



CODEN [USA]: IAJPBB

ISSN: 2349-7750

**INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES**<http://doi.org/10.5281/zenodo.2227800>Available online at: <http://www.iajps.com>

Research Article

**ROLE OF ULTRASOUND IN SCREENING OF
DEVELOPMENTAL DYSPLASIA OF THE HIP JOINT IN
THE NEONATES (DDH) IN ONE CENTER IN BURAIDAH
CITY, SAUDI ARABIA.****Lamia Aiad Alonazi¹, Mahboob Hussain², Reef Deyf Allah ALMutairi¹, Hanadi
Mufakkir ALMutairi¹, Maha Awad Alenizi¹, Ashwaq Mohammed ALHarbi¹**¹Qassim University, ²Assistant Professor of Radiology_ Qassim University**Abstract**

Background: DDH most common orthopedic disorder in babies that detected in the newborn period or after 9 months, clicking sound when baby move their legs apart, it's an early sign of DDH. It's more common in girls and affected the left side more than right, usually unilaterally but, there is a chance to be bilateral. DDH can cause limping, pain or even osteoarthritis. If DDH detected early can usually be corrected with conservative management Pavlik harness, closed reduction or cast, late presentations require surgery and have worse outcomes.

Methodology: A cross-sectional study based on a questionnaire distributed to the participants which are any radiologists and medical staff working in MCH, and agreed to fill the questionnaire. So a sample of 188 participants was successfully interviewed.

Results: the data showed that 56% of the participated Radiologist admitted that percent of cases confirmed to be diagnosed with DDH by using US as first investigations in the last month (august) was between 50%- 100%.

Conclusion: that participants (radiologists/ medical stuff) with many years of experience and practicing US imagining know well the role of Ultrasound (US) in screening of developmental dysplasia of the Hip-Joint in the Neonates (DDH) and they depends on it in a wide scale.

Key words: Developmental dislocation of the hip, DDH, Radiologist, Ultrasound, screening.

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Please cite this article in press Lamia Aiad Alonazi et al., *Role Of Ultrasound In Screening Of Developmental Dysplasia Of The Hip Joint In The Neonates (Ddh) In One Center In Buraidah City, Saudi Arabia., Indo Am. J. P. Sci, 2018; 05(12).*

INTRODUCTION:

Developmental dislocation of the hip (DDH) is abnormal formation of the hip joint in which the articulating bones femoral head and acetabulum aren't stable, as well as the labrum, capsule and other soft tissues.

Leading to a separation of the joints surface in many degrees of instability subluxation or completely dislocation.

DDH most common orthopedic disorder in babies that detected in the newborn period or after 9 months, clicking sound when baby move their legs apart, it's an early sign of DDH. It's more common in girls and affected the left side more than right, usually unilaterally but, there is a chance to be bilateral.

First-born child, breech positioning, and presence of this condition in the parents or grandparents all are associated with an increased prevalence of DDH.

DDH can cause limping, pain or even osteoarthritis. If DDH detected early can usually be corrected with conservative management Pavlik harness, closed reduction or cast, late presentations require surgery and have worse outcomes.

Using of ultrasonography and other diagnostic imaging modalities and implementation of educational programs mostly will decrease the number of children with DDH who are diagnosed late [1,2].

"Evidence from case series and historical comparisons does suggest that enhanced models of DDH detection involving expert examiners or increased use of ultrasound imaging may improve early diagnosis and minimize the probability of children requiring surgical treatment"[3,4].

The ultrasound firstly was introduced by Austrian orthopedist, Rein-hard Graf to examination the hip in 1980, in his technique calculation of numerous angles a complicate classification system of hip subtypes and the orientation of the B-mode images so, that all hips were displayed on right coronal projections, exponents of static scanning mentioned that was the fast, easy to perform and Replicable. Spread out usage of Rein- hard technique in Western Europe decrease the incidence of undetected DDH that require surgery than other places in the worldwide.

Medical agencies addressed that both the clinical examination and imaging as valued aspects of the early investigation of DDH. American Academy of

Pediatrics revealed new instructions for assessment and referral of DDH, Imaging is strongly recommended when clinical examination rises suspicion of DDH. Furthermore, risk factors such as Breech position in the 3rd trimester, Family history of DDH, History of incorrect swaddle or previous History of abnormal hip clinical examination in the neonatal term.

