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Original Article

Role of preoperative arthrography in Developmental Dysplasia of the Hip. How much it is helpful ?

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ABSTRACT

Aim of the study : to try to put an answer to whether this type of invasive procedure of studying the child's hip joint is really helpful and affect the decision management of DDH cases. **Method:** This is a retrospective study, between 1995-2006. The clinical records, arthrograms and X-ray of of (176) children (273 hips) with dislocated or subluxated hips with poor coverage on X-ray or failed conservative treatment were collected The mean time of follow-up is (8)years range from (2 to 13) years and the mean age at the time of arthrogram was(16)months ranges from 7 to 34 months. **Results:** The decision which depends on arthrographic finding is differ from that made on just simple X-ray view in a good percentage of patients. In this population of the study 84 of the hips went into conservative treatment while the first decision on simple views without arthrogram was operative treatment in 50 hips, those (84) hips were followed for up to (8) years .The other (189) hips were underwent open reduction, no repeated arthrogram was done for any cause. **Conclusion :** In all cases the arthrograms were helpful in providing the information about the shape of the head, shape of the acetabulum, labrum, ligamentum teres, containment of the hip and external obstacles that, guides the surgical decision. This procedure is very helpful in many cases of DDH.

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1. Introduction

The late presentation of developmental dysplasia of the hip (DDH) is becoming less common because of neonatal screening and the introduction of sonography. Some abnormal hips still fail to early conservative treatment and others are diagnosed after the patient has begun to walk. For these patients, closed reduction is indicated only when a concentric and stable reduction of the hip can be obtained; the remainder will require an open procedure.

The main objective of closed reduction in developmental dysplasia of the hip (DDH) is to obtain and maintain early, concentric reduction without inducing a vascular necrosis (AVN) while the biologically plastic hip remodels [1-5].

The role of arthrography in different aspects of treatment of DDH is well established[7,9,10]. It allows better visualization of the major intra- and extra-articular obstacles to safe reduction; it therefore assist in the prediction of potential treatment failure and complications[1,9,11-15].

Soft tissue obstruction that may prevent the proper reduction of dislocated hip dysplasia of the hip have been recognized for a long time. Leveuf[7] described constriction of the capsule, adherence of the capsule to the femoral head or to the floor of the acetabulum, hypertrophy of the ligamentum teres, the interposition of fibrofatty tissue and inversion of the labrum or limbus as a possible cause of such obstruction.

The extent of femoral head displacement and the shape of the acetabular labrum are important both in making management decision and in evaluating outcome of development dysplasia of the hip. Plain radiographs of the hip in young children often supply limited information about the anatomy of the hip joint because the cartilaginous femoral head and the fibrocartilaginous acetabulum are difficult to assess. The aim of this study is to try to put an answer to whether this type of invasive procedure of studying the child's hip joint is really helpful and affect the decision management of DDH cases.

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2. Materials and Methods

Hip arthrogram performed under general anesthesia and complete aseptic technique, fluoroscopic control, through the adductor(inferior) approach with the needle directed to the ipsilateral shoulder; aerogram performed to confirm the position in the joint space and a total of 3cc diluted dye is injected under fluoroscopy control then three X-Ray views are taken, anteroposterior, Von-Rosen and the position of the device, then dynamic examination is performed to study more the joint .The advantage of the inferior approach that the hand is just outside the field of radiation and it doesn't obscure the area under observation, and if dye leak occur it will not obscure the area of the hip joint.

This is a retrospective study, between 1995-2006 .The clinical records, arthrograms and X-ray of all with dislocated or subluxated with poor coverage on X-ray or failed conservation treatment of (176) children (273) hip were collected . The mean time of follow-up is (8)years range from (2 to 13) years and the mean age at the time of arthrogram was(16)months ranges from 7 to 34 months.(121) patients were females and only(55) were males. The left hip was involved in (55) patients, the right in (24) patients but there were (97) patients with bilateral involvement.

The hip joint was examined dynamically using image intensifier under general anesthesia, looking for the quality and stability of the reduction anatomic of stability, the depth of the acetabulum and intrinsic barriers to concentric reduction.

Arthrographic Findings

Based on arthrogram one should be able to make comments on the shape of the labrum, the normal shape of the labrum on the anteroposterior projection is depicted as a triangular area surrounded by contrast material, its apex is lateral and inferior and its base continuous with the roof of the acetabulum. A rose thorn appearance is given by the contrast material outlining the labrum(fig.1).

