



**Al-Nahrain University**

**Collage Of Medicine**

**Department Of Orthopedic Surgery**

**OUTECOME OF OPEN REDUCTION IN  
PATIENTS WITH DEVELOPMENTAL  
DYSPLASIA OF THE HIP FROM  
1.5 To 4 YEARS**

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**2018-2019**

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## **Acknowledgement**

I would like to express my deepest appreciation to Dr. Zaid Abd-Ali for his help and support. His guidance and expertise have helped me all the way to finish this research. Without his persistent help this work would not have been possible . A special gratitude I give to my family and friends for their continuous support.

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*I dedicate this research to DDH patients and their families who suffer so much pain but still offer so much love and cooperation*

## **Abstract**

**Background.** DDH comprises a spectrum of conditions that lead to hip subluxation and dislocation. Patients with late-presenting developmental dysplasia of the hip (DDH) are more likely to require an open reduction. Since in our developing countries do not have mandated screening, there continues to be a relatively high incidence of late-presenting DDH. We report the clinical and radiographic outcomes of open reduction in a series of patients who presented late.

**Aim.** To evaluate outcome open reduction management for children with developmental dysplasia of the hip (DDH)

**Patients and Methods.** The type of study used was a cross sectional study. 30 children were evaluated who were diagnosed with DDH after 18 months of age to 4 years and were treated surgically . Type of surgical management was broadly categorized into: open reduction internal fixation, pelvic osteotomy and femoral osteotomy . Patients were evaluated clinically and radio logically

**Results.** Of the 30 cases studied, 8 patients were male and 22 were female , included 4 patients diagnosed at an age of < 18 months (13% of the total), 10 patients diagnosed between 18months – 2 years of age (33% of the total) , 12 patients diagnosed at 2 years of age (40% of the total) and 4 patients diagnosed between 2-4 years of age (13%of the total) , 13% of patients were diagnosed with developmental dysplasia of the left hip, 60% of patients had bilateral DDH and 27% presented with developmental dysplasia of the right hip , 4 cases (13%) were diagnosed with developmental dysplasia by ultrasound, 26 cases (87%) were diagnosed with developmental dysplasia by x-ray , 100% of patients underwent open reduction alone or in combination with pelvic osteotomy which was 53% and femoral shortening which was 20%,20 cases (67%) were developed stiffness, 2cases (7%)were developed infection, 4 cases (13%) developed avascular necrosis of femoral head, only

1 case(3%) developed with recurrent dislocation and 3 cases (10%) were with no complication.

**Conclusion.** Open reduction management is the treatment of choice for those above 18 months of age. Outcome of open reduction management depends on the age of the patient at the time of diagnosis and whether the condition is unilateral or bilateral.

**Keywords.** DDH, surgical management, open reduction.

## Introduction

-the term “congenital dislocation of the hip” (CDH) has been largely superseded by developmental dysplasia of the hip (DDH) in an attempt to describe the range and evaluation of abnormalities that occur in this condition<sup>[1]</sup>

. This comprise a spectrum of conditions that lead to hip subluxation and dislocation which include : dislocated femoral head completely out of acetabulum ,dislocate head in socket, and a head that subluxates out of joint when provoked and dysplastic acetabulum<sup>[2]</sup>

-Normal hip development depends on proportionate growth of the acetabular triradiate cartilages and the presence of a concentrically located femoral head. Whether the instability comes first and then affects acetabular development because of imperfect seating of the femoral head, or is a result of a primary acetabular dysplasia, is still uncertain. Both mechanisms might be important<sup>[1]</sup>.

-The incidence of neonatal hip instability may be as high as 20 cases per 1000 live births, whereas the incidence of dislocated hips is about 2cases per 1000live births :this is because many hips that are unstable at birth will stabilize spontaneously<sup>[3]</sup> .Girls are much more commonly affected than boys ,the ratio being about 7:1.the left hip is more affected than the right :in 1in5 cases the conditions is bilateral<sup>[1]</sup>.

### **-Risk factors of DDH include :**

1.Gender :DDH is five times more common in girls than boys, possibly related to hormonal factors causing temporary joint laxity<sup>[3]</sup>

2. Hormonal joint laxity . It is possible that in females a ligament-relaxing hormone (relaxin) may be secreted by fetal uterus in response to estrogen and progesterone reaching the fetal circulation. This may cause instability in the same way as does genetically determined joint laxity It is possible ,also ,that laxity of the hips ligaments from this cause might help to explain the greater incidence of dislocation in girls (the relaxing agent is not produced in boys) [4]

.this could account for the rarity of instability in premature babies ,born before the hormones reach their peak [1]

3- Breech presentation ,(especially a breech position with extended legs) favors dislocation; this so called 'packaging disorder' is linked with the higher incidence in first-born babies, among whom spontaneous version is less likely [1]

4-Caesarean section: possibly through restricted fetal movements .

5-Birth order :DDH is more common in firstborns

6-Oligohydramnios

7-Family history :this may reflect faulty acetabular development(a polygenic trait, which is seen mainly in girls and their mothers )or excessive ligamentous laxity (a dominant trait).DDH tends to run in families and even in entire populations (e.g in countries along the northern and eastern Mediterranean seaboard)[3]

8-seasonal variations: the influence of the season in the past ,several series of congenitally. Dislocated hips have shown an apparent seasonal incidence ,higher in the darker months –the first and last quarters of each year .The present series shows no such seasonal incidence :in fact over the last four years the infants with dislocated hips were born at irregular intervals throughout the whole period [5].

9-Racial variations :Dislocation is very common in Lapps and North American Indians who swaddle their babies and carry them with legs



together ,hips and knees fully extended ,and is rare in southern Chinese and African Negroes who carry their babies astride their backs with legs widely abducted. Swaddling the legs together will exacerbate an unstable hip whereas carrying the baby astride the carers hip encourages a position of hip flexion and abduction that will help stability<sup>[3]</sup> .