The instructions note that before six weeks of age Imaging is frustrated because of the false positives rate or immature hips which resolve spontaneously often by age six weeks versus radiographs at 4-6 months, but imaging should be regard to accessibility of trained, experienced pediatric hip sonographers and local conditions.

While American Institute of Ultrasound in Medicine (AIUM) instructions involve finding in clinical or imaging examination of the hip, Breech presentation whatever is the sex others intrauterine causes of postural molding, family history of DDH, Neuromuscular conditions or patients with DDH being treated with a Pavlik harness or other devices. Additionally, it's recommended that any female infant with a breech presentation at birth and a family history of DDH should undergo ultrasound screening at 4-6 weeks of age.

There are no exact contraindications to ultrasound of the infant hip for DDH, but the value of ultrasound decrease as the femoral head ossifies. The American College of Radiology (ACR) note that 41-58% of abnormal findings from physical examinations were negative in US studies, thus confirming the value of US evaluation [5].

The awareness of DDH should be increased among pediatricians to decrease the incidence of late DDH diagnosis [11]. The retrospective study comprised data exploring some related factors of DDH in King Abdul- Aziz Medical City (KAMC) in Riyadh from 2004 to 2014.

Primary data of children referred to the orthopedic outpatient clinic with DDH were analyzed. Data included: gender, laterality, place of delivery, age at the time of diagnosis and type of intervention. Descriptive and inferential statistics were computed. 176 newborns diagnosed with DDH were studied; 151 of which were female (85.8%).

There were 82 patients diagnosed with bilateral DDH (46.6%). The ages of diagnosis were included with 88.8% of the sample diagnosed after 3 months which was highly associated with unilateral disease ($P < 0.001$). There was a highly significant difference

between the place of delivery and the age of diagnosis ($P < 0.001$).

The pelvic osteotomy was the intervention in 50% of the cases. There was a statistically significant difference in the type of intervention with laterality ($P = 0.016$), the age of diagnosis ($P < 0.001$) and place of delivery ($P = 0.015$).

There is no clear consensus as to what degree of ultrasound does not show abnormality in a newborn hip should be treated, Longitudinal studies of universal hip screening show that 90.4% of hips that are ultrasound positive for DDH in the newborn period become normal without treatment, implying that many infants are treated for DDH unnecessarily [12].

An alternative to universal screening is targeted screening in which only infants with risk factors for DDH or abnormal clinical examination are evaluated by ultrasound. Universal hip ultrasound screening has been associated with higher rates of treatment than targeted ultrasound screening, but that treatment is generally shorter and less intrusive.

Randomized, quasi-randomized controlled trials and cluster randomized trials comparing the effectiveness of different types of a screening programmed for developmental dysplasia of the hip (DDH).

Applied to All newborn infants, up to six weeks of age, being screened for DDH. Trials enrolling infants with unstable hips on clinical examination were eligible as a separate comparison group. Types of outcome measures include 1ry: Incidence of late diagnosed DDH ($>$ eight weeks of age diagnosed by either clinical examination, ultrasound or x-ray) for which either medical or surgical intervention was required. And Secondary outcomes e.g. Any treatment. Delayed abduction splinting, after eight weeks of age. Open surgery for correction of hip dysplasia.

Avascular necrosis or osteoarthritis of the hip, at any age. Limb length discrepancy, at any age. Gait abnormality, at any age. Chronic hip pain, at any age. Hip replacement, at any age. Delayed walking, $>$ 18 months of age.

In this research, we trying to find out the accuracy of US in early detection of DDH to provide early intervention and prevent late complications and deformities. So this study amid to know what is the role of US as screening modality to recognize early developmental dysplasia of the hip joints in neonates.

METHODOLOGY:

A cross-sectional study based on a questionnaire distributed to any radiologists and medical staff working in MCH, and agreed to fill the questionnaire. This study were carried out in maternity and children hospital in Buraidah city.

Therefore, the study depends on exclusion Criteria which were: a) Any radiologists and medical staff working in another hospitals, b) Any other health care workers.

The questionnaire contained many different questions, in which most of them were close- ended questions. No personal, social or private questions were involved, which means no contact information was collected, while gender, status of the radiologists/ medical stuff, years of practicing ultrasound, and the specialty were considered to be respondents' background characteristics.

