Systematic Review

Arthroscopic Irrigation and Debridement in the Treatment of Septic Arthritis After Anterior Cruciate Ligament Reconstruction

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Purpose: To systematically review the literature and characterize the success and failure rates of arthroscopic irrigation and debridement (I & D) in the treatment of septic arthritis after anterior cruciate ligament (ACL) reconstructions. We also aimed to identify which variables affected the failure rate. **Methods:** Five databases (MEDLINE, Ovid, Medscape, Web of Science, and Google Scholar) were screened for clinical studies involving the treatment of septic arthritis after ACL reconstruction with arthroscopic I & D. A full-text review of eligible studies was conducted. Inclusion and exclusion criteria were applied to the searched studies. Failure of I & D was defined as the need for graft removal or revision ACL reconstructive surgery because of infection. Data from the selected studies were combined for statistical analyses to elucidate factors associated with the success or failure. **Results:** We identified 11 eligible studies involving 90 patients. These studies described the results of 90 arthroscopic I & D procedures with an overall success rate of 85.6%. Repeated I & D was necessary in 34.5% of patients. Removal of the graft with or without subsequent revision ACL reconstruction was reported in 13 (14.4%) cases. Statistical analysis showed that cases involving *Staphylococcus aureus* ($P = .053$), 2 or more I & D procedures ($P = .029$), and allografts ($P < .0001$) were at greater risk of failure. **Conclusions:** Arthroscopic I & D with graft retention is an effective treatment for patients with septic arthritis after ACL reconstruction. Factors affecting the failure rate may include graft choice and organism virulence. **Level of Evidence:** Level IV, systematic review of Level IV studies.

Deep infection after arthroscopic anterior cruciate ligament (ACL) reconstruction is a relatively rare but potentially costly and serious complication, occurring in 0.14% to 1.7% of cases.[1] Various treatment options have been proposed, with surgeons generally agreeing on surgical irrigation and debridement (I & D) and culture-specific intravenous or oral antibiotics.[2] Yet, treatment with graft retention or removal during the debridements 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 & D with retention of the graft is an attractive low-cost, low-morbidity treatment for acute septic arthritis after ACL reconstruction. However, the success rate of this procedure is highly variable in the literature, with an average failure rate ranging from of 0 to 100%.[4-14] 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 & 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.[16,17]

The literature is limited to a few case series with small numbers of patients treated in a multitude of ways. These publications have produced a wide range of results, with different risk factors being emphasized by different studies. The purpose of our study was to perform a systematic review of the available literature to characterize the success and failure rates of

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arthroscopic I & D, with particular interest being focused on potential predictors of failure. We hypothesized that organism type, graft choice, and length of time between the index procedure and I & D may affect the success of arthroscopic I & D of an infected ACL reconstruction.

Methods

The study was exempted by our institutional review board. We conducted a combined search of the MEDLINE, Ovid, Medscape, Web of Science, and Google Scholar databases of the years between 1988 and 2013 for clinical studies reporting on the treatment and outcomes for septic arthritis after ACL reconstruction. The search strategy combined the following keywords: *anterior cruciate ligament, reconstruction, infection, sepsis, irrigation,* and *debridement*. M.S. and K.S. independently reviewed full texts for promising articles or when a decision regarding inclusion or exclusion could not be made from the title or abstract (or both) alone. After identifying studies from the electronic databases, the references were reviewed to identify any additional relevant studies. References from recent review articles were also searched. Any disagreement on article eligibility was resolved through discussion.

Studies meeting the following inclusion criteria were included in the review: (1) adult human patients aged 17 years or older, (2) development of septic knee arthritis after arthroscopic ACL reconstruction, and (3) at least one arthroscopic debridement procedure. Exclusion criteria were as follows: (1) non-English–language studies, (2) abstract-only publications, (3) case reports, (4) review articles with no original data, (5) nonbacterial infections, (6) nonarthroscopic ACL reconstructions, (7) extra-articular infections, and (8) graft removal during the initial I & D.

