

# Management of Infection Following Arthroscopic Anterior Cruciate Ligament Reconstruction

P Anoop<sup>1</sup>, Mathew David<sup>1</sup>, M. Madan Mohan<sup>1</sup>, Rajkumar S Amaravati<sup>1</sup>

## Abstract

**Aim:** The purpose of this case series is to summarize our experience in the diagnosis and management of septic arthritis after anterior cruciate ligament (ACL) reconstruction. Infection after arthroscopic ACL reconstruction (AACLR) is a relatively rare but potentially a serious complication.

**Settings and Design:** Case series, prospective study.

**Materials and Methods:** We present a series of four cases who presented with septic arthritis following AACLR. After initial evaluation and intravenous antibiotics, the patients were subjected to early arthroscopic wash, debridement and graft retention, and antibiotics for 6 weeks. Postoperative rehabilitation protocol was followed and the patients were reviewed for a period of 2 years. Functional evaluation was done and the patients were found to have good to satisfactory results with no complaints of instability.

**Statistical Analysis Used:** Functional outcome measured with Tegner and Lysholm scores, IKDC, KOOS score, and X-ray.

**Results:** At 2-year follow-up, patients had good functional outcome measured with Tegner and Lysholm scores, KOOS, IKDC scores, and with no evidence of instability.

**Conclusion:** Infection post-arthroscopic anterior cruciate ligament reconstruction (AACLR) is a relatively rare but potentially devastating complication, early diagnosis in infection following AACLR and prompt treatment is necessary. Diagnosis relies on clinical evaluation, laboratory tests, synovial fluid analysis, and bacterial culture. Our proposed treatment protocol is arthroscopic debridement and irrigation as early as possible with retention of the graft.

**Keywords:** Septic Arthritis, Knee Arthroscopy, ACL, Management

## Introduction

Infection post-arthroscopic anterior cruciate ligament reconstruction (AACLR) is a relatively rare but potentially serious condition leading to various complications, occurring in 0.14% in our experience. Various treatment options have been proposed in literature, with surgeons generally agreeing on surgical irrigation and debridement (I and D) and culture-specific intravenous or oral antibiotics [1, 2]. The decision to remove or retain

the graft during the debridement has not been clearly defined [2, 3]. Some prefer to remove the graft immediately. Others remove the graft with persistent infection. A survey of directors of sports medicine fellowship programs showed that graft removal was chosen by only 6% and 33% of these surgeons for treating the infected autograft and allograft, respectively [2]. I and D with retention of the graft is an attractive low-cost, low-morbidity treatment for acute infection after ACL reconstruction. However, the success rate of this procedure is highly variable in the literature, with an average failure rate ranging from 0% to 100% [4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14]. Patients in whom septic arthritis develops as a complication of ACL reconstructive surgery have diminished long-term

subjective, functional, and radiographic outcomes [15]. Failure of I and D of an infected ACL reconstruction frequently results in increased patient morbidity. Cartilage destruction, graft loosening and failure, and arthrofibrosis are sequelae associated with persistent infection [1, 16]. In this case series, we review our experience with post-operative joint sepsis of ACL reconstruction, identification, analysis of presentation and our management.

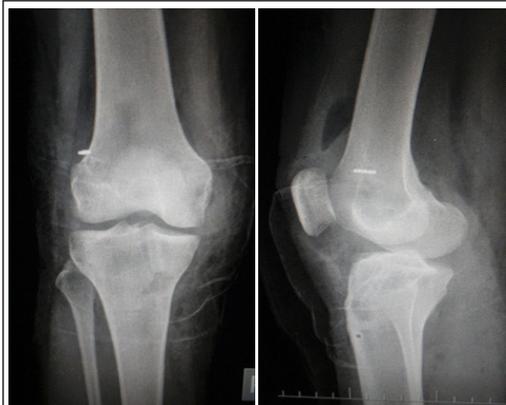
## Case Report

We defined our cases consistent with joint sepsis as patients who were culture positive with intraarticular infections (total leucocyte count in synovial fluid > 10,000 cells/ $\mu$ L) and in our experience, we had four such cases.

