Screening of developmental dysplasia of the hip in the newborns

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ABSTRACT

Background: Newborn babies are known to have risk for occurrence developmental dysplasia of the hip so early clinical screening test is very important to detect this problem and prevent further abnormal growth. The aim of this study is to find the rate of occurrence of developmental dysplasia of the hip (DDH) among newborn babies and establish good screening program.

Patients and methods: From August ٢٠٠٦ to March ٢٠٠٩ in AL-Khansaa Maternity and Children Teaching hospitals, ٩٥٩٢ newborn babies were examined clinically using Barlows and ortolani tests for detecting DDH.

Results: Only ١٦٢ newborn babies out of ٩٥٩٢ examined babies had DDH and it was found more common among female and more on left side than right side. Female sex, rural residence, first born baby breach, caesarean section positive family history, multiple pregnancy post-mature babies, high birth weight (>٣٥٠٠ g).

Conclusion: The occurrence of neonatal DDH is still form a major problem among newborn babies causing a lot of morbidity need to follow up to avoid further complicating problem.

Keywords: DDH, newborn .

الخلاصة

المقدمة: من المعروف لدى أطفال حديثي الولادة أن لديهم عوامل لحدوث الإصابة بالحثل الولادي لذلك كان من المهم جدا القيام بإجراء الفحص ألسريري المبكر لمفصلي الوركين لاكتشاف هذه المشاكل وبالتالي الوقاية من العوق والمضاعفات المستقبلية الناتجة عنها والتي تؤثر على النمو. ان الهدف من الدراسة هو معرفة نسبة حدوث الإصابة بهذا المرض وإقامة برنامج الفحص ألسريري المبكر لاكتشافه.

المرضى وطرائق العمل: تم إجراء فحص سريري لمفاصل الوركين لتسعة الآلف وخمسمائة واثنين وتسعين طفلاً حديث الولادة خلال الأيام الأولى من حياتهم في مستشفى الخنساء للولادة والأطفال في مدينة الموصل، وذلك خلال الفترة من ٢٠٠٦ إلى ٢٠٠٩.

النتائج: تأكدت إصابة ١٦٢ طفلاً بالحثل الولادي لمفصل أو مفصلي الوركين، وهذا يعطي نسبة إصابة مقدارها ١٦.٨٨ لكل ١٠٠٠ ولادة من الولادات الحية.

لوحظ أن الجنس الأنثوي والسكن الريفي والطفل البكر وزواج الأقارب وولادة المقعد والولادة القيصرية وتاريخ العائلة الإيجابي لوجود الحثل الولادي والحمل المتعدد والولادة المجاوزة التمام والأطفال المولودين بأوزان عالية أكثر من ٣٥٠٠غم ووجود تشوهات خلقية مصاحبة كانت جميعها عوامل خطورة لحدوث داء الحثل الولادي.

الاستنتاج: إن الحثل الولادي لايزال يمثل مشكله كبيرة لدى أطفال حديثي الولادة والتي تؤدي إلى اعتلال وتعوق في النمو مما يحتاج إلى المتابعة المستمرة لتجنب مثل هذه المضاعفات المستقبلية .

Developmental dysplasia of the hip (DDH) is an abnormal formation of the hip joint occurring between organogenesis and maturity as a result of instability[١]. It occurs usually in the neonatal period, dislocations tend to occur after delivery, and thus are postnatal in origin, although the exact time when dislocations occur is controversial[٢]. The term DDH is now used instead of congenital dislocation

of hip (CDH)[٣], since they are not truly congenital in origin.

Developmental dysplasia of the hip is classified into two major groups:

Typical in a neurologically normal infant

Teratologic in which there is an underlying neuromuscular disorder, such as myelodysplasia, arthrogryposis multiplex congenita or a syndrome complex[٢].

Teratologic dislocation occurs in utero and is therefore congenital, in which the hip is fixed in the dislocated position at birth[٤].

