ACTA ORTHOPAEDICA et TRAUMATOLOGICA TURCICA
www.aott.org.tr

Research Article

Management preferences of orthopedic surgeons in developmental dysplasia of the hip under 1 year of age in Türkiye: Results of a nationwide cross-sectional survey

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ARTICLE INFO

Article history:
Submitted April 12, 2023
Received in revised form
August 18, 2023
Accepted November 17, 2023
Publication Date December 22, 2023

Keywords:
Developmental Dysplasia of the Hip
Treatment
Diagnosis
Case Management

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ABSTRACT

Objective: This study aimed to evaluate the diagnosis and treatment preferences of orthopedic surgeons in developmental dysplasia of the hip (DDH) cases under the age of 1 in Türkiye with a higher incidence of DDH, estimated to be around 5-15 per 1000 live births.

Methods: This was a nationwide cross-sectional survey. A link for the online survey, including 16 multiple-choice questions, was sent to the email group of the National Orthopedic Society.

Results: Among 233 filled-out surveys, 211 met the inclusion criteria. Half of the participants had experience of <10 years as orthopedic surgeons, managed <25% of pediatric patients in daily practice, and treated <25 DDH cases per year before walking age. Ninety-seven percent used more than one method, hip ultrasound the most common, for exact diagnosis of DDH under 6 months. Pavlik harness was the most commonly preferred brace, but the use of Tübingen orthosis increased among experienced surgeons. The uppermost age limit for bracing was higher in surgeons dealing with more pediatric patients and treating more DDH cases. Dislocated hips and hips requiring closed/open reduction were more commonly referred to other surgeons by less experienced surgeons in terms of years, number of pediatric patients, and treated DDH cases per year. The lowest age limit for intervention under general anesthesia was lower in surgeons treating >25 DDH cases per year. Over one-third used both anterior and medial approach open reduction, but a trend to anterior open reduction alone was more evident in surgeons treating >50 DDH cases per year. More experienced surgeons were more prone to check the intraoperative reduction with postoperative computed tomography or magnetic resonance imaging. Diagnosis and treatment ages of DDH cases did not significantly change during the coronavirus disease 2019 pandemic.

Conclusion: Management preferences of orthopedic surgeons in DDH before walking age primarily depend on the rate of pediatric patients in daily practice and the number of treated DDH cases per year.

Introduction

Developmental dysplasia of the hip (DDH) is defined as a hip with a shallow acetabulum that can be combined with femoral head subluxation or dislocation.[1] The incidence per 1000 live births ranges from 0.06 in Africans in Africa to 76.1 in Native Americans, with significant variability between and within racial groups and geographic locations.[2] In studies conducted in Türkiye, the incidence of DDH is 0.5%-1.5%, and the prevalence is 0.59%.[3,4] On the other hand, if DDH is not treated or treated insufficiently, it can result in some devastating outcomes, such as early hip degeneration and the necessity of hip replacement surgery in the young population. Uluçay et al[5] reported that DDH was still the most common cause of coxarthrosis, with a rate of 37% of patients who had undergone total hip replacement.[5]

Even though it is a ubiquitous problem in children, available data regarding treatment options and duration are limited. Furthermore, surveillance studies show that there is no consensus regarding diagnosis and treatment options among orthopedic surgeons.[6-8] In addition to clinical examination, USG should be taken as essential in the screening, diagnosis, and follow-up of possible DDH in the first 6 months of life. Direct radiography should be preferred after this age. It is generally accepted that the first treatment option for DDH detected before 6 months of age is a Pavlik harness;[9] closed or open reduction can also be performed in the operating room, especially for children

Cite this article as: *Çetin BV, Bakırcıoğlu S, Çiftci S, et al. Management preferences of orthopaedic surgeons in developmental dysplasia of the hip (DDH) under 1 year of age in Türkiye: Results of a nationwide cross-sectional survey. Acta Orthop Traumatol Turc., 2023;57(6):322-328.*

DOI: 10.5152/j.aott.2023.23080

older than 6 months.[10] Besides, various treatment modalities, such as static abduction braces, early spica casting with closed reduction and others, are available in the current literature.[11]

This study aimed to evaluate the preferences of orthopedic surgeons in diagnosing and treating DDH before walking age in Türkiye with a higher incidence of DDH. To reveal its consistency with other survey studies in the literature and identify areas that can be improved on a national basis regarding the diagnosis and treatment of DDH. We hypothesize that this paper would be a starting point for future studies and/or guidelines in Türkiye.

Materials and methods

A survey was distributed to 2000 Turkish Orthopaedic and Traumatology Associations Society (TOTBID) members. This group comprises of staff orthopedic surgeons, residents, and nonphysician technical team members. However, only staff orthopedic surgeons were asked to answer the survey, and the exact number of active staff orthopedic surgeon members is unknown. The Kocaeli University Non-invasive Clinical Research Ethics Committee approved the survey and study protocol (ID: KÜ GOKAEK-2022/10.32). An email with a link to the survey, hosted by https://docs.google.com/forms, was sent from TOTBID to their members. The society sent 3 reminder emails at 3-week intervals.