<sup>1</sup>Department of Orthopaedics, Division of Arthroscopy & Sports Surgery, St. John's Medical College, Bengaluru, Karnataka, India.

### Address of correspondence

Dr. P Anoop  
Department of Orthopaedics, St. John's Medical College, Bengaluru - 560 034, Karnataka, India.  
E-mail: dranoopp07@gmail.com



**Figure 1:** X-ray: Showing graft with endo button and biodegradable screw in situ

### Case 1

A 21-year-old male who had sustained a mid-substance tear of ACL following a road traffic accident, underwent AACL R of ACL with hamstring graft (Fig. 1). Immediately following the surgery patient developed high-grade fever which lasted 31 days. There was no evidence of infection at the surgical site, with the initial blood work up within normal parameters. A repeat magnetic resonance imaging (MRI) and computed tomography (CT) scan were performed, which were inconclusive (Fig. 2). An arthrocentesis under aseptic precautions was performed a week later, which subsequently showed growth of enterococcus species and hence, the patient was started on sensitive antibiotics. He was evaluated further to look for other sources of infection with a positron emission tomography CT which showed post-operative changes around the knee joint and a few abdominal lymph nodes. It was then decided to perform a diagnostic

arthroscopy followed by wash and debridement. Arthroscopy showed inflamed hypertrophied synovium (Fig. 3) with intact graft which had adequate tension and strength with no evidence of damage (Fig. 4). Part of it was also taken for biopsy. Following this procedure, fever subsided and post-operative rehabilitation was started. At 2-year follow-up, the patient had no evidence of instability and had returned to activities of daily living.

### Cases 2 and 3

2nd and 3rd case presented 3 weeks following AACL R with pain and swelling of the knee joint. The evaluation of these patients showed joint sepsis. They were taken up for arthroscopic irrigation and debridement of the synovial tissue. Intravenous antibiotics were continued for a mean period of 20 days. Oral antibiotic was started once C-reactive protein levels had returned to normal. Post-operative rehabilitation was started subsequently. At two years follow up patients are doing well.

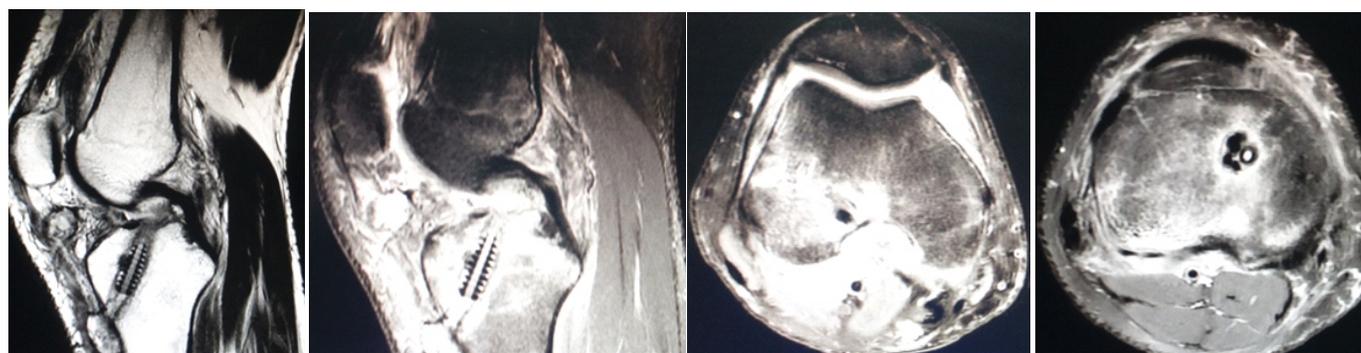
### Case 4

The patient presented with swelling at the tibial tunnel site 3 months following AACL R. On clinical examination, there was no evidence of infection or instability. On the tibial side, the graft was fixed with a biodegradable interference screw as well as backup fixation to the tibia with vicryl no 1

