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ORIGINAL STUDY

Arthroscopic lavage for the treatment of septic arthritis of the hip in children

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Arthroscopic treatment of septic arthritis of the hip is still not an established technique despite its minimally invasive nature and low morbidity. The goal of this study is to present the results of arthroscopic drainage and lavage for the treatment of septic arthritis of the hip in children over the age of six years. A three portal arthroscopic technique was used for drainage and irrigation in six children with septic coxitis. Continuous intra-articular irrigation was not performed, nor were decompression drains used. All patients were treated with intravenous antibiotics, followed by oral antibiotics. The children were followed for 14 to 84 months. *Staphylococcus Aureus* was the infecting organism in all cases. All patients had a rapid postoperative recovery ; they all had excellent clinical and radiological results. All of them had a full range of motion of the affected hip. No complications occurred in this group of children. Three directional arthroscopic surgery combined with large volume irrigation appeared as an effective treatment modality in cases of septic arthritis of the hip. It is less invasive than arthrotomy, and offers low post surgical morbidity.

Keywords : septic arthritis ; hip joint ; arthroscopy ; children.

INTRODUCTION

The early diagnosis and treatment of septic arthritis of the hip in children is vital to minimize complications such as avascular necrosis (AVN) of the femoral head, osteomyelitis, chondrolysis, epiphysiolysis, systemic sepsis, leg length discrepancy, and later osteoarthritis of the hip joint (*11,22*). Open arthrotomy together with drainage and thorough irrigation is a well-accepted treatment modality (*20,22*). Arthrotomy involves an extensive surgical approach, postoperative pain, and prolonged hospital stay. In rare occasions arthrotomy may require dislocation of the femoral head in order to achieve adequate inspection and debridement of the hip joint, which can be complicated by AVN or postoperative hip instability (*23*). Arthroscopic lavage is considered the treatment of choice for septic arthritis of the knee (*2,13,17,21*), and it also has been advocated for the treatment of septic arthritis of the hip (*5-6,9-10,15,19,23*). Uncertainty surrounds the optimal number of portals, the use of continuous

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suction irrigation and the use of postoperative drains.

In this study, the results of arthroscopic drainage and high volume lavage using a three-portal arthroscopic technique as described by Byrd (*7*) and no postoperative drains for the management of septic arthritis of the hip in children are presented.

PATIENTS AND METHODS

Between 2003 and 2009 six children with primary septic arthritis of the hip underwent arthroscopic debridement and drainage. There were three girls and three boys, with a mean age of 9.5 years (range : 6-13).

At presentation all children underwent a thorough clinical examination, radiographic examination of the pelvis and the affected hip, and laboratory tests including complete and differential blood count, erythrocyte sedimentation rate (ESR), C-reactive protein (CRP) and blood culture. Kocher's criteria (*16*) were used to calculate the predicted probability of septic arthritis of the hip. Patients with a high probability of septic arthritis of the hip (three or four Kocher's predictors – 93.1% and 99.6% respectively) had their hip aspirated in the operating theatre, given the likelihood that subsequent arthroscopic drainage and lavage will be necessary.

Operative technique

The patient was positioned supine on a fracture table. A well padded perineal post was used for counter traction. Both lower limbs were abducted approximately 25°, positioned in extension and neutral rotation, and anchored to footplates. A draped fluoroscopic C-arm was positioned between the legs. The initial aspiration was performed through the arthroscopic antero-lateral portal (positioned over the antero-superior margin of the greater trochanter), which was located most centrally in the "safe-zone", using a 15 cm 17-gauge spinal needle under fluoroscopic control. Capsular penetration was confirmed by back-flow of pus or synovial fluid, which was collected for white cell count, culture and microscopy. Traction was then applied to both limbs simultaneously in order to keep the pelvis from tilting or shifting. Joint penetration was confirmed again by "contrast aerogram" caused by the negative intracapsular pressure created during joint distraction. The joint was distracted approximately 10 mm. A stab wound was made through the skin at the entrance site of the needle, followed by placement of a switching wire through the needle. The needle was then removed and a cannulated obturator with a 5 mm arthroscopy cannula was passed over the wire into the joint. Once the antero-lateral portal was established, a 70° arthroscope was inserted for initial joint orientation. Positioning of the other two portals (anterior – coinciding with the intersection of a vertical line drawn distally from the anterior superior iliac spine and a transverse line drawn medially from the superior margin of the greater trochanter, and postero-lateral – positioned over the postero-superior border of the greater trochanter) was performed with a 15 cm 17-gauge spinal needle and facilitated by direct arthroscopic visualization and fluoroscopy. Following their establishment, 5 mm cannulas were placed over switching wires to allow interchangeability of the arthroscope and instruments while assuring high fluid flow.