The purpose of the questionnaire (*supplementary material*), which included 16 multiple-choice questions, was to assess how orthopedic surgeons preferred to treat DDH in infants under 1 year of age. The survey included multiple-choice and open textbox questions. The first 3 questions of the survey questioned the participants' demographic information. Afterward, diagnostic, conservative treatment and closed/open reduction preferences, and DDH management during the coronavirus disease 2019 (COVID-19) pandemic were questioned. Investigated questions of the survey were the experience of the participants as staff orthopedic surgeons, the estimated percentage of patients aged between 0 and 16 years in their daily practice, and the estimated number of DDH cases under 1 year of age they treated in any way (brace, harness, and surgery) per year. Surgeons not treating DDH under one or examining patients under 16 years old were asked to refrain from conducting the survey. Survey results of the participants who are staff orthopedic surgeons and treat DDH patients and pediatric patients in their daily practice were included in the study. The survey results of the participants who do not see or treat DDH patients and/or pediatric patients were excluded from the study.

The questions focused on evaluating the diagnostic and treatment preferences in different scenarios, preferences on ultrasound use in DDH screening, experience with ultrasonography, timing decisions for closed reduction under anesthesia, and observations on effects of the COVID-19 pandemic on diagnosis and treatment ages of the patients. Then, the answers were analyzed whether experience by means of years, the intensity of pediatric patients examined in daily practice, and the frequency of treating DDH affect diagnostic and treatment preferences of orthopedic surgeons in DDH under the age of 1.

Statistical analysis

Data were analyzed using Statistical Package for the Social Sciences Statistics software, version 22.0 (IBM SPSS Corp.; Armonk, NY, USA). Categorical variables were compared using the Pearson chi-square test and Monte Carlo simulations with Fisher's exact test. Quantitative variables are expressed as mean ± standard deviation and minimum and maximum values. Qualitative variables are expressed as n (numbers), frequencies, or ratios. $P < .05$ were considered to indicate statistical significance.

Results

Among 233 filled-out surveys, 211 met the inclusion criteria. Half of the participants had experience of <10 years as orthopedic surgeons, managed <25% of pediatric patients in daily practice, and treated <25 DDH cases per year before the walking age. Results were given according to the subgroup of the question types (Table 1).

Clinical examination and diagnostic tools

Ninety-five percent of the patients used more than one method, hip ultrasound the most common, for exact diagnosis of DDH under 6 months. Experienced surgeons mostly use a diagnostic tool as a combined USG and clinical findings, while the younger surgeons were more prone to the USG and X-ray of the hip. When we examined the experience with the hip USG (Graf method), there was a statistically significant difference between young and experienced groups regarding the intensity of pediatric patients and years of experience as an orthopedic surgeon ($P = .009$ and .001, respectively). Less experienced younger surgeons were more dependent on USG reports, while experienced surgeons tended to do the USG themselves. More experienced surgeons were prone to check the intraoperative reduction with postoperative computed tomography (CT) or magnetic resonance imaging (MRI) ($P = .02$). The details of the distribution of rankings regarding the clinical examination and diagnostic tools are given in Table 2.

Management and treatment

Pavlik harness was the most commonly preferred brace overall, but the preference for Tübingen orthosis increased among experienced surgeons. In surgeons who handle more pediatric patients and DDH cases, the upper age limit for bracing may be as high as 9 months. Dislocated hips requiring closed/open reduction were more commonly referred to other surgeons by less experienced surgeons in

HIGHLIGHTS

- Surveillance studies show that there is no consensus regarding diagnosis and treatment of developmental dysplasia of the hip (DDH) among orthopedic surgeons.
- Turkish surgeons accept ultrasonography (USG) in diagnosing DDH, but it is not at the desired level in performing and interpreting USG by themselves.
- There is no consensus regarding abduction splints' use, duration, and weaning.
- High referral rates with increasing severity of DDH suggest that it may be related to the orthopedist's background in pediatric orthopedics and DDH.
- The relevant departments and associations should intensify on-the-job training.

Table 1. Distribution of the orthopedic surgeons as regards experience

	Experience		
Experience in years as an orthopedic surgeon	<10 years: 107 (51%)	10-20 years: 51 (24%)	>20 years: 53 (25%)
Percentage of 0-16 years. Patients in the daily practice	<25%: 96 (45%)	25%-50%: 63 (30%)	>50%: 52 (25%)
Number of treated DDH cases under 1 years of age (bracing and surgery) per year	<25: 116 (55%)	25-50: 50 (24%)	>50: 45 (21%)

DDH, developmental dysplasia of the hip.