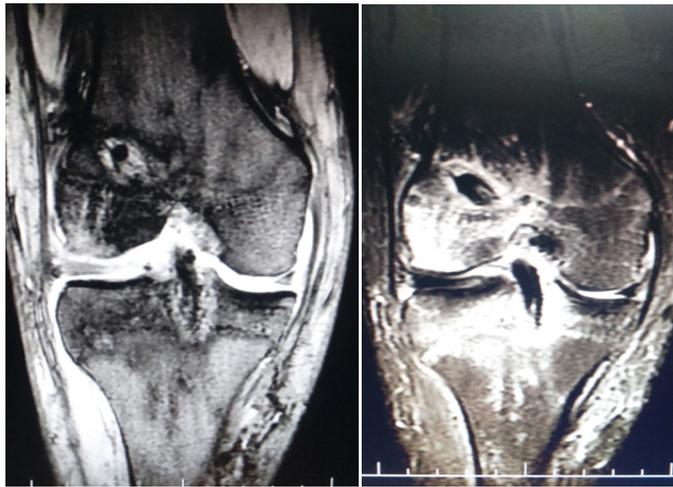
suture for ACL graft. MRI showed failure of the interference screw in the tibial tunnel. The patient underwent arthroscopic procedure which showed normal joint with intact graft which had a good tension and strength (Fig. 5 and 6). At the tibial tunnel site, the biodegradable screw had loosened and backed out (Fig. 7). Copious amount of wash was given, biodegradable screw replaced, and cultures sent which were negative. Post-operative rehabilitation exercise started. At 2-year follow-up, patients' functional outcome is good. All the four patients had received the 3rd generation cephalosporins as perioperative antibiotics and had no comorbid conditions. The patient details have been summarized in the Table 1 and investigations in Table 2.

### Discussion

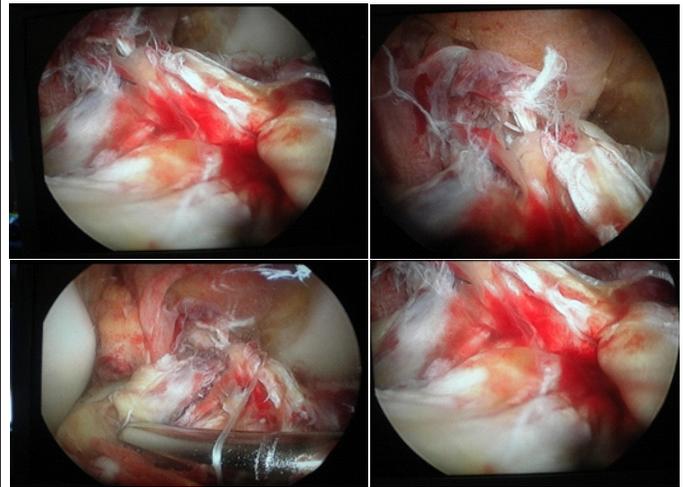
The principal findings of this study show that I and D with graft retention is an attractive option, with low morbidity, for septic arthritis following an ACL reconstruction. Despite a repeated I and D being necessary in approximately one-third of cases, the average success rate of arthroscopic I and D in eradicating infection is 85% [1]. The results of a meta-analysis indicated no differences between the successful and failed cases except for the infecting organism, number of I and Ds performed, and graft type [17]. This treatment option remains popular with both surgeons and patients. Perceived advantages include a technically less



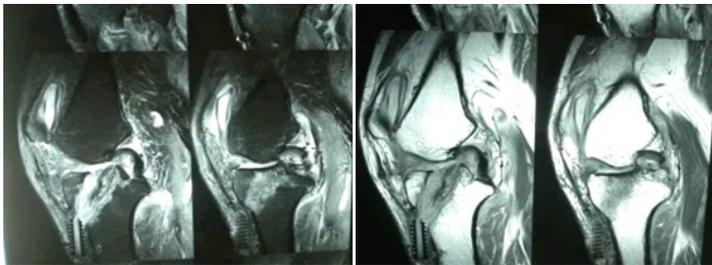
**Figure 2(a-d):** Magnetic resonance imaging showing post-operative anterior cruciate ligament graft in situ with bone contusion and inflammatory changes.



