, gender, residence, date of birth, and medical history. Each infant underwent clinical examinations for developmental dysplasia of the hip (DDH) using the Barlow and Ortolani tests.The examinations were performed by a resident researcher and a pediatric specialist from Salah Al Deen General Hospital. On the same day, an ultrasound examination was conducted for the same infants by a radiologist using a Philips ultrasound machine. The ultrasound assessment involved measuring alpha and beta angles and femoral head coverage percentage, which are indicators of hip joint health.Inclusion criteria for the study were infants aged 1 to 12 weeks, while exclusion criteria included infants younger than 1 week or older than 12 weeks, those who did not complete the ultrasound examination, infants with neuromuscular or congenital anomalies, and cases where the family did not agree to participate.

Statistical analysis of the data involved using the Statistical Package for Social Sciences (SPSS) version 25. The analysis included chi-square tests, t-tests, and univariate binary logistic regression to compare means

and proportions among different groups in the study sample. A p-value of ≤ 0.05 was considered statistically significant.

RESULT

In this study involving 100 cases (61 females and 39 males), the frequency of developmental dysplasia of the hip (DDH) was 9%, as detected through ultrasound examination. **The frequency of DDH** among the total cases was 9%.(figure 1).

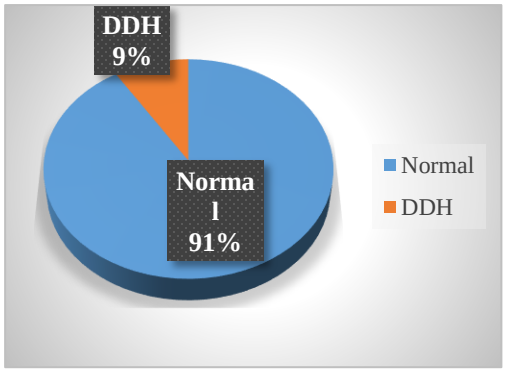

Figure 1: The frequency of DDH according to US examination

Age, Birth Weight, and Parity: Infants with abnormal ultrasound findings had a higher mean age (6 weeks) compared to those with normal findings (2.7 weeks). Similarly, those with abnormal findings had a higher mean birth weight (3.5 kg) compared to those with normal findings (3.1 kg). However, the difference in parity was not statistically significant.(table 1).

Gender and DDH: Females had a slightly higher frequency of DDH (11.5%) compared to males (5.1%), but this difference was not statistically significant.(figure 2)

Table 1: the mean age, birth weight and parity according to US findings.

	Normal US			Abnormal US			
	N	Mean	SD	N	Mean	SD	P value
Age in weeks	91	2.7	1.8	9	6.0	4.2	<0.05 S
Birth wt in Kg	91	3.1	0.5	9	3.5	0.4	<0.05 S
Parity	91	3.4	0.8	9	3.6	1.1	>0.05

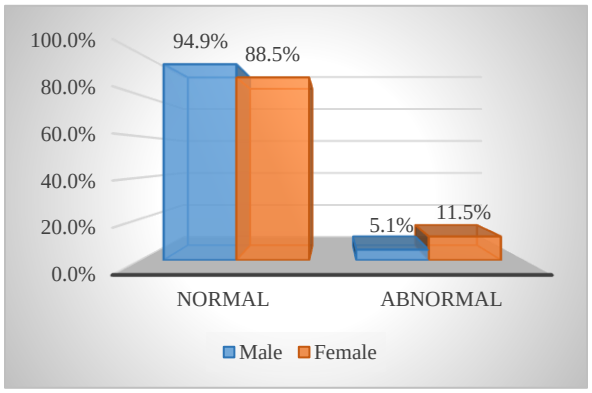

Figure 2: The distribution of study sample according to US finding and gender (P value > 0.05 not significant)

Delivery Presentation: Breech presentation was significantly associated with a higher rate of DDH (60%), whereas vertex presentation had a lower rate (3.3%). Family History: Infants with a family history of the same condition had a significantly higher proportion of DDH (66.7%) compared to those without a family history (7.2%).(table 2)