We used Miyakes[20] classification which defines 6 types of limbus as follows; normal,everted which has a blunted and enfolded shape causing minimal block to reduction,intermediate, inverted which is enfolded and interposed between the femoral head and the acetabulum, blockaded which prevents the entrance of the dye into the true acetabulum, and has an ill-defined shape and, impossible which obviously prevent reduction. Miyake recommended that only the everted and intermediate types should be treated by closed methods (fig. 2).

The type of treatment depends on quality of reduction which is either concentric or eccentric. When reduction of femoral head is concentric there will be a thin meniscus of the dye superiorly, medially and inferiorly outlining the femoral head and separating it from the floor without any filling defect in the dye shadow in the floor of the acetabulum. It can be measured as medial dye pooling less than 3 mm and more than (70%) of the head is covered by the fibrocartilagenous labrum.

The other important factor is the stability of the reduction which can be assessed manually by defining the safety zone of Ramsey in unstable and eccentrically reduced hip the obstacles can be seen, as the aspherisity of the femoral head, the ligamentum

teres size, the capsule whether redundant or constricted, the iliopsoas tendon and the transverse ligament. Depending on these criteria the management will be closed treatment in stable and concentric reduction with good coverage but open reduction in unstable, eccentric and poor coverage.

Fig 1. rose thorn sign on left hip arthrogram



Fig 2a

Fig 2b

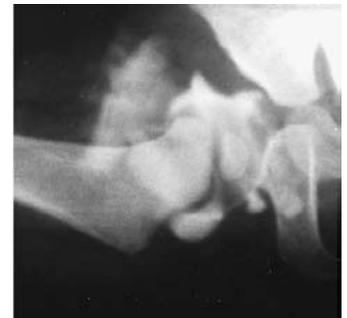
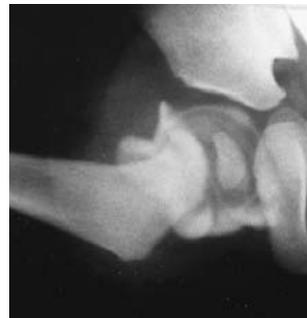


Fig 2c

Fig 2d



Fig 2 e

Fig2 f



Fig 2 Illustration of Miyake's classification of the limbus showing a) normal, b) everted, c) intermediate, d) inverted, e) blockaded and f) impossible types. In our study, the everted and the intermediate types were designated as type CR and the others as type OR.

3. Results

The details of arthrographic findings summarized in table1. Normal labrum was found in (60) hips, whereas everted limbus seen in (46) hips which were stable for closed means of reduction. Inverted limbus seen in (124) hips but blockaded type seen in (34) and impossible seen in only (9) hips. These three later types made closed reduction impossible or eccentric reduction seen in older children who has been walking on their dislocated hip for long time.

Good coverage seen in (121) hips but the other (152) hips where poorly covered; in which less than 50% of the cartilaginous head is covered, which made the hip unstable and eccentrically reduced. Concentric reduction seen in (106) hips, but (150) hips where eccentric,(17)hips were not recorded as concentric or eccentric but the decision was taken to proceed for either closed or open reduction.

Large liqamentum teres in (118) hips, it was not seen (87) hips but the results not recorded in (68) hips. The capsule was redundant in (129) hips but constricted in (84) hips by the iliopsoas tendon.

The decision which depends on arthrographic finding is differ from that made on just simple X-ray view in a good percentage of patients. In this population of the study 84 of the hips went into conservative treatment while the first decision on simple views without arthrogram was operative treatment in 50 hips, those (84) hips were followed for up to (8) years .The other (189) hips were underwent open reduction as shown in table(2), no repeated arthrogram was done for any cause.

Table 1 the results of arthrogram as recorded for the patients.

| Shape of the labrum | Number of hips | Type of coverage | No. of the hips | Type of reduction | No. of hips | Shape of Lig. Teres | No. of hips |
|---------------------|----------------|---|-----------------|----------------------|-------------|---------------------|-------------|
| Normal | 60 | Good(More than 70%of the head is covered) | 121 | Concentric reduction | 106 | Large | 118 |
| Everted | 46 | Poor(Less than 50% of head is coverade) | 152 | Eccentric reduction | 150 | Not seen | 87 |
| Inverted | 124 | Not recordable | | Not recordable | 17 | Not recorded | 68 |
| Blockade | 34 | | | | | | |
| Impossible | 9 | | | | | | |
| Total | 273 | | 273 | | 273 | | 273 |

Table 2 .The final decision on both simple x-ray and after arthrogram.

| | Decision taken of simple X-ray without arthrogram | Decision taken after arthrogram | No. of in which the decision changed |
|---|---|---------------------------------|--------------------------------------|
| To go for conservative treatment | 50 | 84 hip | 42 hips |
| To go for open reduction of the hip | 223 | 189 hip | 63hips |
| Final percentage of changing the decision | | | 105(38%) |

