Original Article

Reliability of International Hip Dysplasia Institute Classification for the Developmental Dysplasia of the Hip Among Different Medical Personnel in Iraq

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Abstract

Background: The international hip dysplasia institute (IHDI) classification is a new method for quantifying the severity of the developmental dysplasia of the hip (DDH). **Objectives:** This study aimed to compare the reliability of this classification between different medical personnel such as pediatricians, general practitioners, and family doctors in addition to orthopedic surgeons and radiologists. **Methods:** Hundred pelvic radiographic films (with 200 hips) were randomly selected from the files of children already diagnosed and treated as DDH cases. These films were analyzed by 12 independent observers of four different specialties: three orthopedic surgeons (Ortho Group), three radiologists (Radio Group), three pediatricians (Pediat Group), and three general practitioners (GP Group). **Results:** The average measures (Cronbach's alpha) for the intraclass correlation coefficient (ICC) for absolute agreement between all observers was 0.874 (with 95% confidence intervals between 0.780 and 0.925). This was considered as having a good level of reliability and agreement between all observers. The ICC for agreement between the observers of radio group showed the highest score (0.904) while that between those of GP Group had the lowest one (0.826). However, during the comparison between the mean score of each group with that of the other groups by the one-way ANOVA method, there was no statistically significant difference between all groups (*P* values were 0.563, 0.415, 0.399, and 0.291 respectively). **Conclusion:** The IHDI classification method for cases of DDH has a good level of reliability among different medical personnel regardless of their specialties.

Keywords: Classification, developmental dysplasia of hip, reliability

Introduction

Developmental dysplasia of the hip (DDH) is a common pediatric orthopedic disorder with an incidence of 1.5–2.5 per 1000 live births.[1] In early infancy, the physical examination cannot diagnose all cases of DDH; therefore, imaging either by ultrasound or radiography is important to settle the diagnosis.[2-4] In the first 3 months of life, ultrasound is superior to radiographs but later on become less accurate when the femoral epiphysis starts to ossify. Hence, in older infants (more than 3 months), the pelvic radiograph replaces the ultrasound in the diagnosis of DDH cases.[5-8]

There are different radiographic methods for the evaluation of DDH severity at the time of diagnosis. Tonnis method is the most useful one, but it depends on the presence of the proximal femoral ossification center and its relative position with the superolateral corner of the true acetabulum. Hence, delay in the appearance of this ossific nucleus may limit the application of this method for all cases.[9-11]

The international hip dysplasia institute (IHDI) group developed a new radiographic classification method to quantify the severity of the displacement of the femoral head. This new method uses the mid-point of the proximal femoral metaphysis as a reference landmark to determine the location of the femoral head in the hip.[12] Hence, ideally, it can be applied to children of all ages. During the literature review, there is an agreement about the reliability of this classification system; however, they

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were done in developed countries and the assessment was done by orthopedic surgeons and radiologists.

Aim of the study

This study aims to compare the reliability of this new classification between different medical personnel in Iraq, such as pediatricians, general practitioners, and family doctors in addition to orthopedic surgeons and radiologists.

Methods

The study was a diagnostic one. It studied previously developed diagnostic criteria adopted by the IHDI group for radiographic diagnosis and grading the severity of DDH cases in the pediatric age group. It included patients with unilateral or bilateral hip joint dysplasia of various severities who attended the Early Detection of Childhood Disability Center in Duhok city/Iraq from January 2015 to September 2018.

In total, 100 pelvic radiographic films were randomly selected from the files of children already diagnosed and treated as DDH cases in that center. They were selected by the author, who was a specialist orthopedic surgeon, and he excluded himself from the assessment method. The inclusion criteria were children aged from 3 to 18 months. The first radiographic film of each child, before starting the treatment protocol, was selected. Any identification information of the patients had been removed from all the radiographs. A serial number was given for each radiograph.

The radiographic films were analyzed by 12 independent observers (raters) who were blinded to the measurements of each other and the identity of the patients. The observers included were of four different specialties: three orthopedic surgeons (Ortho Group), three radiologists (Radio Group), three pediatricians (Pediat Group), and three general practitioners and family doctors (GP Group). The criteria of how to grade the hip displacement according to the IHDI method were explained for each observer because they were not familiar with this classification previously. The observers were asked to classify both hips of each radiograph (total 200 hips) and to write the results in a special table that had been prepared by the author for that. The agreement from all observers was taken to avoid putting any landmark on the radiographs (like putting dots or drawing lines) during the assessment. To facilitate this, a standardized transparent measurement tool was given to the observers to aid them. The observers did the analysis independently and they were blinded from the measurements and results of each other. The observers did the rating for all the selected radiographs and hips even if the femoral epiphysis ossified.

The data were collected and analyzed statistically using the Statistical Package for the Social Sciences software program (SPSS - Statistics, Version 17, SPSS Inc., Chicago, USA). The statistical analysis included the use of the intraclass correlation coefficient (ICC) with 95% confidence intervals to compute the interobserver reliability of this method because the number of raters (observers) were multiple (more than two) and the type of variables was of ordinal type. The two-way mixed-effects model was utilized because the study had a fully crossed design (all the observers coded all the hips in all the radiographs which had been included in this study) and the raters were not randomly selected. The absolute agreement characteristic type was used because it was important for this study that the scores provided by the raters to have similar values.[13] The average-measures (Cronbach's alpha) unit of ICC was chosen because it represents the mean of the values provided by all raters. This measurement is taken for checking the agreement between the observers of each group separately and then between all observers in overall.

