



## Developmental Hip Dysplasia Screening Results in a Children Hospital in Konya: A Large Cohort Study

Konya'da Bir Çocuk Hastanesinde Gelişimsel Kalça Displazisi Taraması Sonuçları: Geniş Bir Kohort Çalışması

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### ABSTRACT

**Aim:** Developmental hip dysplasia (DHD) is the most common congenital hip pathology in babies. The aim of this study is to evaluate the incidence of DHD in Konya region using the ultrasonography(USG) and to emphasize the importance of early detection of DHD.

**Material and Method:** The study was a retrospective study which was designed between June 2016 and March 2022 in Konya region. Hip ultrasonography was used for detection of DHD according to Graf method. Babies who were referred to the pediatric outpatient clinic of our hospital by their family physicians for hip ultrasonography or who applied to the outpatient clinic for any reason and were asked to have hip USG to screen for DHD were included in the study.

**Results:** A total of 2074 infants who met the inclusion criteria were included in the study. The mean duration of the first hip USG was 8.4 (4-18) weeks. In 1946 infants, the hip USG result was found to be bilateral type 1. We found the incidence of DHD to be 1.35% in our series.

**Conclusion:** In our study, the incidence in our series was similar to other studies in which ultrasonography technique was used. In addition, the incidence of 1.35% we found is the same with the study conducted in Konya in 1992 and shows that the incidence for Konya has not changed in the last 20 years. Prospective multicenter studies should be organized to obtain a clearer picture of the incidence of DHD at the national level.

**Keywords:** Developmental hip dysplasia, ultrasonography, baby, incidence

### ÖZ

**Amaç:** Gelişimsel kalça displazisi (GKD) bebeklerde en sık görülen konjenital kalça patolojisi olup, kalça usg ile erken saptanabilir ve geç saptanmasıyla ortaya çıkabilecek komplikasyonlar önlenebilir. Hastalığın görülme sıklığı genetik, tarama teknikleri ve kültürler arası farklılıklara bağlı olarak değişmektedir. Çalışmanın amacı, Konya bölgesinde ultrasonografi kullanılarak GKD insidansını değerlendirmek ve GKD'nin erken teşhisinin önemini vurgulamaktır.

**Gereç ve Yöntem:** Çalışma, Haziran 2016 ile Mart 2022 tarihleri arasında Konya bölgesinde tasarlanmış retrospektif bir çalışmadır. GKD'nin tespiti için Graf yöntemine göre kalça ultrasonografisi kullanıldı. Çalışmaya hastanemiz çocuk polikliniğine aile hekimleri tarafından kalça ultrasonografisi (USG) için yönlendirilen veya herhangi bir nedenle polikliniğe başvuran ve GKD taraması için kalça USG çekilen bebekler dahil edildi.

**Bulgular:** Çalışmaya dahil edilme kriterlerini karşılayan toplam 2074 bebek değerlendirildi. Bunların 1036'sı erkek, 1038'i kız bebektir. Bebeklerimizin ortalama ilk kalça USG zamanı 8,4 (4-18) hafta idi. 1946 bebekte ilk kalça ultrasonu sonucu normaldi ve 27 bebekte bilateral tip 2a vardı. Serimizde DHD insidansını %1.35 olarak bulduk.

**Sonuç:** Çalışmamızda serimizdeki insidans ultrasonografi tekniğinin kullanıldığı diğer çalışmalarla benzerdi. Ayrıca bulduğumuz %1.39'luk insidans 1992 yılında Konya'da yapılan çalışma ile aynıdır ve Konya için insidansın son 20 yılda değişmediğini göstermektedir. Ülke düzeyinde DHD insidansını daha net bir şekilde elde etmek için prospektif çok merkezli çalışmalar düzenlenmelidir.

**Anahtar Kelimeler:** Gelişimsel kalça displazisi, ultrasonografi, bebek, insidans

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## INTRODUCTION

Developmental hip dysplasia (DHD) is the most common congenital hip pathology. In 1988, instead of the term "Congenital Hip Dislocation", the term "Developmental Hip Dysplasia" began to be used all over the world (1). Although the exact incidence in the world is not known, it is estimated to be between 1 and 34 per thousand (2,3). While the incidence of physiological immature hips in newborns in Europe is between 3 and 13%, actual dysplasia rates have been reported to be between 1 and 3% (4,5). The reasons for the different reported incidences are genetic predisposition to DHD, differences in screening techniques, and cross-cultural differences in baby-raising habits (6-9). Differences between studies conducted at different times and in different regions in our country (0.047-17%) also support this conclusion (9-22).

