

Misconception: Hip arthroscopy has no place in pediatric surgery

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1. Introduction

The first attempt at arthroscopy in children was undergone in the 1980s. At the time, indications were limited to diagnostic exploration, synovial biopsies, and excision of loose bodies, especially in osteochondritis dissecans secondary to Legg-Calvé-Perthes disease. Imaging at the time allowed an incomplete evaluation of joint structures due to skeletal immaturity. Arthroscopy allowed an evaluation of intra-articular and extra-articular surfaces before the era of MRI. Despite its advantages in terms of recuperation and early return to activity, hip arthroscopy in children was late to develop. It was not until the 2010s, that publications surrounding this topic started to increase. Similar to knee arthroscopy, the use of this “novel” technique in the pediatric population was delayed by about 30 years. Today, in France, this technique is utilized regularly only in select medical centers [1].

2. Documented indications

2.1. Developmental dysplasia of the hip

Developmental dysplasia of the hip is a common pathology (around 1% of births). Its delayed treatment (after 6 months of age) increases the risk of early secondary hip osteoarthritis requiring prosthetic replacement before the age of 50 years old in around 40% of patients [2]. As such, treatment in these patients should not be delayed once the diagnosis is made and should be adapted to the child's age and physical exam. Closed reduction is prioritized before 18 months of age. In case of failure of conservative treatment or delayed diagnosis, reduction under general anesthesia is indicated. During general anesthesia for reduction and immobilization by a hip spica cast, arthrography may reveal intra-articular obstacles to reduction.

During the first stage of the procedure, arthrography of the pathological hip is obtained through a medial obturator approach between the adductor longus anteriorly and the hamstrings tendons posteriorly. The needle allows the introduction of a radio-opaque guide. The needle is removed, and the guide is used for the introduction of a 2.7mm medial trocar. A 70° arthroscopic should be used (Figure 1).



Figure 1

Through this approach, the femoral head and the head-neck junction can be visualized along with any pathological element related to hip dislocation: A distended or ruptured ligamentum teres, and pulvinar (Figure 2).

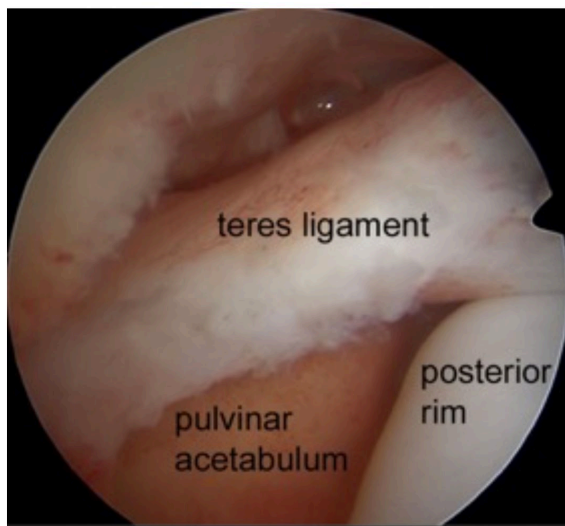


Figure 2

A medial arthroscopic approach [3] described by Eberhardt, allows the resection of these obstacles to reduction (pulvinar and ligamentum teres if hypertrophied), tenotomy of the psoas tendon via a trans-articular approach and, if necessary, capsular release [3].

Nevertheless, strict recommendations have been published by a German team. Specifically, they argue against such an intervention in teratologic hips due to the increased risk of avascular necrosis (AVN) (100%), and of mid- and long-term surveillance due to the high likelihood of secondarily requiring acetabuloplasty (40%) [4]. This team, with its remarkable experience, has expressed its reservations as to the extremely positive results reported by certain authors [5-7].

The take home message is that this technique should be reserved for experienced surgeons due to the small volume of the joint in the newborn, and the possible severe complications encountered in this pathology (AVN).

2.2. Femoro-acetabular impingement

In our experience, femoro-acetabular impingement is often secondary to hip pathologies such as slipped capital femoral epiphysis (SCFE) and Legg-Calvé-Perthes disease.

