



Case Series

Traumatic dislocations of the hip in children About 11 cases and literature review

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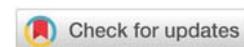
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Abstract

Traumatic dislocation of the hip in childhood is rare. Several small series of this condition have been published. The objective of this study was to evaluate the outcome of treatment of traumatic posterior hip dislocation in children. Data from 11 children (11 hips) with traumatic hip dislocation, collected in 2 centres (2 countries), from January 2010 to January 2019 were analysed. The clinical assessment focused on symptoms and physical findings. X-rays identified the type of hip dislocation. Hip dislocations were classified according to Thompson and Epstein. Reduction was performed using three techniques: technique 1, closed reduction. Technique 2, release of the long adductor muscle, lengthening of the psoas tendon, and placement of a Kirschner wire through the femoral head into the acetabulum. Technique 3, open reduction after hip arthrolysis. X-rays were then used to determine whether the hip is concentric and to check for any other injuries that may have occurred after manipulation. There were 3 girls (27.3%) and 8 boys (72.7%) in this study. All had Type I posterior hip dislocation. Patients at the time of diagnosis were 3 years, 2 months to 9 years, 10 months old. Reduction was performed using technique 1 in 8 patients, technique 2 in 2, and technique 3 in 1 child. We obtained excellent results in four hips (36.4%), good results in three hips (36.4%), satisfactory results in two hips (18.2%), and poor results in two hips (9.1%). There was avascular necrosis in two hips (18.2%), coxa magna in one patient (9.1%), limb inequality of 2 cm in one patient (9.1%), and lameness in one patient (9.1%). Hip scores averaged 82.4 points (range 62-100). Children with traumatic hip dislocation should be reduced as much as possible. If the interval between dislocation and reduction exceeds 3 weeks, we suggest technique 2. This simple and safe method leads to a marked improvement in hip function and prevents further complications.

Material and method

A retrospective bicentre study was conducted to evaluate the outcomes of reductions in traumatic hip dislocation from January 2010 to December 2019 in 11 children with traumatic hip dislocation.

Prior to surgery, information was obtained on the following: (a) patient age and gender; (b) type of dislocation; (c) type of trauma; (d) time from dislocation to reduction; (e) type of treatment; (f) duration of immobilization; (g) associated injuries; and (h) complications. The clinical assessment focused on symptoms and physical examination findings. The clinical data and all radiological examinations were analyzed and the dislocations were divided into two categories: anterior and posterior. The posterior group was subdivided into five groups according to Thompson and Epstein [6] (Table 1). Particular attention was paid to the evaluation of heterotopic ossification, avascular necrosis and epiphysis hypertrophy (coxa magna 2mm to the opposite side).

Table 1: Thompson and Epstein's classification.

Type I	With or Without minor fracture
Type II	With single large fracture of the posterior acetabular rim
Type III	With a Comminuted fracture of the posterior rim of the acetabulum with or without a major fragment
Type IV	With fracture of the acetabular rim and floor
Type V	With fracture of the femoral head

Reduction method

For each patient, we used one of the three reduction methods, as detailed below.

Technique 1: Technique 1 (T1): Is applied to any patient who has an interval of 3 weeks or less between trauma and reduction. Urgent closed reduction for trauma Hip dislocation is indicated for dislocation with or without neurological deficit in the absence of an associated fracture (Figures 1,2).

Technique: General anaesthesia is preferable, but more often, closed reduction under sedation is performed in the emergency room. In the Allis method [7] (Figure 3), the surgeon stands on the stretcher. Pulling just below the knee, he/she applies traction in the axis of the femur. The assistant applies countertraction by pushing down on the two anterior and superior iliac spines. With a constant increase in traction, the hip is bent at 90°. Adduction and internal and external rotation of the hip allows the hip to pass through the lip of the acetabulum. Lateral force may also help. Stability should be checked. After reduction, radiography can be used to determine if the hip is concentric, and to check for other injuries that may have occurred after manipulation. Patients are immediately immobilized with a pelvic-pedestrian cast for an average of 6 weeks with neutral hip extension, abduction of about 40°-45°, and internal rotation of about 20°-30° for patients under 6 years of age (Figures 4,5), for patients over 6 years of age a bonded traction for 3 weeks followed by discharge for about 5 weeks.