The initial pathology is abnormal laxity in the hip joint, causing the femoral head to displace and displace from the acetabulum. Dislocation or permanent subluxation of the femoral head causes permanent degeneration in the acetabulum over time (23). DHD cases that cannot be detected and treated early face serious hip problems in the following years. It has been reported that 9% of patients who underwent hip replacement surgery in Norway had DHD sequelae (24). While DHD can be treated successfully with conservative methods without sequelae when detected at an early stage, surgical interventions become mandatory in late cases and also treatment costs increase (25,26). Genetic, hormonal, mechanical and developmental elements are shown in etiology. Foot deformities, congenital anomalies such as torticollis, female gender, breech presentation, multiple births, birth weighing over 4500 g and a positive family history are known risk factors for DHD (2,27,28). While many advanced stage DHD cases can be detected by physical examination, borderline cases may not be detected. In a study that is of particular importance because it was conducted in our country, it is recommended that all newborns should undergo ultrasonography in the first two weeks (16). The most common recommendation among radiodiagnostic specialists is to perform the procedure every 2-8 weeks. Ultrasonography examination should be performed more later weeks in premature babies. Since most of the upper end of the femur consists of cartilage in babies under three months of age, radiographic examinations may contain diagnostic findings but do not give definitive results. For this reason, hip ultrasonography has become a common diagnostic tool with higher sensitivity and specificity than physical examination and radiography in the diagnosis of DHD and it is the gold standard in screening (2,3,10-12,29). While in some countries such as Germany and Austria, all babies are screened for DHD with hip ultrasonography, in the USA and the UK, only babies with risk factors are screened.

Hip ultrasonography is not included in the routine screening program in our country. In the guide prepared by the Ministry of Health for family physicians, screening with ultrasonography is recommended for risk groups and cases with positive examination findings (30).

Hip ultrasonography was first described by Reinhard Graf in 1978 and this method is static ultrasonography. In the static method, the placement of the femoral head is evaluated by measuring the morphological structure and angular values of the acetabulum (31).

The aim of this study is to draw attention to the fact that hip ultrasonographic evaluation should be included in the routine for screening purposes in our country and to emphasize the importance of early detection of DHD.

## MATERIAL AND METHOD

Our study was a retrospective study which was performed between June 2016 and March 2022. Babies who were referred to the pediatric outpatient clinic of our hospital by their family physicians for hip ultrasonography (USG) or who applied to the outpatient clinic for any reason and were asked to have hip USG to screen for DHD were included in the study. Ultrasonography was requested for premature babies with a corrected week of at least 4 weeks. Since borderline cases may be missed by physical examination, hip USG is requested for screening purposes in all cases aged between 4 weeks and 4 months who apply to our outpatient clinic for any reason, if hip USG has not been requested yet. The data was accessed from the hospital database. All USG results were examined and recorded digitally. All USG examinations were performed with the method described by Graf, by taking standard sections in the coronal plane, with the baby lying in the lateral decubitus position, the hip and knee in semi-flexion, and the hip joint in 15-20°C internal rotation (**Figure 1**). Ultrasonography was performed using a 7.5 Mhz linear probe USG device (Mindray Digi Prince Dp-9900) by experienced radiology specialists in our hospital. Angular measurements are taken twice for each hip in the same session for confirmation purposes. The angular values noted in the USG reports by our radiologists and were classified using the method described by Graf (31) (**Table 1**). While the cases whose USG result was Type 1 at the first admission were considered normal, double spacer cloth was recommended for cases 2a and 2b, and the patient was called for a follow-up check after 4 weeks. The results of our patients who underwent control USG were also documented in the hospital database. At the second follow-up, the cases whose USG results were other than Type 1 were referred to orthopedics. The cases whose first USG results were Types 2c, 2d, 3 and 4 were referred to orthopedics without a control USG.



**Figure 1.** The ultrasonographic examination of a baby which was performed with the method described by Graf.

**Table 1: Ultrasonographic classification of developmental hip dysplasia based on the Graf Method.**

Type	Alpha angle (bone roof)	Beta angle/age (cartilage roof)	Definition
1	>60	<55	Normal hip
2a	50-60	55-75/<3 month	Physiologically immature hip
2b	50-60	55-77/>3 month	Stable centralized hip
2c	43-49	>77	Unstabil centralized hip
2d	43-49	>77	Decentralized hip
3	<43	>77	Excentric hip
4	Unmeasurable	-	Dislocated hip

### Statistical Analysis

The data were analyzed using SPSS (Statistical Package or Social Sciences) Program 15.0. Chi-square test was used to evaluate categorical variables (such as age, gender). A p value of <0.05 was taken for statistical significance. The results were expressed as numbers and percentages.