Data were extracted from included articles by M.S. and were verified by K.S. Any disagreement that arose was resolved by consensus. Extracted data included the following information: title, author, year, location, sample size, percentage of male patients, mean age, and average length of follow-up. For each study, patient data were recorded and included age, sex, initial organism, follow-up, number of I & Ds, graft type, and time to presentation. Failure of I & D was defined as the need for graft removal or revision ACL reconstructive surgery because of infection. Postoperative infections were classified as acute (<2 weeks), subacute (between 2 weeks and 2 months), or late (>2 months).[11]

Whenever possible, data from the selected studies were combined for statistical analysis to elucidate factors associated with the success or failure of arthroscopic I & D treatment. Some publications provided insufficient data for analysis. No attempts were made to contact corresponding authors to obtain these data. Because the data were not normally distributed and there were a small number of failures compared with the number of successes, nonparametric tests were used. The Kruskal-Wallis test was applied for continuous variables and the χ-square test was applied for categorical variables with the treatment success as the outcome. To test whether there were any differences in the presentation frequencies of each organism related to the treatment success or failure, the test of 2 proportions was used. A probability of $P < .05$ was determined as statistically significant. The statistical analysis was carried out using Minitab statistical software, version 13.32 (Minitab, State College, PA).

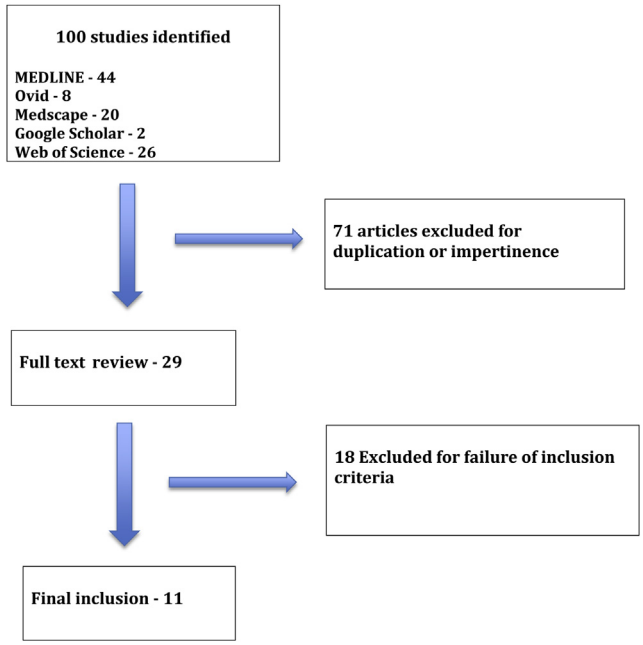

Fig 1. Algorithm of study selection process.

Results

From 100 articles identified, only 11 studies met the inclusion criteria and were included for final analysis (Fig 1).[4-14] Complete study characteristics of the selected articles are presented in Table 1. All included studies were conducted between 1997 and 2011. Of the studies, 5 were conducted in the United States. The remaining studies were conducted in Turkey, Singapore, India, Sweden, Belgium, and China. All the studies were level IV case series. The 11 articles included in this review involved a total of 90 patients with a mean sample size of 8.18 patients (range, 4 to 15 patients). The mean age of the patients was 30.1 years (range, 17 to 58 years). The mean patient follow-up was 34 months (range, 5 to 99 months). Complete data related to the successful and failed cases of arthroscopic I & D procedures are shown in Tables 2 and 3, respectively.

