

Irrigation and Débridement and Prosthesis Retention for Treating Acute Periprosthetic Infections

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Abstract

Background Infections following hip and knee replacements can compromise the function and durability of arthroplasty. When these infections occur during the immediate postoperative period, irrigation and débridement can be attempted to salvage the implant. Prior studies have reported varying results likely due to lack of consistent inclusion criteria, variations in surgical technique, and lack of uniform treatment protocols.

Questions/purposes To supplement this literature we determined the rate at which irrigation and débridement and prosthesis retention would control acute periprosthetic infections.

Methods We retrospectively reviewed the medical records of 18 patients with acute periprosthetic infections occurring within 28 days after 13 THAs and 5 TKAs. The mean time to reoperation was 19 days (range, 6–28 days) after arthroplasty. Superficial débridements were performed in five cases, and a polyethylene or ball head exchange was performed in the remaining 13 cases when fascial defects were encountered at the time of surgery.

Results We salvaged the prosthesis in four of five patients with superficial irrigation and débridement group and eight of 13 with deep infections. Intraoperative cultures were positive in 83% of cases (n = 15). Five patients (one superficial and four deep) eventually underwent resection arthroplasty. Three patients underwent repeat irrigation and débridement, and one of these three ultimately had resection arthroplasty. Polymicrobial infections were detected in four cases, all failures. The average time to resection was 62 days (range, 12–134 days).

Conclusions Consistent with the literature, success of prosthesis salvage for periprosthetic infections occurring within 28 days after arthroplasty depends on the location, extent, and microbiology of the infection.

Level of Evidence Level IV, case series. See the Guidelines for Authors for a complete description of levels of evidence.

Introduction

Infections after hip and knee arthroplasty are devastating complications that cause substantial pain and morbidity for the patient and can pose major challenges to surgeons. Failure to eradicate the infection can lead to chronic pain, functional limitations, sepsis, and a substantial burden upon society [1, 2, 11, 21, 24, 25]. Compared to patients undergoing revision procedures for aseptic loosening, patients with infected hip and knee arthroplasties have a higher rate of postoperative complications, number of hospitalizations, reoperation rates, and outpatient charges within a 12 month period following treatment of the deep prosthetic infection [2, 25]. While historical rates of infection following arthroplasty have been as high as 15% [28], fortunately, over the years, the overall rate of

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Each author certifies that his or her institution approved the human protocol for this investigation, that all investigations were conducted in conformity with ethical principles of research, and that informed consent for participation in the study was obtained.

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infection following primary total hip and knee arthroplasty is low depending upon the patient's comorbidities, definition of infection, and duration of followup with recent large series reporting infection rates as low as 1% [14, 16, 17].

Two-stage reimplantation procedure is considered the gold standard for treatment of subacute and chronic deep periprosthetic infections and is associated with rates of infection control from 41% to 90% [3, 5, 8, 9, 12, 13, 18, 19, 23, 26, 29]. Many surgeons consider surgical irrigation and débridement (I+D) and prosthesis retention as an option for acute postoperative and acute hematogenous infections. Historically, the rates of infection control for prosthesis retention after I+D have been variable and have ranged from 18% to 83% [5, 6, 9, 19, 21, 22]. Thus, the role of this procedure has not been clearly defined.

To supplement this literature we (1) determined the rate at which irrigation and débridement and prosthesis retention would control periprosthetic infections occurring within 28 days in a contemporary group of patients treated with a single protocol; (2) compared the rate of infection control in a group of patients treated by the same protocol between 28 and 90 days; and (3) compared the effect of location of infection (superficial versus subfascial) on the rate of infection control following irrigation and débridement.

