

Original article

Spontaneous Correction of Extreme Degree Femur Ante –Version in Developmental Dysplasia of the Hip

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Abstract:

- **Background:** Developmental Dysplasia of the hip is common problem, both severe acetabular dysplasia and proximal femoral ante-version are the main pathology that should be managed as early as possible. Treatment of Developmental Dysplasia of the hip (DDH) should be commenced after delivery, during infancy and in very young children because maximum potential for development and remodeling of the acetabulum and proximal femur were encountered up to the age of 4 years. Surgical correction of idiopathic developmental dysplasia of the hip (DDH) is one of the most challenging problems in pediatric orthopedic surgery.
- **Method and patient:** Between June 1994 and December 2018, a total of 626 hips with Developmental Dysplasia were treated according to their age at presentation.
- **Result:** In 110 hips (out of the total 132 hips, underwent surgery) treated by open reduction with or without salter innominate osteotomy, the following results were achieved: A – In all these cases , there was severe degree of femoral ante-version (Intra-operative evaluation) and this was found in 100% of the patients with developmental dysplasia (DDH), especially in those children above 2 years of age. B – Open reduction with Salter Innominate Osteotomy gave excellent results in 72 hips within the age group 18 month-2.5 years. There was no indication for femoral shortening to be performed in these patients – All these hips showed spontaneous correction of extreme degree of femoral ante-version, this was seen in all patients underwent open reduction with or without Salter Osteotomy and there was no need for Derotation Osteotomy in all these children with developmental dysplasia of the hip (DDH) in the age group 18 months-2.5 years.

- **Conclusions:** In all children with developmental dysplasia of the hip younger than 2.5 years of age, there will be spontaneous correction of femoral ante-version and there was no indication for de-rotational osteotomy of the proximal femur even in extreme degree of femoral ante-version.
- **Keywords:** Developmental Dysplasia of the hip, femoral Ante-Version, salter Innominate osteotomy.

INTRODUCTION

The choice of treatment for DDH is age- dependent. It is believed that in DDH, if the treatment is not started before weight-bearing, the prognosis is poor for the satisfactory development of hip joint.

The treatment goal is to achieve a stable, congruent, and concentric hip joint as early as possible, which in turn will preclude or postpone the development of degenerative osteoarthritis (OA) of the hip ⁽¹⁻⁴⁾.

In general, for children up to 12–18 months, though open reduction (OR) may be needed to get a concentric reduction, pelvic osteotomy (PO) is rarely required considering remodeling potential ⁽⁵⁻⁹⁾. Between 18 months to 4 years, the need for a PO at the time of OR is controversial (10, 11, 12). However, Salter and Pemberton strongly believed in adding the acetabular procedure at the time of primary treatment to maximize the likelihood of normal acetabular development ^(13,14).

As the child growing older, different surgical intervention will be essential for treatment. Re-directional and reshaping Osteotomy of the acetabulum (salter -1961 or Pemberton – 1965) will be required, in addition to open reduction to encourage development and remodeling of the dysplastic acetabulum and to obtain coverage and containment of the capital femoral epiphysis ⁽¹⁵⁻¹⁷⁾.

Pemberton stated that the ‘structural defect in the anterior acetabulum is a constant finding in DDH, and surgical correction of dysplasia should include correction of this defect.

Until infancy, concentric reduction of the femoral head into the acetabulum through closed or open methods is generally sufficient to get reciprocal remodeling to achieve a stable and congruent hip. Past infancy, most surgeons agree that treatment with a pelvic osteotomy (PO), with or without a femoral osteotomy (FO), is indicated to ensure adequate femoral head coverage ⁽¹⁸⁻²⁰⁾.

Femoral shortening (klisic and jankovic – 1976) is another important procedure in the treatment of older children with DDH ⁽²¹⁻²³⁾.

The aim of this study was to confirm that Spontaneous correction of severe degree of proximal femoral ante –version was possible in children younger than 2.5 years of age without surgery.

PATIENT and METHOD

In this study a total of 626 hips with developmental dysplasia was presented in 401 patients, it was bilateral D. D. H in 225 patients (56.10 %) and unilateral in 176 patients (43.9 %), 236 patients were female (59 %) and 165 patients were male (41 %) with developmental dysplasia of the hip .