The overall success rate of arthroscopic I & D for septic arthritis was 85.5%. Removal of the graft with or

Table 1. Characteristics of Included Studies

Study	Year	Location	% Male Patients	Mean Age (yr)	Sample Size	Follow-Up (mo)	Level of Evidence
Demirag et al.[6]	2011	Turkey	85.7	29	7	48	IV
Fong and Tan[7]	2004	Singapore	100	23	7	11.7	IV
Indelli et al.[4]	2002	USA	83.3	32.5	6	36	IV
Judd et al.[8]	2006	USA	72.7	28	11	22	IV
McAllister et al.[9]	1999	USA	100	26	4	36	IV
Nag et al.[10]	2009	India	62.5	34	8	43.6	IV
Schollin-Borg et al.[5]	2003	Sweden	80	28.3	10	35.8	IV
Van Tongel et al.[11]	2007	Belgium	93.3	31.8	11	58	IV
Wang et al.[12]	2009	China	85.7	28.6	15	NR	IV
Williams et al.[13]	1997	USA	100	31.3	7	29	IV
Zalavras et al.[14]	2005	USA	100	38.6	5	20	IV

NR, not reported.

without subsequent revision ACL reconstruction was reported in 13 (14.4%) cases. Grafts were removed if they were insufficient on probing or were covered with a purulent exudate. In 5 patients, grafts were removed during the first I & D, in 5 patients they were removed during the second I & D, in 2 patients they were removed during the third I & D, and in one patient the graft was removed during the fourth arthroscopic I & D. There were no statistically significant differences between the successful and failed cases with regard to age ($P = .133$), sex ($P = .581$), or follow-up ($P = .278$) (Table 4).

Specific information on the time to presentation was reported in 92.2% (83 of 90) cases. The average time to presentation was 26.3 days (range, 2 to 455 days). The majority (91.1%) of infections were detected in the acute (46.7%) or subacute (44.4%) periods. The mean presentation time in the successful and failed cases was 27.6 days and 19.2 days, respectively. There was no statistically significant difference between successful and failed cases with regard to time to presentation ($P = .982$) (Table 4).

Specific information on the number of arthroscopic debridements was reported in 95.5% (86 of 90) of cases. The average number of I & Ds performed was 1.51 (range, 1 to 4) when successful and failed cases were combined. An average of 1.44 I & Ds were performed in the successful cases, whereas the average number in the failed cases was 1.92. Repeated I & D was necessary in 34.5% of patients. It was performed based on laboratory and clinical results, including persistent wound drainage, fever, effusion, or fluctuation despite intravenous antibiotic administration.[4,6,7,11,13] Patients who underwent 2 or more I & D procedures had a higher rate of failure than did those who underwent one procedure, with failure rates of 27% versus 9%, respectively ($P = .029$) (Table 4).

Regarding graft type, autografts and allografts were used in 64% and 36% of failed cases, respectively. Failure of arthroscopic I & D was also significantly higher in patients with allografts versus autografts, with corresponding failure rates of 80% (4 of 5) and 8.9% (7 of 79) ($P < .001$) (Table 4). There were no significant differences between the hamstring autograft and bone–patellar tendon–bone (BPTB) autograft groups ($P = .119$) (Table 4).

Eighty-five of the 90 cases (94.4%) of septic arthritis after ACL reconstruction had a positive organism cultured. *Staphylococcus aureus* and coagulase-negative staphylococci (CNS), together, accounted for 70% of postoperative ACL infections. Coagulase-negative species alone accounted for 40%. Infections with *S aureus* had a higher risk of failure when compared with all other organisms ($P = .053$), although the difference was not statistically significant (Table 4). The overall failure rate with *S aureus* as the infecting organism was 32%, and it was present in 46% (6 of 13) of failed cases. CNS and polymicrobial infections were present in only 4 (31%) and 3 (23%) of failed cases, respectively.

Discussion

The principal findings of this study show that I & D with graft retention is an attractive option, with low morbidity for septic arthritis in the face of an ACL reconstruction. Despite a repeated I & D being necessary in approximately one third of cases, the average success rate of arthroscopic I & D in eradicating infection is 85%. The results of a meta-analyses indicated no differences between the successful and failed cases except for the infecting organism, number of I & Ds performed, and graft type.