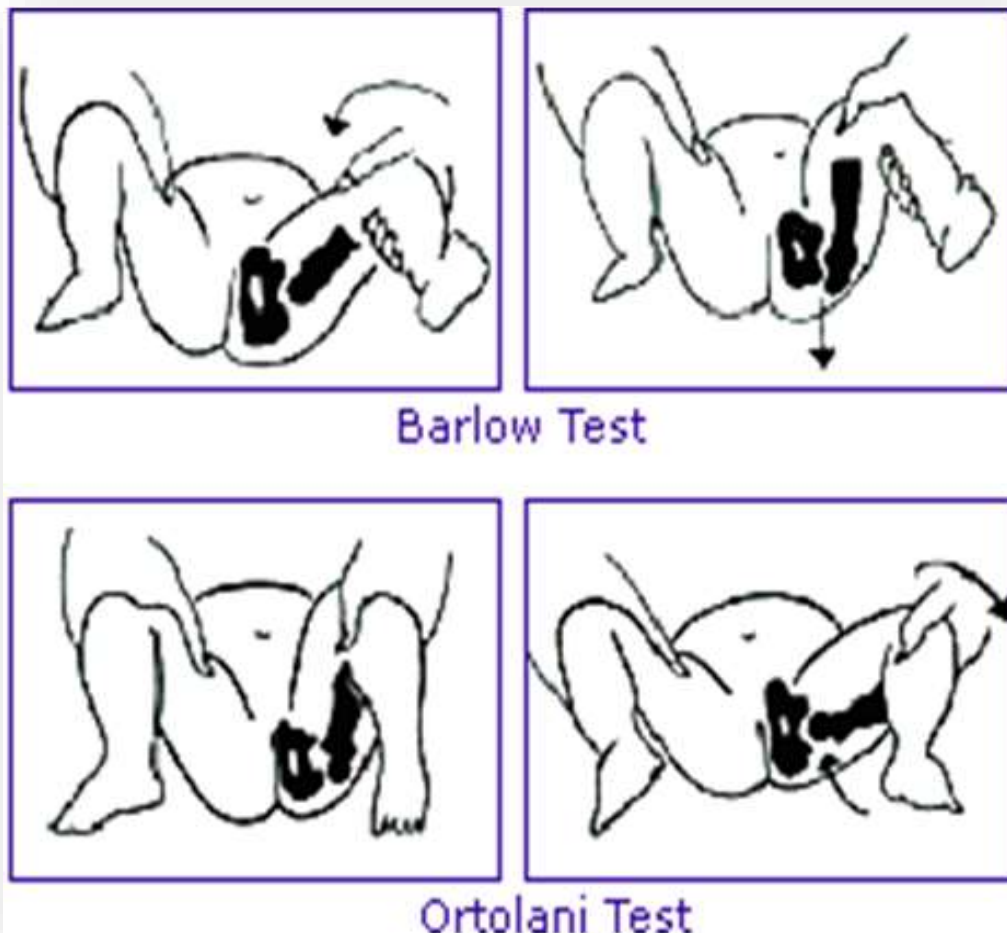
-Secondary factors influencing the results of conservative treatment :Sex :It was noted that the few boys with unilateral dislocations did less well than the girls .Age at first attendance had apparently little influence on the results of treatment .A history of a close relative also affected Conservative treatment in these cases was notably unsuccessful<sup>[6]</sup> .

-Although the clinical examination remains the mainstay for diagnosing DDH in early infancy ,not all cases of DDH are detectable by physical examination .Imaging ,either by ultrasonography or radiography ,have become popular worldwide for screening or confirmation of the diagnosis as well as to classify the severity of the dysplasia<sup>[7]</sup> .

-Physical examination tests in neonates include Barlow and Ortolani tests .The Barlow provocative maneuver assesses the potential for dislocation of a nondisplaced hip .The examiner adducts the flexed hip and gently pushes the thigh posteriorly in an effort to dislocate the femoral head .In a positive test ,the hip is felt to slide out of the acetabulum .As the examiner relaxes the proximal push. The hip can be felt to slip back into the acetabulum<sup>[8]</sup> .

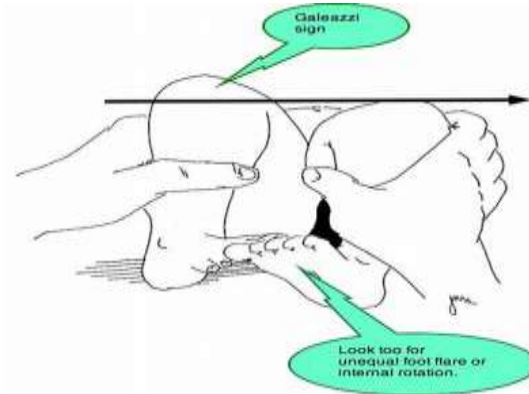
The Ortolani test is the reverse of Barlow test:the examiner attempts to reduce a dislocated hip.The baby's thighs are held with the thumbs

medially and the fingers resting on the greater trochanters; the hips are flexed to 90 degrees and gently abducted. Normally there is smooth abduction to almost 90 degrees. When the test is positive, the femoral head will slip into the socket with a delicate clunk that is palpable but usually not audible [8].



-As the baby enters the 2<sup>nd</sup> and 3<sup>rd</sup> month of life, the soft tissues begin to tighten and the Ortolani and Barlow tests are no longer reliable. In this age group, the examiner must look for a limited hip abduction, apparent shortening of the thigh, proximal location of the greater trochanter, and asymmetry of the gluteal or thigh folds [8].

-Shortening of the thigh ,the Galeazzi sign ,is best appreciated by placing both hips in 90degrees of flexion and comparing the height of the knees looking for asymmetry .Asymmetry of thigh and gluteal skin folds may be present in 10% of normal infants but suggests DDH[8] .



-Regarding ultrasound as a screening tool ,it is superior because the cartilaginous femoral head is not visible on radiograph[7]. As the sonographic appearance of most hips matures (becomes less dysplastic )spontaneously there is a risk of overtreatment if scans are performed too early .If delayed ,the best opportunity for acetabular remodeling may be lost. Ideally,therefore,screening scans should be performed between 4and 6 weeks after birth and treatment instigated promptly[3]. During the early newborn period (0-4weeks),physical examination is preferred over ultrasonography[8] .

