

Original Research Article

**Preliminary over-Head Traction Followed by Closed Reduction Versus
Closed Reduction without Preliminary over-Head Traction;
A Comparative Study Discussing The Treatment of Developmental Dysplasia
of The Hip (DDH) From The Age of 6 To 24 Months**

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Abstract

There is a controversy whether to use preliminary over-head traction or not prior closed reduction in infants treated for DDH.

The aim of this study was to compare the results of treatment of 2 groups of patients; the first group was treated by closed reduction preceded by overhead traction for 2 weeks, while the second group was treated by closed reduction without preliminary traction.

This prospective study reviewed the clinical and radiological outcome of 84 hips in 67 patients having DDH treated in Al-Sader Teaching Hospital between March 2005 & January 2014.

The mean age at the time of the operation was 14 months. The female to male ratio in our study was 8.5: 1.5. The mean period of follow up was 58 months.

The rate of satisfactory results in the first group was 89.5% which is higher than that of the second group in which the rate of satisfactory results was 80.4%.

This study revealed that overhead traction followed by closed reduction give better results and low rate of complications and this justified in patients with DDH aging 6-24 months old.

Key Words: DDH, overhead traction, closed reduction.

دراسة مقارنة لطريقتين تستخدمان في علاج حالات خلع الورك الولادي في الاطفال بعمر 6 شهر ولغاية 2 سنة

الخلاصة

هناك اختلاف في الآراء بخصوص استعمال السحب الجلدي من عدمه قبل محاولة ارجاع الورك المخلوع في الاطفال اللذين يعانون من خلع الورك الولادي.

الهدف من هذه الدراسة هو مقارنة نتائج العلاج في مجموعتين من المرضى. المجموعة الاولى عولجت بواسطة استعمال السحب الجلدي للورك المصاب ولمدة اسبوعين يليها محاولة ارجاع الخلع. المجموعة الثانية عولجت بارجاع الخلع مباشرة دون استعمال اي سحب جلدي. ناقشت هذه الدراسة النتائج السريرية والشعاعية ل 84 ورك تابعه الى 67 طفل مصاب بخلع الورك الولادي عولجوا في مستشفى الصدر التعليمي في محافظة النجف في الفترة ما بين اذار 2005 ولغاية كانون الثاني 2014. كان معدل عمر المرضى 14 شهر. نسبة الاناث الى الذكور كانت 8.5-1.5. كان معدل فترة المتابعة 58 شهر. نسبة النتائج الجيدة في المجموعة الاولى كانت 89.5% وهي اعلى من النسبة في المجموعة الثانية وكانت 80.4%. هذه الدراسة اثبتت ان استعمال السحب الجلدي قبل محاولة ارجاع الخلع هو ذو فائدة كبيرة في تحسين نتائج العلاج وتقليل نسبة المضاعفات في الاطفال المصابين بحالات خلع الورك الولادي وبالعمر 6-24 شهرا.

الكلمات المفتاحية: سحب جلدي، خلع، الورك الولادي

Introduction

Developmental dysplasia of the hip (DDH) is a congenital plus/minus environmental malformation affecting the proximal part of the femur and acetabulum that leads to hip subluxation and dislocation with or without *acetabular dysplasia*. Early diagnosis and treatment is crucial because failure to diagnose and treat DDH at early months of the life may result in significant morbidity [1-3].

The reported incidence of neonatal hip instability is 5-20 per 1000 live births; Any way, most of these hips stabilize spontaneously within 3 weeks, and on re-examination 3 weeks after birth the incidence of instability decrease to 1-2 per 1000 infants. Females are much more commonly affected than males. The left hip is more commonly affected than the right hip [4].

Breech position, swaddling, familial ligamentous hyperlaxity, *genetic factors*, and hormonal factors (females) are the most prominent aetiological conditions [5-9].

The diagnosis of cases at birth still unrealized, for this reason, a newborn baby should be examined for signs of hip instability. Ortolani maneuver and Barlow's test are of great help in the diagnosis of DDH in neonates [4,10,11,12,13].

Additional physical findings for the diagnosis of late unilateral dislocation include asymmetry of the gluteal skin crease or labial skin folds, limited abduction on the affected side, standing or walking with external rotation of the affected leg, limping, and leg-length discrepancy. In bilateral DDH, there is limitation of abduction of both hips, delayed walking, waddling gait with hyperlordosis [14].

