Specific Tissues and Conditions: Pediatric Conditions

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Introduction

Minimally invasive procedures are growing in all areas of medicine. Orthopedics has had special importance in this development with the creation and improvement of arthroscopic surgeries. The use of this technique in the hip joint, however, had a long lag period since its initial description had been made in 1931, by Michael Samuel Burman. For many decades, there were few publications. After the 1980s, with the improvement distraction and positioning techniques, this method of approach received a boost. We believe that the diseases that affect the hips of children and adolescents are very peculiar. While in adults traumatic injuries and degenerative diseases predominate, children have different conditions.

There are few references related to hip arthroscopy in children and adolescents [1, 2], mostly case series. They also do not address in depth the technical details and difficulties involved in adolescent surgical procedures.

Our goal in this chapter is to present the indications, surgical technique, and complications of hip arthroscopy in the pediatric population.

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Indications

Hip arthroscopy, as well as any other surgical procedure, must be indicated with great care. We do not know the limits of its application in pediatric hip. Studies in cadavers of newborns performed by Oliveira et al. [3] describe the minimum weight for its realization as being 1700 g. We find references to its successful application in children as the minimum age of 2 years and 4 months by Chung et al. [4]. In our experience, our youngest patient was 11 months (8 kg) with femoral neck osteomyelitis and pyoarthritis of the hip (Fig. 56.1).

We do not recommend arthroscopy as explorative or random. The doubtful cases should undergo a detailed investigation including a thorough medical history, complete physical examination, and radiological exams sufficient to a precise diagnosis, or at least that allow us an adequate strategic planning.

Contraindications

Skin infection, cellulitis, extra-articular abscesses, and cutaneous lesions that may predispose to infection are contraindications to this procedure.

Ankylosis or arthrofibrosis are considered contraindications by many authors, by hindering the achievement of a efficient joint space, preventing intra-articular access, but we believe that arthroscopy, in specific clinical situations, has its usefulness by potentially promoting the release of the lock, resection of fibrosis, and peri- and intra-articular ossifications, aiming to gain mobility.

Acetabular fractures are also relative contraindications, as they may predispose excessive leakage of fluid into the abdominal cavity.

Avascular necrosis is cited as a relative contraindication in adults; however in children it may be used in patients with Legg-Calvé-Perthes (LCP) disease in the active phase of the disease, without progression of necrosis.

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Fig. 56.1 11-month-old child with right hip osteomyelitis and pyoarthritis treated arthroscopically. (**a**) Pre-op X-ray with subluxation of the hip. (**b**) Image of lateral portal being made. (**c**) Post-op X-ray with reduced hip and drain

In our experience, special care should be taken with patients with chondrolysis; despite the apparent improvement in mobility at the time of anesthesia and after resection of bone blocks, there is a great tendency for loss of mobility postoperatively.

Surgical Technique

Positioning

There are two options for positioning: lateral or supine. The lateral decubitus position has the advantage of facilitating traction while allowing the fatty tissue of obese patients to fall away by gravitational action, thus facilitating joint access via lateral portals. The supine position has the advantage of using a conventional orthopedic table, available on most services. This is also our choice of positioning.

Use of Traction

Basically, the surgery may be performed with or without traction. Sometimes it is necessary to use the two techniques.

Traction is obtained with the patient positioned on orthopedic table, feet and ankles carefully protected and secured to the table. The pin properly padded when placed eccentrically allows the facilitation of lateral force vector. If the table does not have the option of the lateralized pin, an alternative is to adapt a large foam around it functioning as lateralization vector and protecting the perineal region. The contralateral limb is held in abduction, thus facilitating the use of fluoroscopy.

Our choice in performing arthroscopy in children is the use of table with a central pin. The common orthopedic table can easily be used in adolescents and children over 5 years, provided that the lower limbs fit the table leg extension. In younger children, we developed a specific traction table, allowing better positioning. We also adapted the foam around the central pin of the table, varying its diameter according to the size of the child. Traction is done manually. In children, the joint space is achieved with ease. Remember that the protection of traction areas, especially the perineum, must be done carefully (Fig. 56.2).