-In the Graf technique, the transducer is placed over the greater trochanter ,which allows visualization of the ilium ,the bony acetabulum, the labrum, and the femoral epiphysis .The angle formed by the line of the ilium and a line tangential to the bony roof of the acetabulum is termed the  $\alpha$  angle and represents the depth of acetabulum .Values $>60$  degrees are considered normal and values  $<60$  degrees imply acetabular dysplasia .The  $\beta$  angle is formed by a line drawn tangential to the labrum and the line of the ilium;

this represents the cartilaginous roof of the acetabulum .A normal  $\beta$  angle is  $<55^\circ$ ;as the femoral head subluxates, the  $\beta$  angle increases<sup>[8]</sup> .

-Following the appearance of the ossific nucleus in the older infant ,anteroposterior(AP)

Pelvic radiographs replace ultrasonography as the screening image modality of choice. Plain radiographs can be also used to evaluate dysplasia from about 12 weeks .The appearance of the femoral ossific nucleus is often delayed in the presence of dysplasia <sup>[3]</sup>.

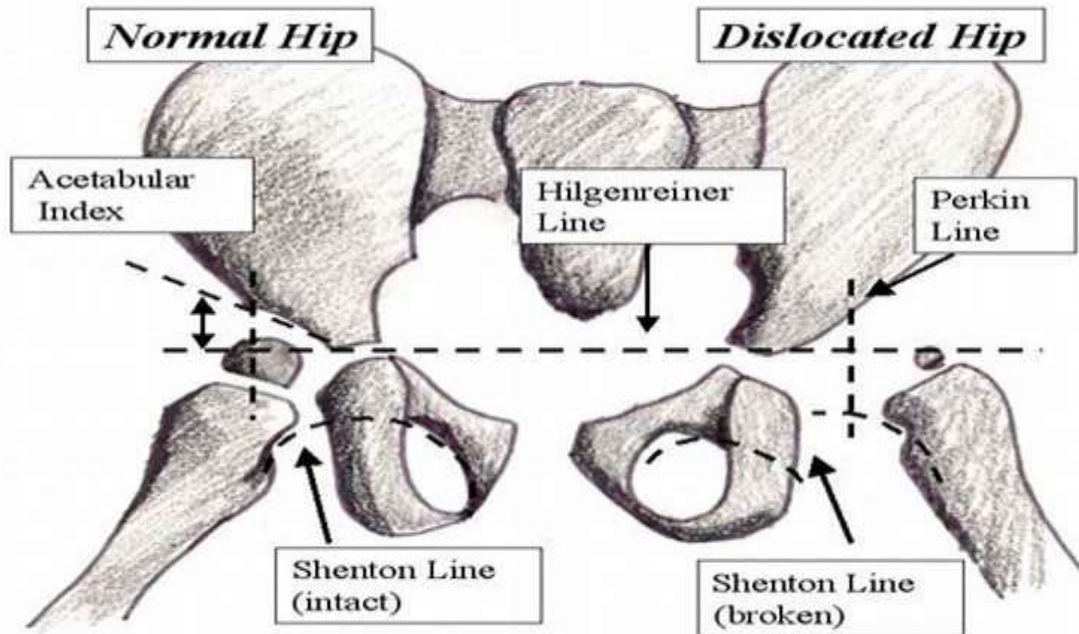
From an AP radiograph of the hips, a horizontal (Hilgenreiner line)

The Hilgenreiner line is drawn horizontally through the superior aspect of both triradiate cartilages. It should be horizontal but is mainly used as a reference for Perkin line and measurement of the acetabular angle. (Perkin line), is drawn perpendicular to Hilgenreiner line dividing the hip into four quadrants. The proximal medial femur should be in the lower medial quadrant, or the ossific nucleus of the femoral head, if present (usually observed in patients aged 4-7months), should be in the lower medial quadrant <sup>[9]</sup>.

-Shenton line is drawn along the inferior border of the superior pubic ramus and should continue laterally along the inferomedial aspect of the proximal femoral neck as a smooth line. If there is a superolateral migration of the proximal femur due to DDH then this line will be some degree of hip subluxation<sup>[9]</sup> .

-The acetabular angle is formed by the intersection between a line drawn tangential to the acetabular roof and Hilgenreiner line, forming an acute

angle. It should be approximately 30° at birth and progressively reduce <20 degrees by 2 years of age .



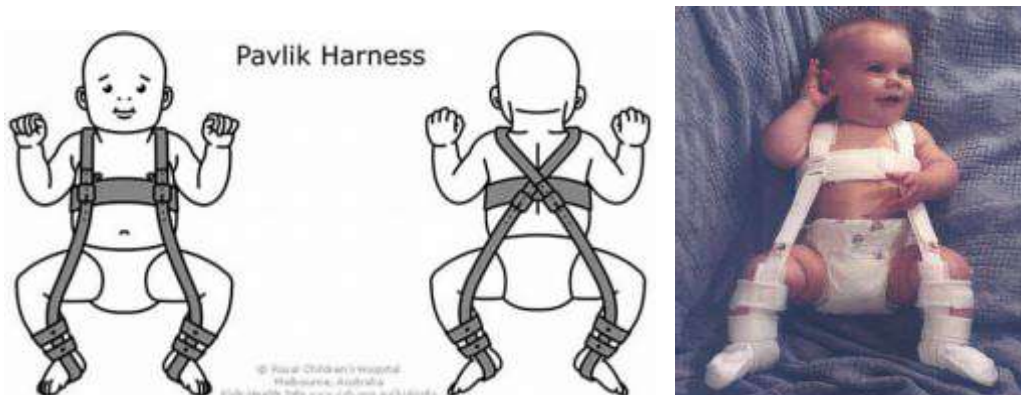
- Conservative treatments of DDH aims is to hold the legs in such a way that the femoral head fits snugly into the acetabulum .The constant pressure of the head against the floor of the acetabulum helps mold it and this cause it to develop properly therefore stabilizing the hip. The later the diagnosis of DDH is made ,the more difficult it is to achieve this and the more complex are the required treatments<sup>[10]</sup> .

