Combined Pelvic Osteotomy in the Treatment of Both Deformed and Dysplastic Acetabulum Three Years – Prospective Study

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Abstract: Kuwait has a very high incidence of all types of developmental dysplasia of the hip. One of the most complicated forms is the deformed dysplastic acetabulum, which has not only abnormal orientation but it also has lost its shape by the pressure of the subluxed femoral head. The outer part of the socket involves the upper part of the original acetabulum, thus giving it a bipartite appearance. Clear border like edge separates this outer part from the inner part, which represents the lower part of the original acetabulum and it has no direct contact with the femoral head. Combined pelvic osteotomy (CPO) restores both the original shape and treats the malalignment of the acetabulum. Twelve children, aged between 18 and 54 months underwent CPO, two of them bilaterally. The follow up is between 36 – 60 months. In all cases, concentric stable reduction with good acetabular cover was obtained.

Key words: Developmental dysplasia of the hip – Surgical treatment – Combined pelvic osteotomy

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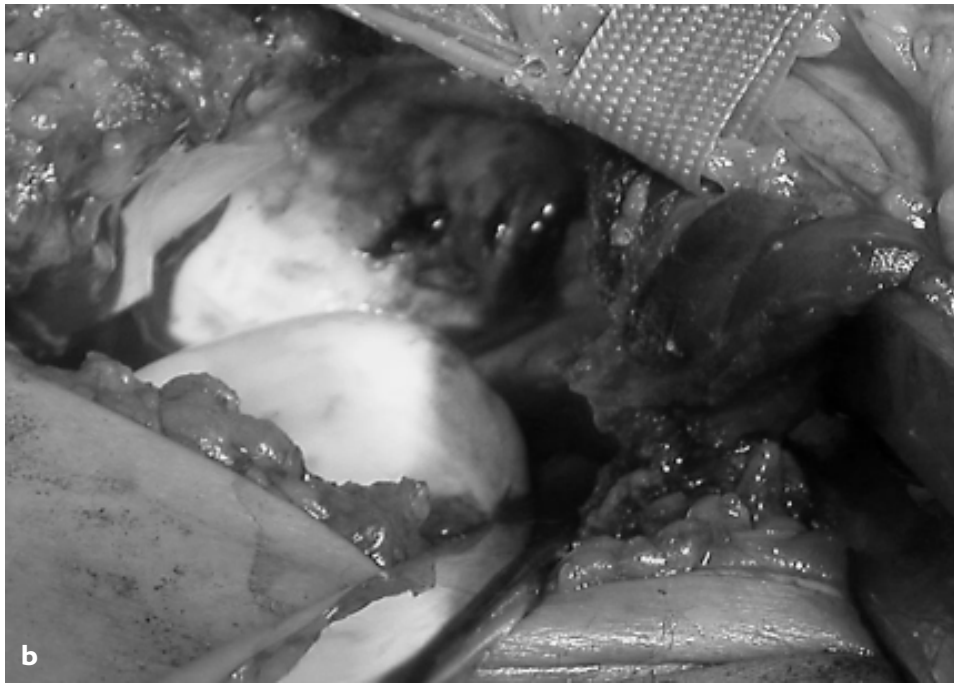
Introduction

Kuwait has a very high incidence of the developmental dysplasia of the hip including late presentation [1]. Some of these are subluxation or low dislocation with bipartite acetabulum, divided into the inner and the outer part, caused by pressure from the subluxated femoral head. Reconstruction is difficult. Treatment is surgical and traditionally involves open reduction, possible femoral osteotomy and either acetabuloplasty or innominate osteotomy [2]. Neither of these pelvic procedures can address the whole problem. Innominate osteotomy alone carries the risk of the reduced head slipping back into the outer part of the socket. Acetabuloplasty can give good lateral cover but it leaves the dysplastic socket

Figure 1 – a) Deformed bipartite acetabulum is obvious on plain radiogram; b) Intraoperative view of deformation.



in its malaligned position. For these reasons, a new operative technique, the combined pelvic osteotomy (CPO), was developed to address both problems.

Patients and Methods

Twelve children, nine girls, 10 unilateral, 2 bilateral, underwent CPO between 1999 and 2001. Their average age at operation was 30 months (18–54). The follow up was between 36–60 months; with three months clinical and radiological follow up during the first year after the surgery and six months at the second postoperative year.