Manual traction may be done in young children. We carried out this method in two patients, achieving a relative gain in joint space, but we do not recommend this form of traction due to the risk of provoking a joint injury when positioning the portals.

In the technique without traction, the patient is positioned on a conventional radiolucent table, lower limbs loose, allowing them to move freely. This is our choice when needed to address only the peripheral and lateral compartments, or when the hip is dislocated.

Equipment

Adequate table and fluoroscopy are essential. 4.5, 5.0, and 5.5 mm cannulas are usually used. Exceptionally, 2.7 mm cannulas can be used in very small children, but they are not cannulated, thus hindering access to the joint. The most often used arthroscope was the 70° scope, and less frequently the 30°.

Portals

The portals usually used are the anterior, lateral, and posterior [5]. In young children, because of the greater proximity between the portals there is an increased difficulty in handling the instruments; also they are located closest to important neurovascular structures, and, therefore, care must be constant (Fig. 56.3).

Some anatomic conditions as coxa vara, pelvic osteotomies, and high-riding trochanter can make the execution of these portals difficult.

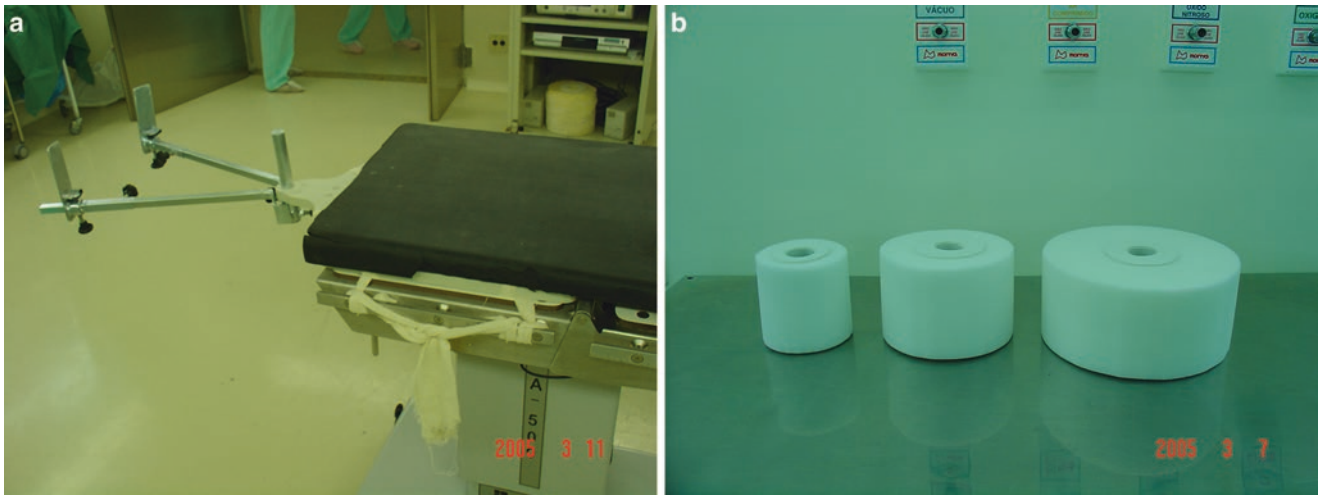

Fig. 56.2 (**a**) Adapter for an orthopedic fracture table and (**b**) foam posts of different diameters to promote a lateral vector of traction

