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TREATMENT OF DEVELOPMENTAL DYSPLASIA OF HIP (DDH) USING OPEN REDUCTION THOUGH MEDIAL APPROACH, OUR EXPERIENCE IN ROYAL MEDICAL SERVICES

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ABSTRACT

Objective: To evaluate the outcome and the complications after using medial approach for open reduction of the hip in infants with Developmental Dysplasia of the Hip. **Method**:This is a retrospective over 36 months from June/2017 to June/2020, on infants operated in Queen Rania Pediatric Hospital and Royal Jordanian Rehabilitation Center under the age of two years with Developmental Dysplasia of the Hip. Fifty children (56 hips), 42 girls and 8 boys. with mean age at operation was 13.2 months (8 to 24) treated with ludloff medial approach and the mean follow-up was 24 months (3 to 36). **Results:** The acetabular index improved by average 7 degrees in 93%of the operated hips, 78% of the hips were found to good or excellent according to Severin classification, 27% of hips had evidence of AVN, 6% had inferior subluxation which was treated by modifying spica postion,7% needed revision by anterior approach due to persistent instability, 9% had secondary procedure to correct hip coverage, no bleeding or wound complication happened. **Conclusion:**Open reduction using medial approach is safe method of treatment for Developmental Dysplasia of the Hip below the age of 18 months, good results can be achieved in short term follow up but prolong follow up is still needed to be sure if these results can be maintained in the long run.

KEYWORDS: Developmental Dysplasia of the Hip, DDH, Medial Approach, Acetabular Index.

INTRODUCTION

The main indications for open reduction in developmental dysplasia of the hip are either late presentation or failure of conservative treatment. Still there is no ideal approach that all pediatric orthopedic surgeons agreed to use in all cases of developmental dysplasia of the hip (DDH). The main two approaches used either the anterior or the medial approach.

Ludloff in 1908 introduced the medial approach for open reduction of DDH.[1,2] He described the interval between the adductor brevis and the pectineus to approach the hip. Modifications on the medial approach by Ferguson in 1973,[3] he used interval posterior to adductor longus and brevis and anterior to gracilis and adductor magnus. Another modification by Weinstein and Ponseti (1979),[4,5,6] they described the approach anterior to the pectineus muscle and posterior to the femoral neurovascular structures.

There are several advantages to the medial approach, minimal blood loss (transfusion is never necessary), direct approach to extra-capsular and intra-capsular obstacles, both hips can be operated at the same time, the scar is cosmetically acceptable and there is no damage to iliac apophysis nor to the hip abductor muscles. The disadvantages of medial approach, it is not familiar approach to most surgeons, capsular plication and pelvic osteotomy is not possible through this approach and many authors reports about the increased incidence of avascular necrosis, the medial femoral circumflex artery (the main blood supply to the femoral head) cross the operative field.[7,8,9,10]

The purpose of the present study was to review the short term results after open reduction through medial approach, in order to outline a treatment plan for cases of DDH that present late or failed conservative treatment, to evaluate the results of this approach by assessing the last radiograph, concentrating on the acetabular index, type of reduction and changes in the proximal femur

METHOD

Between June 2017and June 2020, 110 hips were operated for dislocated hip, 60 through medial approach, the remaining through anterior approach. 2 hips with arthrogryposis multiplex congenita were excluded from the study, and another 2 hips were excluded for missing follow up. A total of 56 hips were followed in the clinic and final assessment done by clinical and radiological

exam. 42 females 8 males, right hip was involved in 12, left hip in 30. Bilateral in 7. All were operated by senior author.

The average age at the time of surgery was 13 months range from 8 to 24 months. 30 (60%) were operated below the age of 12 months. 35 (70%) were failed conservative treatment the remaining were late presentation.

Arthrogram done on 10 hips (18%) only to show the obstacles in late presented DDH, later the author was convinced not to do an arthrogram as routine in late presented DDH because it will give the same picture and it will take more theater time.

