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Frequency of Developmental Dysplasia of Hip Detected by Graf'S Ultrasonographic Method in Icteric Newborns: A Preliminary Study

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Abstract

Background: Limping is a debilitating problem that can be prevented by screening at risk newborns. Jaundice is a problem that brings approximately one fifth of newborns to hospital in early infancy. The aim of this study was to find out whether the newborns with physiologic jaundice are at an increased risk of developing developmental dislocation of hip and whether it is logical to screen these newborns with Graf's ultrasonographic method.

Methods: Throughout a year, 320 icteric newborns (640 hips) that referred to Nemazee Hospital Neonatal Emergency Room for checking their bilirubin were screened by Graf's ultrasonographic method for developmental dislocation of hip (DDH). Any newborn with other problems such as congenital anomalies were excluded form this study.

Results: Of the 640 hips, 21 newborns (3.28%) had a dysplastic hip (Class IIa) that needed follow up and 12 from them came back for follow up of hip ultrasongraphy, all of whom became normal (Class Ia) without treatment. Only 1 hip did have severe dysplasia (Class IIc) (.16%) that needed treatment at the time of discovery.

Conclusion: The rate of DDH seems not to increase in the newborns with physiologic jaundice. It seems not to be logical to screen newborns with physiologic jaundice with Graf's ultrasonographic method, if screening is not cost-effective.

Keywords: Developmental Dysplasia of Hip (DDH); Icter; Ultrsonography

Introduction

Developmental dysplasia of the hip (DDH) is a term used to describe an abnormal relationship between the femoral head and the acetabulum. This term is used to describe dislocation, subluxation, instability and all abnormalities that cause inadequate acetabular development.[1] Developmental Dislocation of Hip is an anomaly that affects 1-20 victims per 10000 people, while it is treatable if detected early in life.[2-6]

We find many persons in our society limping, and its origin goes back to their infancy, when the developmental anomaly of the hip joint was missed. This anomaly causes limping for life long and has grave results in the patient's social performance and can preclude the person from doing many activities. It is the physician's duty to prevent this disaster by programming a suitable method for screening the innocent infants, whose parents are not aware of the problem.

Hyperbillirubinemia is one of the most common causes of neonatal admission,[7-9] the incidence of which is defined as bilirubin levels exceeding 6 mg/dL [11 mol/L] that is exceeding the 95th percentile for infant's age in the population is near 19% in some studies.[7,10] Most of these newborns have physiological jaundice and treated mostly by phototherapy or discharged from hospital;[7] so these newborns that are about one fifth all newborns in the society are available

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for other screening programs such as hip ultrasonography when they are admitted to the hospital.[11]

Some methods are proposed for screening the infants,[12,13] the most famous of which is physical examination by Ortholani and Barlow method.[14] In the field of radiology, ultrasonography was proposed for the screening of newborn hip non-invasively. According to the literature, the most accepted method of hip ultrasonography is the Graf method. However, dynamic hip ultrasonography also exists that is not as useful, simple and effective as Graf method.[2]

According to some studies,[15-17] currently selective screening of those neonates with positive risk factors or those that have abnormal physical examination seems to be the cost-effective and practicable method for some countries. Considering cost effectiveness in our country, the screening of at risk newborns seems to be more desirable; the icteric newborns that constitute one fifth of all newborns are readily available in neonatal wards and emergency rooms but up to this time, predisposition of those to DDH is not studied. The goal of our study is to see whether the newborns with jaundice are at increased risk of DDH.

Materials and Methods

From May 2007 to May 2008, 320 newborns born in different places and referring to Nemzee Hospital Emergency Room in Shiraz for the hyperbilirubinemia level check and were clinically normal except for having jaundice were included in this study (irrespective of being treated with phototherapy on the ward or discharged). As our plan was to do hip ultrasonography bilaterally for every newborn, this study was done at Ulrasonographic Department of Nemazee Hospital. We used GE ultrasonographic equipment (GE logique 7) with linear 10 Mhtz probe.

Our colleagues in the pediatric ward examined the newborns with Ortholani and Barlow tests and the results of the physical examination were recorded and then the newborns were sent to the Ultrasonographic Ward for performing the hip ultrasonography.