Diagnosis of DDH by x-ray in infancy is almost completely forbidden nowadays because it has been replaced by sonographic examination, ultrasound is more informative with no radiation hazards [15-19].

Ultrasound examination is the only diagnostic tool that permits real-time assessment and a three-dimensional view of a neonate's hip. The cartilaginous head & acetabulum can be readily seen on ultrasonography; the relationship between

each other can be calculated statically & dynamically. The newborn should be examined clinically for DDH at birth, and then the suspicious and at-risk patients should be selectively examined with ultrasound. An ultrasound examination is typically performed either by assessing the alpha and beta angles (static examination) or by performing a dynamic examination. The alpha angle determines the slope of the superior aspect of the bony acetabular socket, with an angle greater than 60 ° considered normal. The beta angle considered normal if less than 55 °, depicts the cartilaginous component of the acetabular socket. Many centers now use a dynamic form of ultrasound, as shown by Harcke [20-24].

Because the center of the femoral head begins to ossify at the age of 6 months-1 year, the diagnosis must then be made radiologically. The antero-posterior view in the infant should always be an x-ray of both hips so that the horizontal situation of pelvis can be evaluated and both hips can be compared.

A few guidelines will facilitate a general assessment of the AP view of an infant's radiograph (fig. 1).

1-The Hilgenreiner line which joins the center of triradiate cartilage in transverse direction.

2.The Ombrédanne line is drawn from the lateral edge of the acetabular roof, and crosses through the Hilgenreiner line to form four quadrants. In normal x-ray the center of the femoral head lie in the lower inner quadrant.

3- Orientation line *according* to Shenton and Ménard: Normally there is smooth continuation of the line drawn along the medial border of the femoral neck and then passing through the superior border of the obturator foramen in a well formed arc. In congenital dislocation of hip this arc (or what is called Shenton's line) is disrupted.

4- Acetabular index = AC or Acetabular roof angle: angle between Hilgenreiner line and the line joining the triradiate cartilage and the lateral acetabular epiphysis. Normally the angle at birth is about 30°, at 1 year age it is few degrees over 20° and at 3 years of age less than 20° [15-19].

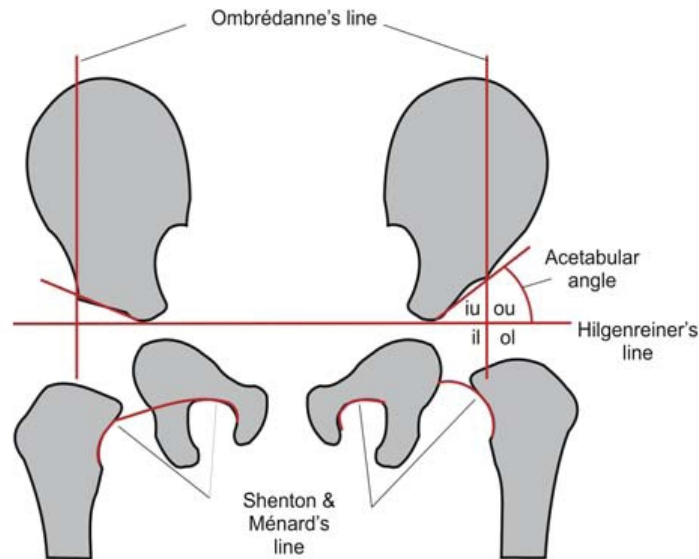


Figure 1: Lines and angles used in the assessment of infant's x-rays (Hilgenreiner, line, acetabular angle, Shenton-line); ou outer upper; iu inner upper; ol outer lower; il inner lower [19].

Once a dysplastic hip recognized in new born, the hip should be allowed to lie in flexion & unforced abduction in the appropriate splint. This type of treatment can be tried in DDH till the age of 6 months [5].

If the diagnosed of DDH is delayed after the age of 6 months or if the abduction splint is failed to reduce the hip, a closed reduction is attempted. Usually, traction is applied for 2-3 weeks before closed reduction [14]. There are 2 types of traction. 1-longitudinal traction for the treatment of DDH was first introduced by Pravaz in 1847. This method still used, in some cases of DDH as a home-based management. The

end of the bed elevated to apply counter traction. The legs are abducted by approximately 20 degrees [25].

2-Over head traction was attempted first in 1955 by Craig, and it is still used widely till now. A bilateral traction was applied for 2-3 weeks during which a gradual abduction is done [25] Fig.2

Closed reduction is better to be done under general anesthesia with or without adductor tenotomy, then hip spica is applied for both hips (fig.3). Open reduction of the dislocated hip is indicated in children with the age of more than 2 years at the time of diagnosis or for those in whom attempts of closed reduction have been failed [26].