Patients and Methods

We retrospectively reviewed all 18 patients with infections occurring within 28 days of a hip or knee arthroplasty who were treated with I+D and prosthesis retention between 2004 and 2008 by a single surgeon. All patient information was collected from a departmental operative database and clinical patient records. There were seven men and 11 women with a mean age of 55.3 years (range, 40–90 years). Five patients were type A and 13 patients were type B hosts according to the classification of Cierny et al. [7]. Four patients had undergone primary TKA, one a revision TKA, seven a primary THA, and six a revision THA. All revision surgeries were performed for aseptic loosening of the hip and knee joints; all patients had negative intraoperative frozen sections and cultures at the time of revision. All patients had received intravenous antibiotics immediately following their index hip or knee replacement for a standard period of 24 hours postoperative. Patients with sterile wound hematomas were excluded from this study. The average and median time to surgical I+D in this group of patients was 19.4 days and 22 days, respectively (range, 6–28 days). For patients with the acute infections the minimum followup was 12 months (mean 31 months; range 13 to 57 months). As a comparison group we identified a contemporaneous group of 11

patients with infections following arthroplasty (six superficial and five deep) who presented with recent postoperative infections occurring within 90 days from surgery but outside the 28 day window from 2004–2008. These 11 patients were treated in the same manner by the same surgeon with I+D and prosthesis retention; the average and median time to irrigation and débridement was 53.3 and 47 days following surgery respectively (range, 35–82). There were six men and five women with an average age of 56 years. Four patients were type A hosts (Cierny et al. [7]) and seven patients were type B hosts. Seven had undergone TKA and four had undergone THA. For these 11 patients with the later infections the mean followup was 32 months (range 14–59). No patients were lost to followup.

Patients were returned to the operating room for purulent wound drainage, pain, and other clinical signs of infection including fevers, wound erythema, and elevated markers for infection (C-reactive protein and sedimentation rate) (Table 1).

Preoperatively, antibiotics were withheld until surgical cultures were obtained; no patient had received antibiotics within 5 or more days of I+D. The hip or knee was approached using the previous incision. The fascial layer was thoroughly inspected, and if any gross perforation or discontinuity was noted, deep dissection and joint arthrotomy were performed. In cases of an intact fascia lata or knee retinaculum, only a superficial I+D was performed. In cases of subfascial extension, a polyethylene exchange was performed in all knees and the ball of the THA was exchanged. No acetabular liners were exchanged at the risk of loosening the acetabular component. A superficial I+D was performed in five cases (all hips), and an arthrotomy and polyethylene or ball head exchange was performed in the remaining 13 patients (five knees, eight hips). In three cases, a repeat I+D was performed because of persistent wound drainage or nonhealing wounds. The average time to repeat irrigation and débridement was 156.3 days (range, 7–477 days). A drain was placed in all wounds and was removed during the postoperative hospitalization when the output was less than 30 cc for two consecutive 8 hour shifts (range, 1–3 days).

Operative cultures were positive in 15 of the 18 patients. Methicillin-sensitive *Staphylococcus aureus* was the most

Table 1. Patient symptoms preceding I+D

Symptom	Number of patients exhibiting symptom
Purulent wound drainage	16
Significant pain	2
Significant swelling	3
Extensive erythema	2

commonly isolated organism ($n = 9$) followed by coagulase-negative *S aureus* ($n = 3$) and methicillin-resistant *S aureus* (MRSA) ($n = 3$). Polymicrobial infections were present in four patients. There was no difference in the rate of positive cultures between patients with superficial (extrafascial) and deep (subfascial) infection.

Following surgery, all patients were treated with culture-specific intravenous antibiotics for 6 weeks. Patients who had negative intraoperative cultures received intravenous cefazolin for 6 weeks, and those with penicillin allergies received vancomycin. No patient was treated with chronic antibiotic suppression following completion of intravenous treatment.

The patients were followed at 2 weeks, 6 weeks, 3 months, and 1 year for clinical symptoms or signs of infection. Serum markers for infection (complete blood count, sedimentation rate, and C-reactive protein) were followed at regular intervals (6 weeks, 3 months, 1 year) and compared to preoperative values.