These patients were collected and treated from June 1994 to December 2018 in Two Teaching Governmental Hospitals (Kirkuk & Erbil) because congenital dislocation of the hip is very common in this province.

These cases were arranged according to the age to the following groups:

1 – Total NO. of 494 hips in 298 patients (196 bilateral, 102 unilateral) were treated non – operatively and arranged as follows:

Group A:

included 352 hips in patients aged from < 1 month till 3 months, were treated by pavlik harness brace or plaster spica for 2 – 3 months (the hips should be protected in about 100 – 110 degrees flexion & around 50 – 60 degrees abduction.

Group B:

included 142 hips in patients from the age > 3 months till 18 months, treated as follows: in younger children, directly under general anesthesia , both hip should be gently reduced , then plaster spica cast was applied (with or without adductor tenotomy) , post-operative checking x-ray was mandatory in every case to confirm the reduced position and the containment of the hips in plaster spica .

Always those hips with adductor tenotomy showed better outcome than those without tenotomy.

Plaster spica was applied for 2—3 months until growth and remodeling of the osseus acetabular roof was obvious on follow-up x-ray films.

In 12 patients with bilateral D. D. H and because of persistent acetabular dysplasia, after removal of the plaster spica it was followed by another Batchler plaster cast for about.

4 - 6 weeks period.

Checking x-ray monthly was taken during follow –up.

In older children, at the start of treatment and on admission to the Hospital, skin traction was applied to the lower limb on gradual abduction frame for about 10 days, was found to be very beneficial.

Failure of conservative treatment, open reduction should be performed once containment and concentric reduction of the hip was not achieved at the start with closed method.

2 – The following groups included a total of 132 hips in 103 patients (29 bilateral, 74 unilateral) were treated operatively and arranged as follows:

Group A:

included 110 hips ranged between 12 months-2.5 years old, 38 hips were treated by open reduction alone, provided that the acetabulum was not dysplastic, and reduction was stable.

In the remaining 72 hips open reduction with salter innominate osteotomy of the iliac bone were performed, were manipulated as follows:

In all hips treated surgically, severe proximal femoral ante-version was encountered (which was very clearly observed per-operatively because once the capsule opened the femoral head was looking and pointing to the ceiling) which indicate severe ante-version (up to 90 degrees) and to keep the femoral head stable and well contained inside the acetabulum , the limb must be in extreme position of internal rotation .

This position of internal rotation was maintained in plaster spica cast post-operatively for two – three months , in few cases , this plaster spica is replaced and followed by cross – bar plaster involving the both legs only (broomstick plaster) for about 4 - 6 weeks , thus the hip region is free (above knee plaster with the limb in abduction and internal rotation) thus allowing and encouraging sitting and lying exercises (flexion and extension of the hip) , gradually ante-version will be corrected and the limb will be in neutral position .

Checking x-ray monthly was ordered to check containment, the growth, development and remodeling of the osseous acetabular roof and the growth and remodeling of proximal femoral epiphysis.

These 110 hips showed spontaneous correction of femoral ante-version. All these cases had complete correction of extreme degree of femoral.

ante-version without any surgery.

SURGERY

Regarding the surgical procedure, the hip was approached anteriorly through ilio-femoral incision (smith – Petersen). Gluteus medius, G. minimus, tensor fascia lata and abdominal muscles must be stripped subperiosteally from outer and inner surfaces of the iliac bone to the greater sciatic notch specially if acetabuloplasty was decided.

The dissection was carried more medially by dividing both heads of rectus femoris muscle to get access to the acetabulum, therefore anatomical landmarks like the anterior superior iliac

spine, anterior inferior iliac spine and the greater sciatic notch, all must be clearly seen in the operative field in front of the surgeon.

Kirschner wires were used to secure the bone graft which was used in performing salter innominate osteotomy. During surgery division of iliopsoas tendon at insertion to the lesser trochanter was done, division of transverse ligament of the acetabulum and capsulorrhaphy were performed in all patients.