### RESULTS

Hip USG was performed on 2074 babies in our pediatric clinic between June 2016 and March 2022. Of these, 1036 were male babies and 1038 were female babies. The average time in our babies' for first hip USG was 8.4 (4-18) weeks.

The distribution of the initial hip USG results when classified according to the Graf method is shown in **Table 2**. The patients with type 1 initial USG results were considered normal, while the patients with type 2a and 2b results were recommended to use double spacer and were called for follow-up after one month. All other cases were referred to orthopedics after the first USG. 121 patients were called for control USG. Of these, 36 patients did not come for follow-up. The results of the patients who underwent USG for the second time are shown in **Table 3**. Dysplasia was detected and referred to orthopedics in a total of 28 cases who were found to have type 2a and 2b dysplasia that did not improve in the control USG performed one month after double spacer application and type 2c or more advanced dysplasia in the first USG. Of these 28 babies, 23 were girls and 5 were boys. 6 of 28 patients had bilateral dysplasia. Of the 85 patients who were offered double diapers and who came for follow-up, 64 had normal control USG. According to the first USG result, 7 patients were referred to orthopedics.

**Table 2: The results of initial hip ultrasonography of patients.**

Ultrasonography results	Number of patients
Bilateral type 1	1946
Bilateral type 2a	27
Bilateral type 3	1
Bilateral type 4	2
Left type 1 / right type 2a	33
Left type 2a / right type 1	59
Left type 2c / right type 2a	1
Left type 2b / right type 1	1
Left type 2b / right type 2c	2
Left type 2a / right type 2b	1
Left type 2c / right type 1	1

**Table 3: The results of second control of hip ultrasonography of patients.**

Ultrasonography results	Number of patients
Bilateral type 1	64
Bilateral type 2a	6
Left type 1 / right type 2a	5
Left type 2a / right type 1	10

### DISCUSSION

Developmental hip dysplasia, which is thought to develop before or after birth as a result of a dynamic process, is seen at a high rate in our country, especially in regions where swaddling is common. The disease affects around 15.000 newborns per year in our country. Some of the cases may resolve spontaneously, but lack of improvement leads to serious morbidity. For this reason, DHD is a process that must be recognized early and managed appropriately. Delays in diagnosis lead to longer treatment times, the need for more invasive interventions, and decreased treatment success rates.



This situation negatively affects not only the patient, but also his family and the country's economy. For this reason, especially the first 2-3 months of life are the golden period in the treatment of DHD (32).

In our study, the hip USG examination results performed with the Graf method of 2074 babies who were referred to the pediatric outpatient clinic of our hospital by their family physicians for hip ultrasonography (USG) between June 2016 and March 2022, or who applied to the polyclinic for any reason and asked for hip USG to screen for DHD, were evaluated. In our study dysplastic hips were detected in 28 (1.35%) babies, so, our result is compatible with dysplasia rates in Europe (4,5,32) There are many studies published on the incidence of DHD in our country, and in these reports, the incidence has been reported at very different levels such as 0.047-17% due to differences in the number of cases included and the method of case selection (9-23,33,34). In a review, the incidence of DHD detected only by clinical examination was found to be between 0.047 and 1%. [19] In the study conducted by Kutlu et al. in 1992, the frequency of DHD in the Konya region was reported as 1.34% (15). Karapınar et al. conducted a three-year study between 1993 and 1996, in which 15.000 newborns in the Izmir region were screened only by clinical examination without USG, and the incidence of DHD was reported as 0.5% (21). In another study of Karapınar et. al. with USG guidance in 2002, the incidence was reported as 5.2% (12). This difference in incidence between USG scan and physical examination indicates that many DHD cases can be missed with physical examination. Soyuncu et al. examined 447 cases in the Antalya region in 1999 and stated the incidence as 6.2% (20). In the study conducted by Karapınar et al. in Izmir region, where 327 babies were examined with hip joint USG, the incidence of DHD that required treatment was reported as 5.2% (12). On the other hand, Sahin et al. reported the results of the screening of 5798 babies in the Ankara region, and found the incidence as 0.17% in 2004 (35). In another study published by Köse et al. the incidence of DHD in the Eskişehir region was reported as 1.2% (22). Additionally, Doğruel et al. reported the incidence of DHD by ultrasonography screening and clinical examination, as 5.3% in 3541 babies in Ankara region (11). Also, in another study conducted in Ankara in 2009, type 2b hips were detected in three cases (1%) as a result of hip examination using the Graf method among 300 babies who applied to the well-child clinic (14). Can et al. reported the frequency of DHD as 0.3% in the hip USG examination performed in the first month of 258 babies in Istanbul in 2010 (10). However, Tosun et al. reported the frequency of dysplasia in the Elazığ region as 14.7% (36). In this study, only 310 patients who were referred to the orthopedic outpatient clinic were evaluated, and this may be one of the reasons for the high incidence. In the study of Duramaz et al. which was