- For the FIRST 3–6 MONTHS Where facilities for ultrasound scanning are available, all newborn infants with a high-risk background are examined by ultrasonography. If this shows that the hip is reduced and has a normal cartilaginous outline, no treatment is required but the child is kept

under observation for 3–6 months. In the presence of acetabular dysplasia or hip instability, the hip is splinted in a position of flexion and abduction and ultrasound scanning is repeated at intervals until stability and normal anatomy are restored<sup>[1]</sup>.

- If ultrasound is not available, the simplest policy is to regard all infants with a high-risk background or a positive Ortolani or Barlow test, as 'suspect' and to nurse them in double napkins or an abduction pillow for the first 6 weeks. At that stage they are re-examined: those with stable hips are left free but kept under observation for at least 6 months; those with persistent instability are treated by more formal abduction splintage until the hip is stable and x-ray shows that the acetabular roof is developing satisfactorily (usually 3–6 months) [1] .

-Von Rosen's splint is an H-shaped malleable splint that has the merit of being easy to apply. The Pavlik harness is more difficult to apply but gives the child more freedom while still maintaining position. The three golden rules of splintage are :(1)the hip must be properly reduced before it is splinted ;(2)extreme positions must be avoided;(3)the hips should be able to move[1] .



- **PERSISTENT DISLOCATION: 6–18 MONTHS** If, after early treatment, the hip is still incompletely reduced, or if the child presents late with a 'missed' dislocation, the hip must be reduced – preferably by closed methods but if necessary by operation – and held reduced until acetabular development is satisfactory. Closed reduction Closed reduction is suitable after the age of 3 months and is performed under general anesthesia with

an arthrogram to confirm a concentric reduction. To minimize the risk of avascular necrosis, reduction must be gentle and may be preceded by gradual traction to both legs<sup>[1]</sup>. Failure to achieve concentric reduction should lead to abandoning this method in favour of an operative approach at approximately 1 year of age. The hips should be stable in a safe zone of abduction, which may be increased with a closed adductor tenotomy<sup>[1]</sup>.

- **Operation** If, at any stage, concentric reduction has not been achieved, open operation is needed<sup>[1]</sup>. Femoral osteotomy can stabilize the hip and reduce pressure on the femoral head. Pelvic osteotomy can redirect or reshape the acetabulum<sup>[3]</sup> .

- **Operation** , The joint capsule is opened anteriorly, any redundant capsule is removed along with any other blocks to reduction including the hypertrophied ligamentum teres and transverse acetabular ligament and the femoral head is seated in the acetabulum. Usually a derotation femoral osteotomy held by a plate and screws will be required. At the same time a 1 cm segment can be removed from the proximal femur to reduce pressure on the hip. If there is marked acetabular dysplasia, some form of acetabuloplasty will also be needed <sup>[1]</sup>— either a pericapsular reconstruction of the acetabular roof (Pemberton’s operation) or an innominate (Salter) osteotomy which repositions the entire innominate bone and acetabulum<sup>[1]</sup>

- **PERSISTENT DISLOCATION: 18 MONTHS – 4 YEARS** In the older child, closed reduction is less likely to succeed; many surgeons would proceed straight to arthrography and open reduction. Traction Even if closed reduction is unsuccessful, a period of traction (if necessary combined with psoas and adductor tenotomy) may help to loosen the tissues and bring the femoral head down opposite the acetabulum. Arthrography An arthrogram

at this stage will clarify the anatomy of the hip and show whether there is an inturned limb or any marked degree<sup>[2]</sup> of acetabular dysplasia.



**FIGURE** Two-year-old female status post right hip open reduction, femoral shortening, and placement of spica cast.

## Complications

1- Failed reduction: Multiple attempts at treatment, with failure to achieve concentric reduction, may be worse than no treatment. The acetabulum remains undeveloped, the femoral head may be deformed, the neck is usually anteverted and the capsule is thickened and adherent<sup>[1]</sup>.

2-Avascular necrosis A much-feared complication of treatment is ischemia of the immature femoral head. It may occur at any age and any stage of treatment and is probably due to vascular injury or obstruction resulting from forceful reduction and hip splintage in abduction. Prevention is the best cure: forced manipulative reduction should not be allowed; traction should be gentle and in the neutral position; positions of extreme abduction must be avoided; soft-tissue release (adductor tenotomy) should precede closed reduction; and if difficulty is anticipated open reduction is preferable<sup>[1]</sup>.

3- Persistent dislocation in adults Adults who appear to have managed quite well for many years may present in their thirties or forties with



increasing discomfort due to an unreduced congenital dislocation. Walking becomes more and more tiring and backache is common. With bilateral dislocation, the loss of abduction may hamper sexual intercourse in women. Disability may be severe enough to justify total joint replacement<sup>[1]</sup>.

## **Aim of the study**

- To evaluate outcome of open reduction management for children with developmental dysplasia of the hip (DDH) presenting after 18 months of age to 4 years and correlate the results with age group, gender, the presence of a family history and the diagnosis of which hip is affected (right, left or bilateral) and complications of surgery .

## **Patients and Methods**

- The type of study used was a cross sectional study (also known as a cross-sectional analysis, transversal study, prevalence study) which is a type of observational study that involves the analysis of data collected from a population, or a representative subset, at one specific point in time.

- The study was conducted from November, 2018 to March, 2019 at Al-Imamain Al-Kadhemain teaching hospital .

- We retrospectively evaluated children who were diagnosed with developmental dysplasia of the hip after 18 months of age to 4 years and were treated operatively. Children who have first presented before 18 months of age or who were treated conservatively were excluded from this study.

- Type of surgical management was broadly categorized into:

1) Open reduction

2) Pelvic osteotomy

3) Femoral osteotomy

- Patients were evaluated clinically by look, feel, and move, and radiologically by establishing whether reduction has been achieved or the treatment has failed

- Other information that were collected from the patients in order to study their relation to the outcome of open reduction management include: Gender of the patient, age of the patient, age of the patient at the time of the diagnosis, diagnosis of which hip is affected and whether there is infection ,stiffness , avascular necrosis of femoral head and recurrent dislocation after surgery

- The statistical analysis was performed with the use of SPSS data editor 17 for Windows and Microsoft Excel 2013.