The technique used was as described by Ludloff, using the interval between the pectineus and adductor brevis. tenotomy of the adductor longus and Iliopsoas and identification and protection of the medial circumflex femoral artery, opening the capsule and cleaning the joint followed by reduction and test stability of the joint, closure of the adductor fascia and skin. Spica application in the most stable position and molding is very important part of the procedure and done by the senior author followed by CT scan of both hips to assure the concentric reduction. Spica is kept for 3 months followed by abduction splint then either broom stick or abduction splint till the remodeling of the acetabulum. No patient had traction before surgery. Follow up 3 to 36 months with an average of 24 months.

Preoperative assessment of the radiograph using the method of Tonnis to evaluate the position of the capital femoral ossific nucleus.[12] The acetabular index of the dislocated hip and the other hip was measured preoperatively. At the final follow up acetabular index was measured, radiographic assessment of avascular necrosis (AVN) using the method of Kalamchi and MacEwen[13] and Severin classification[11] used to grade the operated hip, Subsequent surgeries were recorded if performed.

RESULT

The acetabular index was measured post operatively and compared for the preoperative results for all patients, 5 hips were below 30 degrees, 37 hips between 30-40 degrees, and 14 above 40 degrees. The postoperative acetabular index improved by 5-10 degrees (average 7) in 93%of operated hips after 2 years of follow-up. The level of the hip dislocation at the preoperative X-ray, as Tonnis Grade found to be grade 2 in 28 hips, Grade 3 in 20 hips and Grade 4 in 8 hips. Severin grade at the last follow-up, 78% were classified good or excellent. 15 hips out of 56 (27%) had evidence of AVN, half of the hips diagnosed to be grade 1 AVN.

No patient need blood transfusion and no patient develop wound infection. Three patients (6%) had inferior subluxation in the first 6 weeks of follow-up, these patients underwent change of the hip spica under fluoroscopy in the OR, by making the hip flexion less than 90 degrees. 4 hips (7%) were unstable and subluxated after 8 months of follow-up, those patients underwent revision surgery by open reduction through anterior approach with capsulorraphy and pelvic osteotomy. At the final follow-up, we found that more 5 hips (9%) needed Derotational varus osteotomy (DVO) due to high degree of anteversion.

Table 1 Shows the age distribution of the patients at the time of open reduction.

Age (months)	Number of patients
6-9 months	8
9-12	13
13-16	18
17-20	6
21-24	4

DISCUSSION

The first goal in treating developmental dysplasia of the hip is to achieve and maintain concentric reduction as early as possible, to take the chance of maximum remodeling potential in early childhood. The second goal is to decrease the incidence of complications especially avascular necrosis of the hip. The advantages of medial approach, it requires minimal soft tissue dissection, it has direct access to the extra and intra capsular obstacles for reduction. Extra-capsular obstacles usually the adductor muscles and iliopsoas tendon which are short most of the time, it can be seen and lengthened easily under direct vision without injuring adjacent structures. Hypertrophic Ligamentum teres, migrated transverse acetabular ligament and thickened pulvinar are the main intracapsular obstacles which can be seen and released after opening the capsule.[14] The surgery can be performed in short time, very minimal blood loss, without need for blood transfusion, both hips can be operated at the same time. The growth plate of the iliac crest is not injured in this approach, and the scar is more cosmetically acceptable and well hidden.[7,8,9,10,15,16]

Criticism to medial approach came from the inability to do capsulorraphy, which make the hip unstable and increase the incidence of hip subluxation and dislocation. Another criticism to medial approach is the incidence of avascular necrosis may be higher than in anterior approach.[7,8,9,10,17]

The rates of avascular necrosis (AVN) after open reduction through medial approach ranges from 0-67%.[3,6,17,18,19] There is no study comparing the rate of AVN after different approaches to open reduction in DDH, despite that, few authors blame the medial approach for high incidence of AVN up to 67%.[20,21] In the current study the rate of AVN was 13% at an average follow up of 24 months, which is an acceptable rate. And if type I AVN excluded because of benign nature, the rate is much less as low as 4%.