Outcome variables were identified to define success versus failure for the I+D procedure. Success was defined as prosthesis retention after I+D with normalization of laboratory values off antibiotics, and failure was defined as persistent pain, elevated ESR and CRP, and resection of the prosthesis. The success rate compared to the similar group of 11 patients with infections following arthroplasty with recent postoperative infections occurring within 90 days from surgery but outside the 28 day window.

Results

We achieved prosthesis retention following irrigation and débridement of hip and knee infections occurring within 28 days in 13 of the 18 patients. Five patients eventually underwent prosthesis explantation to control chronic infection at a mean and median of 62.2 and 62 days, respectively, after initial I+D (range, 12–134 days). Three patients had repeat I+D (two hips and one knee) following the initial attempt at prosthesis salvage. The average time to repeat débridement was 156.3 days (range 7–447 days). One patient in this group eventually required resection for failure of treatment. At last follow up, retention of the hip or knee prosthesis was successfully achieved in four of five patients with superficial (extrafascial) infections compared to eight of 13 patients with deep prosthetic infections. No patient was treated with chronic antibiotic suppression.

Four patients with positive intraoperative cultures in the deep infection group eventually underwent explantation. All four patients with polymicrobial infections failed irrigation and débridement and needed resection of their implants. Three patients with deep infections had negative cultures at the time of débridement. All three were

successfully treated with irrigation and débridement and intravenous antibiotics.

In the comparison group with later treatment (28–90 days), the treatment was successful in all six patients with superficial infections and in one out of the five patients with deep (subfascial) infection.

Discussion

Periprosthetic infections are classified as acute postoperative, chronic postoperative, or acute hematogenous according to their duration of involvement and proximity to the preceding joint arthroplasty [30]. While two-stage reimplantation is considered the gold standard for treatment of subacute and chronic infected hip and knee arthroplasties, acute infections may be amenable to débridement and prosthesis retention. While many authors define acute postoperative infections as occurring within 4 weeks from surgery, others have considered this time period to be as short as 2 weeks and as long as 3 months [5, 10]. The reported success rates for prosthesis retention in the literature are highly variable due to a lack of consistency in the definition of what is considered acute, multiple surgeons in a single study, and nonconsecutive series, all of which contribute to bias. To supplement this literature we (1) determined the rate at which irrigation and débridement and prosthesis retention would control periprosthetic infections occurring within 28 days in a contemporary group of patients treated with a single protocol; (2) compared the rate of infection control in a group of patients treated by the same protocol between 28 and 90 days; and (3) compared the effect of extent of infection (superficial versus subfascial) on the rate of infection control following irrigation and débridement.

There were several limitations to this study. First, multiple factors can affect the likelihood of infection control after periprosthetic infection, including pathogen, extent of infection, and patient comorbidities [1, 3, 12, 15, 19, 20, 23, 26, 27, 29, 30]. Because of these multiple variables, small size, and the observational nature of this study, our data precluded statistical analysis of confounding factors, and we were unable to generate a sufficiently powered study to create predictive models that accurately predict the outcome of patients with acute postarthroplasty infection treated with irrigation and débridement and prosthesis retention. Second, many patients had superficial infections confined above the fascial layer and thus, their inclusion skewed our success rate. While all of these patients had culture confirmed infections, these infections behaved differently compared to those that extended beneath the fascial layer as shown by the higher ratios of retention even beyond 4 weeks of the initial surgeries. The

inclusion of these patients demonstrates the variability of presentation of early postoperative infections, and illustrates how the location and extension of infection can influence the outcome of irrigation and débridement and prosthesis retention.