The bipartite acetabulum is seen on plain radiographs in older children (Figure 1) but it can require an arthrography to demonstrate it in the younger child (Figure 2).

Operative Technique

The child is supine with a sandbag behind the buttock; a preliminary open adductor tenotomy is carried out. The hip is exposed through a Salter approach, splitting the iliac apophysis and stripping the ilium on both sides to the sciatic notch. On the lateral side, rectus femoris tendon is temporarily divided and the reflected head used as a guide to the edge of the acetabulum.

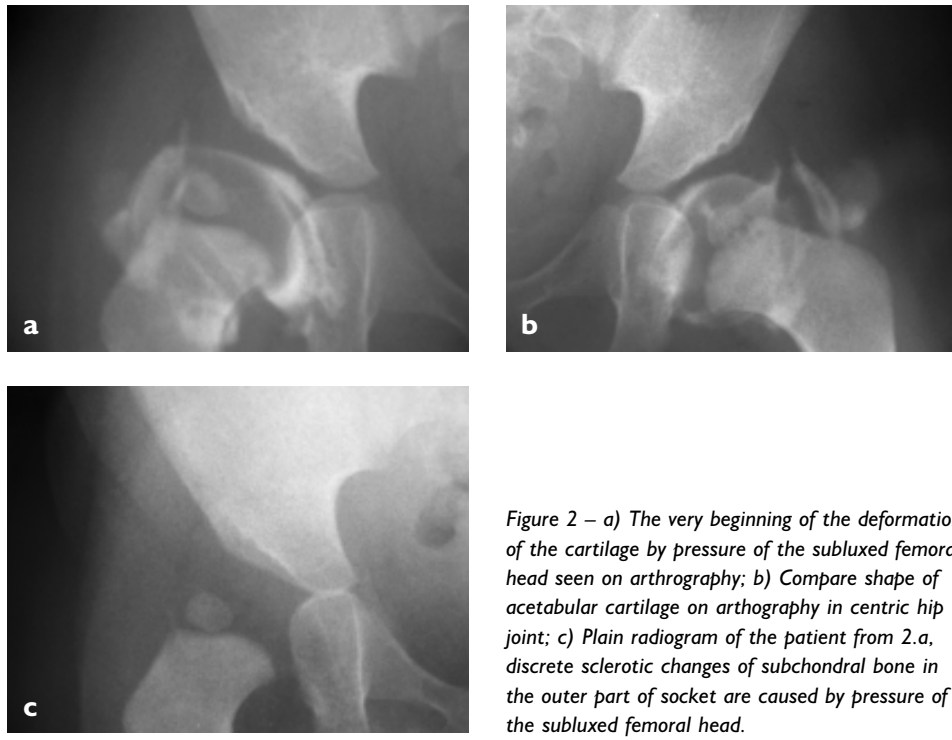


Figure 2 – a) The very beginning of the deformation of the cartilage by pressure of the subluxed femoral head seen on arthrography; b) Compare shape of acetabular cartilage on arthography in centric hip joint; c) Plain radiogram of the patient from 2.a, discrete sclerotic changes of subchondral bone in the outer part of socket are caused by pressure of the subluxed femoral head.

The capsule is opened and the whole socket is defined and cleaned. The transverse ligament and inferior capsule are divided and the ligamentum teres excised. At this stage, the acetabuloplasty is done by turning down the cartilage of the outer part of the socket. This is achieved by defining the osteochondral margin of the edge of the socket and using a periosteal elevator to develop this plane as far as the border between inner and outer part of the socket.

The down turned cartilage restores the spherical shape of the whole socket and is held in place by small pieces of bone grafts from the ilium (Figure 3). Congruent reduction of confirmed at this stage, modified innominate osteotomy is then carried out [1] (Figure 4). Capsulorhaphy, closure of the wound, a plaster spica cast with the hip in 30 degrees abduction, 20 degrees flexion and 15 degrees internal rotation completes the operation. The spica is replaced at six weeks by broomstick plasters for a further four weeks, after which the child is allowed to mobilize.

Results

In all cases, concentric reduction with excellent cover was achieved. All hips were classified clinically as excellent (Table 1). Thirteen cases were radiogically excellent Severine I (Table 2, Figure 5), one was graded Severine II (Figure 6) [3].