Although it is well recognized that a truly accurate assessment shouldn't be made until the patient has reached skeletal maturity.[22,23] type 2 AVN appears at an average age of 10 years,[24] and the results were satisfactory in 60% of the hips with type 1 or 2 AVN.[24] The findings in this study showed that the age at which surgery done doesn't appear to affect the incidence of AVN, and this also seen in other studies.[22,25,26] Segal et al, and Ucar et al, found that the appearance of the ossific nucleus protect against AVN.[27,22] However, it is not justified to postpone the surgery until the ossific nucleus seen on the X-ray.[23] Nevertheless, the incidence of AVN in the current study almost similar to that after closed reduction or open reduction through anterior approach, therefore we totally agree that open reduction through medial approach doesn't increase the incidence of AVN.

The medial approach doesn't allow the surgeon to do capsulorraphy. This is the second criticism that many authors talked about, increased rates of subluxation or redislocation.[6,9,14,28] Only few studies compare subluxation rate with that in the anterior approach.[17] Many believe such lateralization of the femoral head is a benign issue, that only need longer period of immobilization to ensure concentric reduction and to stimulate acetabular remodeling.[23] The maximum rate of acetabular development and remodeling achieved in the first year after reduction and continues for many years if reduction is obtained and maintained.[6,17,18,22,28] In this current study the rate of subluxation or dislocation is, and this mainly in period where we used broomstick plaster after 6 weeks of surgery, and that's why we change our postoperative protocol to keep the hip spica for 12 weeks, then to continue on abduction splint till we see a well-developed acetabulum and concentric reduction.

The age of the infant at time of surgery is an important factor concerning the subluxation rate and the need for another surgery, which considered as a poor result. The younger the infant at time of surgery the more favorable the results.[17,18,29] Mankey et al said that medial approach was effective in infants below 24 months of age.[17] Castillo et al found that good results in infants between 5-14 months of age.[18] Whereas Okano et al stated that, all patients treated at more than 17 months of age had poor results when followed-up until skeletal maturity,[29] and to improve the results one should select patients below 17 months of age for medial approach. In this current study results showed favorable outcome in infants below 16 months of age, and poor results after that age in which infant need more surgery either revision of secondary surgery, and this can be explained that by age of 16 months, the infant already started to walk, which means a high dislocation with adhesions on the posterosuperior capsule that can't be tackled through medial approach.

Baki et al advocate that in 14 hips underwent open reduction through medial approach and innominate osteotomy through anterior approach done in single-stage operation in patients over 12 months, no patient required subsequent surgery.[14]

Surgery photo illustration

Radiology figure 1: preoperative pelvic x ray showed bilateral hip dislocation.

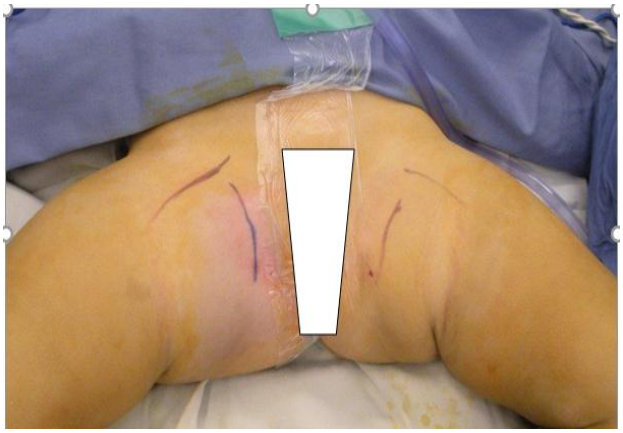


Figure 1: planned skin incision.