## Questions Paper

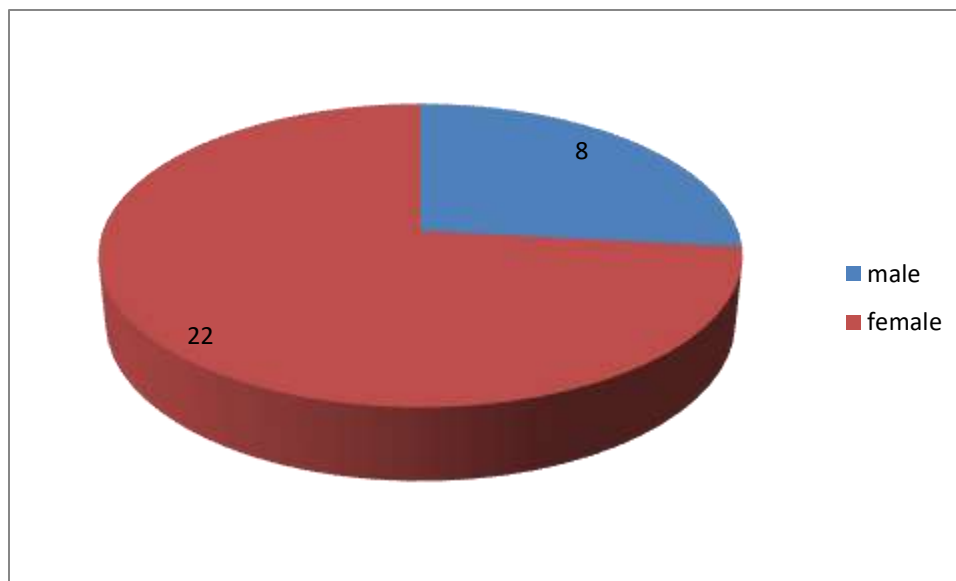
<b>Name:</b>
<b>Age:</b>
<b>Sex:</b>
<b>Unilateral :Lt or Rt Bilateral:</b>
<b>Age at which DX:</b>
<b>Method of Dx:</b>
<b>Type of surgery :</b>
<b>Outcome :</b> <b>Infection</b>  <b>Stiffness</b>  <b>Avascular necrosis of femoral head</b>  <b>Recurrent dislocation</b>

## Results

- A total of 30 cases with developmental dysplasia of the hip (DDH) were studied

valid	Frequency	Percent	Valid percent	Cumulative percent
Male	8	27%	27.00	27.00
Female	22	73%	73.00	73.00
Total	30	100	100	100

**table 1. Gender frequency**

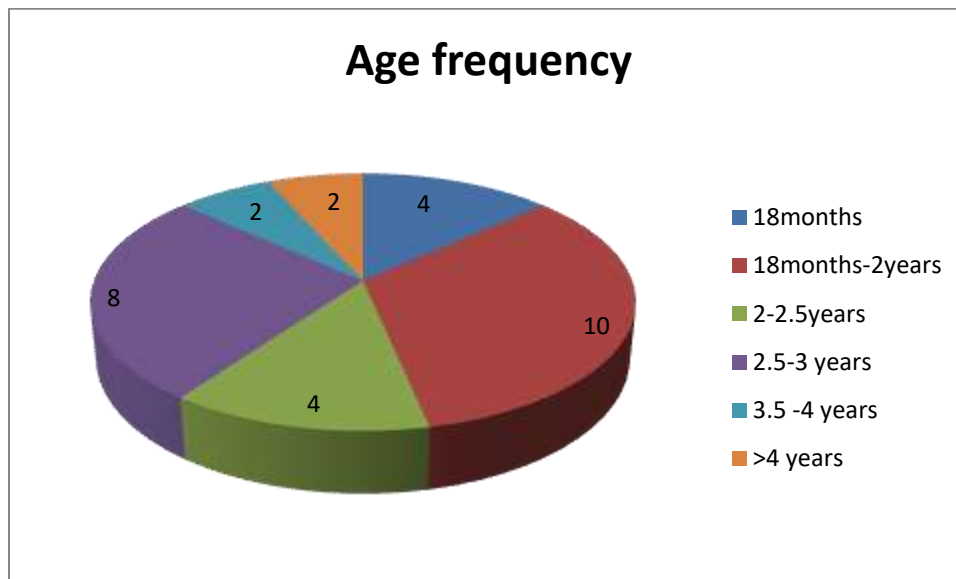


**Figure 1. Gender frequency**

- *Of the 30 cases studied, 22 were females (representing 74% of total) and 8 were males (representing 26% of total)*

