Anatomical Changes in the Hip Joint in Iraqi Patients with Developmental Dysplasia of the Hip by Using Ultrasonography

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Abstract:

Background: One hundred and sixty babies with positive clinical examination to have developmental dysplasia of the hip were referred to ultrasonic clinic.

Objectives: 3D ultrasonic machine was used to study the hip to diagnose which baby has proven to have developmental dysplasia of hip, to study the anatomical changes of the hip especially α and β angles of the hip and to compare that with normal babies, and finally to identify the risk factors that associate with developmental dysplasia of hip.

Results and conclusions: Our finding shows that 38 babies had that anomaly; we found that α angle was less than 60º and β angle was more than 55º. Moreover, it was more common in females than males and more on the left side. Also, it showed that developmental dysplasia of hip is more frequent in ladies delivered by caesarian section and more often in babies lie in breech presentation. It can be concluded that our sample findings were almost similar to those previous universal findings.

Keywords: Developmental dysplasia, hip, α angle, β angle, ultrasound.

Introduction:

Developmental Dysplasia of the Hip (DDH) is a term which describe a wide range of abnormalities of the hip of infants, ranging from acetabular dysplasia, to subluxation and dislocation, these also include abnormal growth of femoral head and /or the acetabulum, which results in mechanical instability of the hip in infants and young children [1]. DDH include hip with radiological abnormalities of the acetabulum or the head of femor which may or may not associated with joint instability [2].

The prevalence of DDH is ranging from 1.6 to 28.5 per 1000 lived birth depending on the tested population [2]. The cause of DDH is still unclear, but combination of genetic and environmental factors may contribute to its development [3].

Unstable hip joint is common in infancy and can be corrected spontaneously without the need for intervention [4], but, if the uncorrected hip joint left without treatment especially those with dislocated hips, this may lead to significant permanent morbidity like gait abnormality, hip dysplasia, early hip joint osteoarthritis, and chronic pain which might need hip replacement in the future.

American Academy of Pediatrics suggests clinical examination for all the newborns for the DDH and every health visit until the child becomes able to walk [5]. Ultrasonography (US) is recommended by American Academy of pediatrics to be used as the primary tool in only infants with abnormal clinical examination of the hip and in infants carrying risk factors. In the United States of America, US still the main technique to examine the stability and morphology of hip joints in infants [6].

Most of the cases of DDH are diagnosed in the first 3 months of life, this is what's called "early presentation", while those who diagnosed after 3 months, they are called "late presentation", this is more often associated with a complex treatment with increase long term complications and increase the risk of surgical intervention [7]. In some countries, DDH screening made for every newborn by clinical examination, ultrasonography for the hip or both [8, 9]. These methods used for diagnosis and for follow up during treatment.

Materials and methods:

One hundred and sixty babies were involved in this study. Their parents were informed that the results would be a part of scientific research They were referred by pediatrician to the clinic of ultrasonography after clinical examination of them which revealed a suspicion of having DDH. Their age range was from 15 days to 6 months. 110 out from 160 were female and the remaining 50 babies were male. 3D US examination was by using Sonoscape 20, linear prop at high frequency 10-20MH. It was performed in the coronal plane with the transducer positioned on the lateral aspect of the flexed, slightly abducted hip (figure 2). All the available data was analyzed by using Graph pad prism software version 6.

Radiological signs of hip joint:

Alpha angle (α): It was created by lines passing through the actabulum and ilium, it is normally more than 60º [10], In DDH, it was less than 60º (figure 1).