Table 2. Diagnosis and imaging preferences according to subgroups

Question	Total	Experience in years as an orthopedic surgeon	% of 0-16 years patients in daily practice	Number of treated DDH cases per year
Your definitive diagnostic tool(s) in DDH under 6 months of age?	Hip USG+plain radiography (49%) Hip USG+clinical examination (45%)	<10 years: hip USG+plain radiography (54.2%) 10-20 years: hip USG+plain radiography (49.1%) >20 years: hip USG+clinical examination (49.6%)	<25%: hip USG+plain radiography (57.3%) 25-50%: hip USG+plain radiography (47.6%) >50%: hip USG+clinical examination (59.6%)	<25: hip USG+plain radiography (54.3%) 25-50: hip USG+clinical examination (52%) >50: hip USG+clinical examination (55.6%)
Your experience with the hip US (Graf method)?	I perform USG myself (29.7%) I evaluate USG images myself (32.1 %) I stick to the radiological USG report (31.1 %) *	<10 years: I stick to the radiological USG report (35.8%) 10-20 years: I stick to the radiological USG report (35.3 %) >20 years: I perform USG myself (46.2 %) *	<25%: I stick to the radiological USG report (42.1 %) 25-50%: I stick to the radiological USG report (35.5%) >50%: I perform USG myself (57.7 %) *	<25: I stick to the radiological USG report (37.4%) 25-50: I perform USG myself (44%) >50: I perform USG myself (36.4 %)
Your preferred intraoperative method to check the quality of closed reduction in DDH?	Clinical examination+fluoroscopy/x-ray (22%) Clinical examination+arthrography (25.8%) arthrography only (18.7%) *	<10 years: Clinical examination+Fluoroscopy/x-ray (17%) Clinical examination+arthrography (23.6%) Arthrography only (22.6%) 10-20 years: Clinical examination+fluoroscopy/x-ray (22%) Clinical examination+arthrography (26%) Arthrography only (22%) >20 years: Clinical examination+fluoroscopy/x-ray (32.1%) Clinical examination+arthrography (30.2%) Arthrography only (7.5%)	<25%: Clinical examination+fluoroscopy/x-ray (21.3%) Clinical examination+arthrography (20.2%) Arthrography only (10.6%) 25%-50%: Clinical examination+fluoroscopy/x-ray (28.6%) Clinical examination+arthrography (20.6%) Arthrography only (18.7%) >50%: Clinical examination+fluoroscopy/x-ray (15.4%) Clinical examination+arthrography (42.3%) Arthrography only (25%) *	<25: Clinical examination+fluoroscopy/x-ray (15.4%) Clinical examination+arthrography (42.3%) Arthrography only (25.0%) 25-50: Clinical examination+fluoroscopy/x-ray (28.6%) Clinical examination+arthrography (20.6 %) Arthrography only (25.4%) >50: Clinical examination+fluoroscopy/x-ray (15.4%) Clinical examination+arthrography (42.3%) Arthrography only (25%)
You order CT/MRI after closed/open reduction in DDH?	Consistently (14.3%) Frequently (8.6%) Rarely (31.9%) Never (29%) I do not perform closed/open reduction (16.2%) *	<10 years: Consistently (15.1%) Frequently (9.4%) Rarely (34%) Never (19.8%) I do not perform closed/open reduction (21.7%) 10-20 years: Consistently (13.7%) Frequently (9.8%) Rarely (25.5%) Never (35.3%) I do not perform closed/open reduction (15.7%) >20 years: Consistently (13.2%) Frequently (5.7%) Rarely (34%) Never (41.5%) I do not perform closed/open reduction (5.7%)	<25%: Consistently (13.7%) Frequently (4.2%) Rarely (24.2%) Never (31.6%) I do not perform closed/open reduction (26.3%) 25-50%: Consistently (12.7%) Frequently (11.1%) Rarely (39.7%) Never (25.4%) I do not perform closed/open reduction (11.1%) >50%: Consistently (17.3%) Frequently (13.5%) Rarely (36.5%) Never (28.8%) I do not perform closed/open reduction (3.8%) *	<25: Consistently (12.2%) Frequently (5.2%) Rarely (27.8%) Never (30.4%) I do not perform closed/open reduction (24.3%) 25-50: Consistently (24%) Frequently (12%) Rarely (36%) Never (22%) I do not perform closed/open reduction (6%) >50: Consistently (8.9%) Frequently (13.3%) Rarely (37.8%) Never (33.3%) I do not perform closed/open reduction (6.7%) *

CT, computed tomography; DDH, developmental hip dysplasia; MRI, magnetic resonance imaging.
*Indicates statistically significant differences.

terms of years, the intensity of pediatric patients, and treated DDH cases per year. The lowest age limit for intervention under general anesthesia (UGA) was lower in surgeons treating >25 DDH cases per year than in subgroups (P=.03). Over one-third of the surgeons used both anterior and medial approach open reduction. However, a trend to anterior open reduction alone was more evident in surgeons treating >50 DDH cases per year (P < .001). There was no statistically significant difference regarding the definitive diagnostic tools, abduction brace choice, ending protocol, and initial treatment in dysplastic and stable hips between 3 and 6 months regarding experience, percentage of daily practice, or the number of treated DDH cases. Diagnosis and treatment ages of DDH cases did not significantly change during the COVID-19 pandemic. The details of the distribution of rankings regarding management and treatment modalities are given in Tables 3 and 4.