This treatment option remains popular with both surgeons and patients. Perceived advantages include a technically less 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 with greater morbidity and less predictable results after revision ACL reconstruction.[9] Persistent intra-articular bacteria that are incompletely removed during I & D can have an adverse effect on articular cartilage and lead to the

Table 2. Successful Cases

Patient	Age (yr)	Sex	Initial Organism	Follow-up (mo)	Number of Repeated I & Ds	Graft Type	Time to Presentation
A1	26	M	CNS	60	1*	HS auto	Subacute
A2	40	M	CNS	72	1*	HS auto	Subacute
A3	30	M	CNS	33	1*	HS auto	Subacute
A4	37	M	CNS	17	1*	BPTB	Subacute
A5	37	F	*S aureus*	60	1*	HS auto	Chronic
A6	37	M	CNS	21	1*	BPTB	Acute
A7	21	M	CNS	60	1*	HS auto	Subacute
B1	25	M	Polymicrobial	8	1	HS auto	Subacute
B2	23	M	Polymicrobial	5	1	HS auto	Acute
B3	23	M	GPC	12	1	HS auto	Subacute
B4	19	M	*S aureus*	7	1	HS auto	Subacute
B5	23	M	GPC	19	1	HS auto	Subacute
B6	19	M	MRSA	5	2	HS auto	Acute
B7	30	M	*S aureus*	26	3	HS auto	Subacute
C1	20	M	*S aureus*	24	3	HS auto	Subacute
C2	35	M	CNS	96	2	NR	Acute
C3	44	M	CNS	24	1	NR	Subacute
C4	22	M	GPC	42	2	NR	Subacute
D1	NR	NR	CNS	10	2	HS auto	Acute
D2	NR	NR	CNS	30	3	HS auto	Acute
D3	NR	NR	GNR	16	1	HS auto	Subacute
D4	NR	NR	CNS	48	4	HS auto	Subacute
D5	NR	NR	GNR	10	2	HS auto	Acute
D6	NR	NR	*S aureus*	20	2	HS auto	Acute
D7	NR	NR	CNS	31	2	HS auto	Acute
D8	NR	NR	CNS	13	2	HS auto	Subacute
D10	NR	NR	CNS	NR	2	HS auto	Acute
D11	NR	NR	CNS	NR	3	HS auto	Acute
E1	28	M	*S aureus*	42	NR	HS auto	Acute
E2	20	M	*S aureus*	28	NR	BPTB	Acute
E3	34	M	*S aureus*	39	NR	BPTB	Subacute
E4	22	M	*S aureus*	34	NR	BPTB	Acute
F1	30	M	TB	72	2	BPTB	Subacute
F2	41	M	TB	61	1	HS auto	Subacute
F3	35	M	TB	32	1	HS auto	Chronic
F4	46	F	TB	30	1	HS auto	Chronic
F5	26	F	TB	48	1	HS auto	Subacute
F6	23	M	TB	44	1	HS auto	Chronic
F7	31	M	TB	37	2	HS auto	Chronic
F8	40	F	TB	25	1	HS auto	Subacute
G1	39	M	CNS	56	1	BPTB	Subacute
G3	25	M	CNS	24	1	BPTB	Acute
G4	26	M	CNS	24	1	BPTB	Acute
G5	33	M	*S aureus*	26	1	BPTB	Acute
G6	19	F	CNS	32	1	BPTB	Acute
G7	26	F	Neg	48	1	HS auto	Acute
G8	27	M	Neg	56	1	HS auto	Acute
G9	29	M	GNR	24	1	HS auto	Acute
H1	35	NR	CNS	28	4	HS auto	Subacute
H2	24	NR	GPC	76	1	HS auto	Chronic
H3	26	NR	CNS	63	1	Mixed†	Acute
H4	47	NR	CNS	51	1	HS auto	Subacute
H5	44	NR	GPC	51	1	HS auto	Subacute
H6	37	NR	Polymicrobial	99	3	HS auto	Subacute
H7	17	NR	Polymicrobial	84	1	HS auto	Acute
H8	26	NR	CNS	83	2	HS auto	Acute
H9	50	NR	Polymicrobial	29	1	HS auto	Acute
H10	41	NR	CNS	56	2	HS auto	Acute
H11	18	NR	GNR	9	3	HS auto	Acute
I5	21	M	Neg	NR	1	HS auto	Subacute
I8	29	M	CNS	NR	1	HS auto	Subacute
I9	25	M	CNS	NR	1	HS auto	Subacute