Beta angle (β): It was between the lines passing through the ilium and the labrum (L), it was less than 55º [11], in DDH, it was more than 55º (figure1), as shown below**.**

Results:

The present study showed that 23.75% of all the babies examined in pediatric clinic had DDH according to Graf table, in which α angle was less than 60º and β angle more than 55º, as shown in figure (3). Also, it appeared that 73.68% of the cases were female. In case of which side was involved, 84.21% was unilateral and 65.78% of the cases occured in the left side. Our results demonstrated that DDH was more common in babies delivered by caesarian section, which represented 78.94 % of the DDH cases and 10.52% of our cases were twins (Figure3). Moreover,

breech presentation appeared to have high incidence in DDH cases and it was about 78.94%. 10.52% of our cases are twins and 15.78% of the cases had positive family history. Finally, 78.94% of the babies were 1st born babies. As shown clearly in the figures (4):

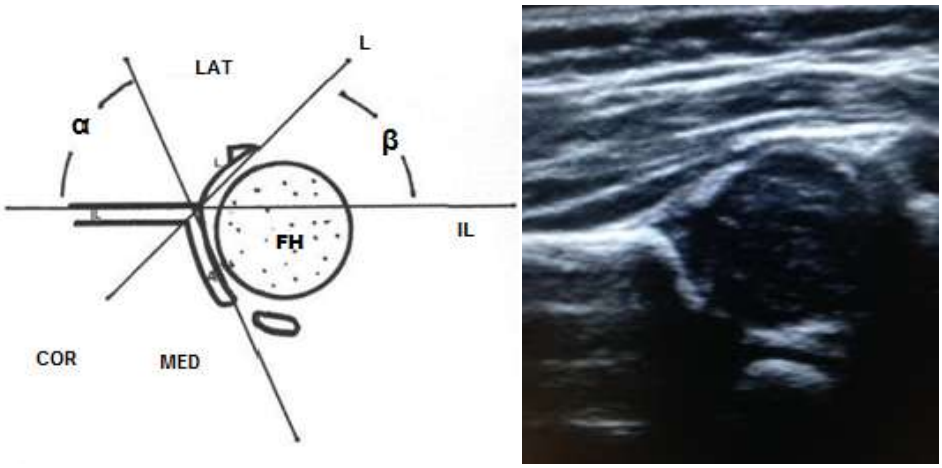


Figure 1: Demonstrates the Graf method in measuring α and β angles of the hip in diagnosis DDH. FH (Femoral head), L (labrum), IL (Ilium), LAT (Lateral), MED (Medial), COR (Coronal)