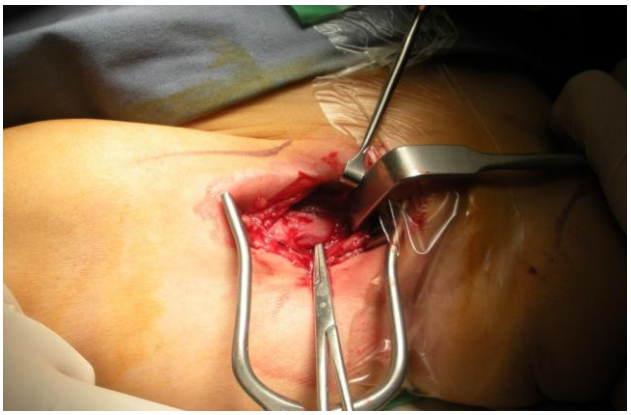


Figure 2: identification and isolation of adductor longus muscle.

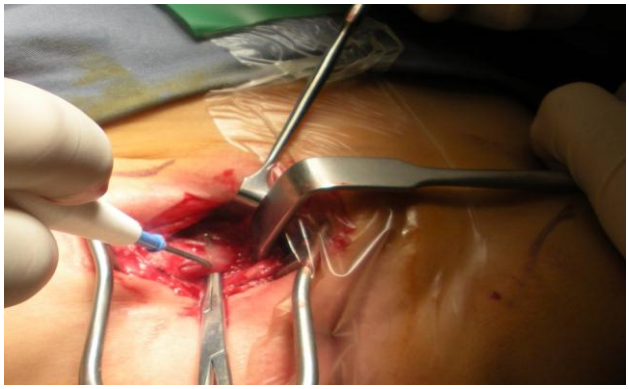


Figure 3: complete cut of adductor longus muscle.

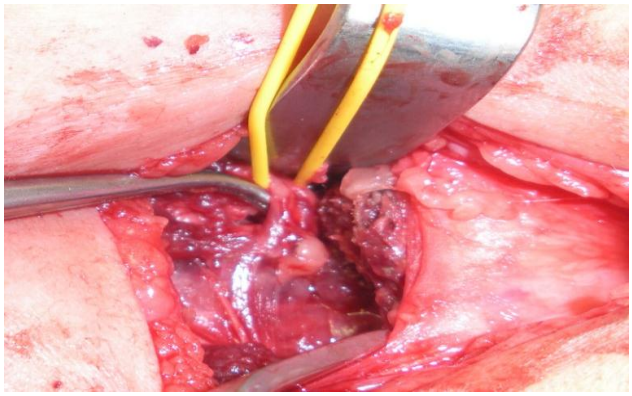


Figure 4: identification and protection of medial femoral circumflex artery.

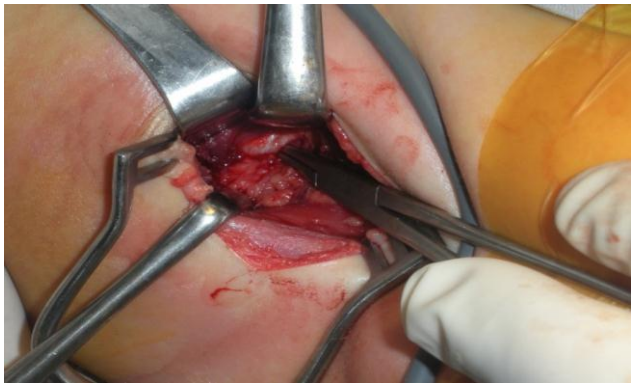


Figure 5: identification of iliopsoas tendon.

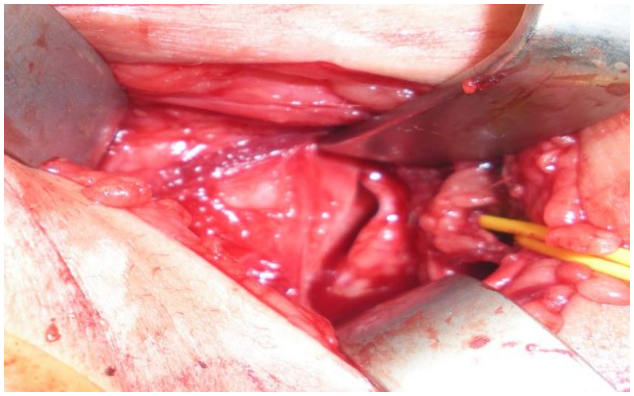


Figure 6: opening of the capsule.