**Table 2. Age Frequency**

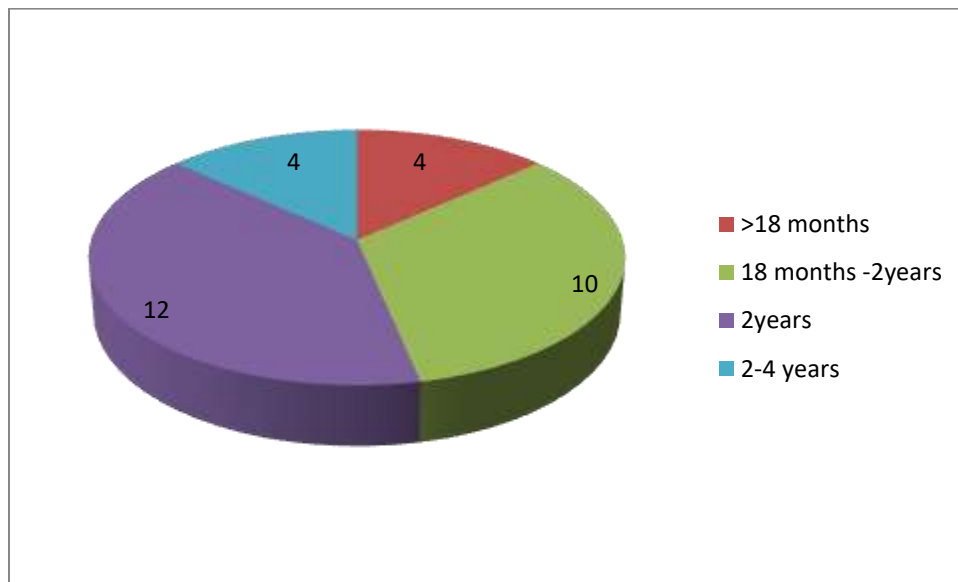
<i>valid</i>	<i>frequency</i>	<i>percent</i>	<i>Valid percent</i>	<i>Cumulative percent</i>
<i>18 months</i>	<i>4</i>	<i>13.0%</i>	<i>13.0%</i>	<i>13.0%</i>
<i>18months-2years</i>	<i>10</i>	<i>33.0 %</i>	<i>33.0%</i>	<i>33.0%</i>
<i>2 - 2.5 years</i>	<i>4</i>	<i>13.0%</i>	<i>13.0%</i>	<i>13.0%</i>
<i>2.5 -3 years</i>	<i>8</i>	<i>27.0%</i>	<i>27.0%</i>	<i>27.0%</i>
<i>3.5-4 years</i>	<i>2</i>	<i>7.0%</i>	<i>7.0. %</i>	<i>7.0%</i>
<i>&gt;4years</i>	<i>2</i>	<i>7.0%</i>	<i>7.0%</i>	<i>7.0%</i>
<i>Total</i>	<i>30</i>	<i>100</i>	<i>100</i>	<i>100</i>



**Figure 2. Frequency of age groups**

**Table 3. Frequency of age groups at the time of the diagnosis**

Valid	Frequency	percent	Valid percent	Cumulative percent
>18 months	4	13%	13%	13%
18months - 2years	10	33%	33%	33%
2 years	12	40%	40%	40%
2-4 years	4	13%	13%	13%

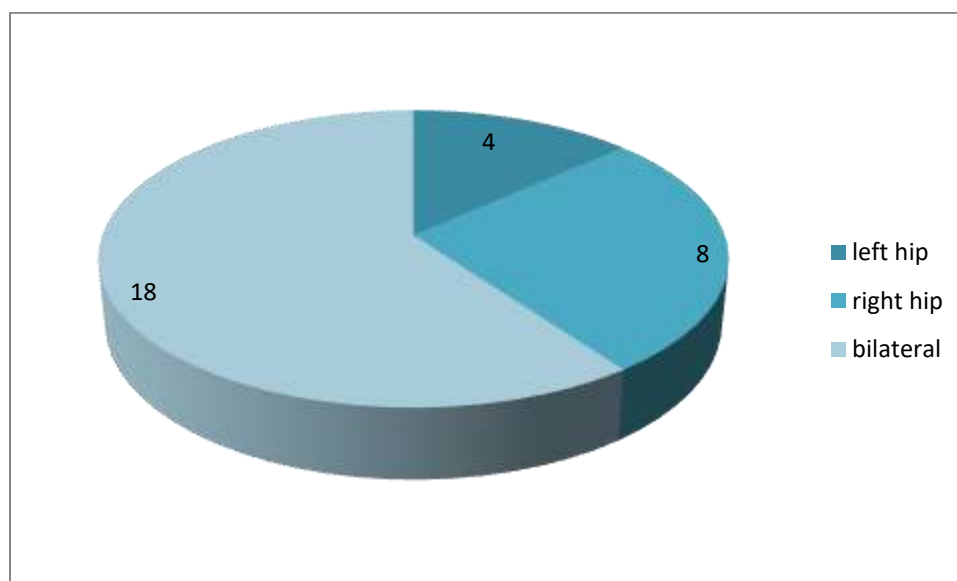


**Figure 3. Frequency of age groups at the time of the diagnosis**

*- The study included 4 patients diagnosed at an age of < 18 months (13% of the total), 10 patients diagnosed between 18months – 2 years of age (33% of the total) , 12 patients diagnosed at 2 years of age (40% of the total) and 4 patients diagnosed between 2-4 years of age (13%of the total)*

**Table 4. Frequency of affected hip**

valid	frequency	percent	Valid percent	Cumulative percent
Left hip	4	13%	13.00	13.00
Right hip	8	27%	27.00	27.00
Bilateral	18	60%	60.00	60.00



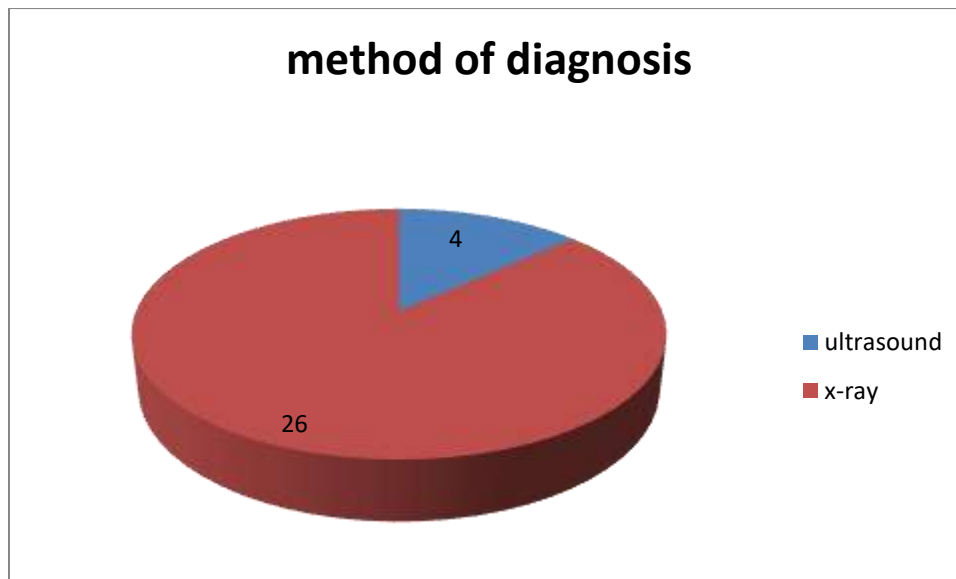
**Figure 4. Frequency of affected hip**

*- Of the 30 patients in this study, 4 cases (13%) were diagnosed with developmental dysplasia of the left hip, 8 cases (27%) were diagnosed with developmental dysplasia of the right hip and 18 cases (60%) were diagnosed with bilateral DDH*