Figure 2: Shows the normal positioning in ultrasonography

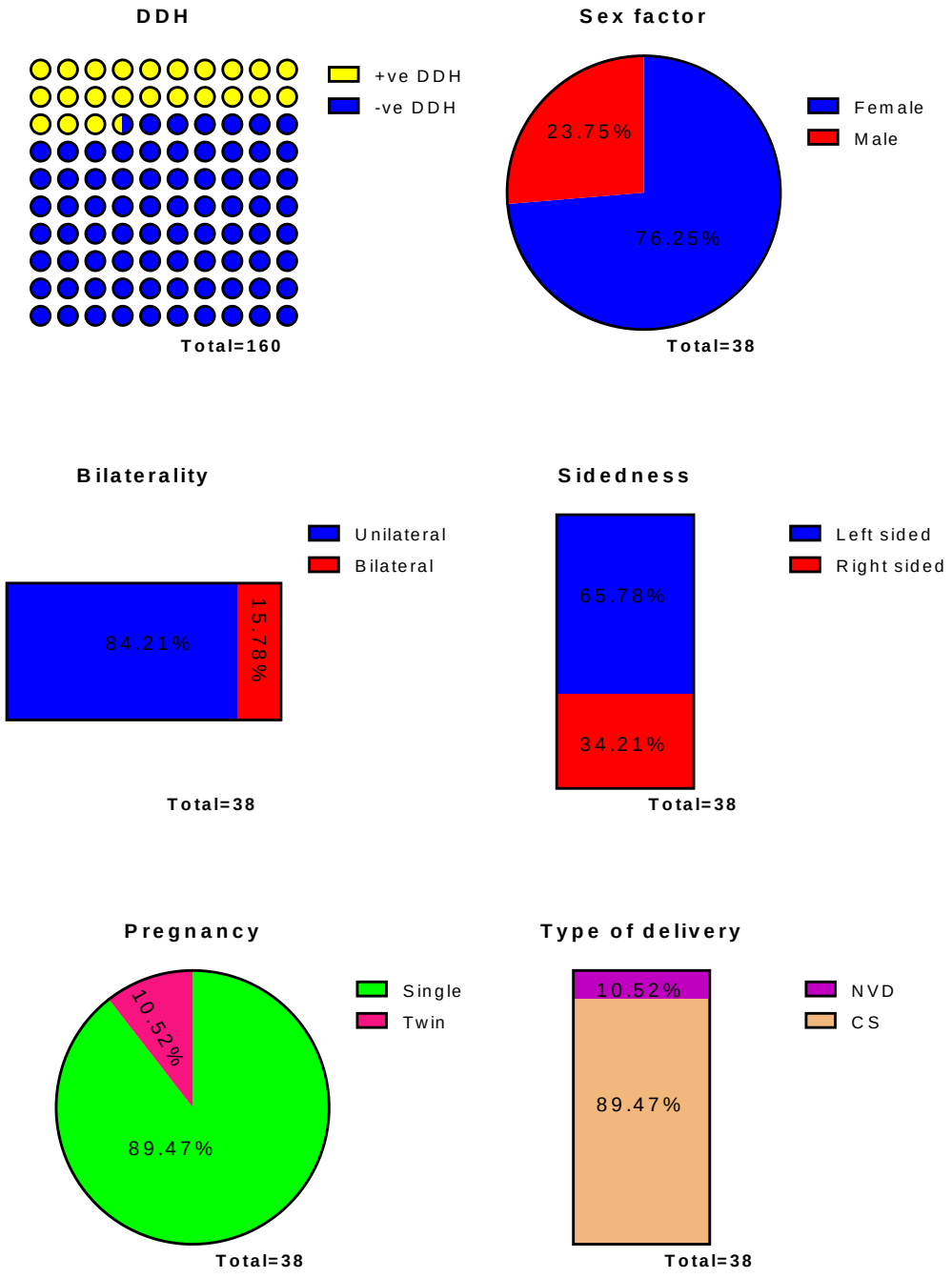


Figure (3): Illustrates the percentage of babies with DDH among the examined babies in pediatric clinic, the distribution of the disease according to the sex, and the involved side(s), type of pregnancy and the type of delivery.