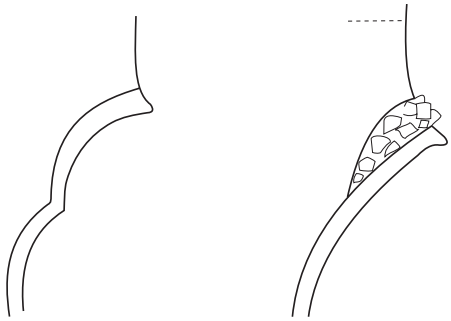


Figure 3 – Schematic drawing: Left: Dysplastic and deformed bipartite acetabulum with outer (upper) and inner (lower) part. Right: Shelf acetabuloplasty, the first step of combined pelvic osteotomy, release of the acetabular cartilage from outer part of the socket and grafting to restore spherical shape of the acetabulum; line of innominate osteotomy right top.

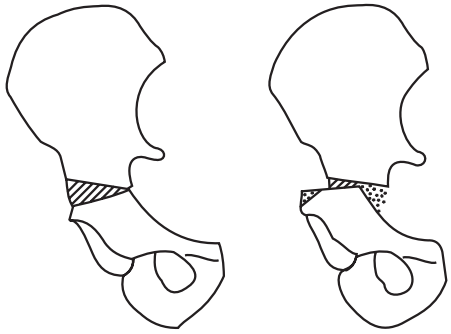


Figure 4 – Modified innominate osteotomy – second step in combined pelvic osteotomy – compare classical Salter osteotomy (left) and modification (right) to prevent: 1) lower limb lengthening, 2) hyperpressure in hip joint 3) difficulties in reduction of the femoral head.

Table 1 – Clinical assessment of surgical results – McKay's classification [6]

Grading	Clinical Observations
1. Excellent	Stable, painless, no limp, negative Trendelenburg, full range of movement
2. Good	A mild limp and mild restriction (up to 20 deg.) of range of movement
3. Satisfactory	Limping, positive Trendelenburg, range of movement limited by more than 20 deg.
4. Unsatisfactory	Unstable, severe limitation of movement
5. Poor	Redislocation

Table 2 – Radiological assessment of surgical results – modified Severin's classification [3]

Grading	Findings
A.	Normal, with AC angle < 15 deg.
B.	Slight deformity of head and acetabulum, concentric reduction, AC angle < 20 deg.
C.	Dysplasia without subluxation. AC angle > 20 deg.
D.	Subluxation
E.	Dislocation