Discussion

Early diagnosis and treatment of DDH are essential to achieve the best functional outcomes. However, there has yet to be an international consensus in the literature regarding the management of the disease.[6-9] In addition, prepared guidelines for this problem are far from presenting the sufficient level of evidence.[1,12] Furthermore, there were only a few survey studies in which the diagnosis, treatment, and follow-up algorithm had been evaluated before. Therefore, in this study, we aimed to reveal the diagnosis and treatment approaches of Turkish orthopedic surgeons in managing DDH patients before walking age and whether the preferences were consistent with the studies in the literature. In this respect, it is the first survey study conducted in Türkiye on this subject.

Table 3. Treatment preferences according to subgroups [most frequent answer(s)]

Question	Total	Experience in years as an orthopedic surgeon	% of 0-16 years. Patients in daily practice	Number of treated DDH cases per year
Your first-choice abduction brace in DDH?	Pavlik harness (63.8%) Tubingen splint (13.3%) Pavlik harness+Tubingen splint (12.9%) *	<10 years: Pavlik harness (71.7%) Pavlik harness+Tubingen splint (22%) 10-20 years: Pavlik harness (52%) Pavlik harness+Tubingen splint (12.9%) >20 years: Pavlik harness (63.5%) Tubingen splint (23.1%) *	<25%: Pavlik harness (73%) 25%-50%: Pavlik harness (62.9%) Pavlik harness+Tubingen splint (19.4%) >50%: Pavlik harness (45.1%) Tubingen splint (35.3%) *	<25: Pavlik harness (73%) 25-50: Pavlik harness (62.9%) Pavlik harness+Tubingen splint >50: Pavlik harness (45.1%) Tubingen splint (35.3%)
Your uppermost age limit for abduction brace treatment in DDH?	3-6 months (48.3%) 7-9 months (26.1%) 10-12 months (11.4%) *	<10 years: 3-6 months (54.2%) 10-20 years: 3-6 months (47.1%) 7-9 months (29.4%) >20 years: 7-9 months (41.5%)	<25%: 3-6 months (53.1%) 25%-50%: 3-6 months (49.2%) 7-9 months (25.4%) >50%: 7-9 months (44.2%) 3-6 months (38.5%) *	<25: 3-6 months (56.9%) 25-50: 3-6 months (40%) 7-9 months (29.4%) >50: 7-9 months (40%) 3-6 months (35.6%) *
Your abduction brace ending protocol in DDH?	Immediate ending (22.4%) Gradual ending (74.3%)	<10 years: Immediate ending (21.7%) Gradual ending (75.1%) 10-20 years: Immediate ending (22%) Gradual ending (72%) >20 years: Immediate ending (24.5%) Gradual ending (75.5%)	<25%: Immediate ending (18.9%) Gradual ending (78.9%) 25-50%: Immediate ending (21%) Gradual ending (74.2%) >50%: Immediate ending (30.8%) Gradual ending (67.3%)	<25: Immediate ending (17.5%) Gradual ending (77.2%) 25-50: Immediate ending (32%) Gradual ending (68%) >50: Immediate ending (24.4%) Gradual ending (75.6%)
Your initial treatment preference in dysplastic and stable hips between 3 and 6 months of age in DDH?	Immediate treatment (82.5%) Observation (7.1%) Referral to another center (5.7%)	<10 years: Immediate treatment (79.4%) Observation (8.4%) Referral to another center (7.5%) 10-20 years: Immediate treatment (84.3%) Observation (3.9%) Referral to another center (7.8%) >20 years: Immediate treatment (86.8%) Observation (7.5%) Referral to another center (0%)	<25%: Immediate treatment (79.2%) Observation (7.3%) Referral to another center (7.3%) 25-50%: Immediate treatment (79.4%) Observation (9.5%) Referral to another center (6.3%) >50%: Immediate treatment (92.3%) Observation (3.8%) Referral to another center (1.9%)	<25: Immediate treatment (75.9%) Observation (6.7%) Referral to another center (10.3%) 25-50: Immediate treatment (90%) Observation (8%) Referral to another center (2%) >50: Immediate treatment (91.6%) Observation (6.7%) Referral to another center (0%)
Your initial treatment preference in dislocated hips under 6 months of age in DDH	Orthosis (60.7%) Closed/open reduction (25.1%) Referral to another center (12.8%) *	<10 years: Orthosis (58.7%) Closed/open reduction (22.4%) Referral to another center (16.8%) 10-20 years: Orthosis (52.9%) Closed/open reduction (31.4%) Referral to another center (15.7%) >20 years: Orthosis (71.7%) Closed/open reduction (24.5%) Referral to another center (1.9%)	<25%: Orthosis (49%) Closed/open reduction (28.1%) Referral to another center (20.8%) 25-50%: Orthosis (60.3%) Closed/open reduction (28.6%) Referral to another center (9.5) >50%: Orthosis (82.4%) Closed/open reduction (15.7%) Referral to another center (1.9%)	<25: Orthosis (49.1%) Closed/open reduction (28.4%) Referral to another center (20.7%) 25-50: Orthosis (80%) Closed/open reduction (18%) Referral to another center (2%) >50: Orthosis (68.9%) Closed/open reduction (24.4%) Referral to another center (4.4%) *
Your lowest age limit for a procedure under general anesthesia in DDH?	3-6 months (42.9%) 7-9 months (30%) Did not perform (19.5%) *	<10 years: 3-6 months (42.5%) 7-9 months (31.1%) Do not perform (21.7%) 10-20 years: 3-6 months (49%) 7-9 months (25.5%) Do not perform (19.6%) >20 years: 3-6 months (37.7%) 7-9 months (32.1%)	<25%: 3-6 months (32.6%) 7-9 months (32.6%) Do not perform (25.3%) 25%-50%: 3-6 months (46%) 7-9 months (33.3%) Do not perform (15.9%) >50%: 3-6 months (57.7%) 7-9 months (21.2%)	<25: 3-6 months (32.2%) 7-9 months (33.0%) Do not perform (26.1%) 25-50: 3-6 months (52%) 7-9 months (34%) Do not perform (10%) >50: 3-6 months (60%) 7-9 months (17.8%) *
Your preferred open reduction approach in primary cases in DDH?	Anterior (21.4%) Medial (21%) Depends on the case (38.1%) I do not perform open reduction (19.5%) *	<10 years: Anterior (23.6%) Medial (17.9%) Depends on the case (33%) I do not perform open reduction (25.5%) 10-20 years: Anterior (19.6%) Medial (19.6%) Depends on the case (33%) I do not perform open reduction (25.5%) >20 years: Anterior (18.9%) Medial (28.3%) Depends on the case (47.2%) I do not perform open reduction (5.7%)	<25%: Anterior (16.8%) Medial (24.2%) Depends on the case (28.4%) I do not perform open reduction (30.5%) 25%-50%: Anterior (23.8%) Medial (17.5%) Depends on the case (42.9%) I do not perform open reduction (15.9%) >50%: Anterior (26.9%) Medial (19.2%) Depends on the case (50%) I do not perform open reduction (3.8%) *	<25: Anterior (20%) Medial (22.6%) Depends on the case (27%) I do not perform open reduction (30.4%) 25-50: Anterior (10%) Medial (24%) Depends on the case (60%) I do not perform open reduction (6%) >50: Anterior (37.8%) Medial (13.3%) Depends on the case (42.2%) I do not perform open reduction (6.7%) *