If the hip fails to reduce after two or three attempts at a closed reduction, an open reduction must be performed.

Technique 2: Technique 2 (T2): If the hip fails to reduce after two or three closed reduction attempts, and/or the patient has a time interval of more than 3 weeks between trauma and reduction, T2 is performed. We release the long adductor muscle at its attachment and lengthen the psoas tendon.



Figure 1: Clinical aspect of traumatic hip dislocation.



Figure 2: Radiological aspect of traumatic hip dislocation. A: left; B: right.

Allis maneuver

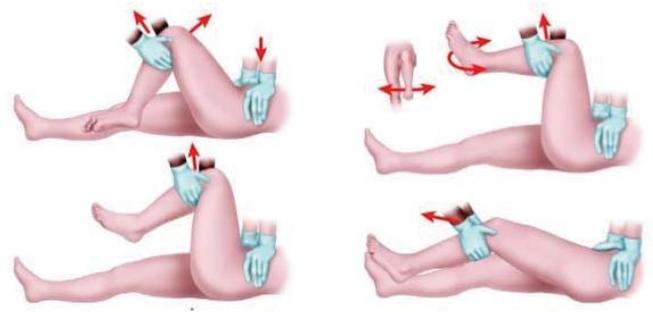


Figure 3: Allis maneuver for reduction of traumatic hip dislocation.



Figure 4: Immobilization after reduction of traumatic hip dislocation [26].



Figure 5: Traction after reduction of traumatic hip dislocation.

Technique: Figures 6,7 (a) The incision is in line with the lateral edges of the long adductor muscle, 1 cm below the pubis, longitudinal incision 6 cm over. (b) Release the long adductor muscle and lengthen the psoas tendon. (c) The hip was held in place with a 3 mm Kirschner wire through the femoral head into the acetabulum.

Technique 3: Technique 3 (T3): If the hip does not reduce according to T2, and/or the patient has a time interval of more than 6 weeks between trauma and reduction, a

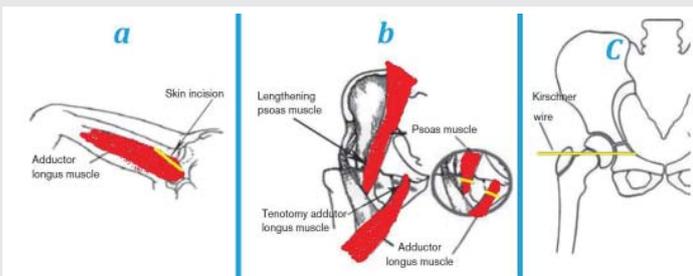


Figure 6: Image illustrating technique 2.

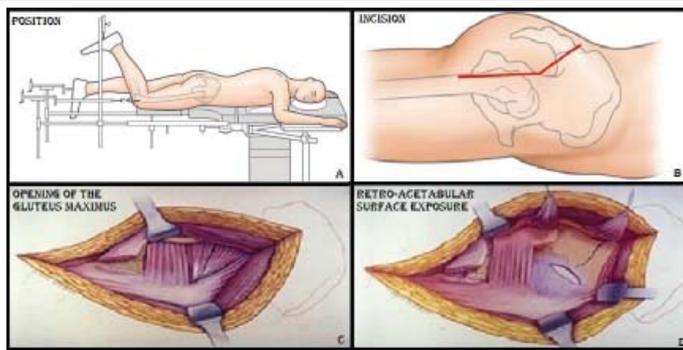


Figure 7: Image illustrating the posterior Kocher-Langenbeck route in technique 3 [27].

posterior technique (Figures. 7) is used to avoid further devascularization of the femoral head and special attention is given to visualization and protection of the sciatic nerve. The hip capsule is exposed to identify the articular cartilage of the femoral head, the round ligament and the acetabular cavity. Parts of the very thick antero-inferior capsule are removed and the psoas insertions are detached. If the acetabular cavity appears to be very shallow, the acetabulum is cleaned of all scar tissue with a sharp spoon. The femoral head is reduced in the acetabulum by traction and countertraction. The capsule is joined at the bottom and left open for drainage [8].

