Arthroscopic Anatomy of the Dislocated Hip in Infants and Obstacles Preventing Reduction

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Purpose: The purpose of this study was to describe the anatomy as seen arthroscopically, the role of the labrum and its relevance in luxation and reduction procedures, and secondary changes to the cartilaginous acetabular roof and to determine the main obstacles preventing reduction of dislocated hips in infants and young children. **Methods:** A specialized pediatric medial approach to hip arthroscopy was performed on 25 hip joints in 21 patients younger than 4 years of age. The arthroscopic procedure was conducted using a 2.7-mm cannulated instrument. A subadductor portal was used for the 70° arthroscope, and a high anterolateral portal served as a working portal. The anatomic findings of the individual hip joints were recorded. We examined the femoral head, the teres ligament, the transverse ligament, the acetabulum, and the acetabular labrum. The obstacles preventing reduction were successively resected. **Results:** An arthroscopic investigation of all major structures and arthroscopic reduction was possible in 25 hip joints. A hypertrophic teres ligament was present in 23 of the 25 hips. Capsular constriction prevented reduction in 22 of the 25 hips. The acetabular labrum was not inverted in any of the examined hip joints and was also never an obstacle to reduction. Secondary changes to the cartilaginous preformed acetabular roof were present in 10 hips. **Conclusions:** We have shown that arthroscopy of a developmentally dislocated hip can be safely performed using the subadductor portal. Through this arthroscopic approach, we were able to identify the previously described pathologic structures—the limbus, neolimbus, pulvinar, hypertrophic teres ligament, and capsular constriction. The capsule was the most common block to reduction, followed by the teres ligament. Successful reduction can be achieved by removal of intra-articular tissues, the pulvinar, and the teres ligament, and nearly always a capsular release. The limbus and neolimbus were not factors in achieving reduction in our series. **Level of Evidence:** Level IV, case series.

The anatomy of hip dysplasia along with its pathologic changes and the anatomic obstacles preventing reduction are described based on cadaveric studies, histologic examinations, and magnetic resonance imaging (MRI).[1-3] Pathologic changes that are deemed obstacles to reduction include an inverted limbus, a hypertrophic teres ligament, a hypertrophic transverse ligament, intra-articulated soft tissue, and the psoas tendon. The impact these individual pathologic changes have on reduction is debated. Ishii et al.[4] do not regard changes to the cartilaginous acetabulum or an inverted labrum as being indications for surgery. In contrast, they believe a capsular constriction or a hypertrophic teres ligament and a hypertrophic transverse ligament represent indications for open reduction. Intraoperative observations of hip dysplasia have been based on findings identified within the context of open reduction.[4,5] It should be stated that the anatomy of young children is very sophisticated and represents a challenge for every orthopaedic surgeon.

Hip arthroscopy is one of the latest developments in clinical diagnostics and treatment of hip joints. Hip arthroscopy of dislocated hips has been performed in only a small number of cases.[6-10]

The purpose of this study was to describe the anatomy as seen arthroscopically, as well as the role of the labrum and its relevance in luxation and reduction procedures and secondary changes to the cartilaginous acetabular roof, and to determine the main obstacles preventing reduction of dislocated hips in infants and young children. Our hypothesis was that from an arthroscopic perspective, there will be easily identifiable structures that block reduction and that sequential removal of these structures will allow the hip to be reduced by arthroscopic means.

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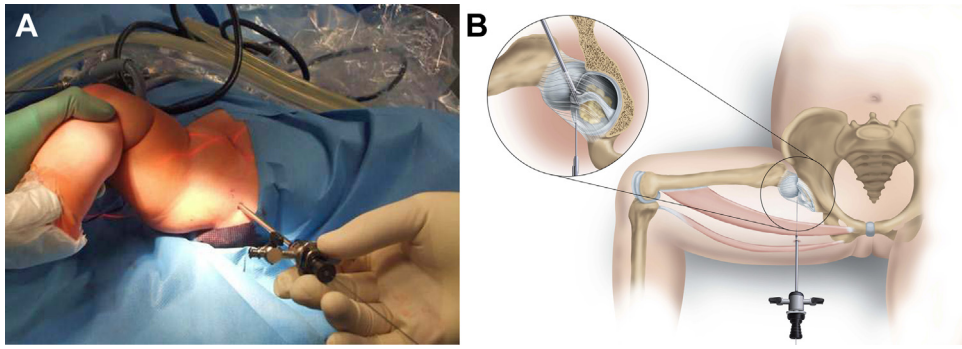