Because the incidence of the DDH varies in the different seasons of the year,[18] the samples were gathered in all four seasons randomly in different days of the week. The ultrasonography of both hips were done by a radiologist (trained previously for performing hip ultrasonography by Graf's ultrsonographic method) who was blind to the result of Ortholoani and Barlow's tests previously conducted on the newborns. The results of hip ultrasonographies were recorded in the information form and then the results of physical exams were also added.

Because this study was a pilot study for the next future extensive survey, the sample volume was 320 newborn (640 hips) and the frequency of hip dislocation and dysplasia was calculated. The ages of newborns were under 1 month at the time of first ultrasonogaphy. If an abnormality (Class IIa) was noted at the ultrasonographic exam, then a follow up ultrasonography 1 month later was recommended to the newborn parents to rule out any false positive result.[18] Unfortunately, some parents did not refer for follow up (despite exact information offered to parents about the nature of DDH and the need for screening this disease during the newborn period and the importance of commencement of early treatment). Only one newborn had hip dislocation (type IIc) that was referred to the orthopedic service for further assessment and treatment. The infants were examined using the static technique pioneered by Graf and Colleague.[2]

We used statistical Chi-Square test to compare our results in male and female neonates. Also the statistical Fisher Exact test was used to compare incidence of abnormal hips in this study to that in the other studies. It must be mentioned that incidence of DDH is the same in different countries and no geographic difference exists in this incidence.[2-6]

Results

Of the 320 newborns, 19 were found to have dysplastic hips (Class IIa). Grading of sonographic findings was conducted according to Graf's classification, (Table1) that needed follow up. A total of 12 newborns from Class IIa came back for follow up hip ultrasongraphy, all of whom became normal (Class Ia) without treatment. From the abnormal Class IIa hips, 10 were right sided and 11 were left sided (two newborns had bilateral abnormal hips.)

Only 1 hip had severe dysplasia (Class IIc) that needed treatment at the time of discovery, so the newborn was referred to the orthopedic service for further assessment and treatment. It must be mentioned that this newborn had hypokalemia in further lab tests.

Based on Ortholani and Barlow clinical exam, all the discovered class IIa abnormal hips were normal in physical examination. The Ortholani and Barlow's clinical exam of our colleague in the pediatric department for one newborn with Class IIc (severe

Table 1: Ultrasonographic hip types according to Graf

Hip Type	Osseous Roof Contour	Superior Osseous Rim	Cartilaginous Rim	Osseous Roof: Angle (degrees)	Cartilaginous Roof: ß Angle (degrees)
Fully mature (any age)					
Ia	Good	Angular	Narrow; Triangular; covers femoral head	≥ 60	<55
Ib	Good	Usually slightly rounded (blunt)	Wide-based; short; Covers femoral head	≥ 60	>55
IIa+:physiological delay of ossification appropriate for age (before age of 3 mos)	Adequate	Round	Wide; covers femoral head	50-59	>55
IIa-: physiological delay of ossification with maturity deficit (before age of 3 mos	Deficient	Round	Wide; covers femoral head	50-59	>55
IIb: delay of ossification after age of 3 mos.	Deficient	Round	Wide; covers femoral head	50-59	>55
IIc: critical range(any age)		Round to flat	Wide;still covers femoral head	43-49 (critical range)	70-77
D: decentering (any age)	Severely deficient	Round to flat	Displaced	43-49 (critical range)	>77 (decentering range)
Eccentric					
IIIa	poor	flat	Displaced, without structural alteration	<43	>77
IIIb	poor	flat	Displaced, without structural alteration	<43	>77
IV	poor	flat	Displaced inferomedially	<43	>77

dysplastic hip) was abnormal. It must be mentioned that some other physicians that had examined the newborn did not detected the abnormality of hip. From 19 abnormal newborns, 10 were male and 9 were female.

Twenty one sonographically pathologic hips (irrespective of being clinically stable or unstable) out of 640 hips examined represents a frequency of 3.28% or 32.8 per 1000, for which suggested the term of sonographic frequency of DDH was used. (It must be mentioned that two newborns had bilateral abnormal hips.) No hips were detected unstable on initial clinical examination; they were normal in sonography (type I according to Graf).

As opposed to a 32.8 per 1000 sonographic frequency of affected hips, namely 21, from the total of 640 hips examined, only 1 hip genuinely required treatment, a frequency of 1.6 per 1000 representing, in our view, the proven incidence of DDH.