DDH, developmental hip dysplasia.
*Indicates statistically significant differences.

Table 4. Change in the management during coronavirus disease 2019 pandemic according to subgroups (most frequent answer(s)):

Question	Total	Experience in years as an orthopedic surgeon	% of 0-16 years. Patients in daily practice	Number of treated DDH cases per year
Any change in the initial diagnosis and treatment ages of your DDH cases during COVID-19 pandemic?	Yes (Age at the initial diagnosis and treatment was increased) (25.7%) No (Age at the initial diagnosis and treatment remained stable) (41.9%) *	<10 years: Yes (age at the initial diagnosis and treatment was increased) (23.6%) No (age at the initial diagnosis and treatment remained stable (37.7%) 10-20 years: Yes (age at the initial diagnosis and treatment was increased) (29.4%) No (Age at the initial diagnosis and treatment remained stable (51%) >20 years: Yes (age at the initial diagnosis and treatment was increased) (26.4%) No (age at the initial diagnosis and treatment remained stable (41.5%)	<25%: Yes (age at the initial diagnosis and treatment was increased) (14.7%) No (age at the initial diagnosis and treatment remained stable (36.8%) 25%-50%: Yes (age at the initial diagnosis and treatment was increased) (33.3%) No (age at the initial diagnosis and treatment remained stable (42.9%) >50%: Yes (age at the initial diagnosis and treatment was increased) (36.5%) No (age at the initial diagnosis and treatment remained stable (50%) *	<25: Yes (age at the initial diagnosis and treatment was increased) (14.8%) No (age at the initial diagnosis and treatment remained stable (37.4%) 25-50: Yes (age at the initial diagnosis and treatment was increased) (42%) No (age at the initial diagnosis and treatment remained stable (46%) >50: Yes (age at the initial diagnosis and treatment was increased) (35.6%) No (age at the initial diagnosis and treatment remained stable (48.9%) *
Any change in the number of your treated DDH cases during COVID-19 pandemic?	No change (20.1%) Decreased (38.8%) *	<10 years: No change (34.9%) Decreased (19.8%) 10-20 years: No change (41.2%) Decreased (23.5%) >20 years: No change (17.3%) Decreased (44.2%)	<25%: No change (33.7%) Decreased (18.9%) 25-50%: No change (34.9%) Decreased (19%) >50%: No change (52.9%) Decreased (23.5%)	<25: No change (30.4%) Decreased (17.4%) 25-50: No change (46.9%) Decreased (22.4%) >50: No change (51.1%) Decreased (24.4%) *

DDH, developmental hip dysplasia.
*Indicates statistically significant differences.