2.2.1. Slipped capital femoral epiphysis

Treatment is always surgical, most often requiring in situ cervico-cephalic pinning. The progression of the disease may lead to femoro-acetabular impingement by a cam effect. Arthroscopic resection of the bony bump is an interesting therapeutic option in patients with mild to moderate displacement; The surgical technique is similar to that of femoro-acetabular impingement by cam effect in the adult patient. During the procedure, the quality of the resection by fluoroscopy should be controlled by rotating the hip. This treatment strategy allows primarily an improvement of pain, although gain in range of motion is moderate. Arthroscopy may secondarily allow a resection of any anterior residual cam effect after open reduction [8]. It should also be noted that hips with severe displacement may not be accessible via arthroscopy, in which case open osteotomy would be preferable [9].

2.2.1. Legg-Calvé-Perthes disease

By the end growth, patients with Perthes disease may present signs of impingement during the remodeling phase, especially in patients with Stulberg grades III and IV. The femoral head presents Coxa Plana or Coxa Magna deformities [10]. In this case, the amount of bone to be excised is more significant than in the case of a simple resection of a bony bump. As such, open resections by either an anterior or a Röttinger approach may be more feasible.

2.2.1. Multiple hereditary exostoses

The acetabulum is rarely affected in multiple hereditary exostosis. These exostoses may be responsible for an eccentric femoral head, pain, and early onset osteoarthritis. Their excision by a burr via arthroscopy may be an interesting alternative to open surgery which requires femoral head dislocation.

2.2.4. Idiopathic

Femoroacetabular impingement, either “cam” or “pincer” type, may be accessible by arthroscopy with good outcomes, as was described by Philippon et al. [11]. The authors reported a case series of 17 patients aged younger than 16 years old who had undergone hip arthroscopy. Procedures ranged from simple resection of the bony bump by burr to labral suture. It should be noted that, in order to facilitate the procedure, the author utilized specific instruments, such as arthroscopic knives, and frequently realized an arthroscopic capsulotomy. No complications were reported.

Arthroscopic treatment of femoro-acetabular impingement has shown good outcomes with a return to sports at the preinjury level in 85 to 95% of cases [12]. Functional results at mid-term have shown an improvement in the modified Harris hip score of 15-30 points, depending on the case series [11,13].

In case of bilateral femoro-acetabular impingement in young athletes, a period of 4 to 6 weeks between each arthroscopic procedure is indicated in order to allow early return to sports [14].

2.2.5. Labral lesions

Lesions of the labrum are most frequently encountered in adolescents and may be idiopathic or secondary to dysplasia, Perthes disease, or SCFE. They may be responsible for pain and an intra-articular etiology of snapping hip. Arthroscopy is the preferred technique allowing a precise simultaneous assessment of associated lesions and treatment by reinsertion or partial resection [15].

2.3. Articular exploration and debridement

2.3.1. Septic arthritis

In septic arthritis, arthroscopic irrigation, which is less invasive than arthrotomy, allows a complete exploration and irrigation of the hip joint, as well as synovial biopsies in patients in whom the diagnosis is uncertain. The use of 2 approaches is sufficient for effective irrigation, whether anterolateral and lateral, or anterolateral and medial [16, 17]. This includes irrigation with large volumes until obtaining a transparent liquid and the verification of a lack of debris in the joint.

2.3.2. Osteochondral lesions

Osteochondral lesions are generally secondary to trauma, including dislocations of the hip which sometimes spontaneously reduce. This situation always requires a CT scan to assess for intraarticular loose bodies.

At the remodeling phase, Perthes disease may be complicated by osteochondral loose bodies with fragments that include flaps or loose bodies. Simple arthroscopic removal of these fragments is the preferred treatment when said fragments are small enough [10]. This may be associated with retrograde perforations with both fluoroscopic and arthroscopic control.

2.3.4 Synovial pathologies

Loose bodies are encountered in synovial chondromatosis, displacement of osteochondral fragments in the natural history of Perthes disease, or in systemic pathologies such as sickle cell disease, Gaucher disease, etc. Arthroscopy is the preferred technique for the removal of these intra-articular loose bodies.