The questionnaire involved questions about background characteristics of the participants (radiologists/ medical stuff). In addition to that the rest of questionnaire included some questions to know what the role of US as screening modality is to recognize early developmental dysplasia of the hip joints in neonates. The questionnaire was pre-tested before data collection started.

The Study targeted to interview any radiologists and medical stuff working in maternity and children hospital in Buraidah city, and agreed to fill the Questionnaire.

Finally, a sample of 188 participants was successfully interviewed. The size and sampling technique for the study is considered convenience, since we only interviewed participants within this predesignated period, also the mode of sampling is considered convenience sampling. In addition to the fact that according to WHO, the worldwide estimated prevalence of DDH is 30%, and by using (95%) confidence interval by (5%) accuracy, the sample size was determined.

A structured data sheet was created to aid in data collection as a study tool, in addition, data was entered into the data sheet then into an Excel document, and this process was repeated for all variables. The duration of the data collection process was not exceeding four weeks, since the full duration of the study was 6 months.

After raw data was processed in accordance with the best practice for raw data management to identify any inaccuracies in advance to the statistical analysis. And in order to achieve that task, implausible values were flagged. A similar process

was applied to categorical variables to identify any potential anomalies. All identified anomalies were discussed with biostatistics team and were corrected prior to initiation statistical analysis. Data was filled into appropriately designed excel sheet. Statistical analysis was done using SPSS V20. Descriptive statistics will be presented as number, percentages, means and standard deviation in that report. In addition, chi-square tests were used for categorical variables and the Mann-Whitney U test for continuous variables in the analyses. All statistical tests was declared significant at a P-value smaller than 0.05.

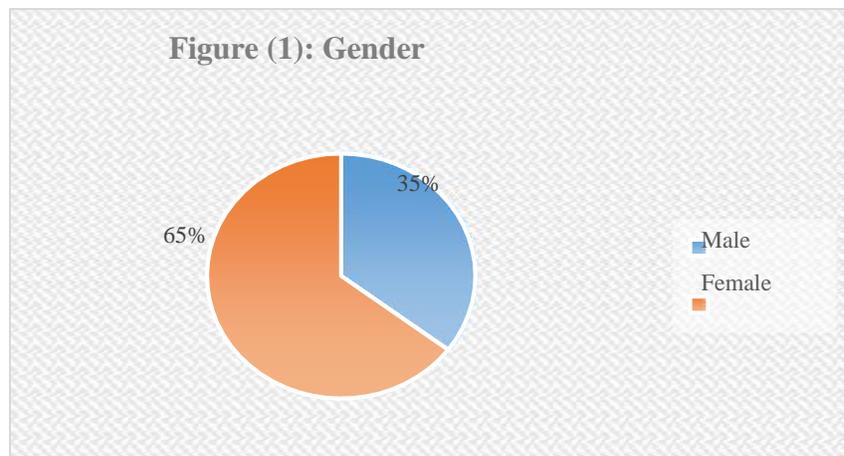
Data was identified initially and was coded in the database excel sheet using a unique identification number. The data was stored on a password-protected laptop with PI and CI; and all data was maintained confidential. Only the research team will had access to the database for analyses purpose. The publication only present summary statistics and no identifying information was used. The name that used for determining the current health status was

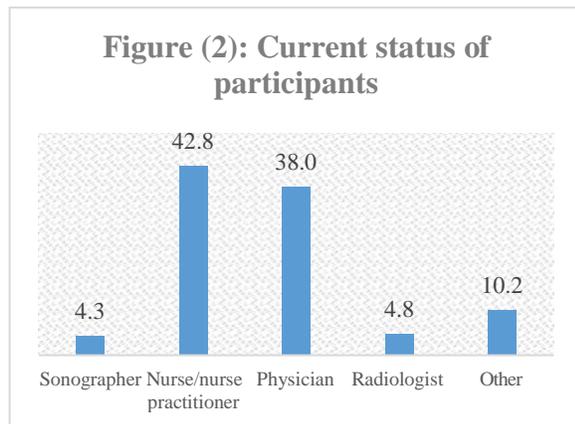
kept is a separate database, so it cannot be linked with any medical data as an ethical consideration. In addition, informed consent was obtained from the participants.