(continued)

Table 2. Continued

Patient	Age (yr)	Sex	Initial Organism	Follow-up (mo)	Number of Repeated I & Ds	Graft Type	Time to Presentation
I10	32	M	Neg	NR	1	HS auto	Acute
I11	30	M	*S aureus*	NR	1	HS auto	Acute
I12	38	M	GPR	NR	1	HS auto	Acute
I13	17	M	CNS	NR	1	HS auto	Subacute
I14	30	M	CNS	NR	1	HS auto	Acute
I15	19	M	Neg	NR	1	HS auto	Subacute
I16	58	F	CNS	NR	1	Allo	Acute
I17	18	F	Polymicrobial	NR	1	HS auto	Acute
I18	21	M	CNS	NR	1	HS auto	Subacute
I19	18	M	GPC	NR	1	HS auto	Acute
I20	24	M	CNS	NR	1	HS auto	Subacute
I21	26	M	CNS	NR	1	HS auto	Acute
J3	50	M	Polymicrobial	7	1	BPTB	Subacute
J6	35	M	*S aureus*	7	1	BPTB	Chronic
J7	25	M	*S aureus*	35	1	HS auto	Acute

Allo, allograft; BPTB, bone—patellar tendon—bone autograft; CNS, coagulase-negative staphylococci; GPC, other gram-positive cocci; GNR, gram-negative rods; NR, not reported; *S aureus, Staphylococcus aureus.*

*One patient had 2 I & Ds.

†Hamstring autograft augmented with Achilles tendon allograft.

development of degenerative changes.[8,9,16-18] Patients then have a longer period of pain and swelling in the knee, culminating in later revision surgery. Additionally, 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.[9,19]

The decision of when to remove the graft in the treatment of a postoperative 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 intrasubstance degeneration, gross evidence of infections compromising the graft, or a nonfunctional 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 was 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.[20] 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 BPTB allografts (0.44%) and autografts

Table 3. Failure Cases

Patient	Age (yr)	Sex	Initial Organism	Follow-up (mo)	Number of I & Ds	Graft	Time to Presentation
C5	33	F	*S aureus*	24	4	NR	Subacute
C6	51	M	*S aureus*	24	2	NR	Subacute
D9	NR	NR	CNS	18	3	HS auto	Subacute
G2	33	M	CNS	36	1	BPTB	Acute
G10	26	M	CNS	32	1	HS auto	Acute
J1	17	M	*S aureus*	10	2	BPTB	Acute
J2	23	M	*S aureus*	9	2	BPTB	Subacute
J5	45	M	*S aureus*	63	2	HS auto	Acute
K1	36	M	Polymicrobial	NR	1	Allo	Subacute
K2	46	M	Polymicrobial	NR	3	Allo	Subacute
K3	56	M	Polymicrobial	NR	2	Allo	Acute
K4	27	M	CNS	NR	1	HS auto	Acute
K5	28	M	*S aureus*	NR	1	Allo	Chronic

Allo, allograft; BPTB, bone—patellar tendon—bone; CNS, coagulase-negative staphylococci; HS auto, hamstring autograft; *S aureus, Staphylococcus aureus.*