A typical dislocation occurs in an otherwise healthy infant and may occur in utero, at birth or after birth[٥].

Developmental dysplasia of the hip includes hips that are unstable, malformed, sublaxated or dislocated.[٦]

In ١٩٢٠s, an extensive programme of early diagnosis and treatment of DDH done, while in ١٩٥٦ an extensive neonatal hip surveys were begun in USA, Sweden and Britain. Very early diagnosis in these centres has resulted in simple, safe and effective treatment, and led to excellent results[٧].

The causes of DDH are multifactorial, which include genetic factors, physiological, mechanical, postnatal factors and other risk factors[٨].

Clinical screening

The purpose of screening programs is to diagnose dislocation at early age when treatment is easy and the prognosis is excellent[٧], also to prevent pain, limitation of function and disability due to dislocated or subluxated hips[٩].

Ortolani/Barlow's maneuvers are the only currently acceptable non-traumatic procedures which do not unduly expose all children to routine irradiation[١٠]. The Ortolani / Barlow's tests are ١٠٠% specific but only ٦٠% sensitive in expert hands[١٠].

Patients and methods

Nine thousand five hundred and ninety two newborn babies out of were examined clinically (in patients) for the presence of any sign of DDH in Al-Khansaa Maternity and Children Teaching Hospitals during the period from the ١st of August ٢٠٠٦ to the March ٢٠٠٩.

Detailed information were taken from their mothers or any near relative including:

١. General information: Sex, date of birth, residence, age.
٢. Maternal information: Mother's age, birth order, parental consanguinity, intrauterine presentation and type of delivery.
٣. Family history of DDH.
٤. Neonatal information: Multiple pregnancy, gestational age and birth weight.
٥. Presence of other congenital anomalies.
٦. Presence of asymmetry in skin thigh creases and inguinal skin folds.

All these examined cases came from Mosul city and its vicinity.

Teratological and neuromuscular cases were excluded.

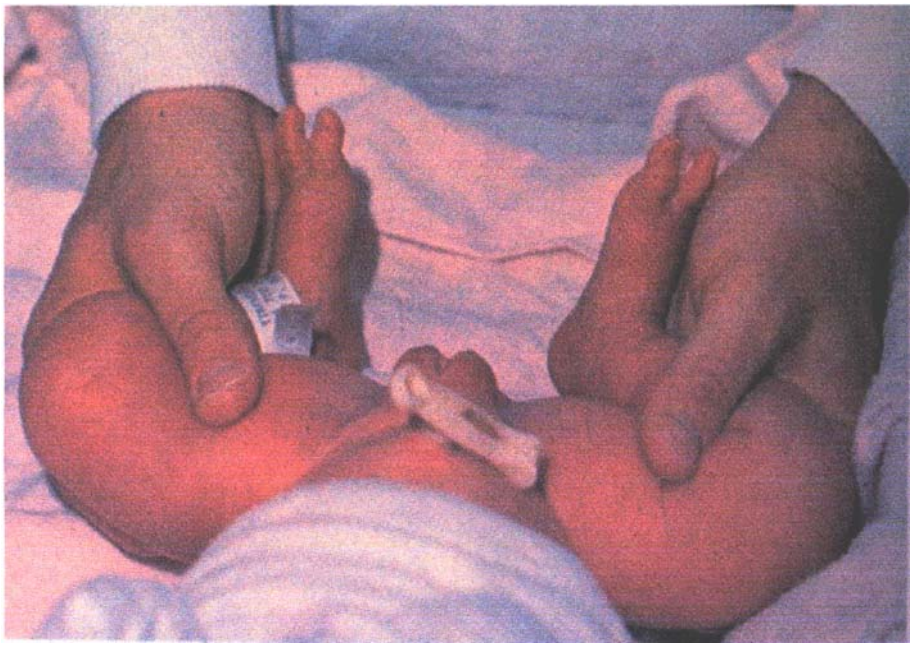

Figure ١. Ortolani test

The clinical examination consisted of the following maneuver: Ortolani (reduction) test: to detect dislocated hip, with the newborn relaxed and content on a firm surface the hips and knees are flexed to ٩٠°, the hips are examined once at a time, then grasping the newborn thigh with the middle finger over the greater trochanter and lifts the thigh to bring the femoral head from its dislocated posterior position to reducing the femoral head into the acetabulum. In a positive finding, examiner senses
reduction by a palpable and nearly audible clunk (Figure ١).