RESULTS:

As mentioned before a sample of 322 participants was successfully interviewed. Since, the objective of this study was to know what is the role of US as screening modality to recognize early developmental dysplasia of the hip joints in neonates. Through establishing the accuracy of US in early detection of developmental dysplasia of the hip joints in neonates, Incidence of neonates diagnosed with developmental dysplasia of the hip (DDH) and confirmed by US, and The best age group for accurate detection of developmental dysplasia of the hip (DDH) in US.

Concerning background of respondents, data in figure (1) shows that the sample contained female participants (radiologists/ medical stuff) more than males (65% and 35%, respectively).



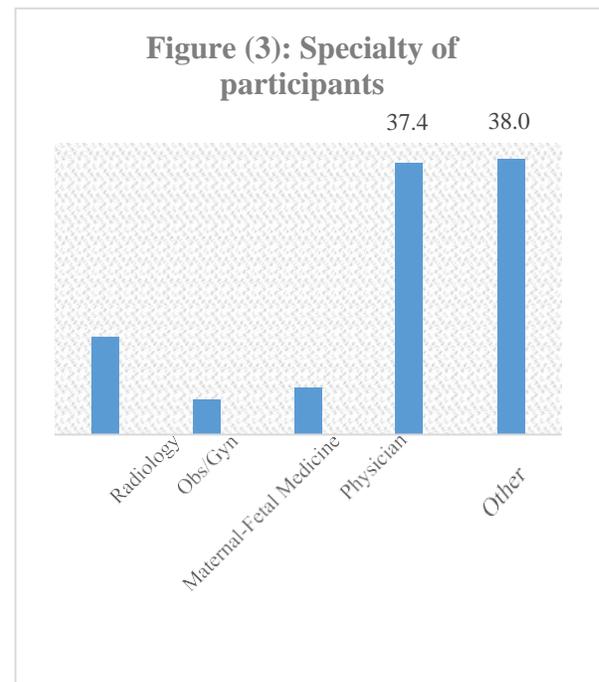


Data presented in figure (2) also showed that around half respondents were nurses/nurses' practitioner, while 38% of them were physicians, and only 4% of respondents were sonographers.

Almost one third of respondents who agreed to participate in the study had less than one year of practicing on ultrasound, and 36% were having 1-5 years of practicing on US, and only 4% had more than 20 years of experience in practicing US.

Moreover, the data in figure (3) showed that 13% of participants who agreed to participate in the study were specialized in Radiology, 5% were specialized in Obs/Gyn, while 6% were specialized in Maternal-Fetal Medicine, and more than one third of respondents (37%) were specialized in Physician.

Concerning the accuracy of US in early detection of developmental dysplasia of the hip-joints in neonates, the data presented in table (1) indicated that using US in early detection of developmental dysplasia of the hip-joints in neonates is useful, since all Sonographer which were interviewed admitted that percent of cases confirmed to be diagnosed with DDH by using US as first investigations in the last month (august) was between 10%-50%.



That pattern was also agreed between Nurses/nurses' practitioner, since more than three quarters of them admitted that percent of cases confirmed to be diagnosed with DDH by using US as first investigations in the last month (august) was between 10%-50%. Moreover, 31% of physicians saw that percent of cases confirmed to be diagnosed with DDH by using US as first investigations in the last month (august) was between 25%-50%.

On the other hand, 56% of the participated Radiologist admitted that percent of cases confirmed to be diagnosed with DDH by using US as first investigations in the last month (august) was between 50%-100%, while only 20% of physicians in the study saw that result.

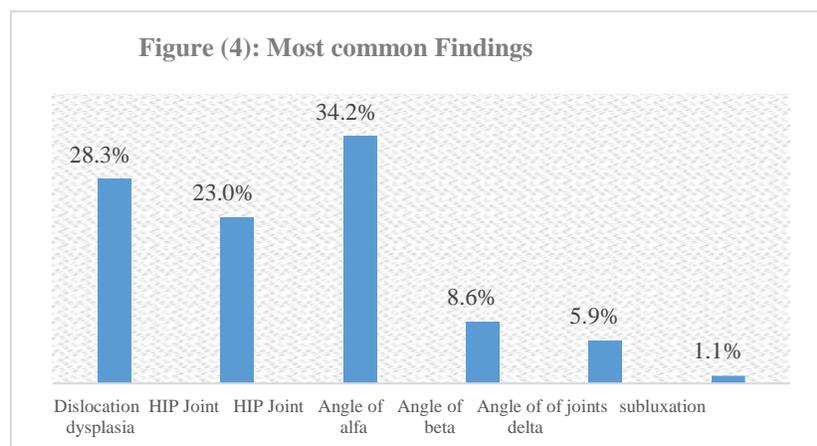
Table (1): Percent of cases confirmed to be diagnosed with DDH by using US as first investigations in the last month (august) by respondent's background characteristics