**Table 5:method of diagnosis**

valid	frequency	percent	Valid percent	Cumulative percent
ultrasound	4	13%	13.00	13.00
x-ray	26	87%	87.00	87.00



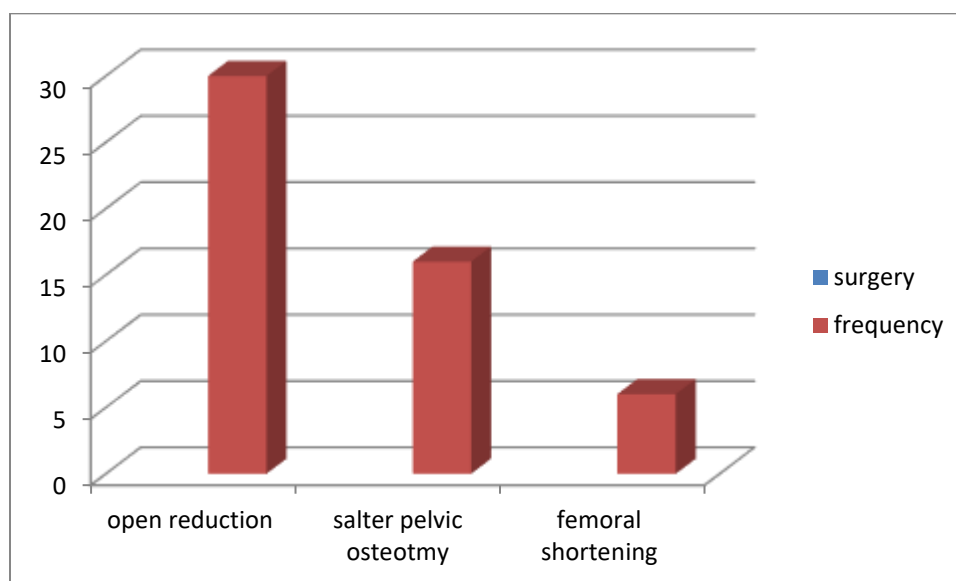
**Figure 5. method of diagnosis**

*- Of the 30 patients in this study, 4 cases (13%) were diagnosed with developmental dysplasia by **ultrasound** and 26 cases (87%) were diagnosed with developmental dysplasia by **x-ray**.*

**Table 6.types of surgery**

valid	frequency	percent	Valid percent	Cumulative percent
Open Reduction	30	100	100.00	100
Salter Pelvic osteotomy	16	53%	53.00	53.00
Femoral osteotomy Shortening	6	20%	20.00	20.00

-of the 30 patients on this study all of them under went open reduction,16 cases(53%) underwent open reduction and salter pelvic osteotomy and6 cases (20%) underwent open reduction ,pelvic osteotomy and femoral shortening.



**Figure 6.types of surgery**



**open reduction and salter osteotomy**





**Open reduction**





Femoral osteotomy

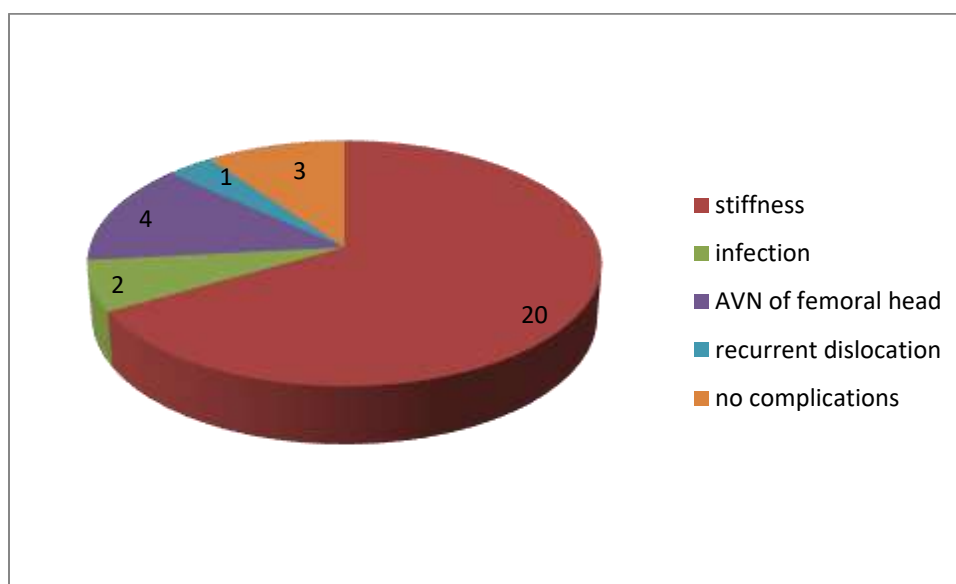


**Open reduction**



**Table 7:Outcome of open reduction**

outcome	Frequency	Percent	Valid percent	Cumulative percent
Stiffness	20	67%	67.00	67.00
Infection	2	7%	7.00	7.00
Avascular necrosis of femoral head	4	13%	13.00	13.00
Recurrent dislocation	1	3%	3.00	3.00
NO complications	3	10%	10.00	10.00



**Figure 5. outcome of open reduction Management**

*Of 30 patients in this study 20 cases (67%) were developed stiffness ,2cases (7%)were developed infection,4 cases (13%) developed avascular necrosis of femoral head,0cases developed recurrent dislocation and 3 cases (10%) were with no complications*



## **Discussion**

- This study has included 30 cases visiting outpatient clinic in Al-Imamain Al-Kadhemain teaching hospital. All these patients were treated surgically and were evaluated for the outcome. In our study 100% of patients achieved reduction with surgically treatment

- Of the 30 cases examined 73 % were females and 27 % were males and this is similar to a study conducted in the Department of Orthopedics, College of Medicine, King Khalid University, Al-Riyadh, Saudi Arabia that showed about 78% of patients were females and 22% were males [10]. The difference between our study and this study could be attributed to the sample size

-In this study the mean age group of patients was 2years and 9 months ranging from 18 months to 4 years

While the mean age of diagnosis of patients with developmental dysplasia of hip was 2 years .