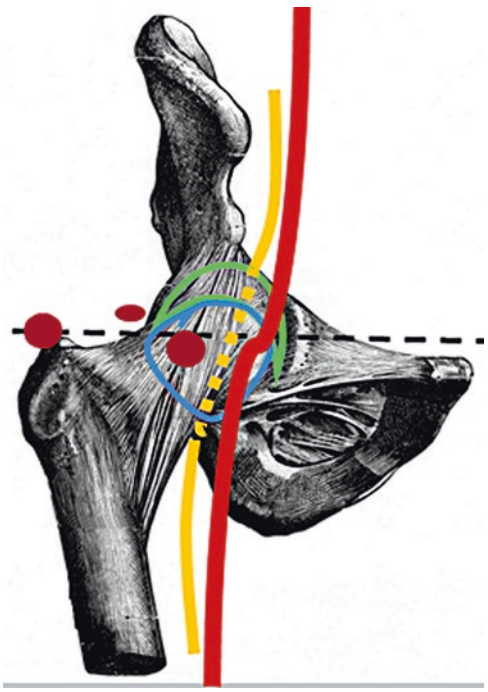

Fig. 56.3 Always consider that in a child the arteries and nerves are closer to the anterior portal than in the adult. *Red line*: Femoral artery, *yellow line*: femoral nerve. *Red dots*: Anterior, anterolateral and posterolateral portals, *blue circle*: peripheral compartment, *green circle*: central compartment

Knowledge of the cartilaginous thickness is very important, because it cannot be identified by fluoroscopy. To avoid unwanted injuries, air may be injected during portal placement, identifying the cartilaginous limits. The greater trochanter also has a cartilaginous part that may hinder the lateral portal [6].

Pediatric Conditions

Etiological Investigation, Biopsies, and Joint Cleaning

Arthroscopy may be useful in the etiological investigation of the child's painful hip, allowing a direct view of the joint and also obtaining tissue for pathological and microbiological studies.

Chronic inflammation may promote articular cavity filling with inflammatory and fibrous tissue, causing a subluxation of the hip and thus perpetuating the pain. In situations like this, hip arthroscopy may be useful to perform a cleanup of the joint cavity and reduction of subluxation. One advantage of the arthroscopic approach compared with open access is not causing instability of the hip joint, eliminating the use of braces, casts, or traction postoperatively.

Septic Arthritis

Septic arthritis of the hip is a serious and relatively common condition and can lead to crippling deformities. Surgical drainage of the infected joint is indicated in most patients. Several open approaches have historically been used, but more recently arthroscopy has many advantages: it allows efficient articular cleaning with copious irrigation, a detailed investigation of the cavity, adds no joint instability, allows the installation of irrigation with negative aspiration, rapid rehabilitation, shorter hospital stay, and better aesthetics [7–9] (Fig. 56.4).

Fig. 56.4 Seven-year-old boy with septic arthritis of the left hip treated arthroscopically. (**a**) Patient with hip flexion due to septic arthritis. (**b**) Anterior and anterolateral used to drain. (**c**) Good joint space

Developmental Dislocation of the Hip

Arthroscopy may have its indication at different times during the treatment of developmental dislocation of the hip (DDH) [10, 11], these being the following:

Acetabular Cleaning to Facilitate Reduction

In attempting closed reduction of DDH, we may have some unwanted situations such as inability to obtain a reduction or an unstable reduction. In these situations, an alternative is open reduction, with the risk of necrosis or cicatricial retraction. Arthroscopy may be applied in lieu of open reduction, with exploration of the joint cavity, articular cleaning, and consequent increase in the security zone of the reduction (Fig. 56.5).

As Adjunctive Procedure to Pelvic Osteotomies

Arthroscopy can be helpful in exploring and articular cleaning or repair as an adjunct to pelvic osteotomies.

Postoperative Exploration for Persistence of Joint Incongruity

The persistence of hip subluxation postoperatively may have several causes: inadequate capsuloplasty, insufficient acetabular cleaning, femoral or acetabular deformities, or a persistent mechanical obstacle among others. We had the opportunity to explore one of these situations and we observed that the cause of subluxation resulted from the interposition of the suture used in capsuloplasty.

Labrum and Cartilage Debridement

Hip arthroscopy may be used to repair or debride labral or cartilage lesions.