Figure 2: overhead traction [19]



Figure 3: hip spica [19]

Materials and Methods

Between march 2005 and January 2014, 84 dislocated hips (in 67 patients with DDH) were treated in the orthopedic department of AL-Sader Teaching hospital. Patients who had a neuromuscular or teratological dislocation had been excluded from the study previously. The patients were divided into 2 groups, the first group composed of 38 hips while the second one composed of 46 hips. The first group were treated by preliminary overhead traction for 2 weeks followed by closed reduction; a skin traction was applied for both legs with the hips flexed at 90–100°, abducted approximately 20° and with the extension of both knee joints. A weight of 1-1.75 Kg is applied to the patient's legs. The degree of traction should be arranged to produce a hip flexion of more than 90 degrees. Then the legs are gradually abducted to achieve an abduction of around 70 degrees after 10-14 days.

The second group was treated by closed reduction without any preliminary traction. In both groups, closed reduction was done under general anesthesia with the aid of adductor tenotomy. Concentric reduction of the hip was verified with radiographs. All reduced hips were immobilized in hip spica in which the hips are flexed by up to 100-120 degrees and abducted to 50-60 degrees. Hip spica was applied for 6 weeks followed by abduction splint for another 6 weeks. Partial weight bearing was permitted while the patient wearing the splint at the last 3 weeks, followed by full weight bearing as early as the patient could.

There were ten male and fifty-seven female patients. Four of the ten male patients and 13 of the fifty-seven female patients had a bilateral procedure. The mean age at the time of the surgery was 14 months (range, 6-24 months) for all patients.

Thirty-seven right hips and 47 left hips were involved. The mean period of follow up was 58 months (range 23-72 months).

From the total number of patients there were 45 patients (67 %) firstborn children, ten patients (15 %) had a positive family history of congenital hip dislocation, Fifteen patients (22.3 %) had a positive history of breech presentation and 15% were delivered by cesarean section.

Results

Sixty seven children with 84 hips were included in our study. 20.2% of patients had bilateral DDH, while 79.8% of them had unilateral DDH. The left side was affected in 56% of patients while the right side was affected in 44%.The female to male ratio in our study was 8.5 : 1.5.The age of our patients was ranging between 6-24 months (mean 11 months). The mean period of follow up was 58 months.

Preoperative evaluation of the involved hips was done according to Tonnis classification [27]. Post-operatively, the results were evaluated functionally and radiologically. Functional assessment was done according to Harris [28] scoring system while radiological assessment was done according to Severin classification [29].

Thirty four hips (89.5% 34) in the first group(preliminary traction) had either

excellent or good results(Harris); 80.43% of the hips (37 hips) in the second

group(without traction) had either excellent or good results (Harris). Table (1)

Table 1: Results of our study

	Patients number	♂	♀	Bilateral	unilateral	Lt.	Rt.	hips	Harris Hip score		Severin Type	
									good excellent	Bad fair	1,2,3	4,5,6
1st group	31	4	27	7	24	21	17	38	34	4	32	6
2nd group	36	6	30	10	26	26	20	46	39	9	36	10

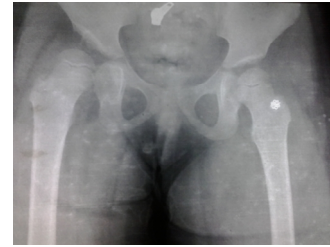
The x- rays in the figure below (fig. 4) showing a good result in female patient of 17 months age presented to us with right sided DDH.



Preoperative x- ray



45 days postoperative
(Figure 4)



13 months postoperative

In the 1st group 4 major complications were found, avascular necrosis in 2 hips and re-dislocation in 2 hips. In the second group 9 major complications were found, avascular necrosis in 5 hips & re-dislocation in 4 hips. The rate of major complication in the 1st

group was 10.52% while that of the 2nd group was 19.56%.

Figure 5 showing the x-ray of one of our cases from the second group which end with avascular necrosis.



Figure 5: avascular necrosis

Avascular necrosis of the head of femur was assessed with the classification system described by Bucholz and Ogden [30]. According to the classification of Bucholz and Ogden, 5 hips had type-II avascular necrosis, 1 hip had type-III and 1 hip had type-IV.

Re-dislocation treated by open reduction with or without pelvic osteotomy. Avascular necrosis treated with abduction splint with decreased weight bearing.