Of the 320 newborns (640 hips) in this study, 194 were male and 126 were female. A total of 11 abnormal hips were left sided, i.e. 3.44% and a total of 10 abnormal hips were right sided, i.e. 3.12%. From 194 (388 hips) male newborns, 10 hips were abnormal (Class IIa) representing 2.58%, but from 126 (252 hips) female newborns, 11 hips were not normal, i.e. 4.36%.

Discussion

Clinical screening fails to diagnose abnormal hips in a considerable proportion of cases of DDH.[19-23] While there have been a number of reports of high rates of detection[24] the rate of failure was also high using clinical examination alone and the Ortolani-Barlow maneuver physical examination, as now performed,

cannot be proposed as a good screening test.[22]

One study (Clegg *et al.*) noted the overall cost of management of DDH in Coventry has increased marginally since the introduction of routine ultrasound scanning. This does not take into account the potential long-term savings of costs which would occur by the reduction in the risk of developing arthritis secondary to acetabular dysplasia or the costs of litigation from missed cases.[25]

It must be mentioned that by these 640 samples correlation between sensitivity of hip ultrasonography and physical exam was not possible and for this purpose, repetition of the study with much more samples is recommended. But the Ortholani and Barlow's tests are hard exams and most of the physicians do them differently and one hip that is normal in one exam by one physician might be found abnormal by another physician. So significance of more accurate tests for screening of DDH such as hip ultrasonography can not be ignored.[19] The technique of hip ultrasonography is applied differently by different sonographers and for achieving expertise, enormous sonographies must be done by one sonographer. So for screening, the radiologist should be well-experienced.

Screening the newborns with some risk factors may miss some newborns that have the diseased hips without risk factors, so it supports the ultrasonographic screening of all newborns. For better evaluation of the role of screening, we must have exact number of the patient with limping due to DDH and the economic burden of this disease must be calculated the in our society. However, it must be mentioned that the cost of screening all the newborns and also the newborns with risk factors must be calculated to find out whether utrasonographic screening for DDH is cost-effective or not.

Most of the infants that were screened were normal so the ultrasonography is not cost- effective for them. The screening of the newborns with risk factors for DDH seems to be more reasonable; however, it must be mentioned that the pediatric physicians must consider such risk factors. As the DDH has minor signs and symptoms in the newborn period, most of the pediatric physicians do not consider DDH in visiting the patients, so the chance of missing the patient is high.

Screening all newborns by ultrasonography is expensive for families. So it seems to be not reasonable to screen all newborns. Also it must be mentioned that even children with negative results at the ultrasonographic exam might develop the disease later. So even by screening all the newborns with ultrasonography by an expert radiologist some of the patients are missed and the disease is not eliminated in the society. We believe that the risk of parents' anxiety and over treatment associated with ultrasound screening, given the non-invasiveness of the treatment and the small number of treated children, is more acceptable than the risk of under diagnosis associated with the Ortholani-Barlow maneuver.[23,26]

While it is not a logical cost-effective way to screen all newborns worldwide, it is easily predictable that we do not have a wide DDH screening here in Iran. DDH is still a significant problem in Iranian society and it is our duty to prevent it by ultrasonographic screening at least in high risk newborns.

One of the most available newborn groups in hospitals is those who are taken to the neonatal emergency room for yellowish discoloration of skin and clera.[9,10] Most of these newborns have indirect hyperbilirubinemia and physiological jaundice. These newborns are discharged or admitted for phototherapy according to their level of billirubin.[9,10] If these newborns are at risk of DDH then it is a proper occasion for the physician to screen them. But the question is "Are the newborns with jaundice at risk of DDH?"

We had no control group but it must be again emphasized that the incidence of DDH in the various parts of world are the same and no geographic predisposition is noted in it. So the comparison of our results with those of the other studies[2-6,18,27,28] did not show any meaningful difference. We recommend further studies with more newborns and control groups.

We did not have a control group, so further studies with more neonates and with control groups are recommended. We conclude that indirect hyperbilirubinemia is not a risk factor for DDH and the icteric newborns with physiologic jaundice are not at an increased risk for dysplasia of hip. So it seems not to be logical to screen the newborns with jaundice by ultrasound for possible DDH. We can conclude that owing to several limitations, screening of all newborns for DDH by Graf's ultrasound method is not a logical approach in our society.

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