For interpretation purposes, the levels of reliability suggested by Koo *et al*. (2016) were founded to be acceptable by the author (values <0.5 are indicative of poor reliability, values between 0.5 and 0.75 indicate moderate reliability, values between 0.75 and 0.9 indicate good reliability, and values >0.90 indicate excellent reliability).[14]

The one-way ANOVA method of analysis was done to compare the different groups of medical personnel. The mean of each group was calculated and then the overall (Grand) mean was obtained. The Between Group Variation and Within Group Variation were used to find the *F*-test value to know how much the groups were equal. The result of this test was considered to be statistically significant when the $P < 0.05$.

The study was approved by the Research Ethics Committee/ Scientific Research Division/Duhok General Directorate of Health/Kurdistan Region/Iraq, reference number (30072019-5).

Results

The total number of hips evaluated in this study was 200 from the 100 pelvic radiographs selected. The mean of the patients' age was 7.07 months (range 3–17 and a standard deviation of 3.352).

The average measure (Cronbach's alpha) for ICC for absolute agreement between all observers was 0.874 (with 95% confidence intervals between 0.780 and 0.925). This was considered as having a good level of reliability and agreement between all observers.

The ICC for agreement between the observers of radio group showed the highest score (0.904) while that between those of GP Group had the lowest one (0.826) [Table 1]. The Ortho Group and Radio Group had an excellent level of reliability, but the Pediat Group and GP group had a good one. However, during the comparison between the mean score of each group with that of the other groups by the one-way ANOVA method, there was no statistically significant difference between all groups (*P* values were 0.563, 0.415, 0.399, and 0.291, respectively) [Table 2].

Table 1: Separated groups intraclass correlation coefficient

Group	Observers included	Mean of grading	SD	Variance	Cronbach's alpha	95% CI
Ortho	Observer 1, 2, 3	1.682	0.623	0.389	0.903	0.877-0.924
Radio	Observer 4, 5, 6	1.682	0.648	0.420	0.904	0.878-0.925
Pediat	Observer 7, 8, 9	1.688	0.644	0.414	0.861	0.824-0.891
GP	Observer 10, 11, 12	1.731	0.593	0.351	0.826	0.780-0.864
Average	All	1.696	0.627	0.396	0.874	0.780-0.925

SD: Standard deviation, GP: General practitioners

Table 2: One-way ANOVA analysis for comparing between groups

Group	Mean square between groups	Mean square within groups	*F*-test	*P*
Ortho	0.258	0.286	0.904	0.563
Radio	0.357	0.340	1.050	0.415
Pediat	0.292	0.274	1.067	0.399
GP	0.283	0.237	1.196	0.291

GP: General practitioners

Discussion

In developing countries, like Iraq,[15] there may be a deficiency of efficient radiologists to perform a proper ultrasound of the hip in the first few weeks and months of baby's life. Hence, most of the medical personnel may depend on the ordinary radiograph for confirmation of the DDH which may delay the accurate diagnosis. In addition to that, with the absence of a screening program, the pediatricians, the general practitioners, and family doctors are the first line of contact with babies and if they diagnose a case, then they will refer the case to a specialist orthopedic surgeon for treatment. Hence, it is an important issue that this medical personnel has a reliable method for diagnosis and grading of DDH cases to depend on it when they deal with neonates and infants of the first few months of life when the femoral epiphysis was not yet ossified (usually) and a properly interpreted hip ultrasound is not available.

The IHDI classification was proved to be reliable in some developed countries and among pediatric orthopedic surgeons and radiologists.[12,16,17] The result of this study showed also a high level of agreement (0.874) with a good level of reliability among different Iraqi medical personnel. This result was comparable with that of previous studies which also showed an excellent or good level of reliability. Thus, the IHDI classification exhibited good international reliability in different countries. Hence, it is wise that this method of classification for DDH cases to be adopted universally and to be included in the textbooks and medical teaching. It is practically more applicable (than Tonnis) because it can be applied in all cases of DDH whether the femoral appear or not. The classification claimed by Ahmad *et al*. was of no significant value for this study because it concentrated mainly on the uni- and bi-laterality of the DDH.[18]

It is interesting to notice that although there were differences in the result of assessment for this classification method between the different groups of specialties that have been included in this study, being highest among radiologists, by comparison, these differences were statistically not significant. Hence, this IHDI classification can be used by different medical personnel regardless of their specialties. Thus, it is supposed to work even among general practitioner doctors in primary health centers in rural districts.

The limitations of this study were: first, the study included some medical personnel from the north of Iraq only; however, even if the study includes some observers from the other parts of this country, the author does not suspect to have many different results as the principle of application of this type of classification is easy and every medical personnel can apply it simply on the radiograph and do not require any special equipment's or experience. Thus, the geographical distribution of the medical personnel will not have any role in the application of this classification method. Second, during the literature review, there was no similar study from surrounding countries or other developing countries to compare the result of this study with them. Finally, this study didn't use other classification methods for DDH cases (like Tonnis classification) to compare it with the new IHDI method because the previous studies did this job,[12,16,17] so the author of this study did not find it necessary to repeat the same thing which had been done in the previous studies, as there were no controversies between the result of these studies regarding this point of view.

Conclusion

The IHDI classification method for cases of DDH has a good level of reliability among different medical personnel in Iraq regardless of their specialties.

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Conflicts of interest

There are no conflicts of interest.

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