Release of Postoperative Arthrofibrosis

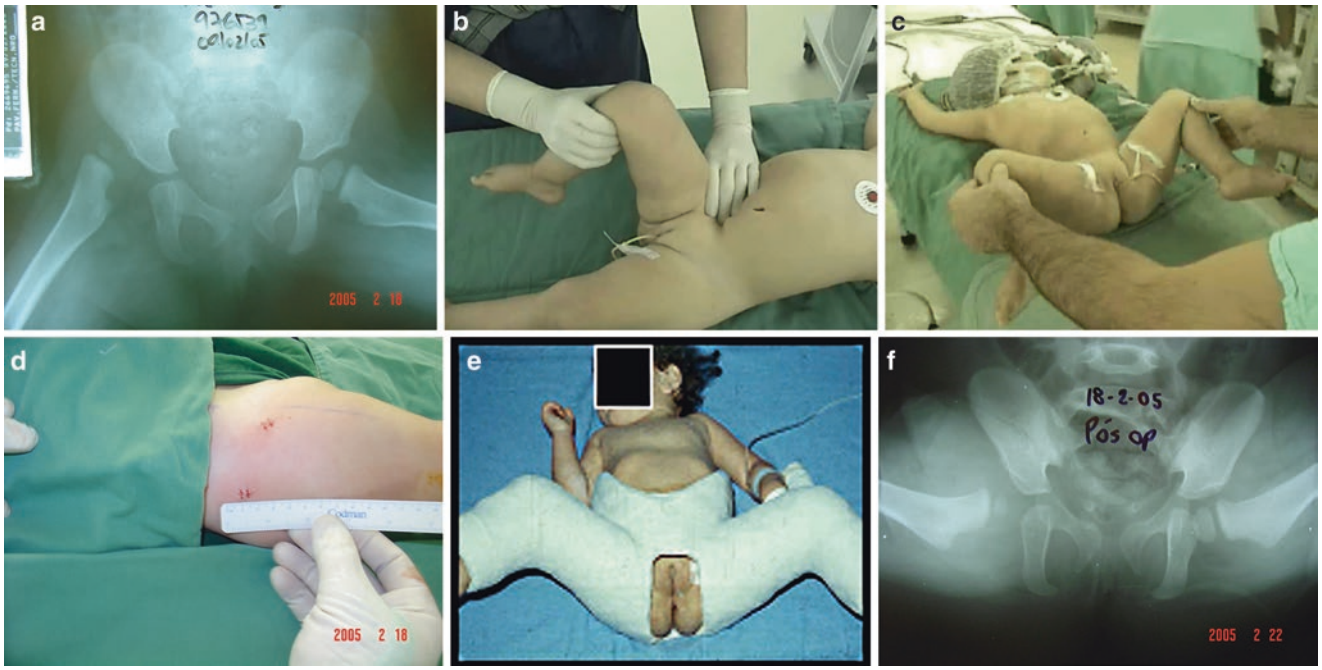

Fig. 56.5 16-month-old girl with right hip DDH and unstable reduction, arthroscopically acetabular cleaning was done to facilitate reduction. (**a**) Right hip subluxed. (**b**) Unstable reduction. (**c**) Reduction after arthroscopy. (**d**) Anterior and anterolateral portal. (**e**) Spica cast. (**f**) Post-op X-ray with reduced right hip

One of the most feared complications in surgical treatment of DDH is postoperative stiffness. Despite the articular fibrosis being described as one of the contraindications of hip arthroscopy, we have had the opportunity to perform the arthroscopic release in a patient with postoperative stiffness, achieving a significant mobility improvement.

Legg-Calvè-Perthes Disease

Pain in adolescents and young adults with previous LCP can have several causes: acetabular and femoral deformities, lesions of the articular cartilage or labrum, lesions of the teres ligament, osteochondritis, loose bodies, hyperpressure on the psoas tendon, or muscle fatigue due to biomechanical changes among others.

Hip arthroscopy may be useful to treat several of these different clinical situations.

Loose Body Removal: Sometimes during the regeneration process of the femoral epiphysis loose bodies may be formed. Arthroscopic removal is very advantageous when compared to open surgery.

Articular Cleaning in Synovitis: Articular cleaning may be effective in improving mobility and decreasing pain in these patients.

Teres Ligament Treatment: Changes of the teres ligament may cause pain in patients previously affected by LCP disease, among the most common injuries found: hypertrophy, rupture, anomalous insertions, or degenerative lesions. Arthroscopic surgery is very useful in addressing the round ligament and may have both diagnostic and therapeutic purposes.