Once the femoral head was reduced into the acetabulum, reduction must be easy without using force to avoid risk of avascular necrosis of the capital femoral epiphysis, reducing the femoral head by force is the main cause of failure of surgery directly in the follow-up period and the hip will subluxate or even frankly dislocate.

The surgeon must be very meticulous in dissection and respect anatomy of each muscle, tissue planes and protect the main neuro-vascular structures during dissection. Protect the blood supply around the proximal femur (tributaries of medial and lateral circumflex femoral artery) to minimize the risk of avascular necrosis of the femoral epiphysis and to avoid tissue necrosis.

Bad surgical technique and forcible reduction of the femoral head are the main causes of post-operative stiff hip and avascular necrosis of the proximal femoral epiphysis.

Group B: included 22 hips with unilateral DDH aged 3 years to 4 years, were treated by open reduction with sub-trochanteric osteotomy (shortening, varus, and derotational osteotomy) , femoral shortening was very necessary to reduce pressure on the hip and to avoid reduction by force , in all cases salter innominate osteotomy was done at the same time .

RESULTS

In majority of patients treated for DDH, the only possible follow-up of these patients was by keeping the family in contact during the period of treatment in plaster and until ambulation.

The common cause of failure in treatment of DDH in children was improper plaster spica application and poor family compliance during follow up.

The criteria for success are:

- 1- Containment and concentric reduction of the femoral head inside the acetabulum on plain radiology or CT imaging and subsequent checking x-rays in the period of follow-up.
- 2- During the period of follow-up, the growth and appearance of the ossifying nucleus center in the cartilaginous capital femoral epiphysis is another good prognostic sign.

- 3- After a period of 2—4 months (rarely up to 6 months) ossification of the hyaline cartilage, growth and the development of the bony acetabular roof should be obtained and the dysplastic acetabulum must be replaced by well-formed bony roof with acetabular index should be $< 25^\circ$ (Hilgenreiner's line and a line from a point on the lateral triradiate cartilage to a point on lateral margin of acetabulum) .
- 4- Developmental dysplasia of the hip cause delayed walking and once the child was treated and the femoral head stable and well contained in the acetabulum, the patient can put body weight on the limb and start walking.
- 5- The remodeling of the shaft – neck angle from the coax – valgus position to be around 120 – 130 degrees, is another indication for remodeling of proximal femur.
- 6- Recurrence of the dislocation was never recorded in the following years until adult life because once containment of the femoral head and developmental of the osseous acetabular roof were achieved within the period of treatment which usually takes 3—6 months after surgery, this indicate normal stable hip joint and there is no chance of recurrence in future.

Complication like avascular necrosis of proximal femoral epiphysis was seen in two hips treated conservatively only (may be due to prolonged plaster spica application or forcible reduction).

Joint stiffness and deep seated wound infection were not seen.

Avascular necrosis of proximal femoral epiphysis was not happened in surgically treated patients with DDH.

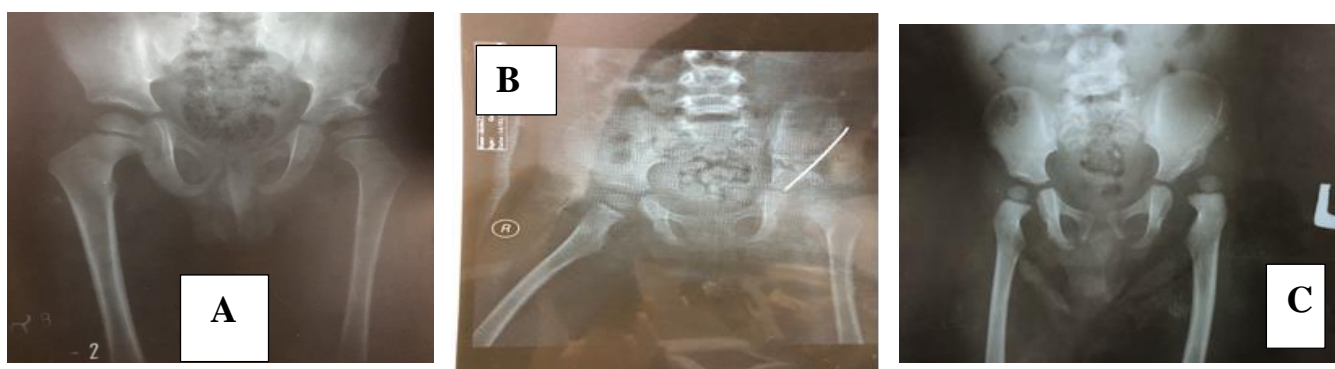


Figure 1: A 32 month old child with Lt. side DDH.