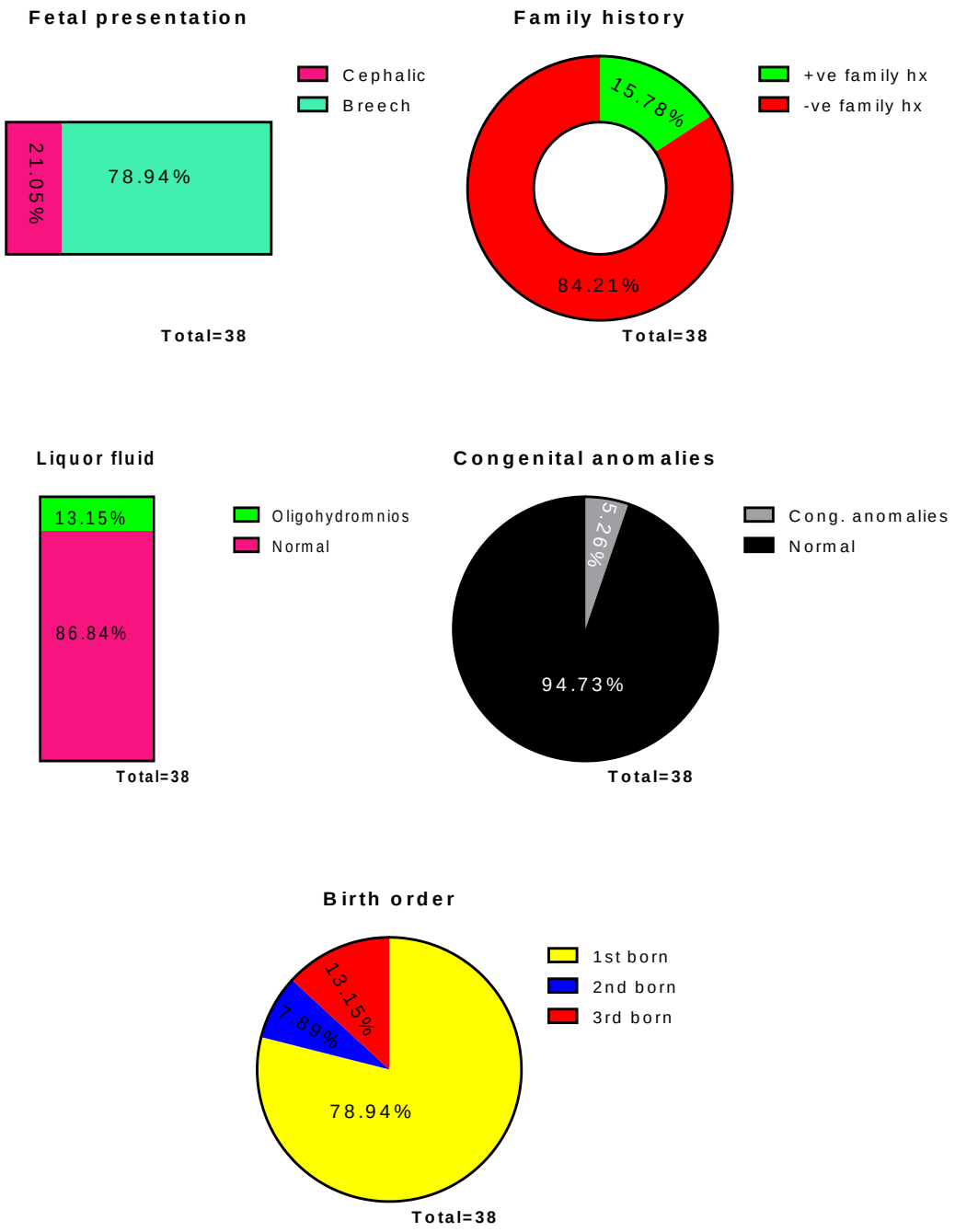
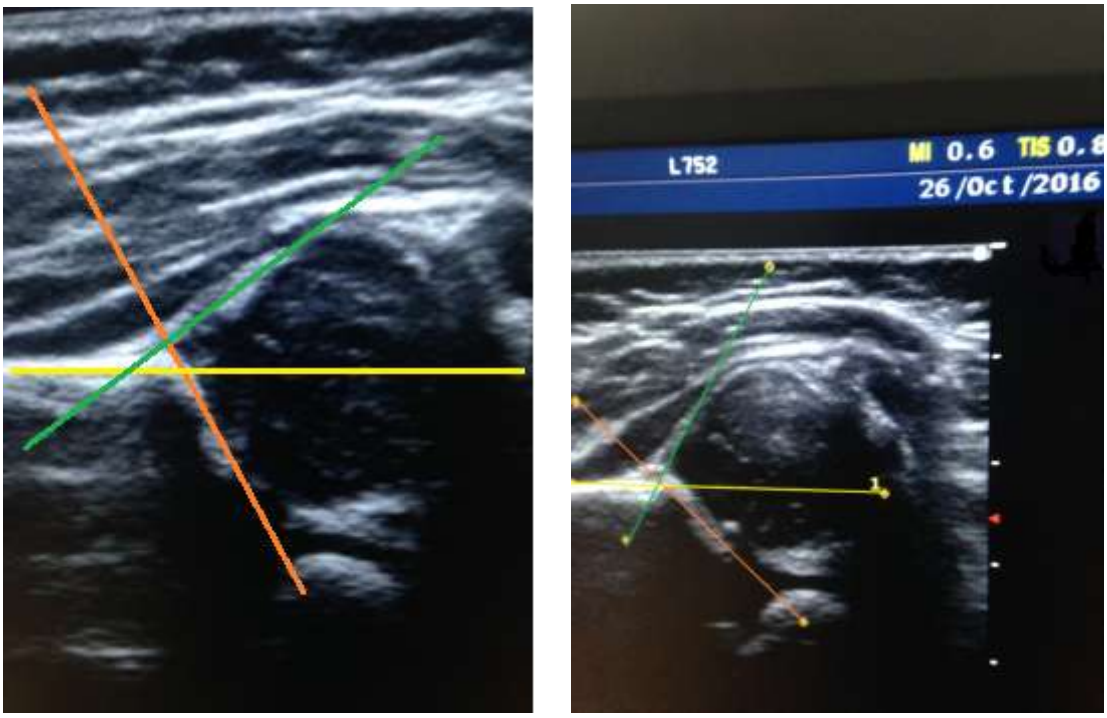


Figure (4): Shows the type of fetal presentation, family history, Presence of normal or oligohydramnios, presence or absence of congenital anomalies, and the birth order.