Barlow (dislocation) test: to detect dislocatable hips.

This test was also carried as the following:
After placing the baby on his/her back with the leg pointing towards the examiner, the hips are flexed to a right angle and the knees are fully flexed. The finger applied to the greater trochanter and the thumb of each hand is applied to the inner side of the thigh opposite to the position of the lesser trochanter as shown in (Figure ٢). Then the newborn thigh is adducted with a gentle downward pressure (posterior force). If the hip is dislocatable this usually readily felt as femoral head slips out of the acetabulum. After release of posterior pressure the hip will usually relocate spontaneously.

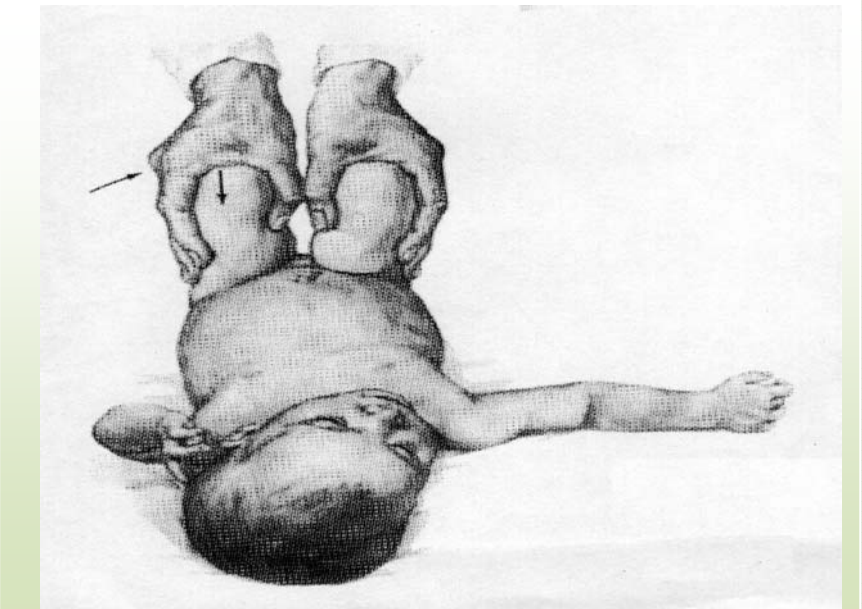

Figure ٢. Barlow's test[١٢]

The results were analyzed statistically by using Chi-square (χ^2) test, Odd's ratio and Confidence Interval (C.I.) for the Odd's ratio. P value less than ٠.٠٥ was considered significant.

Results

One hundred and sixty two newborn babies out of the examined ٩٥٩٢ proved to have DDH in one or both hip joints during the first few hours after birth forming a rate of ١٦.٩/١٠٠٠ live births.

Table ١. Sex distribution of neonatal DDH cases and control

Sex	Cases		Control	
	No.	%	No.	%
Female	١٢٢	٧٥	١٥٦	٤٨
Male	٤٠	٢٥	١٦٨	٥٢
Total	١٦٢	١٠٠	٣٢٤	١٠٠

χ^2 = ٣٢.٥, df = ١, P ≤ ٠.٠٠١, OR = ٣.٣, C.I = ٢.١٩ – ٤.٩٧

P-Value is signifigant.

Table ١ shows that the majority of the cases were female (٧٥%) with a female to male ratio of ٣:١.