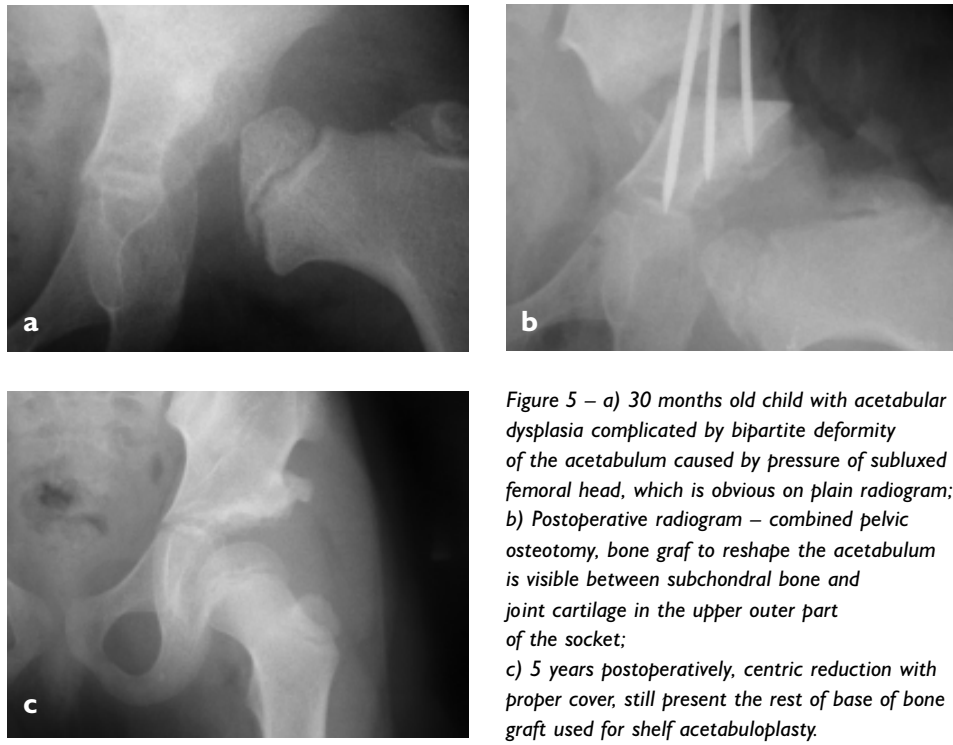


Figure 5 – a) 30 months old child with acetabular dysplasia complicated by bipartite deformity of the acetabulum caused by pressure of subluxed femoral head, which is obvious on plain radiogram; b) Postoperative radiogram – combined pelvic osteotomy, bone graf to reshape the acetabulum is visible between subchondral bone and joint cartilage in the upper outer part of the socket;
c) 5 years postoperatively, centric reduction with proper cover, still present the rest of base of bone graft used for shelf acetabuloplasty.

In this case, the cause of downgrading was a mild deformity of the femoral head due to ischaemia.

No evidence of ischemic change on the acetabular side was observed.

Discussion

In age group between 18 months and 6 years, the surgical treatment of acetabular dysplasia is provided by Salter or Pemberton osteotomy according to the shape of the acetabulum, especially according the length of iliac part of the acetabulum [1, 2]. Salter osteotomy is appropriate for the acetabulum with short iliac part up to the AC angle 35 degrees, Pemberton acetabuloplasty is indicated for the acetabulum with long iliac part, known also as the double-diameter acetabulum, and AC angle even up to 50 degrees [4, 5, 6].

In case of the deformity of the outer part of the acetabulum by pressure of the subluxating femoral head, this deformity should be removed first before malalignment of the acetabulum is treated. If not removed this deformity, even after combination of femoral and pelvic osteotomy the femoral head slides to the deformed outer part of the acetabulum (Figure 7). This recurrent subluxation and necessary revision may be complicated by ischemic necrosis of the femoral head Lit. [7, 8].

Figure 6 – 7 years old child, 5 years after combined osteotomy, post ischemic changes of the femoral head are visible.

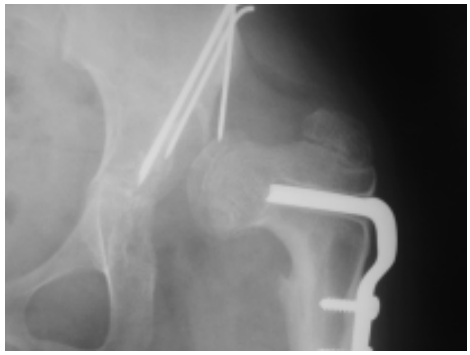


Figure 7 – Patient after innominate and femoral osteotomies without reshaping of the acetabulum, even femoral osteotomy did not prevent the femoral head to move to the outer part of the acetabulum, preoperative radiogram on Figure 1a.

In this problematical group of patient three criteria has to be satisfied:
1) Open reduction
2) Satisfactory spherical acetabular cover
3) Realignment of the socket

CPO addresses the later two at the same time; CPO is combination of two different pelvic osteotomies. First is shelf acetabuloplasty of the deformed outer part of the acetabulum restoring the spherical shape of the malaligned socket. The second osteotomy is a modified Salter innominate osteotomy to restore proper alignment of the socket. Both procedures are carried out far enough from each other to prevent ischemic changes of iliac bone (Figures 3, 4, 5b.)

Fixsen and Li [9] give good clinical results in older children, 5 to 10 years of age, with subluxation of the hip after combination of open reduction, femoral derotational osteotomy, Salter osteotomy or Pemberton acetabuloplasty for misshapen acetabulum with a double diameter. No bipartite deformity was mentioned by authors in this group. They advised one stage procedure, correcting both the femur and acetabulum.

Since age limit of innominate osteotomy is 6 years [5] and also remodellation of proximal femur is limited by this age [10], combination of open reduction, femoral and pelvic osteotomy is beneficial in the group of children over the age of 6 years, while below this age the results of presented study support the use of open reduction with CPO only.

Conclusion

CPO represents combination of two well known methods, Salter pelvic osteotomy and shelf plasty. Each of these methods was separately tested with very good results in clinical practice for many decades. Since the short term results of CPO show to be promising, also the long term results can be expected similar to the long term results of both of its components.

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