Table 4. Summary of Patient Characteristics

Variable	Patients with Successful I & D n	Patients with Failed I & D n	*P* Value
Age (median [range]) (yr)	27 (17-58)	33 (17-56)	.133
Sex			.581
Female	8	1	
Male	48	11	
Time to presentation			.982
Acute	36	6	
Subacute	34	6	
Chronic	7	1	
Follow-up (median [range]) (d)	31.5 (5-99)	24 (9-63)	.278
Graft type			**<.001**
Autograft	72	7	.119
Hamstring	59	4	
BPTB	13	3	
Allograft	1	4	
Mixed	1	0	
Number of I & Ds			**.029**
1	51	5	
2+	22	8	
Organism			
S aureus	13	6	.053*
CNS	32	4	.446*
MRSA	1	0	
Other GPC	6	0	
TB	8	0	
Gram-positive rods	1	0	
Gram-negative rods	4	0	
Polymicrobial	7	3	.242*
Culture negative	5	0	

NOTE. Bold type = significant finding ($P < .05$).

BPTB, bone-tendon-bone; CNS, coagulase-negative staphylococci; GPC, other gram-positive cocci; MRSA, methicillin-resistant *Staphylococcus aureus;* TB, *Mycobacterium tuberculosis.*

*Comparison to all other organisms.

(0.49%). Maletis et al.[21] 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.[22] 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. Although there is no consensus on graft type as a risk factor for infection after ACL surgery, our study sought to identify if graft choice was a risk factor for failure of arthroscopic I & D for infection after ACL reconstruction. Interestingly, our study showed a statistically significant risk of failure with allografts compared with autografts. However, these results must be interpreted with caution considering the very small sample size and number of allografts used.

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 5 consecutive patients with persistent septic arthritis after ACL reconstruction. All patients previously had one to 3 I & 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. In contrast, this review demonstrated that a polymicrobial infection was not a risk factor for failure of arthroscopic I & D when compared with all other organisms. Analysis of the included studies revealed that failure was more likely when *S 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.[23,24]

Patients who underwent a single arthroscopic I & 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 & D are intuitively more likely to have been successful in retaining their grafts. If there were persistent signs of infection, they would have gone on to repeated I & D. The practice of routine repeated I & D was not evident in the included studies. Repeated arthroscopic debridements 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 8 cases that were detected more than 2 weeks after the procedure, only one went on to failure (12.5%).

Limitations

This study had limitations. Combining data from different studies was limited by the fact that the management of the infection differed significantly between the authors. Furthermore, not all necessary data required for comparison between studies were reported. Also, as with any systematic review, publication bias is always a concern. The literature review identified only 11 studies meeting our inclusion criteria, demonstrating the currently limited published evidence regarding the outcomes of this procedure. It is possible that some important studies may have been missed, and there may be numerous unpublished studies on this topic, particularly ones with substantial negative results, which would affect the overall conclusions of this study. Also, this review looked solely at studies published in the English language, and as such may add to the degree of publication bias. This review looked at nonrandomized controlled trials and thus is weakened by the limitations of nonrandomized study designs. The results are, at best, hypothesis generating. It is difficult to establish cause and effect. We had to depend on the availability and accuracy of the medical record because no attempt was made to contact the authors of the included studies to ensure data accuracy. There is selection bias because the investigators self-selected the cases. Therefore, the findings should be interpreted with caution. Although our data set was sufficiently large for most evaluations, it was insufficient for stratified analyses such as organism type and graft type, which are relevant clinical factors associated with failure rates resulting from infection. Despite these limitations, we believe our data help to clarify the role I & D should play in the treatment of septic arthritis after an ACL reconstruction. The 85.5% success rate noted in this study is encouraging for using arthroscopic I & D with graft retention as the initial treatment for the infected ACL. This information can be useful in counseling patients and in surgical decision making.

Conclusions

Arthroscopic I & D with graft retention is an effective treatment for patients with septic arthritis after ACL reconstruction. Factors affecting the failure rate may include graft choice and organism virulence.

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