Minor complications like superficial wound infection at the site of adductor tenotomy, napkin dermatitis around and beyond the spica, transient stiffness or supracondylar femoral green stick fracture were found to affect 13.15% of hips in the first group & 15.2 of the second group (table-2). All these minor complications were treated conservatively without affecting the final results.

Table 2: Complications

	AVN	redislocation	infection	dermititis	stiffness	Fracture
1st gr.	2	2	1	1	2	1
2nd gr.	5	4	1	2	3	1

Figure (6) below showing the better results and the lower rate of complications in the first group if it is compared with the second group.

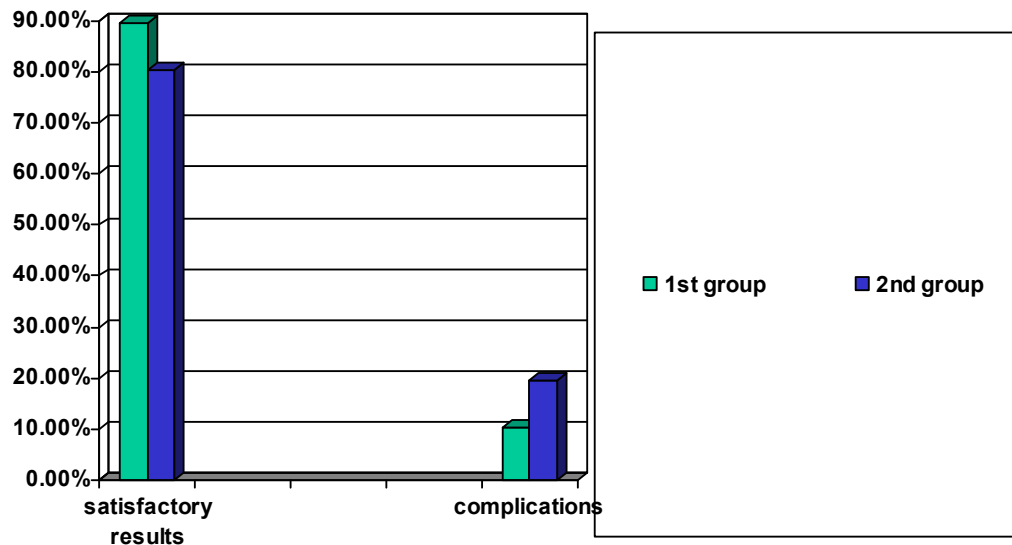


Figure 6: Comparison between 1st & 2nd groups (Results & complications)

Discussion

Many papers have discussed the benefit of closed reduction in the management of DDH. In our study we compared the result of closed reduction in 2 groups of hips; one of them underwent preliminary overhead traction followed by closed reduction while the second group underwent closed reduction without overhead traction.

Closed reduction of DDH under general anesthesia is typically attempted in children aged 6-24 months. The use of preliminary traction is controversial. Proponents of traction believe that slow, gentle stretching of both the neurovascular structures and the soft tissues about the hip increases the likelihood of a successful reduction and minimizes the risk of osteonecrosis [29]. A study of Gage and Winter seems to support

the use of traction [32]. In contrast, Brougham found that traction did not influence the rate of osteonecrosis [33]. Fish et al [34] published a paper conducted by the Pediatric Orthopedics Society of North America; 87% of the 335 members of POSNA replied to a questionnaire prepared to define the role of pre-reduction traction in the treatment of DDH; 95% of the participants used preliminary traction and most of them supposed that traction decreases the incidence of avascular necrosis and facilitates closed reduction. Traction improves the success rate of closed reduction and decrease the incidence of avascular necrosis of the head of femur [35].

In North America most orthopedic surgeons use traction in a modified overhead position with the hips in some degree of flexion

[34,36]. This position relax the iliopsoas, but unless the hips are significantly abducted, no effect can be expected to perform reduction. Salter *et al.* demonstrated the importance of avoiding excessive abduction position which may cause growth disturbances of the femoral head. However adductor tenotomy at the time of closed reduction play a major role in facilitating reduction and decreasing the incidence of avascular necrosis [37].