| background characteristics | | Percent of cases confirmed to be diagnosed with DDH by using US as first investigations in the last month (august) | | | | |
|-----------------------------------|--------------------------|--|---------|---------|----------|--------|
| | | 10%-25% | 25%-50% | 50%-75% | 75%-100% | Total |
| Current status of respondents | Sonographer | 50.0% | 50.0% | 0.0% | 0.0% | 100.0% |
| | Nurse/nurse practitioner | 27.5% | 51.3% | 20.0% | 1.3% | 100.0% |
| | Physician | 19.7% | 60.6% | 18.3% | 1.4% | 100.0% |
| | Radiologist | 44.4% | 0.0% | 22.2% | 33.3% | 100.0% |
| | Other | 42.1% | 31.6% | 10.5% | 15.8% | 100.0% |
| Years of practicing on ultrasound | Less than 1 year | 29.0% | 54.8% | 16.1% | 0.0% | 100.0% |
| | 1-5 years | 32.8% | 53.7% | 10.4% | 3.0% | 100.0% |
| | 6-10 years | 27.8% | 47.2% | 19.4% | 5.6% | 100.0% |
| | 11-20 years | 6.7% | 40.0% | 33.3% | 20.0% | 100.0% |
| | more than 20 years | 14.3% | 14.3% | 57.1% | 14.3% | 100.0% |
| Specialty of respondents | Radiology | 40.0% | 16.0% | 24.0% | 20.0% | 100.0% |
| | Obs/Gyn | 55.6% | 33.3% | 11.1% | 0.0% | 100.0% |
| | Maternal-Fetal Medicine | 33.3% | 41.7% | 25.0% | 0.0% | 100.0% |
| | Physician | 20.0% | 58.6% | 20.0% | 1.4% | 100.0% |
| | Other | 26.8% | 57.7% | 12.7% | 2.8% | 100.0% |

Given the years of practicing on ultrasound for respondents, we can find clearly the relation between years of practicing on US and level of trusting the results of US in confirming cases to be diagnosed with DDH. As the years of practicing on ultrasound increases the percent of cases confirmed to be diagnosed with DDH by using US as first investigations in the last month (august) increases. Where 71% of respondents with more than 20 years of practicing on ultrasound admitted that the percent of cases confirmed to be diagnosed with DDH by using US as first investigations in the last month (august) was between 50%-100%, and 53% of respondents with 11- 20 years of practicing on ultrasound saw the same results.

According the specialty of respondents, we can obviously notice that respondents with Radiology specialty seems to be more reporting that percent of cases confirmed to be diagnosed with DDH by using US as first investigations in the last month (august) varies between 50%-100%, since 44% of them admitted that.

Figure (4) shows that participants admitted that the most common findings of cases confirmed to be diagnosed with DDH by using US as first investigations in the last month (august) was HIP-Joint dysplasia (34%), followed by Dislocation of joints (28%), and HIP Joint subluxation (23%).



Concerning options other than US imaging used in DDH diagnosis, data showed that 58% of participants saw that there were another more accurate options than using US imaging, while 36% said that there were no more accurate options than using US imaging in DDH diagnosis. However, 18% of respondents admitted that they did not consider US as definitive & an accurate tool for diagnosis DDH, while 22% of those who did not consider US as definitive & an accurate tool for diagnosis DD asking for US imaging because it is routinely requested without belief in its role or benefits in diagnosis.