- The study included 4 patients diagnosed at an age of < 18 months (13% of the total), 10 patients diagnosed between 18months – 2 years of age (33% of the total) , 12 patients diagnosed at 2 years of age (40% of the total) and 4 patients diagnosed between 2-4 years of age (13%of the total) And this is similar to study conducted in the Department of pediatric Orthopedics, College of Medicine, University children’s Hospital , Belgrade, Serbia [11].

- In this study, 13% of patients were diagnosed with developmental dysplasia of the left hip, 60% of patients had bilateral DDH and 27% presented with developmental dysplasia of the right hip. This is inconsistent with results of a study conducted in the Department of Orthopedics surgery , faculty of Medicine ,Gaziantep University ,Sahinbey ,Gaziantep Turkey[12]. .which show 2 groups one of them bilateral DDH more and the second was

40 patients : 33 girls and seven boys. Thirteen patients had dislocation of the left hip, 16 had dislocation of the right, and 11 had bilateral dislocation.

-In this study , Of the 30 patients in this study, 4 cases (13%) were diagnosed with developmental dysplasia by **ultrasound** ,which is the most preferred way to diagnose hip dysplasia in babies to 6 months of age , and 26 cases (87%) were diagnosed with developmental dysplasia by **x-ray** , which is more reliable test for the child after a 6 months of age because additional bone forming into the head of the femur interferes with the accuracy of the ultrasound imaging<sup>[11]</sup>

-In this study 100% of patients underwent open reduction internal fixation alone or in combination with pelvic osteotomy which was 53% and femoral shortening which was 20% .This is inconsistent with results of a study conducted in Shriners Hospital for children ,Mexico City <sup>[13]</sup>. Which show 712 hips in 645 patients that underwent open reduction, alone or in combination with a pelvic osteotomy. In all, 91 hips had open reduction alone and 621 had open reduction and pelvic osteotomy. Femoral shortening was performed in 221 hips

-In this study of 30 patients in this study 20 cases (67%) were developed stiffness

Pathological Stiffness as complication is rare and is usually resolved without treatment or simple physical therapy. Usually it is related with prolong immobilization, the multiple stages surgical treatment includes open reduction, pelvic osteotomy and femoral osteotomy, time different between two hips reduction or surgery associated joint contracture are causes of stiffness , and spontaneous recovery reported. Hip stiffness due to underlying local hyper tonicity. That is resolved with anesthesia and it was treated after using botulinum toxin A injection. and this is inconsistent with results of a study conducted in Istanbul University , Istanbul Medicine ,Faculty orthopedics and traumatology Department ,Millet ,Caddesi ,capa,Fatih ,Istanbul , Turkey<sup>[14]</sup>.

-In this study 2 cases (7%) were developed infection . and this is inconsistent with results of a study conducted in Department of Orthopedics ,student ,Ayub Medical college ,Abbottabad, \*\*khyber Teaching Hospital ,Peshwar-Pakistan<sup>[15]</sup>. which show 2 cases (3%) developed with wound infection from 60 cases after open reduction surgery .

-In this study 4 cases (13%) developed avascular necrosis of femoral head which is a serious complication and can lead to acetabular dysplasia, joint incongruity, limb-length discrepancy, and early osteoarthritis. we can explain the cause of AVN in open reduction based on these 2 mechanisms. First, open reduction is invasive. The medial femoral circumflex artery is the main blood supply to the femoral head. It lies between the adductor and iliopsoas muscles and traverses the anteromedial capsule of the hip. This artery needs to be ligated during open surgery or may be injured during capsulotomy. During capsulotomy, the acetabular labrum, ligamentum teres, and other soft tissues may be separated intraoperatively, leading to tightness of the posterosuperior capsule, contracture of the external rotators, increased pressure of the joint cavity, and increased pressure on the femoral head. Because extrinsic compression of the blood vessels and excessive pressure on the femoral head may occur during joint reduction, patients who undergo repeated reduction attempts for recurrent dislocation are believed to have a higher risk of AVN . and this is inconsistent with results of a study conducted in Department of Orthopedics ,Hospital of China Medical University ,No.36 Sanho Street,Heping District . <sup>[16]</sup>.

-In this study only 1 case(3%) developed with recurrent dislocation ,greater pelvic width ,decreased abduction in spica cast were risk factors for Re- dislocation after open reduction ,also abnormal femoral version and femoral head dysplasia are also important factors .and this correlate with a study conducted in Division of Orthopedic surgery ,The Children's Hospital of Philadelphia, PA-shrines Hospital for children ,los Angeles, CA <sup>[17]</sup>.

-In this study 3 cases (10%) were with no complication .

## **Conclusion**

- Developmental dysplasia of the hip is a common problem and open reduction management is the treatment of choice for those above 18 months of age. Outcome of open reduction management depends on the age of the patient at the time of diagnosis, and whether the condition is unilateral or bilateral. Gender of the patient has little influence on the outcome.

There was a high rate of good clinical and radiographic outcomes at a minimum six-year follow-up in patients with late-presenting DDH who underwent open reduction.

## **Recommendations**

- Given the infrequent nature of DDH, multicenter studies of interventions that measure functional outcomes (including long-term outcomes) in a standardized fashion are needed.
- Studies designed to identify valid and reliable radiologic outcomes of DDH as proxy measures of functional outcomes are also needed.
- Determining patient preferences and identifying outcomes that are relevant to patients and families would be valuable.
- Controlled studies that assess the effects of delaying treatment on outcomes would allow physicians who care for children to better manage those with DDH.

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