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IS CLINICAL EXAMINATION RELIABLE IN DIAGNOSIS OF DEVELOPMENTAL DYSPLASIA OF THE HIP?

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ABSTRACT

Purpose: To assess the sensitivity and specificity of clinical examination compared with ultrasonography (USG) in diagnosing developmental dysplasia of the hip (DDH).

Methods: The files of children aged 6 months or younger who were born at the Başkent University Hospitals in the years 2000-2002 were examined. After examination of 443 infants by an experienced paediatrician, an orthopaedic surgeon evaluated all neonate hips by USG. The validity of the clinical examination results versus the validity of the USG examination results was assessed and analysed.

Results: Of the 443 children, 55.8% were female and 44.2% were male; 74.7% of the infants having DDH were female and 25.3% were male ($P < 0.05$). Of the infants with DDH, 8.8% had a family history of the disorder. Analysis of the validity of the clinical examination results compared with USG examination results showed the sensitivity, specificity, (+) and (-) predictive values of clinical assessment to be 38.5%, 84.9%, 39.8%, and 84.2%, respectively.

Conclusions: We recommend USG examinations for all infants at high risk for DDH because the examination is non-invasive, repeatable, inexpensive, and has no risk of ionizing radiation. Additionally, there is no need for sedation or contrast material administration.

Key Words: Developmental Dysplasia Of The Hip, Sensitivity, Specificity, Ultrasonography.

GELİŞİMSEL KALÇA DİSPLAZİSİNİN TANISINDA KLİNİK MUAYENE GÜVENİLİR MİDİR?

ÖZ

Amaç: Bu çalışmanın amacı gelişimsel kalça displazisinin (GKD) tanısında fizik muayenenin sensitivitesinin ve spesifitesinin ultrasonografi (USG) ile değerlendirilmesidir.

Gereç ve Yöntem: Bu çalışmada 2000-2002 yılları arasında, Başkent Üniversitesi Hastanesi'nde doğmuş 6 aydan küçük çocukların dosyaları incelenmiştir. 443 yeni doğmuş çocuğun önce klinik muayenesi pediatrist tarafından yapılmış daha sonra ortopedist tarafından USG ile değerlendirilmiştir. Fizik muayene bulgularının USG'ye göre geçerliliği değerlendirilmiş ve analiz edilmiştir.

Bulgular: 443 çocuğun %55,8'i kız ve %44,2'si erkekti; GKD olan bebeklerin %74,7'si kız ve %25,3'ü erkekti ($P<.05$). GKD olan bebeklerin %8,8'sinde aile hikâyesi vardı. Fizik muayenenin USG ile karşılaştırıldığında duyarlılık, seçicilik, pozitif ve negatif beklenen değerleri sırasıyla %38.5, %84.9, %39.8 ve %84.2 olduğu görülmüştür.

Sonuçlar: Sonuç olarak, GKD açısından yüksek riskli olan tüm yeni doğanlarda girişimsel olmadığı, tekrarlanabilir olduğu, pahalı olmadığı ve iyonize radyasyon riski bulunmadığı için USG'yi öneriyoruz. Ayrıca, bu uygulamada sedasyona veya kontrast madde uygulanmasına ihtiyaç yoktur.

Anahtar Kelimeler: Gelişimsel Kalça Displazisi, Duyarlılık, Seçicilik, Ultrasonografi.

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INTRODUCTION

Developmental dysplasia of the hip (DDH) is a spectrum of disorders, including subluxation and dislocation, affecting the proximal femur and acetabulum. DDH is a frequently encountered, major health problem whose outcomes could be greatly prevented through early diagnosis. Early diagnosis and treatment are important because failure to diagnose DDH in neonates and young infants can result in significant morbidity.

The reported incidence of DDH varies throughout the world. It is a consequence of genetic susceptibility as well as differences in medical care and diagnostic capabilities. Worldwide, DDH occurs in approximately 1% of all neonates. For example, in Africa and India, where parents carry their babies on their backs, DDH may be seen less frequently than in Turkey, where traditional cognate marriages and baby swaddling are still seen although not as frequently (1,2). In various studies performed using clinical examination and USG, the incidence of DDH has been found to vary between 0.8% and 2.5% (3).

The prevalence of DDH has been reported as varying from 0.8 to 1.6 per 1000 births in populations not screened in the neonatal period, but high rates have been determined up to 10 per 1000 among ethnic communities in which infants are traditionally cradled or clothed with their hips extended and adducted. In screened populations, rates of 2.5 to 20 per 1000 births have been reported and these rates can reach 40-90 per 1000 births in some countries (4). According to some local surveys, the prevalence in Turkey is 4-5 per 1000 (1).