4. Discussion

The aim of treatment in DDH is to obtain a stable and concentric reduction with minimal risk of AVN. Children less than one year of age be managed by closed methods but open reduction is necessary for those over the age of three years. Between these two age groups a dislocated hip may be managed by closed or by operation which allows complete removal of all soft tissue obstruction and shorter immobilization. Zoits[19], concluded that the child who is between

one and two years old when treatment for a developmental dislocation of the hip is best treated by closed reduction. Open reduction should be reserved for hips that cannot be reduced by closed methods.

Arthrography has the advantages of showing the shape and size of the cartilaginous part of both the acetabulum and the femoral head, and soft tissue obstacles, which are clearly seen before reduction while the femoral head is dislocated[1]. Severin [21] followed by Leveuf [6] provided the earliest detected description of the pathological findings seen on hip arthrography in DDH.

In cases which underwent open reduction after an arthrogram, I found a good correlation between the findings on the arthrogarm and operative findings. The same thing found in a study done by Ishii [11], in his study on correlation between arthrogram and operative findings concluded that, Arthrography can be a useful aid in the treatment of DDH in helping to determine if a congruous reduction has been obtained. It can be helpful in determining some of the anatomic intra- and extra-articular obstacles to reduction such as an enlarged ligamentum teres, shallow acetabulum secondary to soft-tissues interposition and capsular constriction. In some cases, the presence of an inverted labrum and/or a neolimbus can be determined.

It is necessary to ask why so many children should be clinically considered to have unsatisfactory reduction on x-ray, while when the arthrogram done subsequently showed a good position without obstruction. One of the causes appears to be the asymmetrical position that the ossification centre can occupy within the femoral head. Thus, judgement of position on the straight X-ray can be misleading--the centre may appear slightly out of correct position whereas the invisible cartilage around it is really properly placed within the acetabulum[9].

In this study, in a good percentage (38%) of patient the decision changed after arthrogram from operative treatment to conservative treatment and vice versa. Kotnis et al (22), In the prospective study, treatment was modified as a consequence of arthrography in 57.1% (12 of 21) of patients with DDH and 31.6% (six of 19) of those with Perthes' disease. This number of modifications was surprising. Although each consultant performed an arthrogram before definitive treatment, each believed it was likely to modify treatment only slightly.

The medial approach to the hip joint is preferable in all pathologic processes we have encountered because the anatomical changes of particular interest have uniformly been located in the superior and lateral aspects of the joint. With the medial approach, if dye were to be inadvertently extravasated, it would be done so inferiorly, where it could not obscure the pathologic condition. The medial approach is also useful in the patient who is immobilized in plaster cast and is less likely to injure the femoral nerve. Initial injection of air for localization of the needle reduces the chance of extravasation of dye [10].

Severin[21] believed that outcome couldn't be judged entirely from arthrogram taken immediately after reduction. In contrast, Forlin[18], concluded that certain arthrographic findings were a predictive of a satisfactory results.

It has been stated that when positional changes don't achieve accurate congruity it is usually due to some intrinsic obstructive causes and arthrography should help to define its nature when skillfully carried out and intelligently interpreted[8,16].

The question that arises is; how many different views are necessary or is there one standard position to be used to evaluate the reduction? Crawford and Carother[10] used the standard projections to assess the arthrogram. Drummond et al(17) created 3 views for all patients, comparing the relative value of the various positions used in arthrogram. Most of the structures were best observed on the neutral view, the frog leg and the VonRosen view were most useful in determining the depth of reduction.(12).

Crawford and Carother[10] stated "We believe that if there is any question of adequate coverage early arthrography should be performed and serve as the final arbiter regarding the type of therapy to be used. We learned a lot from the arthrogram performed to the patients, especially those where secured for open reduction on simple X-ray but after the arthrogram the decision was changed to conservation treatment with excellent results .

Although many surgeons believe in their knife managing many cases, still we believe the decision for operation on DDH cases must be taken carefully after clinical and arthrographic assessment, as it had been shown that the conservative treatment was the best choice after arthrogram was done

Arthrogram can change our decision and solve many problem cases without the hip joint on the contrary arthrogram will prevent over doing surgery on unnecessary cases.

5. Conclusion

In all cases the arthrograms were helpful in providing the information about the shape of the head, shape of the acetabulum, labrum, ligamentum teres, containment of the hip and external obstacles that, guides the surgical decision. This procedure is very helpful in many cases of DDD.

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