Table ٢. Residence of neonatal DDH cases and control

Residence	Cases		Control	
	No.	%	No.	%
Rural	٥٦	٣٥	٦٤	٢٠
Urban	١٠٦	٦٥	٢٦٠	٨٠
Total	١٦٢	١٠٠	٣٢٤	١٠٠

χ^2 = ١٢.٧, df = ١, P ≤ ٠.٠٠١, OR = ٢.١, C.I = ١.٤٠ – ٣.١٦

Table ٢ shows that a highly significant difference between cases and control in their residence (P value ≤ ٠.٠٠١) were a good number of patients came from rural areas (OR = ٢.١).

Table ٣. Distribution of neonatal DDH cases and control according to birth order

Birth order	Cases		Control		P- value	OR	C.I of OR
	No.	%	No.	%			
١	٥٧	٣٥	٦٢	١٩	≤ ٠.٠٠١	٢.٣	١.٥١ – ٣.٥٠
٢	٣٠	١٨.٥	٤٦	١٤	N.S	١.٣	٠.٨٦ – ١.٩٧
≥ ٣	٧٥	٤٦.٥	٢١٦	٦٧	≤ ٠.٠٠١	٠.٤٣	٠.٢٩ – ٠.٦٣
Total	١٦٢	١٠٠	٣٢٤	١٠٠			

Overall χ^2 = ٢٠.١٣٥, df = ٢, P ≤ ٠.٠٠١

From Table ٣, it is clear that the first born baby is affected more than the subsequent babies with a highly significant difference (P- value ≤ ٠.٠٠١ and OR = ٢.٣ for the first born baby).

Table ٤. Parental consanguinity in neonatal DDH cases and control

Parental consanguinity	Cases		Control	
	No.	%	No.	%
Present	٨١	٥٠	١٥٠	٤٦.٣
Absent	٨١	٥٠	١٧٤	٥٣.٧
Total	١٦٢	١٠٠	٣٢٤	١٠٠

χ^2 = ٠.٥٩, df = ١, P = ٠.٤٤١, OR = ١.١٦, C.I = ٠.٨٠ – ١.٦٩

Ttable ٤ shows that consanguineous marriage is a risk for the occurrence of DDH (OR = ١.١٦) although there is no significant difference between cases and control in the frequency of parental consanguinity.

Table ٥. Intrauterine presentation of neonatal DDH cases and control

Intrauterine presentation	Cases		Control	
	No.	%	No.	%
Breech	١٣	٨	١٢	٣.٧
Non-breech	١٤٩	٩٢	٣١٢	٩٦.٣
Total	١٦٢	١٠٠	٣٢٤	١٠٠

χ^2 = ٤.١٣, df = ١, P = ٠.٠٤, OR = ٢.٢, C.I = ١.٠٣ – ٤.٧٠

Table ٥ shows that breech presentation is a risk factor with a significant difference (P-value = ٠.٠٤, OR = ٢.٢) between cases and control.

Table ٦. Type of delivery of neonatal DDH cases and control

Type of delivery	Cases		Control	
	No.	%	No.	%
Caesarean section	٣١	١٩	٤٢	١٣
Vaginal delivery	١٣١	٨١	٢٨٢	٨٧
Total	١٦٢	١٠٠	٣٢٤	١٠٠

χ^2 = ٣.٢٢, df = ١, P = ٠.٠٧٣, OR = ١.٦, C.I = ٠.٩٦ – ٢.٦٧

Table ٦ shows no significant difference between cases and control, while the OR seems to be operational in the causation of DDH (OR = ١.٦).