Regarding the diagnostic approach, in the first 4-6 months of life, in addition to physical examination, USG is the primary method in diagnosing of DDH. Regardless of variables such as professional experience, the intensity of pediatric patients, and the number of DDH patients they treated yearly, 97% of the respondents decided to diagnose DDH with more than one method in the first 6 months. Hip USG was included in almost all participants' diagnosis processes. Only 2% of all do not use USG in diagnostic tools. Likewise, most Pediatric Orthopaedic Society Of North America (POSNA) (89%) and European Paediatric Orthopaedic Society (EPOS) (93%) members use USG in their diagnostic tools to diagnose DDH in the first 6 months.[7]

In our survey, 93% of the participants knew and preferred the Graf classification to determine the treatment for DDH. In addition, most surgeons in both POSNA (75%) and EPOS (86%) used the Graf classification.[7]

Less than 1/3 of Turkish surgeons do the hip USG themselves. The radiologist is commonly involved in interpreting the USG, and the decision is made based on of the reports. POSNA and EPOS members perform USG independently at 14% and 47%, respectively. In all, 70% of POSNA members and only 44% of EPOS members noted that a radiologist was also involved in ultrasound interpretation.[7]

These results show us that Turkish surgeons accept USG in diagnosing DDH, but it is not at the desired level in performing and interpreting of USG by themselves. One reason for that is most orthopedic clinics do not have their own USG. Since hip USG is interpreted in radiology, the surgeon removed it from the job description in thought. Another reason is the lack of adequate training in the usage and interpretation of USG. The relevant departments and associations should intensify on-the-job training.

The first step in the conservative treatment of DDH is the use of an abduction orthosis.[9]

As in the literature, the Pavlik harness (64%) is the most preferred orthosis in this study. Alternatively, Tubingen orthosis is 13.3% between all used splints. The use of Tubingen orthoses and upper age limit for abduction device preference significantly increased as the professional experience, daily pediatric patient rate, and intensity of treated DDH patients increased. Regardless of the aforementioned parameters, 3 quarters of all orthopedists discontinued orthotic treatment gradually.

Although specific devices are prominent in some centers, the Pavlik harness is accepted as the initial treatment by the vast majority of surgeons.[13] In a comprehensive survey conducted by Alves et al,[7] the preference for rigid abduction orthosis is around 20% as an alternative. The most frequent treatment duration for both the EPOS and POSNA groups was 12 weeks, and the weaning of orthosis was gradual, as in our survey.

There is no consensus regarding abduction splints' use, duration, and weaning.[6,7] In Türkiye as well as in the rest of the world, due to the intensity of patients' and surgeons' workloads, the application and follow-up of devices cannot be carried out by doctors. Therefore, follow-up is usually ongoing with the support of a health-care professional.

As a result of incomplete examinations, follow-ups with rapid imaging methods, or only reports left to the nurse or technician of device controls, physicians are prone to prefer rigid orthoses, longer duration, and gradual weaning for treatment failure concerns.

In this survey, as the severity of hip dislocation (Graf type) increased, the rates of closed reduction UGA increased compared to the orthosis. Besides, referral rates were increased approximately 2.5 times in type III and IV hips compared to type IIb and IIc. The number of 0- to 1-year-old DDH patients treated per year was directly effective in referral preferences. Physicians, who treated DDH more frequently, undertook the treatment of more than 95% of patients.

High referral rates with increasing severity of DDH suggest that it may be related to the orthopedist's background in pediatric orthopedics and DDH. An important factor affecting the referral rate must be the lack of surgical experience in the center where the surgeon received orthopedic training. Another essential factor may be the need for long-term follow-up.

The earliest age for the reduction in under general anesthesia was generally stated as 3-6 months. This upper age limit is slightly higher for physicians who follow more DDH patients. However, approximately one-fourth of the interviewers, whose number of pediatric patients and DDH patients they treat annually is relatively low, do not perform the UGA procedure. In this group, the low reduction rates of UGA may be due to the lack of standardization in the literature and referral of DDH patients to regional centers due to possible anesthetic problems for children under the age of 1 in local hospitals.

Among the representatives of EPOS and POSNA, a wide range of responses were given for UGA reduction applications, similar to the difference we encountered in our cross-sectional study. In addition, the earliest ages for EPOS and POSNA members were 1-3 months and 3-6 months, respectively.[7]

Regarding surgical approach, more than one-third of surgeons use both medial and anterior approaches in open reduction. However, surgeons with higher DDH treatment experience were more prone to the anterior approach. In the Netherlands survey, 3-quarters of physicians prefer the anterolateral approach.[6] We think that the choice of anterior surgical approach is related to the education and habits of the orthopedist. In addition, one of the reasons why the anterior approach was preferred is that the medial approach is relatively more complex.