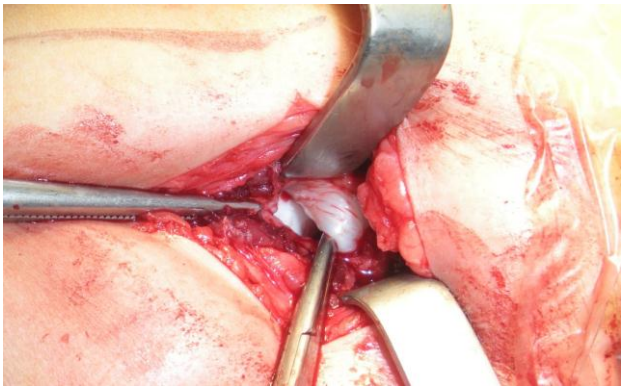


Figure 7: identification of intracapsular obstacle (ligamentum teres).

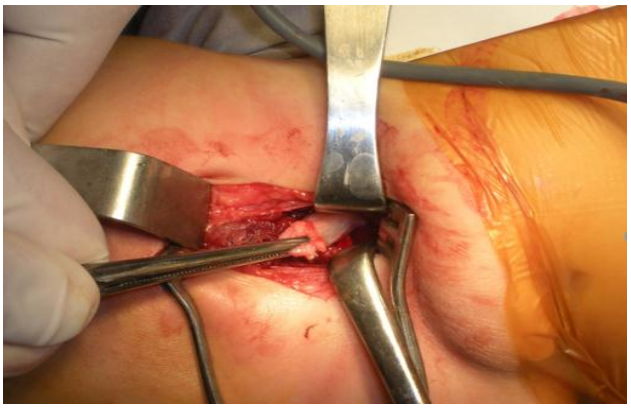


Figure 8: complete cut of ligimuntum teres.

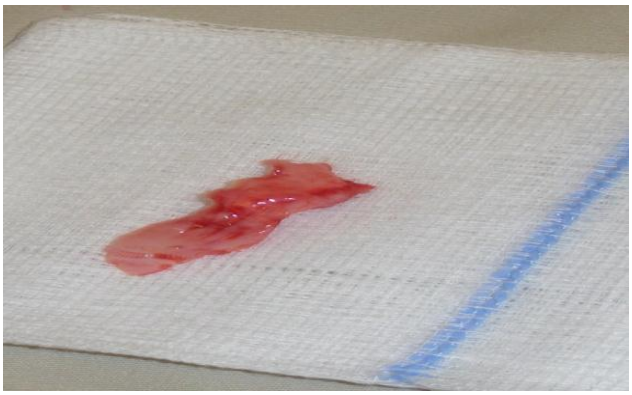


Figure 9: ligimuntum teres after being cut and removed from the hip joint.