Table ٧. Family history of neonatal DDH cases and control

Family history	Cases		Control	
	No.	%	No.	%
Present	٤٣	٢٦	٢٠	٦
Absent	١١٩	٧٤	٣٠٤	٩٤
Total	١٦٢	١٠٠	٣٢٤	١٠٠

χ^2 = ٣٩.٧, df = ١, P ≤ ٠.٠٠١, OR = ٥.٤, C.I = ٣.٢٠ – ٩.١٢

Table ٧ shows that ٢٦% of cases had a family history of DDH compared to ٦% of the control group with a highly significant difference (P ≤ ٠.٠٠١, OR = ٥.٤).

Table ٨. The association of multiple pregnancy with DDH

Multiple pregnancy	Cases		Control	
	No.	%	No.	%
Present	٩	٥.٥	٢	٠.٦
Absent	١٥٣	٩٤.٥	٣٢٢	٩٩.٤
Total	١٦٢	١٠٠	٣٢٤	١٠٠

χ^2 = ١١.٩٠٦, df = ١, P = ٠.٠٠١, OR = ٣.١, C.I = ١.٦٣ – ٥.٨٩

Table ٨ shows that multiple pregnancy is a risk factor for the occurrence of DDH(P = ٠.٠٠١, OR = ٣.١).

Table ٩. Distribution of neonatal DDH cases and control according to the gestational age

Gestational age	Cases		Control		P- value	OR	C.I
	No.	%	No.	%			
Full-term	١٥٤	٩٥	٣٠٦	٩٤.٤	N.S	١.١	٠.٥٧ – ٢.١٢
Pre-term	٣	١.٨	١٤	٤.٣	N.S	٠.٤	٠.١١ – ١.٤٥
Post-term	٥	٣.٢	٤	١.٣	N.S	٢.٥	٠.٧١ – ٨.٨٠
Total	١٦٢	١٠٠	٣٢٤	١٠٠			

Overall χ^2 = ٣.٨, df = ٢, P = ٠.١٤٣ (N.S)

Table ٩ shows no significant difference in the gestational age of DDH cases and control, but there is additional risk for post-term newborn to have DDH than that of preterm (OR = ٢.٥).

Table ١٠. Distribution of neonatal DDH cases and control according to birth weight

Birth weight (gram)	Cases	Control	P- value	OR	C.I		
	No.	%	No.	%			
<٢٥٠٠	٦	٣.٧	١٦	٤.٩	N.S	٠.٧	٠.٢٣ – ٢.١٧
٢٥٠٠ – ٣٥٠٠	٩٦	٥٩.٣	٢٦٨	٨٢.٧	≤ ٠.٠٠١	٠.٣	٠.٢٠ – ٠.٤٦
> ٣٥٠٠	٦٠	٣٧	٤٠	١٢.٤	≤ ٠.٠٠١	٤.٢	٢.٧٠ – ٦.٥٤
Total	١٦٢	١٠٠	٣٢٤	١٠٠			

Overall χ^2 = ٤٠.٢, df = ٢, P ≤ ٠.٠٠١

Table ١٠ reveals that higher birth weight of the baby is effective in the causation of DDH (P-Value ≤ ٠.٠٠١).

Table ١١. The association of congenital anomalies with neonatal DDH cases and control

Associated anomalies	Cases		Control	
	No.	%	No.	%
Present	١٥	٩.٢	٤	١.٢
Absent	١٤٧	٩٠.٨	٣٢٠	٩٨.٨
Total	١٦٢	١٠٠	٣٢٤	١٠٠

χ^2 = ١٨.٥, df = ١, P ≤ ٠.٠٠١, OR = ٨.١, C.I = ٣.١٢ – ٢١.٠١

Table ١١ demonstrates a highly significant (P-Value ≤ ٠.٠٠١, OR = ٨.١) association between DDH and other congenital anomalies such as congenital torticollis, metatarsus adductus, talipes calcaneovalgus and other congenital anomalies.

Table ١٢. Results of Ortolani test

Ortolani test	No.	%
Total Positive cases	٦٦	٤٠
Total negative cases	٩٦	٦٠
Total cases	١٦٢	١٠٠

Table ١٢ shows that Ortolani test was positive in ٤٠% of cases.