Our numbers of successful prosthesis retention in patients with deep prosthetic hip and knee infections occurring within 28 days following surgery are consistent with those previously published in the literature. Eight of 13 patients with infections extending below the fascial layer were successfully treated with I+D, polyethylene or ball head exchange, and postoperative intravenous antibiotics. Tsukayama et al. reported a series of 41 infected THA identified within 4 weeks of arthroplasty and found irrigation and débridement yielded a prosthesis salvage rate of 68% [29]. Segawa et al. [26] reported infected TKAs from the same institution observed knees treated with I+D and polyethylene exchange had only a 59% chance of success for prosthesis retention. However, if the infection was identified within 4 weeks, the rate of success increased to 77% [26]. Other studies have also reported similar success rates as long as the infection was identified and treated early (within 4 weeks), but the results rapidly deteriorated to retention rates as low as 18% if the infection was identified or treatment delayed past this 28 day window (Table 2) [3–6, 9, 19, 21, 22, 26, 29]. Our observations echo these findings as only one out of five patients with deep infections who presented just outside 4 weeks following surgery had of successful prosthesis retention following irrigation and débridement. Consequently, having a high index of suspicion and avoiding delay in diagnosis and treatment can influence the rate of irrigation and débridement and prosthesis retention in patients with acute postoperative infections following hip and knee arthroplasty.

We included patients who had superficial, extrafascial infections that occurred within 4 weeks from surgery. All of these infections were confirmed with positive intraoperative cultures, and the success rate of prosthesis retention in this subgroup was 80% (four out of five patients). Even if the infection occurred past the 28 day window, patients with superficial infections treated with irrigation and débridement still had a good chance for prosthesis salvage. This is in contrast to deep infections treated with attempted salvage. Galat et al. [10] reported a series of 58 patients (59 knees) returned to the operating room for wound complications following TKA. Compared to a group of patients who did not have wound complications, the authors reported a higher probability of reoperation (5.3 % versus 0.6%) and deep infection (6.0% versus 0.8%) within 2 years from surgery [10]. In another study, Rasul et al. reported higher rates of prosthesis salvage if the infection was superficial to the fascial layer [22]. In his series of 15 joint infections, the overall success rate for prosthesis salvage was 60%. However, if the infection was superficial, the success rate of irrigation and débridement was 100% (6/6) [22]. Our observations are consistent with the rates of infection control previously published. One patient with superficial infection had persistent wound drainage and underwent repeat irrigation and débridement. At the time of subsequent reoperation, the fascial layer was violated and the patient ultimately underwent resection arthroplasty to control the infection.

The success rate of irrigation and débridement in patients with hip and knee infections occurring within 28 days following surgery depended on the location, extent, and microbiology of infection. Patients with superficial infections even beyond 4 weeks postoperative were likely to have successful infection control after débridement. Consistent with other published reports, the

Table 2. Prior studies examining prosthesis retention following irrigation and débridement

Author	Number of infected joints	Weeks to irrigation	Polyexchange performed	Retention rate
Brandt et al., 1999 [3]	33	23 pts > 4, 10 pts < 4		12 (36%)
Burger et al., 1991 [5]	39	14.3 (0.14–114.4)		7 (18%)
Chiu and Chen, 2007 [6]	40	73.7 (1.29–311.76)	40	12 (30%)
Deirmengian et al., 2003 [9]	31	104 (2.28–364)	10	11 (35%)
Mont et al., 1997 [19]	24	10 pts < 4, 14 pts 26–307	21	20 (83%) [10(100%) early infx, 10(71%) late infx]
Morrey et al., 1989 [21]	10			8 (80%)
Rasul et al., 1991 [22]	15 (6 superficial, 9 deep)	21.3 (1–156)		9 (60%) [6(100%) superficial, 3(33%) deep]
Segawa et al., 1999 [26]	41	30 pts < 4, 11 pts > 4	41	24 (59%) [23(77%) early, 1 (9%) late]
Tsukayama et al., 1996 [29]	41	< 4	41	28 (68%)

rate of successful infection control and prosthesis salvage was higher in patients with deep infections treated within 4 weeks following arthroplasty.

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