Regarding the aetiology of DDH, Nelson and colleagues have reported the risk factors for DDH to include female sex; a familial history in which subsequent siblings of a child with DDH have a 6% risk of having DDH and children of a parent with DDH have a 12% risk; breech presentation; multiple gestation; first pregnancy; high birth weight; oligohydramnios; and postural and nonpostural abnormalities including clubfoot, congenital muscular torticollis, and cardiovascular and genitourinary system abnormalities (1-6).

The diagnosis of DDH is usually made by clinical examination. The Ortolani and Barlow manoeuvres were designed to detect a subluxated or dislocated hip during the neonatal period. In older children, limited abduction is a more reliable sign. The physical examination is variable depending on the type of dysplasia and the changes in the ongoing growth of the femur. Direct radiography is another method used to diagnose the disorder; however, the sensitivity and specificity of direct radiography in children younger than 4-6 months are controversial (1). USG has been shown to be a sensitive tool to confirm the diagnosis in newborns and infants from birth to 4 months of age. Hip USG was first used in 1980 by Graf, an Australian orthopaedist. He has detailed the characteristics of DDH in newborns (1-3).

This study sought to verify the diagnosis made by clinical examination and identify the sensitivity and specificity of the clinical examination compared with the USG examination in children born in the Başkent University Hospitals Network. We sought to recommend inclusion of USG examination as a routine means of confirming DDH diagnosis in our neonatal screening programme.

METHODS

This study was performed in 2000-2002 at the Başkent University Hospitals Network. During this period, results derived from infants younger than 6 months of age who were born or examined in the network were evaluated by an experienced paediatrician for hip stability using Barlow's and Ortolani's tests. Independently, an experienced orthopaedic surgeon (according to Graf's method) used USG to examine all neonate hips. In this way, 443 newborns were examined and evaluated clinically and ultrasonographically. Until the investigation was completed, there was no sharing of information between the paediatrician and the orthopaedic surgeon. Infants with pathological findings were followed, and, if needed, treated. These infants were examined clinically and sonographically every month until complete clinical improvement was established. To initiate treatment, Pavlik's stirrups were used in infants who showed no improvement or clinical worsening (7). When evaluating the clinical examination, the following physical findings were regarded as abnormal: asymmetry of skin creases, inequality of leg lengths, and positive values of the Ortolani-Barlow test, while USG findings of Type 2A and higher levels were considered pathological (7). An independent researcher recorded the clinical, sonographic, and follow-up findings and validity analyses were performed.

Statistical analyses were performed using SPSS software (Statistical Package for the Social Sciences, version 11.5, SSPS Inc, Chicago, Ill, USA). Correlations between DDH presence and birth type, sex, and family history were evaluated by the chi-square test, and the strength of the statistical significance was calculated using an odds ratio (OR).

To determine the validity of the clinical examination, sensitivity and specificity tests were used. The sensitivity test shows the validity of the selected method of screening and answers the question, "How many patients with this illness can be diagnosed by this method?" The specificity test shows the number of healthy people that may be diagnosed using this new method. A positive estimated value indicates the number of people who are really patients, and a negative estimated value indicates the number of people who are healthy according to the selected method and test of reference (8,9).

RESULTS

Of all the children, 55.8% were female and 44.2% were male; 40% of the births were vaginal, 53.2% were caesarean, 0.9% were by vacuum, and 0.2% were by forceps.

Table 1: Sex and family histories according to records of hip ultrasonographies, Başkent University Hospital, 2002.

	Ultrasonography			
	Pathologic		**Normal**	
Sex	**Number**	**%***	**Number**	**%***
Male	23	11.7	173	88.3
Female	68	27.5	179	72.5
	P <0.05		**OR: 2.86 (CI: 1.66-4.96)**	
Family History of DDH				
Present	7	38.9	11	61.1
Absent	84	19.8	341	80.2
	P >0.05		OR: 2.58 (CI:0.87-7.47)	

%: Row percentage, OR: Odds Ratio, CI: 95, %*: Row Percentage - OR:Odds Ratio - CI: Confidence Interval

Table 2: The results of the physical examination and ultrasonographies, Başkent University Hospital, 2002.

	Ultrasonography							
	Pathologic			**Normal**			**Total**	
Physical Examination	**Number**	**%***	**%****	**Number**	**%***	**%****	**Number**	**%****
Pathologic	35	39.8	38.5	53	60.2	15.1	88	19.9
Normal	56	15.8	61.5	299	84.2	84.9	355	80.1
Total	91	20.5	100.0	352	79.5	100.0	443	100.0

%*: Row Percentage, %**: Column Percentage

Our results showed that no significant relationship existed between DDH and birth type ($P > 0.05$). No swaddling cloth was used for the selected infants. Of the infants studied and of the infants diagnosed with DDH, 4.1% and 8.8% respectively had a family history. No statistical significance was found between familial history and determined DDH ($P > 0.05$).