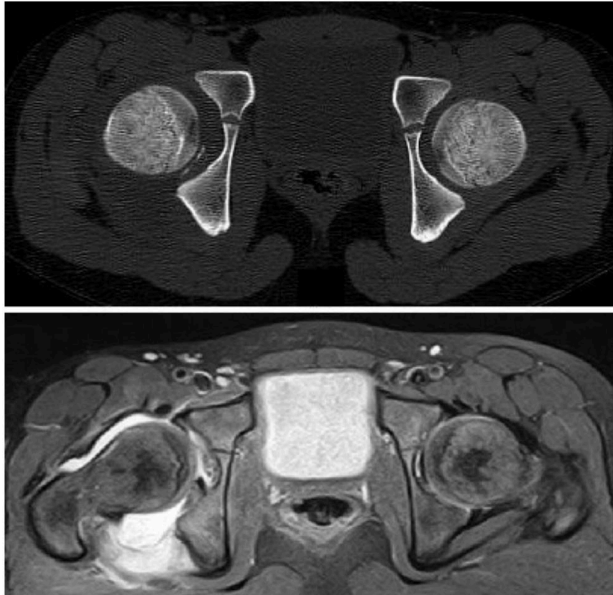


Figure 3

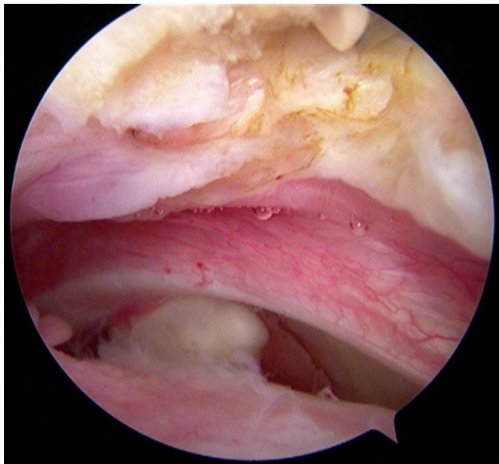


Figure 4

Biopsies to confirm inflammatory synovitis are common indications with which biopsies for histological assessment may be obtained before commencing immunosuppressor therapy (Figure 5).

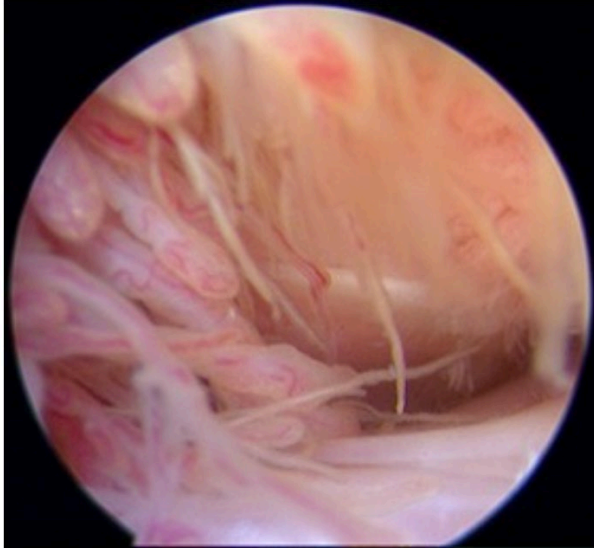


Figure 5

Pigmented villonodular synovitis (Figure 6) is accessible for arthroscopic biopsy and resection. The suctioned liquid is filtered at the end of the intervention and sent for pathological examination.

2.4. Periarticular endoscopy

Extra-articular etiologies of snapping hip are frequent reasons for consultation in adolescent athletes, especially in girls. The management of such pathologies is usually conservative at first. In case of failure of medical management, surgical treatment may be required, and arthroscopic approaches should be privileged.

Lateral extra-articular snapping hip is more frequently encountered. This is due to iliotibial band friction over the greater trochanter, which could lead to discomfort and pain. Injections have shown little to no effect. The preferred surgical treatment is an endoscopic Z-plasty of the fascia lata. Outcomes with this technique have been shown to be equivalent to open procedures and to decrease the burden of healing [18].