Zionts and MacEwen used traction in their study reporting a success rate of 75 per cent of their patients. DeRosa and Feller reported a success rate of 91 per cent after using preliminary traction in the treatment of DDH [36,37]. In the present series, the success rate was 89.5 % using preliminary traction. Fig.7

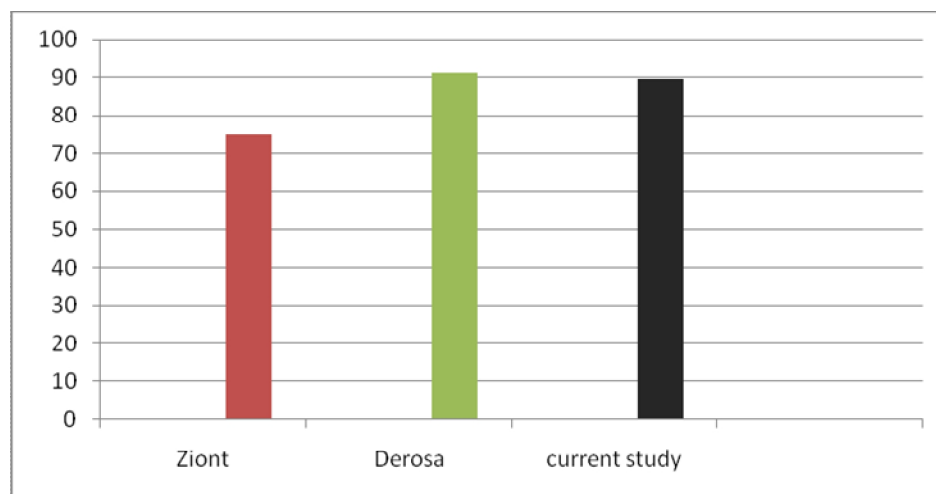


Figure 7: Comparison between current study and other studies

Depending on the better results & the lower rate of complications obtained in the 1st group of our study (fig.6), we can strongly support the use of preliminary over-head traction for 2 weeks as an effective preoperative measure before attempting closed reduction of DDH in patients below 2 years old.

In Europe a study suggests that preliminary traction should be applied among children with DDH treated non-operatively who are older than one year of age and /or have high dislocated hips. In cases that are diagnosed late, this strategy would decrease the incidence of femoral head avascular

necrosis and improve the long term outcome [38].

Clifford advised for management in children between 6 months and 1 year of age, treatment consist of closed reduction following a period of skin traction and with /or without adductor tenotomy (to reduce risk of avascular necrosis; this will be successful in 60-80% of patients [39].

In India study revealed Traction is often applied prior closed or open reduction of hip with DDH, in the belief that it will make reduction easy and decrease the rate of avascular necrosis of the head of femur [40].

The reported rates of avascular necrosis different widely from study to study. Thomas et al have pointed out that the marked variation in the incidence of avascular necrosis reflects not only differences in patient populations but also differences in the definition of this entity. Several systems of classification of avascular necrosis have been developed that encompass the range of disease, from

temporary irregular ossification to total head involvement with growth disturbance. [41] Zions and MacEwen reported (6%) of hips developing clinically significant AVN evidence. Kutlu et al. reported a 5.5% incidence of A.V.N. with the use of traction. Both of these studies showing a comparable incidence of A.V.N to our study fig .8.

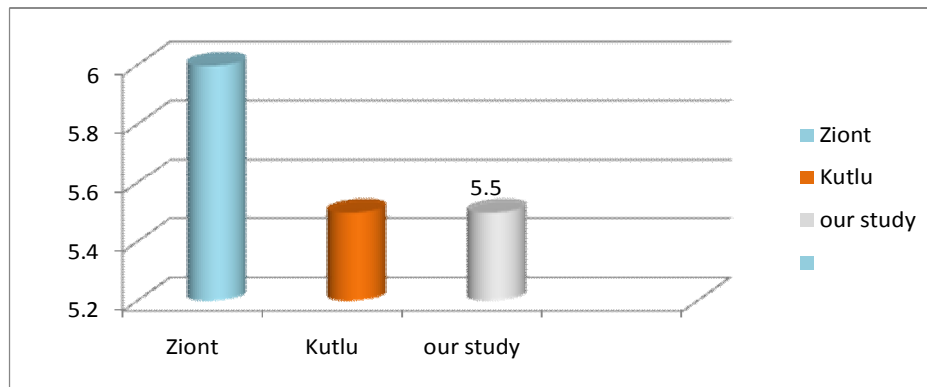


Figure 8: Incidence of AVN of the current study compared to other studies

Conclusion

The use of preliminary over head traction for 2-3 weeks before attempting closed reduction in patients with DDH aging 6-24 months old, recommended by many authors.

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