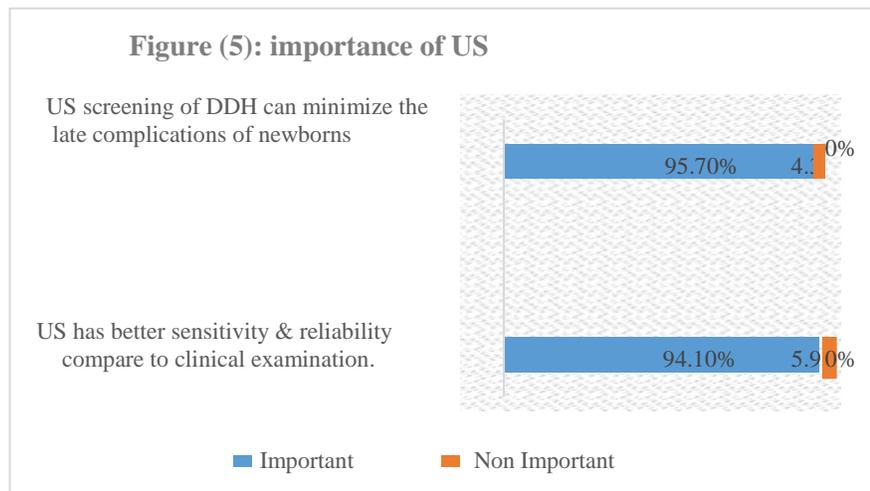
Concerning incidence of neonates diagnosed with

developmental dysplasia of the hip (DDH) and confirmed by US, the study showed that there were a significant relation between Percent were suspected to have DDH, then it's been rolled out by using US in the last month (august) and Percent of all newborns who are diagnosed with DDH in the previous month. Results in table (2) shows the cross distribution of this relation. It is clear that as Percent were suspected to have DDH, then it's been rolled out by using US in the last month (august) decreases, the Percent of all newborns who are diagnosed with DDH in the previous month also decreases.

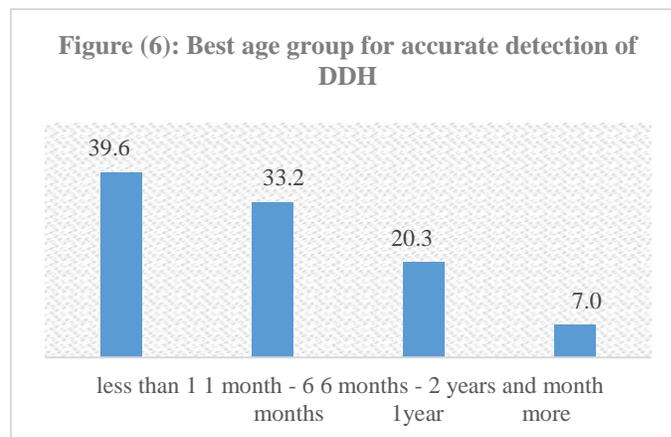
Table (2): Percent were suspected to have DDH, then it's been rolled out by using US in the last month (august) by Percent of all newborns who are diagnosed with DDH in the previous month

| | | Percent were suspected to have DDH, then it's been rolled out by using US in the last month (august) | | | | Total |
|--|----------|--|---------|---------|----------|-------|
| | | 10%-25% | 25%-50% | 50%-75% | 75%-100% | |
| Percent of all newborns who are diagnosed with DDH in the previous month | 10%-25% | 21.4% | 9.6% | 2.7% | 0.5% | 34.2% |
| | 25%-50% | 25.7% | 12.8% | 8.0% | 0.5% | 47.1% |
| | 50%-75% | 2.7% | 9.6% | 3.7% | 0% | 16.0% |
| | 75%-100% | 1.1% | 0.5% | 1.1% | 0% | 2.7% |
| Total | | 95 | 50.8% | 32.6% | 15.5% | 1.1% |
| This relation is significant since: | | | | | | |
| - Pearson Chi-Square (p-value=0.005) | | | | | | |
| - Likelihood Ratio (P-value=0.003) | | | | | | |
| - Linear-by-Linear Association (p-value=0.001) | | | | | | |

On the other hand, data in figure (5) shows that almost all participants (94%) admitted that ultrasound has better sensitivity and reliability compare to clinical examination. Moreover, a bigger percent of respondents (96%) admitted that ultrasound screening of DDH can minimize the late complications of newborns, which indicated the important role played by US in screening of developmental dysplasia of the Hip-Joint in the neonates (DDH).



Coming to the best age group for accurate detection of developmental dysplasia of the hip (DDH) in US, data presented in figure (6) shows that as the child become older the odds of being accurately detected DDH by using ultrasound become smaller, since the best age for detecting DDH accurately is when the child is less than one month of age. Therefore, 40% of participants said that the best age for accurate detection of DDH is when child is less than a month, 33% said that the best age for that is 1-6 months, 20% said 6-12 month, while only 7% of participants said that the best age is 2 years of age or more.