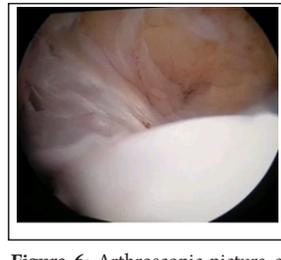
**Figure 3:** Magnetic resonance imaging showing post-operative anterior cruciate ligament graft in situ with bone contusion and inflammatory changes.



**Figure 4 (a-d):** Arthroscopic finding showing synovial hypertrophy, intact graft in situ.



**Figure 5: (a and b)** Magnetic resonance imaging showing implant failure with backup tibial fixation (bold arrow).



**Figure 6:** Arthroscopic picture of intact anterior cruciate ligament.



**Figure 7:** Loosening of the implant.

demanding procedure that can be performed in a short time with low perioperative morbidity. Radical debridement with graft or hardware removal (or both) destabilizes the knee joint and requires. A staged operation is associated with greater morbidity and less-predictable results after revision ACL reconstruction [9]. Persistent intraarticular bacteria can have an adverse effect on articular cartilage and lead to the development of degenerative changes, unless incompletely removed during I and D [8, 9, 16, 17]. Without I and D, patients have a longer period of pain and swelling in the knee, culminating in revision surgery. In addition, this delay in recovery can increase time away from school, work, and sports participation, thus having serious physical, psychological, and financial consequences for the patient [9]. The decision of when to remove the graft in the treatment of a post-operative infection is difficult and

multifactorial. Although the primary goal of any ACL reconstruction is a stable functional knee, the eradication of a resistant infection supersedes graft preservation to prevent problematic consequences such as cartilage destruction, osteomyelitis, and sepsis [2]. Graft removal is recommended in the setting of significant intra substance degeneration, gross evidence of infections compromising the graft, or a non-functional graft as determined by inadequate graft tension or significant pivot shift under anesthesia [4, 8, 11, 13]. Matava et al. [2] surveyed sports medicine fellowship directors regarding their preferred treatment of septic arthritis after ACL reconstruction. For the initial treatment of the infected patellar tendon autograft or allograft, culture-specific intravenous antibiotics and surgical joint irrigation with graft retention were considered the overwhelming treatment of choice. Graft removal was chosen by only 6%

and 33% of these surgeons for treating the infected autograft and allograft, respectively. However, in the event of a persistent infection unresponsive to initial treatment, 36% selected graft removal as part of the treatment regimen. Previous studies have attempted to identify whether graft selection plays a role in the development of infection after ACL reconstruction. Barker et al. reviewed [3] 126 ACL reconstructions. They reported a 3.3 times higher risk of infection in patients treated with hamstring autografts (1.44%) compared with patients with bone-patellar tendon-bone (BPTB) allografts (0.44%) and autografts (0.49%). Maletis et al. [19] reviewed the results of 10,626 patients and found an overall deep infection rate of 0.32%. An 8.2 times higher risk of infection was observed in hamstring tendon autografts when compared with BPTB autografts. No difference was identified between allografts and BPTB

autografts. In the case series published by Judd et al. [8], all 11 infections occurred in procedures using hamstring autografts, even though half of their reconstructions were performed with BPTB autografts. It was postulated that increased risk of infection associated with hamstring autografts might result from the nature of the tissue itself or the extra soft tissue dissection required for graft harvest. Other reports have not found differences in infection rates between graft types. In a series of 801 patients who underwent ACL reconstruction, Katz et al. [20] found that the use of an autograft carried no higher risk of infection than did the use of an allograft. Matava et al. [2] also investigated the effect of graft type and the incidence of infection after ACL