A: One- year post-operative x-ray confirmed containment, growth, and remodeling of the acetabular roof.

B: Open reduction with Salter Innominate Osteotomy postoperatively.

C: Preoperative x-ray with Lt. sided DDH.

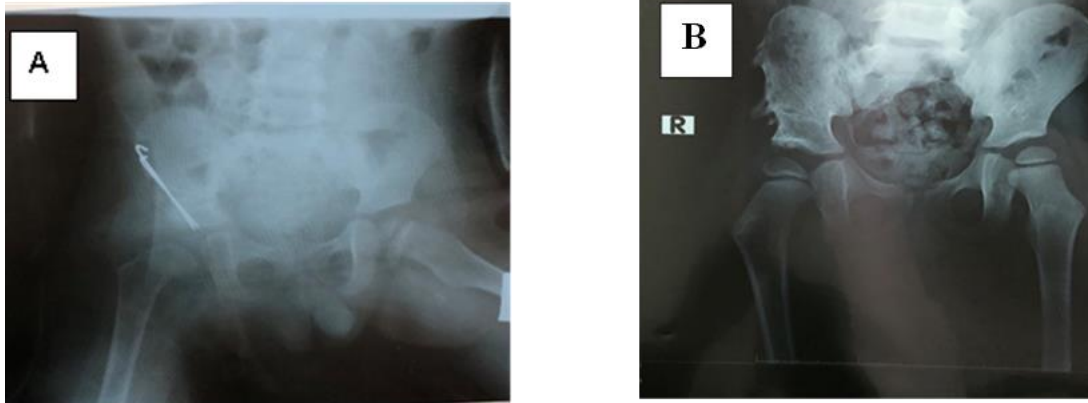


Figure 2: A 2.5 year old child with right side DDH.

A: post-operative X-ray after open reduction and Salter Osteotomy.

B: After two years view showing congruent hip joint with development and remodeling of the acetabulum and proximal femur

DISCUSSION

Containment of the femoral head will encourage and enhance development and remodeling of both the acetabulum and the proximal femur. In a younger child, positioning the femoral head into the acetabulum helps in reciprocal remodeling of the acetabulum and proximal femur, in addition to correction of dysplasia.

Salter innominate osteotomy is safe, usually gives excellent results and should be the first step to be done during open reduction in younger age groups. Innominate osteotomy (salter osteotomy of the iliac bone) was conducted in children above 18 months of age with open reduction for the treatment of DDH and this was recommended by other workers⁽¹⁴⁻¹⁷⁾.

Maximum potential for growth, development and remodeling of the acetabulum and proximal femur was encountered up to the age of 4 years.

In 110 hips treated operatively from the age of 12 months ----- 2.5 years, there was no need for femoral shortening, in all these patients' open reduction with or without salter innominate osteotomy was sufficient provided that containment and concentric reduction was achieved with a stable, congruent hip joint.

Most orthopedic surgeons are routinely doing derotational osteotomy of proximal femur at the time of open reduction (OR) or later about 6---weeks after the first operation (open reduction), to correct the extreme degree of femoral ante-version⁽²¹⁻²³⁾.

In this study there was no need for surgical intervention to correct femoral ante-version and almost always corrected spontaneously.

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CONCLUSION

In all children with developmental dysplasia of the hip younger than 2.5 years of age, even those cases underwent surgery including open reduction with or without salter – innominate osteotomy, there will be spontaneous correction of the extreme of femoral ante-version and there was no indication for de-rotational osteotomy of the proximal femur even in extreme degree of femoral ante-version.

This indicate that up to the age of 2.5 years, a maximum ability of self-correction, development and remodeling of the proximal femur will encounter and indicate the upper age limit for spontaneous correction of femoral ante-version to be achieved without surgery.

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