Medial extra-articular snapping hip manifests as a painful snapping at the level of the inguinal region. It is caused by friction of the iliopsoas tendon over the iliopectineal ridge [19]. The diagnosis is confirmed by dynamic ultrasound. In case of failure of physiotherapy (deep transverse massages, stretching) and steroid injections, an arthroscopic trans-articular tenotomy of the psoas may be a simple procedure with good results [20].

3. Surgical technique

3.1. Patient positioning

The patient is positioned on a fracture table. Use of a regular table without traction should be reserved for simple synovial biopsies surrounding the femoral neck in children younger than 5 years old, in whom manual traction may be sufficient.

Bony landmarks are marked on the skin. Normal saline should be injected before incision in order to reduce the negative pressure seal and the articular coaptation. The angle of skin penetration is crucial and should be guided by fluoroscopy. Penetrating the hip joint requires the use of a sharp trocar.

Before 4 years of age, a 2.7mm arthroscope should be used. After 4 years of age, a 4mm arthroscope can be used instead, preferably with a 70° arthroscope (Figure 7).



Figure 7

3.2. Approaches

3.2.1. Anterolateral approach:

Anterolateral and lateral approaches are the most frequently used. Posterolateral approaches are considered dangerous due to the risk of injuring the medial circumflex femoral artery. Anterolateral approaches are similar to those in adults.

3.2.2. Medial approach:

The patient is placed on a radio-transparent fracture table, the hip is placed in flexion, abduction, and external rotation. A stab incision is made distal to the adductor longus tendon, and the trocar is introduced until reaching the inferior capsule. An “all-medial” approach was described by Polesello [21]. Furthermore, in addition to the posteromedial approach, the technique described an antero-medial approach on the anterior border of the adductor longus tendon, and a distal postero-medial approach with the point of entry lying posterior to the adductor tendon, 5cm from the inguinal crease. The primary risk of this approach is injuring the obturator nerve and the medial circumflex femoral artery.

4. What to expect?

- A steep learning curve:

The study by Mehta et al. in 2018 showed that there is a steep learning curve. The need for revision surgery decreases significantly only with an experiencing 500 hip arthroscopies [22].

- Aesthetic advantages:

The “classic” approach for the treatment of femoro-acetabular impingement, as described by Ganz, includes an invasive arthrotomy requiring a trochanteric osteotomy and dislocation of the femoral head [23]. This can now be undertaken by excision of a bump through a mini-invasive open anterolateral (Röttiger) or anterior (Hueter) approach.

- “Optimized” hospital stay:

Similar to the adult population, arthroscopy in children may be ambulatory [24].

5. Complications

Complications have been reported in 1.8% of children. No episodes of growth disturbance have been reported [25]. Hip arthroscopy complications in children are similar to those in adults, including pudendal neurapraxias when using excessive traction, superficial infections, and breaking of the hardware. Haldane et al. reported in 2018 a 2% rate of thromboembolic complications in all arthroscopies realized in adults and children. Risk factors included age, BMI, and the use of peri-operative traction. Similar rates of avascular necrosis of the femoral epiphysis have been reported after reduction of hip dislocations between open and arthroscopic approaches. One case of pulmonary edema was reported in a child due extravasation of the pumped liquid.

6. “Incorrect” indications for hip arthroscopy in children

Due to the particularly high risk of complications during interventions by arthroscopy, the following indications have been strongly recommended against:

- Resection of a bump due to sequelae of SCFE with large displacement.
- Teratologic hip dislocations.
- Infections after a 2nd revision arthroscopic surgery.

7. Conclusion :

Arthroscopy is a viable alternative to arthrotomy for common pathologies, such as hip septic arthritis and synovial biopsies in children. It is also a viable technique for the treatment of

femoro-acetabular impingement, with an increase in its popularity for the removal of osteochondral fragments. Hip arthroscopy is therefore an essential tool in the adult as well as pediatric populations but requires substantial technical competencies and general experience in arthroscopy. The development of simulators is a key element in the training of surgeons who will undertake such procedures.

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