Femoroacetabular impingement (FAI) treatment and *labrum and cartilage debridement*.

Myo-Tendinous Structures Treatment

The psoas tendon may be the cause of anterior hip pain. This diagnosis is often difficult and can be aided by therapeutic tests.

It is possible to approach endoscopically the tendon of the psoas muscle in both its intrapelvic portion (trans-articular), but also in its femoral insertion (extra-articular), as described by Ilizaliturri, 2005 [12].

Slipped Capital Femoral Epiphysis (SCFE)

Arthroscopy has been very helpful in dealing with these patients, among the indications we quote [13].

Osteochondroplasty for FAI Treatment

In order to correct the femoral bump impingement and gain mobility in the hip, femoral osteoplasty can be accomplished. Arthroscopy has proven to be a good option in this procedure [14, 15] (Fig. 56.6).

Trapezoidal Femoral Neck Bone Correction Through Arthroscopy

The trapezoidal femoral neck osteotomy is used to correct severe deformities in open physis patients, reducing the incidence of necrosis. We have done this fully arthroscopic surgery associated with percutaneous fixation of the femoral epiphysis. This procedure is indicated in very specific situations, mainly severe slips with very limited range of motion.

We have published a mean 2-year follow-up of five patients with severe SCFE that underwent trapezoidal femoral neck correction through arthroscopy [16]. The mean age at the time of surgery was 13.2 years. Mean modified Harris hip score was 17.2 points preoperatively and 86.6 points at the last assessment. The mean epiphyseal deviation ranged from 82° at the initial presentation to 14° postoperatively. There were no intraoperative complications, and there was one case of avascular necrosis [13] (Fig. 56.7).

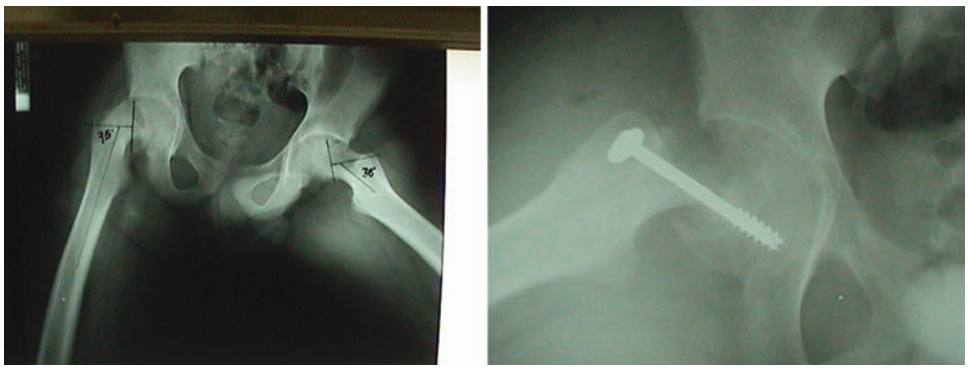

Fig. 56.6 14-year-old boy with SCFE treated with in situ fixation and femoral neck arthroscopic osteochondroplasty. (**a**) Pre-op X-ray. (**b**) Pos-op X-ray