Table 2: The univariate binary logistic regression of different variables

Variables	Non adjusted OR	95% C.I.		P value
		Lower	Upper	
Breech Presentation	43.5	7.865	240.591	0.0001
Female Gender	2.398	0.472	12.193	0.292
No antenatal care	1.297	0.143	11.726	0.817
vaginal bleeding during pregnancy	23.47	4.089	134.667	0.0001
Family History of same condition	25.714	2.068	319.799	0.012

Univariate Binary Logistic Regression: Variables associated with a significantly higher risk of DDH included breech presentation (OR 43.5), vaginal bleeding during pregnancy (OR 23.47), and a family history of the same condition (OR 25.7).(table 2)

Clinical Maneuver Sensitivity and Specificity: Clinical maneuvers (Barlow and Ortolani) had low sensitivity (33-44%) but high specificity (96-98%). The positive predictive value (PPV) was better for maneuvers by residents (60%) than those by senior clinicians (50%), while the negative predictive value (NPV) was better for maneuvers by senior clinicians (94.6%) than those by residents (93.7%).(table 4)

In summary, this study assessed the prevalence of DDH in infants and identified several factors associated with its occurrence. Clinical maneuvers had limitations in sensitivity but were highly specific, while ultrasound examination was more accurate in detecting DDH.

Table 3: The distribution of the sample by Clinical maneuver findings according to US finding and person who made the test

		US finding		Total	P value
		Normal	Abnormal		
Barlow by Senior	Yes	4	4	8	Fisher's Exact Test < 0.05 S
	No	87	5	92	
Ortalani by Senior	Yes	4	4	8	Fisher's Exact Test < 0.05 S
	No	87	5	92	
Barlow by Resident	Yes	2	3	5	Fisher's Exact Test < 0.05 S
	No	89	6	95	
Ortalani by Resident	Yes	2	3	5	Fisher's Exact Test < 0.05 S
	No	89	6	95	
Total		91	9	100	

Four cases of DDH was truly diagnosed by senior, while only 2 was diagnosed truly by resident, these relations was statistically significant.(table 3).

Table 4: sensitivity and specificity of Clinical maneuver senior and resident

Clinical maneuver	Sensitivity	Specificity	False Positive	False negative	accuracy	PPV	NPV
Ortolani by senior	44%	96%	4%	56%	91%	50%	94.6%
Barlow by senior	44%	96%	4%	56%	91%	50%	94.6%
Ortolani by resident	33%	98%	2%	67%	92%	60%	93.7%
Barlow by resident	33%	98%	2%	67%	92%	60%	93.7%

DISCUSSION

The study found a DDH frequency of 9% among the 100 cases examined. This incidence is higher than that reported in some other local studies, such as one from Mosul carried out by Mustafa B Sh., Jasim M Ah, which found that confirmed cases who have DDH in one or both hip joint through the first few hours after delivery establishing a rate of 16.9/1000 live births (10). Another local study carried out by Amel Abdulnabi Hussein et al in Baghdad revealed the incidence of DDH was 4 cases per 1000 live births (11).

The incidence per 1000 live births worldwide ranges from 0.06 in Africans to 76.1 in Native Americans with significant variability between and within racial groups and geographic location (12). However, the worldwide incidence of DDH varies widely, influenced by factors like diagnostic methods, population age, clinical experience, ethnicity, and geographic location (13,14).

The study observed that infants with abnormal ultrasound findings were diagnosed at a higher mean age (6 weeks) compared to those with normal findings (2.7 weeks). This result is higher than a local study carried out by Las J. Hawezy, Hazhen T Mama in north of Iraq which found that the mean age of the babies at first US was 4 weeks (range: 5 days to 6 week) (15). and this is may be due to differences in the screening program between governorates and associated pandemic corona virus during time of data collection of this study which make the families set at home because of quarantine and went to the hospital only for emergency event. Higher birth weight (>3500g) was associated with an increased risk of DDH, while low birth weight (<2500g) appeared to be protective. This result agree with Mustafa B Sh., Jasim M Ah, which revealed that higher birth weight of the baby is effective in the causation of DDH (P-Value ≤0.001) (10). This is similar to the study done by Bower et al in Australia who supported the hypothesis of intrauterine constriction as a cause of neonatal DDH (16).