Synovial samples were obtained for culture and microscopy including Gram-stain. Intraoperative irrigation was performed using 6L physiologic saline. Negative suction was used during the procedure to allow evacuation of debris, fluid and fibrin clots. Continuous postoperative intra-articular irrigation or postoperative suction drains were not used. Tolerable hip range of motion and weight bearing were permitted postoperatively.

Intravenous empiric antibiotic with Flucloxacillin was initiated immediately following synovial fluid aspiration. Based on the culture results there was no need for further readjustment of the anti-microbial therapy. Patients were able to be discharged from hospital four days following surgery. In all cases the CRP level was still elevated at discharge (> 20 mg/L), and intravenous antibiotics were continued on an outpatient base using an Elastomeric Continuous Infusion Device (Infuser LV-10, Baxter, Sydney, NSW, Australia) and Peripherally Inserted Central Catheter (PICC, Arrow, Reading, PA, USA) for a total of two to three weeks. Parenteral antimicrobial therapy was followed with oral antibiotics administered for further three weeks.

The patients were followed weekly to fortnightly with physical examination, leukocyte counts, ESR, and CRP levels. The duration of the antimicrobial therapy was based on the clinical response (no or minimal hip pain, ability to climb a flight of stairs, no use of support for mobilization, ability to sit on a chair comfortably) and normalization of the ESR and CRP levels. The patients were followed again with physical examination, leukocyte counts, ESR, and CRP levels one month after cessation of the antimicrobial therapy. All patients were followed for a minimum of one year after their surgery with physical and radiographic examinations.

Table I. — Clinical and investigative data of the patients

Patient No	Age (yrs)	Sex	Duration of symptoms (days)	Temperature (°C)	Leucocyte count (cells/uL)	ESR (mm/hour)	CRP (mg/L)	Culture Organism	Follow-up (months)
1	8	F	5	38.4	8,600	64	181	*S. aureus*	84
2	8	M	3	37.8	12,700	62	54	*S. aureus*	72
3	10	M	4	38.6	11,600	68	62	*S. aureus*	70
4	6	M	2	38.0	10,700	54	42	*S. aureus*	42
5	12	F	2	38.9	16,400	70	68	*S. aureus*	29
6	13	F	3	38.6	13,200	45	33	*S. aureus*	14

RESULTS

All patients presented with a short history (range : 2-5 days) of painful limitation of motion of the affected hip and inability to bear weight. At presentation all patients had an associated elevated temperature (oral temperature range : 37.8-38.9°C), a leukocyte count range of 8,600-16,400/uL, an ESR range of 45-70 mm/hour, and a CRP level range of 33-181 mg/L (Table I). All children presented with three or four Kocher's predictors (*16*) for septic arthritis of the hip. *Staphylococcus Aureus* was the causative microorganism in all cases.

Pus or turbid fluid was aspirated from the hip joint in all cases. Varying degrees of synovitis were present in all hips. Articular cartilage damage was not observed in any of the hips.

The patients were followed for 14 to 84 months. At the last review there were no signs of recurrence of infection or development of osteomyelitis of the proximal femur in any of the patients. All six children had excellent clinical results based on Bennett's clinical assessment criteria (*4*). All patients had a full range of motion of the affected hip. No post-operative complications were documented in relation to surgery or in relation to the insertion of the Peripherally Inserted Central Catheter. Laboratory follow-up was conducted weekly to fortnightly until obtaining normal leukocyte counts, ESR, and CRP levels together with no further clinical concerns ; these occurred four to six weeks after surgery.

At one year after the index arthroscopy all children had normal radiographic appearance of the affected hip and were graded as excellent according to Bennett's radiographic assessment criteria (*4*).