Responses were also variable in the evaluation of intraoperative and postoperative reduction quality. Therefore, there is no significant superiority between the methods used mostly in radiography and/or arthrography/CT–MRI per international practices.[6,7]

Although there are publications about the approach to DDH patients during the COVID-19 pandemic,[14,15] we are yet to come across a study in which the number of patients and the surgery rate were questioned. In this respect, we present it as new data. When all participants were considered, the first diagnosis and treatment ages and the number of treated DDH patients between 0 and 1 years of age did not change. According to the participants who dealt with relatively more pediatric patients, the number of cases did not change. On the other hand, the age of diagnosis and treatment increased with the participants with more professional experience. It can be explained as follows; since the surgeons dealing with pediatric orthopedics are in specific centers, we can say that the number of patients does not decrease, but the treatment age of the patients has increased due to the limited hospital facilities because of the pandemic.

While there is a general agreement among Turkish orthopedists on issues such as the use of USG, Graf classification, and the preference for Pavlik harness in treatment, there are differences in risk factors, duration and weaning of treatment, and consequent treatments, as in this study, around the world.

Within the limitations of this study, first, although the questionnaire was sent to TOTBID members' mail group, we do not know the actual number of actively working orthopedic surgeons in the email group, so the response rate of the survey could not be determined. Second, we did not question risk factors. Universal USG scanning is performed in our country. In addition, risk factors vary from country to country,[13] and there are differences from region to region in our country. Third, it should also be considered that the answers given to the questionnaire may not be the same as the practical applications. There may be differences between what should be done and what is done. However, in previous studies, it was reported that the answers given in the questionnaire were compatible with daily practice.[16]

Diagnosis and treatment trends of orthopedists in DDH before walking age are mainly influenced by the number of pediatric patients seen daily and the number of DDH patients treated annually. The period of professional experience as an orthopedist is less effective than this. As Graf type and treatment modalities become more complicated, referral rates for treatment to other centers increase. There are many areas open to improvement in practice. In addition, the data obtained from such surveys can guide the associations' education programs.

Ethics Committee Approval: This study was approved by the Kocaeli University Noninvasive Clinical Research Ethics Committee (Approval No: KÜ GOKAEK-2022/10.31, Date: June 9, 2022).

Informed Consent: This study was not patient study. Questionairre was filled by orthopedic specialists who had accepted the terms and conditions.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – H.Ö., K.M., S.E.; Design – H.Ö., K.M., S.D., İ.Y.Ç., Y.T., S.E.; Supervision – H.Ö., T.Y.; Materials – H.Ö.; Data Collection and/or Processing – S.D., İ.Y.Ç., Y.T., S.E.; Analysis and/or Interpretation – H.Ş., K.M., T.Y., Y.T., M.S.S., S.B., B.V.Ç.; Literature Search – H.Ş., K.M., T.Y., Y.T., M.S.S., S.Ç., S.B., B.V.Ç.; Writing – H.Ö., H.Ş., M.S.S., S.Ç., S.B., B.V.Ç.; Critical Review – H.Ö., H.Ş., T.Y., M.S.S., S.B., B.V.Ç.

Acknowledgement: This is a "Hip Disorders and DDH Study Group of the Turkish Society of Children's Orthopaedics" study.

Declaration of Interests: The authors have no conflict of interest to declare.

Funding: The authors declared that this study has received no financial support.

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Supplementary Material (Questionnaire).

Diagnosis and Treatment Preferences of Orthopedic Surgeons in Developmental Dysplasia of Hip Under the Age of One: A Cross-Sectional Survey Study