Females had a higher prevalence of DDH (11.5%) compared to males (5.1%). This aligns with previous research done by Mustafa B Sh., Jasim M Ah, which revealed that the majority of the patients were female 75% with a female to male ratio of 3:1. Also agree with another local study carried out by Baqir (17). A regional study in Saudi Arabia also found a higher ratio 6:1(18). And Apley's in UK found a higher ratio of 7:1(19).

It's suggested that female infants might be more susceptible due to factors like maternal hormones and genetic influences (20,21).

Infants with a family history of DDH were found to have a higher risk of developing DDH. This result agree with Al-Kattan who show the same results (22) This is similar to WOODACRE, Timothy; BALL, Thomas in united kingdom which show that family history of the same condition is a major risk factor for

developing DDH with OR 12.6., this might be attributed to some local cultural habits in nursing the neonates by wrapping clothes and swaddling bed with wrapping legs in extension and by the existence of genetic factor this in accordance with other researchers found powerful family history in their researches (22,23,24).

Breech presentation was associated with a higher risk of DDH compared to vertex presentation, this result agrees with the study done by Mustafa (10) revealed that breech presentation is a risk factor with a significant difference (P-value = 0.04, OR = 2.2) between patients and group of the control. These findings are in accordance with other researches (19, 25, 26, 16, 23, 27) which also revealed that breech presentation and positive family history were the two greatly prevalent risk factors related with DDH. The study emphasizes the importance of considering delivery presentation as a risk factor.

Clinical maneuvers Barlow and Ortolani tests had relatively low sensitivity (33-44%) but high specificity (96-98%), these results higher than results of study carried out by Mustafa (10). And lower than a study in British which show a result of 100% sensitivity (28). Specificities showed greater than 90% for both maneuvers by senior and resident (96%, 98%) respectively; and this result approximately the same of study carried out in Iran which show 94.5% specificity (29).

Positive predictive values were better for Barlow, Ortolani maneuvers by resident (60%) than those by senior (50%), while negative predictive value was better for Barlow, Ortolani maneuvers by senior (94.6%) than those by resident (93.7%). this result was differ from a study in British which show positive predictive value and negative predictive values of having abnormal clinical hip examination findings were, 1.6% and 100.0%, respectively (30).

This result indicates good training program for residence by the seniors and very good examination skills carried out in this department.

In the current study, false negative value was better for maneuvers done by senior (56%) than those done by resident (67%). False positive value was low for both senior and resident 4%, 2% respectively. This is very good evidence about the importance of efficiency of the education program and high index of suspicion of this clinical entity. Four cases of DDH was truly diagnosed by senior, while only 2 was diagnosed truly by resident in a statistically significant relation, this indicate importance of effective residency educational program and clinical training.

This diversity in the results of different studies can be attributed to the fact that physical and U\S examination accuracy is operator dependent as experienced individuals are essential for accurate analysis and diagnosis of DDH (31). In addition, a single examination of the neonate will not exclude the appearance of DDH as it may develop later on with growth as DDH is an evolving disease (32,28). The study also highlighted the importance of training programs and clinical skills in achieving accurate diagnoses.

The discussion underscores the operator-dependent nature of physical and ultrasound examinations for DDH. The experience of the examiner plays a crucial role in accurate diagnosis. Additionally, DDH is an evolving condition, and a single examination may not always detect it. In summary, the study's discussion highlights the variability in DDH incidence, risk factors, and the importance of operator experience in diagnosis. It also underscores the need for ongoing training and educational programs for healthcare

professionals involved in DDH screening and diagnosis.

CONCLUSION

The study concludes that the sensitivity of clinical maneuvers (Barlow and Ortolani tests) was low, while specificity was hi gh.False negative rates were lower for maneuvers conducted by senior clinicians compared to residents. .False positive rates were low for both senior and resident clinicians.

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