conducted in Istanbul in 2014 and examined 1316 cases, the DHD rate was reported as 0.5% that was similar to the literature (9). Also, Çekiç et al. reported the incidence of DHD in the Western Mediterranean region as 1.34% (37). In the study conducted by Ceylan et al., dysplasia could be detected in seven (0.46%) of 1491 babies who underwent hip ultrasonography examination in Istanbul (38). However, Batu et al. reported the incidence of DHD by hip ultrasonography as 1.5% in the same region (33). It has been shown that even some of the cases with completely dislocated hips cannot be detected by physical examination alone (31). Sensitivity of physical examination alone has been reported at levels of 13% to 60% (11). In a study conducted by Dorn and Neumann on 8221 newborns, it was reported that 1.3% of patients with normal physical examination had pathological changes (type 2c, 2d and 3) on ultrasonography (39). Also, in another study, it was determined that only 40% of the patients with positive findings on ultrasonography had positive examination findings (16). For this reason, methods with better sensitivity should be used. Ultrasonography allows the evaluation of the femoral epiphysis and labral cartilage, which cannot be distinguished on direct radiography in babies younger than three months. Additionally, it is radiation-free and frequently repeatable (6). Control of the hip joint and recognition of possible DHD with hip ultrasonography, which is a non-invasive, safe and simple method in the early period, significantly increases the success of treatment (40). Although there is no clear data on timing, the general opinion is to perform hip ultrasonographic evaluation between 4-6 weeks (31). In some European countries, screening examination is performed in the first days following birth (4,5,32)

In the Graf method, control with ultrasonography is recommended on the 40th day (31). In our series, the mean time of ultrasonographic evaluation of DHD was 8.4 weeks.

The relationship between female gender and DHD has been shown in all studies (3,11,15,22,33,34). In the study of Köse et al. which was conducted on 975 babies, it was observed that girls were affected six times more than boys (22). Also, Doğruel et al. reported this rate as 3.6 times (11) Similarly, Kutlu et al. reported that female babies were three times more likely to be diagnosed with DHD than boys (15) In our study, 23 of 28 babies diagnosed with dysplasia were girls, and the number of girls was approximately 5 times more than boys. So, the difference between the male and female ratio was statistically significant ( $p < 0.05$ ). Additionally, only the right side was affected in 5 of 28 babies with hip dysplasia and the remaining 23 patients were either left unilateral or bilateral. It has been emphasized that the left hip being affected more frequently than the right, so it may be due to the intrauterine position (39). There



are other studies supporting that isolated right hip involvement is less common (40,41). In our study, 12 of the 28 cases who were diagnosed as DHD had bilateral involvement. Since our study was retrospective and limited recorded data, the relationship between risk factors, physical examination and DHD frequency could not be evaluated.

## CONCLUSION

As a result, in our study, ultrasonography results of all babies who applied for screening examination were discussed, instead of cases with suspicious clinical conditions or additional problems. In this respect, we think that the incidence obtained as a result of our study is close to reality. The fact that the 1.35% incidence that we found is the same as the study conducted in Konya in 1992 and it shows that the incidence for Konya has not changed in the past 20 years. Prospective multicenter studies should be organized to more clearly obtain the incidence of DHD at the country level..

## ETHICAL DECLARATIONS

**Ethics Committee Approval:** This study was approved by the ethics committee of Republic of Türkiye, Ministry of Health, Konya Provincial Health Directorate (No:E86737044-806,01,03).

**Informed Consent:** Because the study was designed retrospectively, no written informed consent form was obtained from patients.

**Referee Evaluation Process:** Externally peer-reviewed.

**Conflict of Interest Statement:** The authors have no conflicts of interest to declare.

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