1. How many years have you been an Orthopedics and Traumatology specialist?
   - Less than 5 years
   - 5-10 years
   - 11-15 years
   - 16-20 years
   - More than 20 years
2. Pediatric (0-16 age group) patients make up approximately what percentage of your daily clinical practices (total of emergency, polyclinic and surgery)?
   - Less than 25%
   - Between 25-50%
   - Between 51-75%
   - More than 75%
   - I don't see any 0-16 age group patients (if this option is checked, the survey will end)
3. How many DDH patients (conservative and surgical total) do you treat on average in a year in the 0-1 age group?
   - Less than 25
   - Between 25-50
   - Between 51-100
   - More than 100
   - I don't see any patients with DDH in the 0-1 age group (if this option is checked, the survey will end)
4. Which method(s) do you use as a definitive diagnostic tool for DDH in the first 6 months of life?
   - Clinical examination only
   - Radiography only
   - Hip ultrasonography only
   - Clinical examination+radiography
   - Clinical examination+hip ultrasonography
   - Radiography+hip ultrasonography
   - Clinical examination+radiography+hip ultrasonography
   - Other (please specify)
5. What is your experience in hip ultrasonography with Graf method?
   - I have detailed information about the graph method, I do the hip ultrasonography myself / it is done in our own clinic, I evaluate the image outputs and manage the process.
   - I do not do hip ultrasonography myself / it is not done in our clinic, but I have detailed information about the Graf method, I evaluate the image printouts and manage the process.
   - I do not do hip ultrasonography myself / it is not done in our clinic, but I have detailed information about the Graf method, I manage the process through the reports I receive.
   - I do not have detailed information about the graph method, I manage the process through the reports I receive.
   - I do not have detailed information about the graph method, I manage the process with other diagnostic methods.
   - I do not have detailed information about the graph method, I refer babies who come with ultrasonography results to another center/physician.
   - Other (please specify)
6. Which conservative treatment method do you prefer for a baby with DDH diagnosis?
   - Pavlik harness
   - Tubingen orthosis
   - Von Rosen orthosis
   - Frejka pillow
   - Graf-Mittelmeier orthosis
   - Surat orthosis
   - Double diapers
   - I don't have a clear priority preference
   - I refer these babies to another center/physician
   - Other methods (Please specify)
7. At what age do you apply DDH conservative treatment (orthosis) at the latest?
   - Less than 3 months
   - Between 3-6 months
   - Between 7-9 months
   - Between 10-12 months
   - Over 12 months
   - I refer these babies to another center/physician
8. How do you end the treatment in babies with DDH that you have successfully applied orthotic treatment?
   - When I find that the hip is normal after radiographic/ultraso nographic/clinical evaluations, I immediately terminate the treatment.
   - After determining that the hip is normal after radiographic/ul trasonographic/clinical evaluations, I gradually terminate the treatment within a certain period of time.
   - I do not apply orthotic treatment
   - Other (please specify)
9. How do you initially treat babies between 3 - 6 months who have unilateral or bilateral acetabular dysplasia radiographically (Tönnis stage 1 or 2) or ultrasonographically (Graf type IIb or IIc)?
   - I do not treat immediately, I recommend monitoring at regular intervals, I treat if necessary during follow-ups.
   - I treat immediately (double diapers)
   - I treat immediately (orthotics)
   - I treat immediately (closed/open reduction under general anesthesia)
   - I refer these babies to another center/physician
   - Other (please specify)
10. How do you initially treat babies younger than 6 months who have unilateral or bilateral dislocation radiographically (Tönnis stage 3 or 4) or ultrasonographically (Graf type III or IV)?
    - I do not treat immediately, I recommend monitoring at regular intervals, I treat if necessary during follow-ups.
    - I treat immediately (double diapers)
    - I treat immediately (orthotics)
    - I treat immediately (closed/open reduction under general anesthesia)
    - I refer these babies to another center/physician
    - Other (please specify)

11. If you are going to perform an intervention for DDH under general anesthesia, at what age do you apply it at the earliest?
    - I do not treat infants with DDH under general anesthesia.
    - Less than 3 months
    - Between 3-6 months
    - Between 7-9 months
    - Between 10-12 months
    - After 12 months
12. How do you control the quality of intraoperative reduction in babies who have had a closed reduction under general anesthesia?
    - With fluoroscopy / radiography
    - With arthrography
    - With clinical examination
    - With clinical examination+fluoroscopy/ radiography
    - With clinical examination+arthrography
    - I do not perform closed reduction under general anesthesia
    - Other (please specify)
13. With which approach do you perform open reduction under general anesthesia in babies with typical DDH who have not undergone surgical treatment before?
    - Anterior
    - Medial
    - It depends on the case, I use both
    - I do not perform open reduction under general anesthesia
    - Other (please specify)
14. Do you perform MRI/CT for control before discharge in the early period after closed/open reduction under general anesthesia?
    - I always want
    - I want often
    - Sometimes I want
    - I never want
    - I do not perform closed/open reduction under general anesthesia
15. After the start of the Covid 19 pandemic, has there been a change in the first diagnosis and treatment ages of your DDH patients under the age of 1 compared to the pre-pandemic age?
    - Yes, the age of first diagnosis and treatment has increased.
    - Yes, the age of first diagnosis and treatment has decreased.
    - No, it did not, the age of first diagnosis and treatment did not change.
    - No idea
    - I could not treat DDH patients under the age of 1 during the pandemic period.
    - Other (please specify)
16. After the start of the Covid 19 pandemic, has there been a change in the annual number of patients under the age of 1 that you treated for DDH compared to before the pandemic?
    - Yes, the number of patients under the age of 1 that I treated for DDH increased during the pandemic period.
    - Yes, the number of patients under the age of 1 that I treated with DDH decreased during the pandemic period.
    - No, it didn't, the number of patients under the age of 1 who had DDH treatment during the pandemic period did not change.
    - No idea
    - I could not treat DDH patients under the age of 1 during the pandemic period.
    - Other (please specify)