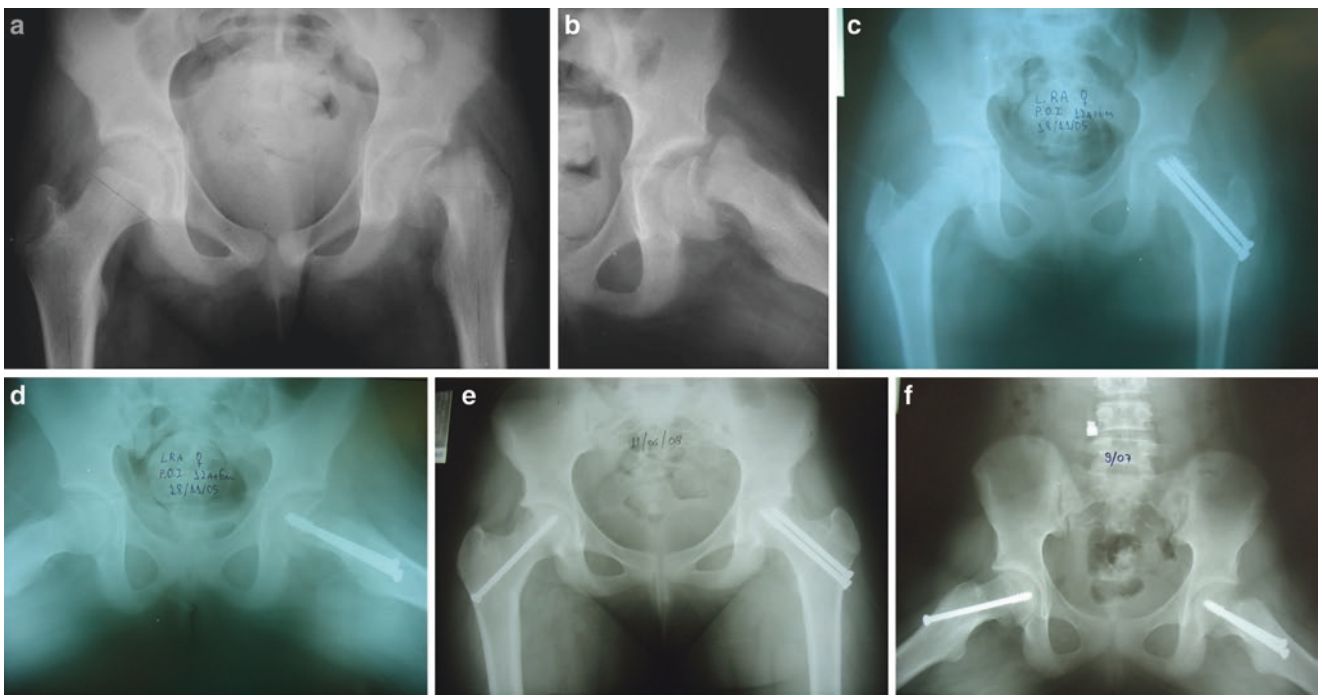

Fig. 56.7 12-year-old male with severe left hip SCFE treated with arthroscopic trapezoidal femoral neck bone correction, and right hip prophylactic fixation. (**a**) Left hip SCFE. (**b**) Left profile with severe SCFE. (**c**) Immediate post-op arthroscopic trapezoidal femoral neck bone correction fixed with two screws. (**d**) Profile immediate post-op. (**e/f**) 2-year follow-up