A 3 mm Kirschner wire is inserted through the femoral head into the acetabulum. A capsuloraphy with non-resorbable sutures. Patients are immobilized in a pelvic-pedestrian cast immediately.

Patient follow-up

The pin removal was done at 3–4 weeks. The time of hip cast removal varies: for patients who underwent reduction according to T1, it was done in 3 weeks; for T2 in 6 weeks; and for T3 in 9 weeks. After removal of the cast, X-rays of the hip were taken for all patients. After cast removal, each patient underwent a period of protection (sports abstention and crutching): for patients with T2 reduction, it was 6 months; and for T3, it was 9 months. Patients were independently assessed every 6 months thereafter.

After reduction, each patient's medical records were reviewed, focusing on symptoms, physical findings, and x-rays of the hip. Clinical assessment focused on range of motion, presence of pain and/or lameness, and ability to squat. A Harris hip score [5] was also calculated for each patient at 6 months after dislocation and at final follow-up.

Avascular necrosis was noted according to Barquet [9] [type I (normal), type II (minimal coxa magna, no coxa breva, no acetabular changes), type III (coxa magna, coxa breva, femoral neck widening, varus/valgus neck angulation, acetabular widening), type IV (coxa magna with flattening of the femoral head, coxa breva, varus or valgus alignment, and acetabular deformity), and type V (variations similar to VNA in adults, no growth disturbance)].

The results were rated as excellent, good, fair or poor according to Garrett, et al. [10]. An excellent result means: no pain, a full range of hip movements, and no limping. A good result showed no pain, 75% of normal hip movement and slight lameness. A fair result meant no severe pain. 50% of normal hip movement, and moderate limping. A poor result indicated disabling pain, markedly limiting hip movement.

Results

From January 2010 to January 2019, 11 patients (11 hips) were treated for traumatic hip dislocation. Of the 11 in our study, 06 (54.5%) occurred on the right side and 05 (45.5%) on the left side. Eight (72.7%) were male and three (27.3%) were female. Age at diagnosis ranged from 3 years, 2 months to 9 years, 10 months. There were two age groups in which hip dislocation appeared to be more common, with 08 of the 11 patients (72.7%) between 3 and 6 years of age, and 3 of the 11 patients (27.3%) between 7 and 10 years of age. All patients had Thompson and Epstein type I posterior dislocations [6] with no associated fractures.

The dislocation was caused by a fall and a banal fall in 04 patients; 03 of the four patients underwent reduction according to T1 and another underwent reduction according to T2. A road accident in four patients; three patients had a reduction according to T1 and one patient had a reduction according to T2. Injuries were caused by playing football in three patients; two of the three patients underwent reduction as per T1 and the remaining patient underwent reduction as per T3.

All patients had a traumatic dislocation of the hip with no other associated injuries.

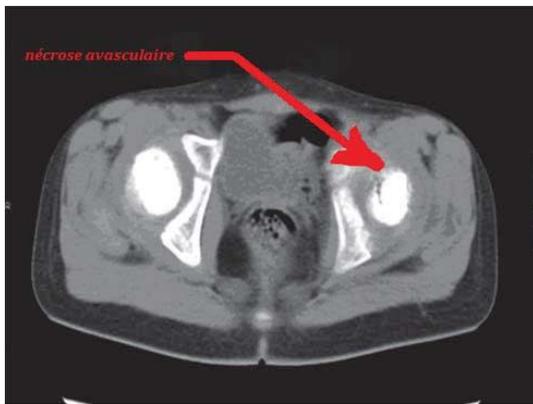
The time interval between dislocation and reduction was 1–3 weeks in 09 patients [(minus 24 hours in 08 patients, >24 hours–3 weeks in 1 patient)]; 3–6 weeks in 1 patient (4 weeks in 1 patient); and more than 6 weeks in 1 patient (9 weeks in 1 patient). 8 patients underwent reduction according to T1; 2 patients underwent reduction according to V2; and 1 patient underwent reduction according to V3 (Table 2).