DISCUSSION

Early operative intervention remains the mainstay of treatment for septic arthritis of the hip as failure to adequately drain the septic joint may result in serious sequelae. Although open arthrotomy is considered standard treatment (*11,20,22*), it may not always achieve adequate inspection and debridement of the hip joint, requiring dislocation of the femoral head and risking AVN of the femoral head or postoperative dislocation (*23*). Arthroscopic treatment of septic arthritis of the hip in children has been reported previously (*5,9-10,15,19*). Hip arthroscopy appears to be easier in children because of the relatively shallower acetabulum and more compliant soft tissues (*9,10*). Hip inspection and irrigation was possible in all cases with the use of conventional hip arthroscopy instruments. When open arthrotomy is used, traction of the affected lower limb is necessary in order to widen the joint space and allow effective irrigation of the entire joint. With hip arthroscopy, thorough irrigation and lavage is possible while allowing for inspection of cartilage to anticipate prognosis.

We acknowledge the limitations of this study, including the small sample of patients and the lack of a comparative group. Chung *et al* (*9*) treated nine children with acute septic arthritis of the hip with arthroscopic lavage and antibiotic therapy for three to six weeks. With this treatment eradication of the infection was achieved in all patients with no

recurrences or complications, although a few cases presented radiographic abnormalities during the post operative follow-up. The authors emphasized the value of a large-bore high-volume lavage as a main therapeutic tool. Kim *et al* (*15*) treated eight children with acute septic arthritis of the hip with arthroscopic lavage ; they reported excellent results in all patients. They reported one case of drain entrapment between the acetabulum and the femoral head which was removed with the aid of traction on a fracture table in the operating room. El-Sayed (*10*) compared the results of open arthrotomy and arthroscopic drainage in a randomized controlled study on 20 children with septic arthritis of the hip. Infection was eradicated in all patients in both groups. The children's hospital length of stay was significantly shorter in the arthroscopic drainage group.

Inconsistency exists regarding the number of arthroscopic portals, the volume of irrigation solution, the use of postoperative drains, or the use of postoperative suction irrigation. Some have used one or two arthroscopic portals (*5,6,9*), where others have used three portals techniques (*10,15,19,23*). Similarly, we believe that three portals offer better visualization and instrumentation of the joint, allowing more thorough debridement.

The optimal volume of irrigation fluid remains uncertain. Although Yamamoto *et al* (*23*) used 24-25L of physiologic saline for irrigation, we do not believe such high volumes are necessary, while smaller volumes may be sufficient avoiding the risk of fluid leakage causing compartment syndrome, and theoretically reducing the risk of fluid overload. The amount of fluid used by us in this age group was based on our experience with arthroscopic treatment of septic arthritis of the hip in adults (*19*).

Similarly there is great variability and inconsistency with the use of postoperative drains. We as others (*19,23*) did not use decompression drains, therefore eliminating the risk of drain entrapment. Blizer (*5*) used continuous irrigation tubes. We found continuous suction irrigation systems unnecessary, thereby reducing the risk of secondary contamination and infection with new bacteria.

Infecting organisms are identified by blood cultures or joint fluid aspiration in 38-55% of children with septic arthritis (*1,8,12*). Pre-operative aspiration of the joint fluid often necessitates the use of sedation and a local anaesthetic. Local anaesthetics possess antimicrobial activity, and even in low concentrations could lead to false negative results or suboptimal culture yields (*14*). In order to eliminate this possibility we believe that joint fluid aspiration should be performed in an operating theatre setting. Further, the operating theatre provides a cleaner environment, reducing the risk of contamination and infection, and reduces the time from the initial presentation to definitive treatment.

Although arthroscopy appears to be effective in instances of delayed diagnosis of septic arthritis (*23*), early intervention, as in our series, seems to be ideal. Furthermore, early diagnosis, arthroscopic washout and administration of appropriate antimicrobial therapy allowed our patients to be discharged early. This allows reduced hospital costs as well as improved patient satisfaction.

The question of the optimal duration and route of antibiotic administration for treatment of septic arthritis continues to be debated (*3,4*). It appears that the duration of antimicrobial therapy in this group of patients is longer than the one expected after surgical drainage. A longer duration of antimicrobial therapy is recommended in cases where the causative organism is *Staphylococcus Aureus* or Gram-negative bacilli which are considered more virulent (*4,18,22*). *Staphylococcus Aureus* was the causative microorganism in all our cases. Although we have no experience with arthroscopic treatment of septic arthritis of the hip in the paediatric age group when the causative organism is other than *Staphylococcus Aureus*, we believe that the same strategy should be applied, perhaps with a need for readjustment of the empiric antibiotic treatment in some of the cases.

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