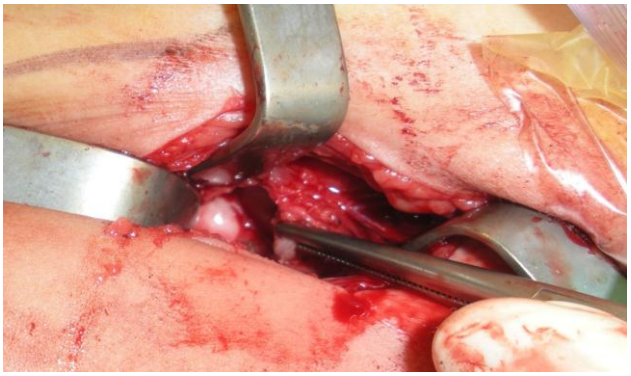
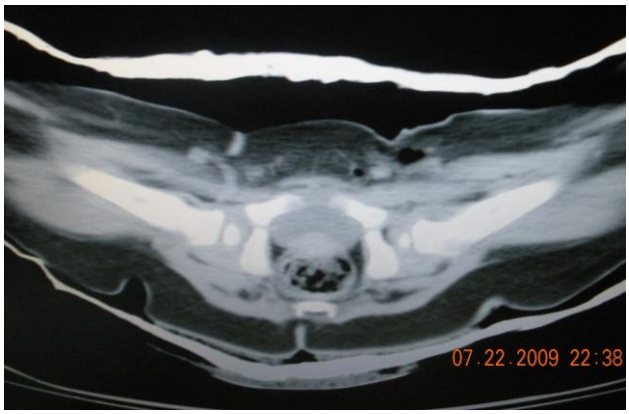
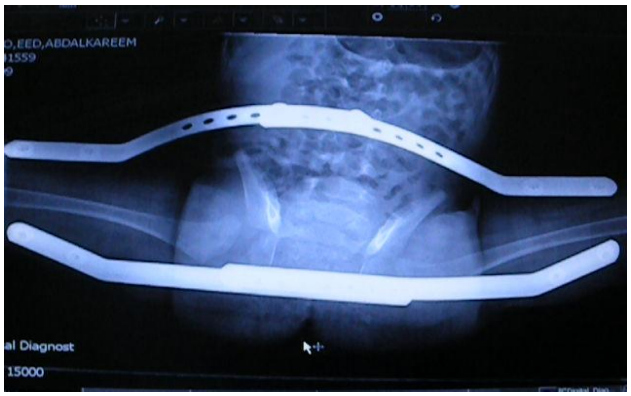


Figure 10: hip reduction done.

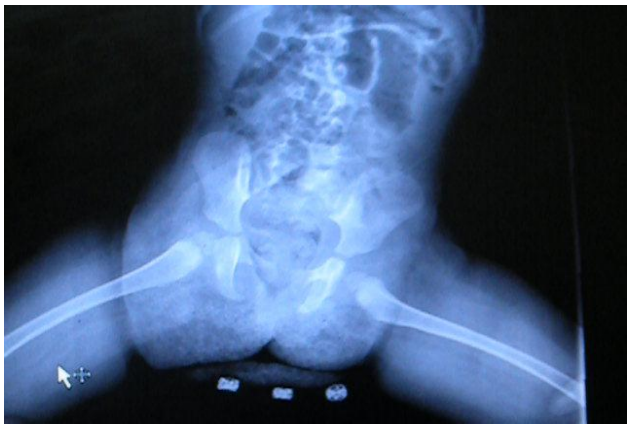
Figure 11: hip spica application after closure.



Radiology figure 2: postoperative CT scan showed both hips are concentrically reduced.

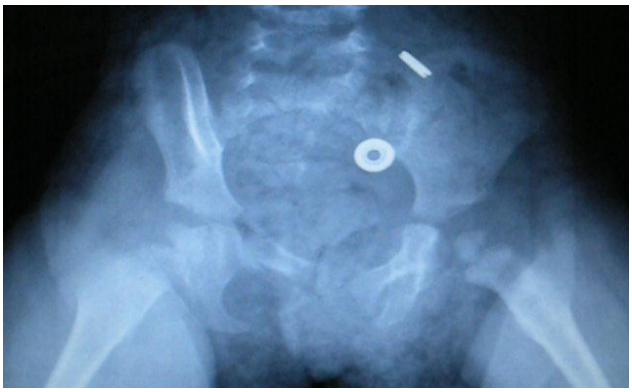


Radiology figure 3: 3 months postoperative x ray.



Radiology figure 4: 6 months postoperative x ray.

Radiology figure 5: 8 months postoperative x ray.



Radiology figure 6: 10 months postoperative x ray.

Radiology figure 7: 12 months postoperative x ray.

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