We had excellent results in four hips (36.4%), good results in three hips (36.4%), satisfactory results in three hips (18.2%), and poor results in one hip (9.1%).

There was avascular necrosis in two hips (18.2%) (Figure 8), a 3cm coxa magna in a single patient (9.1%) (Figure 9), a 2cm limb inequality in a single patient (9.1%), and lameness in a single patient (9.1%).

**Table 2:** Results by technique used.

	Excellent	Good	Medium	Bad
V1	04(36,4%)	03(27,3%)	01(9,1%)	
V2		01(9,1%)	01(9,1%)	
V3				01(9,1%)
Total	04(36,4%)	04(36,4%)	02(18,3%)	01(9,1%)

**Figure 8:** Avascular necrosis of the left femoral head.**Figure 9:** A coxa magna of the left femoral head.

Discussion

Traumatic dislocation of the hip is rare in children and can occur as a result of minor injuries sustained while playing or participating in sports activities. Barquet [9], Hamilton and Broughton [2] and Rieger, et al. [11], also found that the magnitude of the force producing the injury increased with the age of the patients. We believe that low-energy trauma can cause dislocation in younger patients because their periarticular structures are more flexible. The flexibility of the periarticular structures may also explain the absence of bone damage to the acetabulum or femoral head, unlike adults, in whom acetabular fracture is a common problem. However, all patients with traumatic hip dislocation and even patients who have been involved in an accident should have a careful examination of the entire body to identify other associated injuries. Several authors [2,11,12] have classified traumatic hip dislocations into two groups according to age and time of injury. The first group included children under 10 years of age, admitted following a relatively minor trauma, such as a simple fall. Barquet [13] and Schlonsky and Miller [14] also found that the magnitude of the forces involved in the injury increased with the age of the patient.

As Mehlman, et al. [15] point out, the interval between dislocation and reduction should be as short as possible to limit the risk of necrosis. The risk of necrosis is 3-15% [13,15,16]. Although opinions on treatment differ, it is agreed that rapid reduction of hip dislocation is the most important initial treatment [17]. Full recovery can only be achieved after early reduction; a critical delay has been reported by some authors up to 12 h [17]. More recent articles recommend a reduction within 6 h [10,18], but none of these studies have included a sufficient number of patients who underwent hip reduction between 7 and 12 h. Yang, et al. [19]. found no statistical difference between one under 12 and one between 12 and 24 hours. Among our patients, two patients (13.6%) had avascular necrosis and in both cases there was a delay in treatment of more than 4 weeks (Figure 8).

Although a number of treatment methods have been reported, the best strategy for this problem is not yet in place. Several closed reduction manoeuvres have been described in the literature [20]. Possible choices include no treatment [21], closed reduction (manual or traction) [22], open reduction [16,22] or recovery by arthroplasty [16,23], realignment osteotomy [21], arthrodesis [24], pelvic osteotomy [21,25], or total joint replacement [24].

Conclusion

Children with a traumatic hip dislocation should have their hips reduced as soon as possible. All patients with a traumatic hip dislocation should have a thorough whole-body examination to identify other injuries. The factors that seem to have the greatest influence on the final outcome are as follows:

- 1) The time interval between injury and reduction
- 2) Beyond 3 weeks, a reductive operation should be performed; we suggest surgical technique 2. This simple and safe method leads to a marked improvement in hip function and prevents the occurrence of complications.
- 3) Adherence to the principles of immobilization and management after reduction of the dislocation: the shape and duration of the pelvic-pedestrian cast, bonded traction, removal of the pin, protection period, and clinical-radiological control.

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