During this study, more female than male infants had DDH, and this finding was significant ($P < 0.05$). In addition, the risk of DDH presence was 2.86 times higher for female than for male infants.

When we compared the results of the clinical examination with hip USG as a gold standard test, the sensitivity, specificity, (+) and (-) predictive values of clinical examination were 38.5%, 84.9%, 39.8%, and 84.2%, respectively (Table 2). The likelihood ratio of the clinical examination was calculated as 2.55 (1.77-3.64 95% CI).

DISCUSSION

Developmental dysplasia of the hip (DDH) is a significant health problem, the treatment of which is easy and requires a short time and no surgery when diagnosed early. Detecting well-known risk factors and conducting well-established screening programmes in the community are crucial in taking corrective actions to prevent a prevalence of DDH.

In this study, the DDH risk for female infants was found to be 2.86 times higher than that for males by means of ultrasonography. This risk is expected to be 1.3-8.2 times higher for female infants (6,10). As expected, our study showed a tendency toward DDH in females. It is well known that caesarean births and presentation anomalies at the time of delivery are risk factors for DDH (10). However, no significant relationship was found between birth type and DDH presence in this study.

It is also well known that using swaddling clothes increases the risk of DDH. During this study, no infant using a swaddling cloth was examined, and so no comparison was possible.

Analysis of the validity of a clinical examination versus a USG examination showed the sensitivity and positive predictive values to be low. The sensitivity of clinical examination (Ortolani-Barlow test) also has been found to be low in another study by Baronciani and colleagues (6).

DDH is a common and important paediatric health problem in Turkey (1). A clinical examination including asymmetry of folds, inequality of leg lengths, and positive values on the Ortolani-Barlow test has been used since the 1950s (3). Clinical examination is an important means of diagnosing DDH and is part of the routine clinical evaluation of the neonate in the world. The Barlow manoeuvre is used to determine if a hip is dislocated, while the Ortolani manoeuvre is used to reduce a dislocated hip. Clinical examination of newborn hips for stability requires a high level of skill and experience, regardless of the examiner's subspecialty. However, even in the hands of a skilled examiner, its sensitivity is limited (11-13). Furthermore, performance of USG of the infant hip is also highly dependent on the skill and experience of the examiner, but the sensitivity of USG examination of infant hips to detect DDH is quite high, well over 95% (14). Hip USG of a newborn was first used by Graf. During the newborn period, the head and neck of the femur are in a cartilaginous form, and, for this reason, evaluation of the hip joints by radiography is difficult. On the other hand, the structure of the hip joints (especially the cartilage) may be easily determined using USG. Because of these advantages of scanning and because there are no radioactive effects, USG for hip examination in newborns has been rapidly accepted. Graf's method is a proven USG method, and it is the most accurate and easiest means of determining hip morphology (14). Although there are three main ultrasonographic methods (Graf's method, dynamic method, and femoral head coverage percentage) for assessing hips (15), Graf's method is the most commonly used for newborns. Today, in Austria, hip USG is included as part of the routine screening programme for all neonates. Diagnosis of infants, especially those younger than 6 months, has been made by USG since the 1980s (5,13). Having no radioactive effects is one advantage of this method (1). On the other hand, the requirement of an expert is a disadvantage. Still, USG is used routinely in many countries today. According to a study performed by Konus et al. (16), all three ultrasonographic methods are recommended to diagnose hip dysplasia.

In the literature, combining the 2 methods (clinical and USG examination) has been recommended to reduce failure rates. A clinical examination should be performed at every routine assessment of a neonate. If the family history is positive for DDH or an abnormal clinical outcome is seen, then the USG investigation should no longer be regarded as a screening method but should be seen as an investigative and confirmatory instrument to clarify the diagnosis.

Ideal screening techniques consist of simple but reliable tests proving high levels of sensitivity and specificity and providing cost-effective results capable of indicating a clear course of action. Since these criteria are not fulfilled in cases of DDH, the term screening has been criticized, and surveillance has been suggested as a more appropriate alternative. Based on our data and relevant literature, and taking into consideration all the possible conditions related to DDH, we conclude that, along with the clinical examination to detect DDH, USG screening should be added to our neonate screening programme. In addition, if needed, a dynamic investigation must be included. USG, as a test of reference for the diagnosis, should be used to examine suspected newborns and at-risk infants. Its cost-effectiveness and ease of use make USG a valuable screening tool.

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