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## The Knee



## Management of septic arthritis after arthroscopic anterior cruciate ligament reconstruction using a standard surgical protocol

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## ABSTRACT

**Background:** To report the incidence of septic arthritis after anterior cruciate ligament (ACL) reconstruction and management of this complication using a specific treatment protocol.

**Methods:** All primary ACL reconstructions performed in our institution between January 2002 and January 2014 were included in this study. Time to presentation, clinical symptoms, and culture results of all infected patients were analyzed. According to our protocol, an arthroscopic debridement and irrigation of the knee joint was performed immediately after a diagnosis of infection was made. In case of recurrence, knee irrigation with hardware and graft removal and later re-implantation was performed. Patients were evaluated with the Lysholm knee score, International Knee Documentation Committee (IKDC) Form, KT 1000 arthrometer and radiographic evaluation.

**Results:** Postoperative septic arthritis occurred in seven of 1242 patients (0.56%). After initial arthroscopic debridement, infection recurred in six out of seven cases (85%). Graft and hardware removal was performed in these patients. Graft re-implantation was performed in four patients at an average five months after infection. At the final follow-up (mean 6.3 years) all patients had full range of motion, while in patients with graft re-implantation the mean Lysholm score was 92, and the mean IKDC score was 87. Radiographs demonstrated that three patients had normal knees and one patient had a grade one, knee arthritis according to Kellgren–Lawrence classification.

**Conclusions:** Management of septic arthritis after ACL reconstruction using a specific surgical protocol which includes graft removal in case of infection recurrence with later re-implantation, can provide good and excellent results.

**Level of evidence:** Level IV, case series.

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### 1. Introduction

Infection after anterior cruciate ligament (ACL) reconstruction is a rare complication with a reported incidence between 0.15% and 1.72% [1–15]. Because of its rare incidence there is no consensus regarding appropriate management of this complication. According to the literature, most of the authors recommend arthroscopic irrigation with retention of the graft followed by intravenous antibiotic therapy. In almost one third of these cases, infection persists, and a repeated arthroscopic debridement and irrigation is performed by the vast majority of the authors until eradication of infection [9]. The overall success rate (defined as

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graft retention) of this procedure is almost 85% [9]. However, many of these patients managed with this protocol, suffer from persistent pain, knee stiffness and dysfunction, and development of arthritis [5,15,16]. Probably, this is because the infected ACL graft serves as a “continuing nidus of infection” and even after debridement, it is leading in cartilage destruction, pain and stiffness.

Very few surgeons recommend graft removal immediately or after failure of the initial arthroscopic debridement and later re-implantation [3,15]. Burks et al. [3] reported excellent results similar to primary ACL reconstruction after immediate removal of the infected graft and early re-implantation. Definitely, this is a high cost, staged operation but probably an effective treatment in case of infection after ACL reconstruction. In contrast, arthroscopic debridement is a more attractive option for both the surgeon and the patient but carries the risk of an inferior result especially after repeat irrigation [9].

We do believe that an immediate arthroscopic debridement and knee irrigation should be performed in case of infection after ACL reconstruction but if infection persists, graft and hardware removal should be performed to avoid further damage to articular cartilage and sequelae, like stiffness and pain.

The purpose of this study is to report the incidence and management of septic arthritis after ACL reconstruction using a specific protocol.

The protocol described herein first addressed affected patients using irrigation and debridement with graft retention. Patients were then observed. Those patients who demonstrated persistent signs of infection during the first week following surgery were then treated with repeat irrigation and debridement along with graft and hardware removal. Patients who underwent graft removal were eligible for graft re-implantation after successful eradication of the infection. Our hypothesis was that management of an infected ACL with this protocol could produce similar results to a primary ACL reconstruction regarding knee function.

## 2. Materials and methods

Between January 2003 and January 2014, 1242 primary ACL reconstructions were performed in our department. Procedures were performed in two operating theatres, by three different surgeons, including the senior surgeon (M.E.H.) who performed the vast majority (80%) of the reconstructions. Bone patellar tendon bone autograft was used in 311 (25%) patients while hamstring tendon autograft was used in the rest of the study population. Absorbable or metal interference screws were used on the femoral and tibial sides for graft fixation for the patellar tendon grafts, while for hamstring tendon graft fixation a button in the femur and a bioabsorbable interference screw and a post-fixation bicortical screw were used in the tibial side. Seven (0.56%) patients developed septic arthritis and a retrospective analysis of these patients was performed. Autologous hamstring tendon graft was used in all these patients. Symptoms like knee pain, effusion and fever, consistent with septic arthritis were present in almost every patient. In all these patients, a knee aspiration was performed before any other intervention, and an urgent arthroscopic debridement and knee irrigation was performed if more than 10,000 cells/mL were present, followed by intravenous antibiotic therapy, empirical initially, and then according to culture sensitivity. Time to presentation, laboratory results, synovial fluid analysis and culture results of all infected patients were analyzed. An extensive joint lavage combined with debridement of infected tissues, using at least 12–15 L of normal saline was performed. If symptoms (knee pain, effusion and fever) persist or did not resolve within three to five days after arthroscopic debridement, another arthroscopic debridement with graft and hardware removal was performed. Intravenous antibiotics were continued until resolution of symptoms and normalization of laboratory values such as C-reactive protein (CRP).

All patients who underwent graft removal, were offered subsequent graft re-implantation three months after the last operation. Requirements for graft re-implantation were normal knee motion, no knee effusion, and normal laboratory values. An ipsilateral patellar tendon graft was used in these cases for ACL reconstruction.

At the final follow-up clinical evaluation of the knee was performed using the KT-1000 arthrometer, the Lysholm, and International Knee Documentation Committee (IKDC) knee scores. Radiographic evaluation consisted of standing antero-posterior and lateral radiographs. All patients gave their informed consent to being included in the study; the study was approved by the local ethical committee.

A matched control group formed by 20 patients who underwent primary uncomplicated ACL reconstruction was used to compare functional results between groups. Matching criteria were age, sex, body mass index, side affected, limb dominance, associated meniscal injury, and time of follow-up.

One-way analysis of variance (ANOVA) was used to examine the differences between the control, and the infected group in baseline patient characteristics, functional scores and KT-1000 measurements. The Student t test was performed in order to identify differences in infection rate between the two graft types. The level of significance was set at  $p < 0.05$ .

## 3. Results

Seven out of 1242 (0.56%) patients during the study period developed septic arthritis after primary ACL reconstruction. All patients were male and autologous hamstring tendon graft was used in all cases. The infection rate was statistically significant higher ( $p < 0.05$ ) for the hamstring tendon grafts in comparison to the patellar tendon grafts. The average time to presentation of infection was 13 days (nine to 24). All but one patient developed an acute infection (less than two weeks after reconstruction). Knee effusion and pain as well as painful range of motion were present in all patients (Table 1). A concurrent partial medial meniscectomy was performed in three patients.

Knee aspiration was performed immediately and the aspirated knee joint fluid revealed an average of  $53.4 \times 10^9/L$  (range  $20.5\text{--}106.2 \times 10^9/L$ ) with 90% polymorphonuclear cells. Aspiration revealed a turbid synovial fluid in all cases. The mean CRP

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