Fig 1. (A) A 6-month-old patient positioned supine. Introduction of a mini—hip cannulated trocar system through a subadductor portal, which is located in the gap between the adductor and hamstrings muscles. (B) Surgical technique with instrument positioning.

Methods

Hip arthroscopy and arthroscopic reduction was performed in 21 children with 25 hip dislocations between January 1, 2009 and December 31, 2013. All but 2 patients were jointly operated on by the first and last authors (O.E., F.F.F.). Patient data were prospectively documented.

We included all hip dislocations that presented to our clinic with failed closed reduction. Patients with a previous open reduction, and children older than 4 years, were excluded from the study. All patients were followed prospectively. There were 6 teratogenic dislocations (premature infants and patients with syndromes, congenital knee dislocations, and clubfeet) and 19 developmental dislocations of the hip. Twelve children with 16 hip dislocations presented at infancy (age group, 3 to 10 months; average, 6.4 months; n = 6 teratogenic dislocations and n = 10 developmental dislocations). Arthroscopic reduction was performed exclusively in these 16 hip dislocations. Nine children with 9 hip dislocations presented at walking age (age group, 14 to 41 months; average, 21.8 months; n = 9 developmental dislocations). Reduction was performed by hip arthroscopy. We performed an additional Pemberton acetabuloplasty in the 9 cases of acetabular dysplasia. Postoperative MRI immediately after the operation confirmed reduction on the day of operation.

We graded the hip dislocation according to the Tönnis radiological classification.[11] The acetabular index was measured both preoperatively and postoperatively. The Salter classification system was used to evaluate the radiological results and to determine the rate of necrosis of the femoral head.[12]

Surgical Technique

The surgery is performed using full anesthesia with the patient supine. The assistant holds the leg in 90° flexion and 50° to 60° of abduction. The arthroscopic procedure is carried out through a subadductor portal located 1 cm lateral and 1 cm ventral from the ischial tuberosity in the palpable gap between the adductors and the ischiocrural muscles (Fig 1).

Under fluoroscopy, arthrography is initially performed with a spinal needle through the subadductor portal. A flexible guidewire is inserted through the spinal needle into the hip joint. The needle is removed and a cannulated trocar is introduced over the guidewire. A 2.7-mm 70° mini—hip arthroscope is used. The arthroscope is aligned parallel to the operating table during the procedure.

To assess the luxation, we first examine all the major anatomic structures. A diagnostic tour is performed. Starting laterally in the direction of the field of vision, the dislocated femoral head appears with the femoral onset of the teres ligament and the dorsal acetabular rim. By turning the camera medially, we follow the ligamentum teres into the acetabular floor. The acetabulum and teres ligament, the fatty tissue in the acetabulum, the so-called pulvinar, and the acetabular labrum are all identifiable. A high anterolateral portal is positioned, and the position of the acetabular labrum is examined using an examining hook. After this, arthroscopic reduction is conducted in the same manner for all cases.

The obstacles preventing reduction are successively resected, inserting the instruments through the high anterolateral portal. We use a 3.4-mm resector, a 4-mm electrocautery probe, and a 2.7-mm hook punch. To determine the main obstacle, the obstacles preventing reduction are always removed in the same order. First, the teres ligament is removed, then the pulvinar, followed by excision or resection of the transverse ligament if it is hypertrophic. If reduction is still not possible, a capsular release is performed. After successful reduction, a spica cast is applied. Immediately after the application of the spica cast, MRI is used in all cases to determine the femoral head position postoperatively.

Results

Twenty-one children with 25 hip dislocations were treated using arthroscopic reduction. There were 16 girls and 5 boys. Their ages at the time of surgery were between 3 and 41 months (average age, 12.5 months).