DISCUSSION:

This cross-sectional study was undertaken to know what is the role of US as screening modality to recognize early developmental dysplasia of the hip joints in neonates. Through establishing the accuracy of US in early detection of developmental dysplasia of the hip joints in neonates, Incidence of neonates diagnosed with developmental dysplasia of the hip (DDH) and confirmed by US, and The best age group for accurate detection of developmental dysplasia of the hip (DDH) in US. There for, a self- administered questionnaire was randomly distributed to participants of both sexes. 187 people agreed to

participate, answered the questionnaire and involved in the study.

Developmental dysplasia of the hip (DDH) is a disturbance of relationship between the femoral head and acetabulum. When the baby is born, it is mainly cartilaginous, and the growth of the natural hip joint depends on the normal growth of the child. [6] During the neonate's period, unstable hips are common. Although in most affected infants the problem resolves spontaneously in the first several months of life, persistent DDH may result in chronic pain, gait abnormalities, and degenerative arthritis. [7] Frequently the family history of DDH, female sex and breech delivery is a major risk

factor for DDH. [8] In 1994 July a study held to assess the effect of ultrasound screening on primary diagnosis, management, and prevalence of late cases of developmental dysplasia of the hip (DDH). [9] A randomized controlled trial, including 11,925 newborn infants who were allocated to receive either general or selective or no ultrasound screening in addition to the clinical examination. In the selectively screened group, only infants with risk factors or clinical findings of DDH received an ultrasound examination. The infants were at least 27 months old at the conclusion of the study. Those with risk factors for DDH had a radiograph examination of the hips at 4.5 months of age. The Results convince that the three study groups did not differ in terms of sex distribution or positive Barlow/Portolan tests. General ultrasound screening resulted in a higher treatment rate than in either the selective or in the no ultrasound screening groups (3.4% vs 2.0% and 1.8%, $P < .0001$). For infants not subjected to treatment, ultrasound screening resulted in a higher follow-up rate because of non-conclusive early findings (13%, 1.8%, 0%, respectively; $P < .0001$). The prevalence of late subluxation or dislocation was lower for subjects assigned to general ultrasound screening than for those subjected to selective or no ultrasound screening, but the differences were not statistically significant (0.3, 0.7, 1.3 per 1000, respectively; $P = .11$, test for trend). By the end of their study, the conclusion they reached was, the effect of ultrasound screening in reducing the prevalence of late DDH was at best marginal despite a considerable increase in diagnostic and therapeutic efforts. There is still some controversy over the use of ultrasound as a method of screening. Although hip ultrasound is gaining acceptance as the most effective method for early diagnosis of hip dysplasia, there is still some debate about the use of ultrasound imaging as a method of screening. [10] The purpose of this study was to investigate prospectively the capacity of clinical examination findings and associated risk factors to detect developmental dysplasia of the hip defined ultrasonographically in infants. Both clinical examination and hip ultrasonography have been done for 3,541 infants. Measured against ultrasonography as a standard, the sensitivity and specificity of clinical examination were 97% and 13.68%, respectively. Severe type DDH was found in 167 infants, with a frequency of 4.71%. During the study, Graf was met with type II a physiological immaturity in 838 hips, of which, 15 hips (1.78%) developed spinal cord type IIb and underwent treatment. The major risk factors in a patient which considered as a characteristic those whom using stenosis, female sex, and positive family history.

Because of their low privacy, their findings suggest that clinical examination does not reliably detect the regulatory defect of hip tissue development in infants who are screened for the disease.

CONCLUSION:

Finally, we can conclude that participants (radiologists/ medical staff) with many years of experience and practicing US imagining know well the role of Ultrasound (US) in screening of developmental dysplasia of the Hip-Joint in the Neonates (DDH) and they depends on it in a wide scale. While participants with small number of Years of practicing on ultrasound did not see that clearly.

Almost all participants admitted the important role played by US in screening of developmental dysplasia of the Hip-Joint in the neonates (DDH).

data shows that as the child become older the odds of being accurately detected od DDH by using ultrasound become smaller, since the best age for detecting DDH accurately is when the child is less than one month of age

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