A **B**

Figure (5): A: represent the normal ultrasonography of normal hip B: showing the ultrasonic image of DDH, α angle was 45º and β angle was 61º.

Discussion:

Using ultrasonography in diagnosis DDH is very beneficial, because it is not invasive, there is no irradiation, it can show the cartilaginous part of the hip joint, labrum, ligamentous laxity and even the joint capsule [11]. US examination is superior to other radiological venue because even a low grade of dysplasia can be detected by the US alone [12]. Additionally, US allows detection of DDH even if hip joint was stable [13]. Moreover, it can be considered as the unique diagnostic aids which provide a real time assessment and 3D view of neonatal hip [14]. US examination for the hip joint is by using Graf method (Austrian pediatric orthopaedic) which depend on measuring α and β angles of the hip through coronal imaging of the hip. The case was considered as DDH when α angle was less than 60º and when β angle was more than 55º [15]. This method is used widely nowadays because it is easy, simple, and there is no intra or inter-observer variability [16].

American Academy of Orthopaedic Surgeons had published guidelines for the DDH, they considered that breech presentation, family history are significant risk factors [17]. Left side appears to be more commonly affected than the right, this is might be due to left hip position during pregnancy which lie against mother's sacrum which make the hip to in adducted position. Moreover, in our study, it showed that high percentage of the babies were in breech position during intrauterine life, in addition to that some of cases reported that they got oligohydramnios during pregnancy and had some congenital anomalies like metatarsus adductors and club foot deformity, also there were cases of multiple pregnancy, which provide a crowd environment for the babies and could be an important risk factors to develop DDH [7]. That findings were in agreement with previous result which pointed out that DDH is more frequent in female in comparison to male, the male to female ratio is about [18], also, DDH affecting infants with positive family history and more in infants with restricted movement as well as abnormal position like (breech presentation) [18, 19]. The presence of all risk factors in our sample may be because some of the cases have more than one factor to develop DDH like breech presentation and twin pregnancy or more than two factors.

Additionally, in Iraqi culture, swaddling is a general practice in which the babies should be swaddled during their infancy. In swaddling the babies are bound with a blanket, restraining the arms, and the lower limbs are extended with the hip joint forced to be in adducted position. It has been reported by the researchers that swaddling can increase the rate of DDH and can increase the incidence of late presentation of DDH [20].

The decreasing in α angle of the hip joint in DDH occurs due to abnormalities in the development of acetabular site and the changes in the femur are occurred as a result of anteversion and the pressure exerted by the acetabulum or ilium on the femoral head which associated with subluxation and dislocation [14]. The main developmental anomaly in DDH is the presence of a ridge in the acetabulum in the postero-superior and inferior surfaces, which is called neolimbus. Neolimbus is a hyaline cartilage which had been described by an Italian pediatrician Ortolani [21].

In normal hip, there is a surface tension between femoral head and the acetabulum which is created by the synovial fluid. This creates a force holding the femoral head in its position in the acetabulum. Because of the presence of neolimbus, this force between the femoral head and the acetabulum is lost which make the head of femur to glide in and out the acetabulum producing a palpable sensation called the Ortolani sign [14]. Additionally, in most of the cases of DDH the labrum is everted [14]. Normal development of the acetabulum depends on growth of the triradiate cartilage of three pelvic bones, which determines size of the acetabulum. Also, concave shape of acetabulum and the depth rely mostly on the presence of spherical femoral head within the joint, therefore, in DDH as the femoral head glide in and out from the acetabulum, this will affect the normal development of the acetabulum and can result in changes in α and β angles.

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