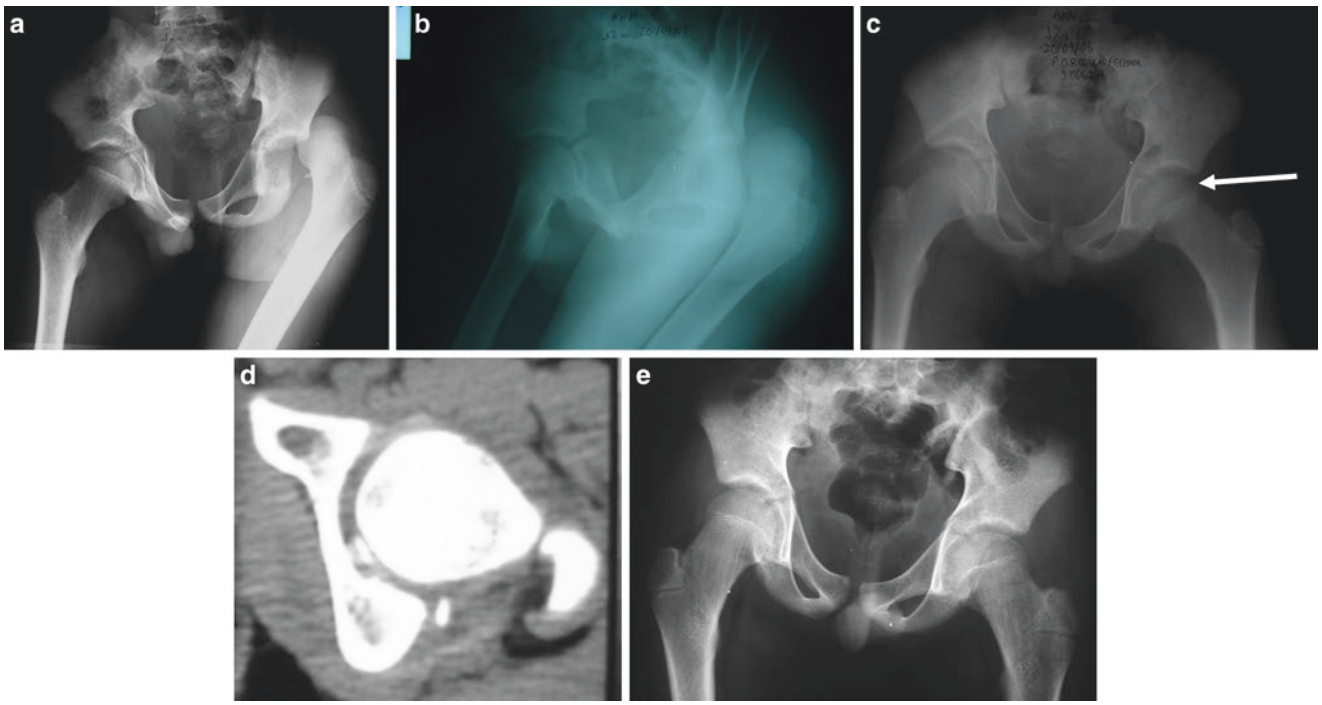

Fig. 56.8 12-year-old male with left hip fracture dislocation of left hip with subluxation after reduction due to osteochondral articular loose body that was removed arthroscopically, achieving adequate reduction. (**a/b**) Fracture-dislocation. (**c**) Persistent subluxation after closed reduction. (**d**) CT with subluxation and loose bodies. (**e**) Post-op arthroscopic removal with good reduction

Pediatric Traumatology

Fracture-dislocations of the hip: May help in loose body removal and chondrolabral junction repair (Fig. 56.8).

Sequelae resulting from epiphyseal necrosis of the femoral neck: Bone resection and osteoplasties of the femoral epiphysis.

Inveterate traumatic dislocation of the hip: Articular cleaning, reduction, and congruence analyses (Fig. 56.9).

Resection of bone tumors: Arthroscopy may be used to resect osteoid osteoma, osteoblastoma, bone cyst, synovial chondromatosis among others.

Complications

Nwachukwu et al. have described a 1.8 % complication rate in his series, the most common complications being transient pudendal nerve palsy, instrument breakage, and suture abcess [17]. We found few other papers mentioning complications of hip arthroscopy in children [18–20]. In our series so far we had a case in which damage to the cartilage of the femoral head caused the introduction of cannulae; this was due to inefficient traction. In another patient removal of articular loose bodies was incomplete, requiring a second arthroscopic surgery.

Conclusion

Arthroscopy should be seen as an adjunct in the treatment of hip disorders of children and adolescents. This minimally invasive procedure should not change the basics of treatment. The successful results are independent of the route of approach but the correct management of each patient.

The option of performing an arthroscopic surgery seeks to bring comfort to the patient, minimizing tissue damage with a low incidence of complications, allowing for a faster recovery and better aesthetics.

We believe that surgery makes sense only when its benefits outweigh the morbidity of the procedure. For this we recommend a great familiarity with pediatric hip diseases, a good surgical experience by conventional methods, and also a theoretical and practical study of hip arthroscopy.

Fig. 56.9 3-year-old boy with inveterate traumatic dislocation of right hip that closed reduction was not possible was treated with arthroscopic removal of interposed tissue, reduction, and spica cast. (**a/b**) Inveterate traumatic hip dislocation. (**c**) MRI with interposed tissue. (**d**) Post-op arthroscopic removal of interposed tissue and reduction. (**e**) Post-op arthroscopic removal of interposed tissue, reduction, and spica cast. (**f/g**) 3-year post-op

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