Table ١٣. Results of Barlow's test

Barlow's test	No.	%
Total Positive cases	١١٦	٧١.٦
Total negative cases	٤٦	٢٨.٤
Total cases	١٦٢	١٠٠

Table ١٣ shows that Barlow's test was positive in ٧١.٦% of cases.

Table ١٤. The laterality distribution of neonatal DDH cases

Laterality	Cases	%
Left	٦٧	٤١.٤
Right	٣٦	٢٢.٢
Bilateral	٥٩	٣٦.٤
Total cases	١٦٢	١٠٠

Table ١٤ shows that the left hip is more commonly involved than right hip, and bilateral involvement of the hips is also common.

Table ١٥. Skin thigh creases for neonatal DDH cases and controls

Skin thigh creases	Cases		Control		P- value	OR	C.I
	No.	%	No.	%			
Equal	١٠٦	٦٥	٢٥٦	٧٩	≤ ٠.٠٠١	٠.٥	٠.٣٣ – ٠.٧٦
Unequal	٤٩	٣٠	٣٨	١١.٧	≤ ٠.٠٠١	٣.٣	٢.٠٧ – ٥.٢٦
Inapparent	٧	٥	٣٠	٩.٣	٠.٠٥٣	٠.٤	٠.١٦ – ١.٠١
Total	١٦٢	١٠٠	٣٢٤	١٠٠			

χ^2 = ٢٦.٨٢, df = ٢, P ≤ ٠.٠٠١

Table ١٥ demonstrates that unequal skin thigh creases were more common in the cases than in the control group (P- value ≤ ٠.٠٠١). Also an evident difference is observed among those with equal and inapparent creases.

Table ١٦. Inguinal skin fold for neonatal DDH cases and control

Inguinal skin folds	Cases		Control	
	No.	%	No.	%
Equal	١٠٩	٦٧.٢	٢٩٤	٩٠.٧
Unequal	٥٣	٣٢.٨	٣٠	٩.٣
Total	١٦٢	١٠٠	٣٢٤	١٠٠

χ^2 = ٤١.٩, df = ١, P ≤ ٠.٠٠١, OR = ٤.٨, C.I = ٢.٩٩ – ٧.٧٢

Table ١٦ shows that unequal inguinal skin folds were more common in DDH cases than in the control group (P-value ≤ ٠.٠٠١).

One hundred forty babies (٨٦.٤%) out of ١٦٢ came for follow-up every two weeks and at the end of one month of their age ١١٠ (٦٨%) of them, their hips were completely stabilized following our instructions of using double or triple nappies together with the avoidance of heavy wrapping and rolling bed. The other remaining ٣٠ cases (١٨.٥%) were asked to come back for other follow-up for every two weeks.

Discussion

In this study, the rate of occurrence of neonatal DDH was ١٦.٩ /١٠٠٠ live birth, and this number are nearly similar to that reported by other studies [١٣-١٥]. Female sex was more affected than male sex as evident by the high OR = ٣.٣, which means that a female sex is an effective risk factor. Female to male ratio, in this study, was ٣:١ similar to that found by other studies [١٦-١٨], but Apley's [١٩] found a higher ratio of ٧:١.

DDH was more common in cases who came from rural areas than in the control group, a difference of highly significant value (P ≤ ٠.٠٠١) with additional risk for rural residence among DDH cases OR = ٢.١, and this is because the incidence of DDH is influenced by geographic and ethnic factors as stated by other studies [١٨-٢٢], however Al-Kattan[١٧] found no additional risk for rural residence among DDH cases.

First order baby is more prone to have DDH where the OR=٢.٣ in contrast to the third or more orders in the family where the OR is ٠.٤. These findings are consistent with other studies [١٩-٢٢]

Parental consanguinity was not significant between the cases and control although OR of ١.١ which means that probably consanguineous marriage is a risk factor similar to that found by Al-Kattan[١٧].