reconstruction. Based on their data, they found no relationship between the number of infections and graft choice. Thus, there is no consensus on graft type as a risk factor for infection after ACL surgery. A variety of microorganisms have been implicated in septic arthritis after ACL reconstruction [3]. Typically, infections are bacterial. However, few studies have separately examined culture results of cases in which the graft had to be removed. Zalavras et al. [14] reviewed five consecutive patients with persistent septic arthritis after ACL reconstruction. All patients previously had one to three I and Ds that failed to control the infection, and the graft was removed in each case. Their results showed that 3 of 5 infections (60%)

were polymicrobial. Analysis of the included studies revealed that failure was more likely when Staphylococcus aureus was the infecting organism. The reasons for this are likely multifactorial, but S. aureus appears to have a higher level of virulence with a more severe picture of the infection. Patients who underwent a single arthroscopic I and D had a higher success rate than those patients who had more than one procedure. Although this difference was statistically significant, few, if any, conclusions can be drawn from it. Patients who had only one I and D are more likely to have been successful in retaining their grafts. The practice of routine repeated I and D was not evident in the included studies. Repeated arthroscopic debridements

**Table 1:** Summary of patient details - HT-hamstring graft.

Sex	Age (years)	Add proc	Graft	Tourniquet time (min)	Sterilization	Drainage	Perioperative antibiotics
M	21	LM balancing	HT	90	Standard	1	3rd gen cephalosporin
M	27	-	HT	105	Standard	1	3rd gen cephalosporin
M	27	-	HT	120	Flash	1	3rd gen cephalosporin
M	30	-	HT	90	Flash	1	3rd gen cephalosporin

**Table 2:** Table 2: Summary of investigations

Blood Investigations	Normal	Normal postoperative patients	Patient 1	Patient 2	Patient 3	Patient 4
WBC in (1000)	4.5-10.5	6.9 (4.5-10.5)	9	12	10	7
PMNN (%)	50-70	60.9 (53.2-69)	79	82	90	62
ESR mm/h	0-15	27.5 ave	78	58	72	25
CRP mg/ml	0-0.8	2.2 ave	8	6.4	6.9	1.6
Fibrinogen mg/ml	200-400	580.1	580	NA	630	NA
C/S early	No growth	No growth	No growth	No growth	Staphylococcus aureus	No growth
C/S delayed	No growth	No growth	Enterobacteria	Coagulase-negative staphylococci	Staphylococcus aureus	No growth

ESR: Erythrocyte sedimentation rate, WBC: White blood cell, CRP: C-reactive protein, PMNN: Polymorphonuclear neutrophils

were performed in patients with persistent clinical signs after the first debridement. Some authors have suggested that graft retention should be attempted in all cases, particularly in acute presentations, and that in the case of subacute and particularly late infections, graft removal may be warranted to eradicate the infection [3]. Wang et al. [1] found that an early diagnosis was important for graft retention and that patients diagnosed after 7 days from the onset of infection had a higher graft removal rate.

Contrary to these concerns, there was not a statistically significant risk of failure with regard to timing of presentation. Of the eight cases that were detected more than 2 weeks after the procedure, only one went on to failure (12.5%).

#### Limitation of the study

The limitation of study is the small number of cases

#### Conclusion

Infection post-arthroscopic anterior

cruciate ligament reconstruction (AACL R) is a relatively rare but potentially devastating complication, early diagnosis in infection following AACL R and prompt treatment is necessary. Diagnosis relies on clinical evaluation, laboratory tests, synovial fluid analysis, and bacterial culture. Our proposed treatment protocol is arthroscopic debridement and irrigation as early as possible with retention of the graft.

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