Breech presentation was a risk factor in the causation of DDH (OR=٢.٢). These result are in agreement with other studies [١٨-٢٣] also found that breech presentation and positive family history were the two most common risk factors associated with DDH. Caesarean section seems to be a risk factor for DDH where OR is ١.٦ similar to that found by Al-Kattan[١٧].

Family history was positive in ٤٣ cases and OR was ٥.٤ which means a high risk factor and this is probably explained by the presence of genetic factor this in agreement with other studies showed strong family history in their studies. [١٧,١٨,٢٣]

Multiple pregnancy was a risk factor for DDH where OR was ٣.١, probably due to the effect of crowding phenomenon within the intrauterine cavity, A similar association was found by Al-Kattan[١٧]. Post-maturity was a risk factor to have DDH (OR=٢.٥) while preterm delivery does not appear to predispose to DDH (OR=٠.٤) as Apley's[١٣] claimed that high level of maternal hormones in the last few weeks of pregnancy might aggravate ligamentous laxity in the infant, and this could account for the rarity of hip instability in premature babies born before the hormones reach their peak. All these findings are consistent with those previously reported[٢١,٢٢].

High birth weight > ٣٥٠٠ g seems to be effective in the causation of DDH where OR=٤.٢, while babies with low birth weigh < ٢٥٠٠ g were protected from having DDH (OR=٠.٧).

This is similar to the study done by Bower et al[٢٢] who supported the hypothesis of intrauterine constriction as a cause of neonatal DDH. Also Beaty[٢٠] reported a low incidence of DDH in babies with low birth weight which was probably due to their premature delivery excluding them from the joint relaxing effects of maternal hormones in the last few weeks of pregnancy.

The presence of associated congenital anomalies was more common in DDH cases than in the control group where the OR was ٨.١, which means an increase risk of DDH among cases with associated anomalies. Beaty [٢٠] found a strong association between DDH and other musculoskeletal anomalies such as congenital torticollis, metatarsus adductus and talipes calcaneovalgus, but Al-Kattan[١٧] found no significant association between DDH and other anomalies.

Ortolani test was positive in ٤٠% of patients and Barlow's test positive in ٧١.٦% of them, this is in agreement with other workers[٢٤].

Left-sided and bilateral hip involvement were found in ٤١.٤% and ٣٦.٤% of patients respectively, and right hip involvement in ٢٢.٢% of patients, similar to that reported by other studies[٢٠,٢٤]. On the other hand Bower C,[٢٢] found that bilateral involvement was twice as common in the neonatal cases and left hip involvement more than right hip involvement in the post-neonatal cases.

Unequal skin thigh creases (٣٠%) were more common in the cases than in the control group (١١.٧%), a difference of a highly significant value (P≤٠.٠٠١). Asymmetry of the skin folds is a common clinical finding of DDH[٢٣].

Unequal inguinal folds was found in ٣٢.٨% of the cases compared to ٩.٣% of the control group (P value ≤ ٠.٠٠١). Beaty, [٢٠] noticed that most of his DDH patients had abnormal inguinal folds and recommended that inguinal fold assessment is useful in screening methods and suggested that babies with asymmetrical inguinal folds need further evaluation.

One hundred ten babies (٦٨%) had clinical stabilization of the hip joint at the age of four weeks, and this is consistent with other results[٢٤].

Conclusions

Developmental dysplasia of the hip is still a major problem among newborn babies causing a lot of morbidity to them. Female sex, rural residence, first born baby, parental consanguinity, breech presentation, caesarean section, positive family history, multiple pregnancy, post-mature babies, high birth weight (>٣٥٠٠ g) and other associated congenital anomalies are all risk factors for DDH. Left hip dysplasia was more common than bilateral hip dysplasia which was more common than right hip dysplasia.The majority of the babies (٦٨%) improved nicely at the age of one month by adoption of double or triple nappies and following our instructions.

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