RESEARCH ARTICLE

Deep Infection after Distal Radius Open-reduction Internal Fixation: A Case Series

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Abstract

Background: Given its low incidence, the management of deep infection following distal radius open-reduction internal fixation (ORIF) has not been well reported. In an effort to expand our current understanding, the purpose of this case series is to present the treatment strategies and functional outcomes associated with deep infection after distal radius ORIF.

Methods: All patients with deep infections after distal radius ORIF over a ten-year period were identified and their treatment courses asessed.

Results: The cohort consisted of three women and one man with an average age of 55.5 ± 17.6 years. Mean time from infection presentation to irrigation and debridement (I&D) with removal of hardware (ROH) was 16 days (Range: 3 – 44 days). The identified bacterial species in all cases was Staphylococcus aureus (MRSA = 2, MSSA = 2). Three patients were treated with intravenous antibiotics, while one patient was treated with oral antibiotics. Mean time from infection presentation to final clinical follow-up was 11 months (Range: 3 – 20 months). Two patients required repeat I&D. A clinical determination of successful infection eradication was made in all cases.

Conclusion: The reported rate of deep infection after distal radius ORIF is less than 1%. There is no well-defined treatment algorithm for patients with deep infection after distal radius ORIF. However, removal of hardware and post-operative oral or intravenous antibiotic therapy appears effective, and is consistent with the standard practices of treating infection after other orthopaedic surgeries.

Level of evidence: IV

Keywords: Distal radius, Infection, Open-reduction internal fixation, Treatment

Introduction

Distal radius fractures are among the most commonly encountered orthopaedic injuries. When surgical management is required, open-reduction internal fixation (ORIF) strategies are often utilized with reliable outcomes (1,2). While various post-operative complications can occur, the reported rate of deep infection is less than 1% (3,4). Due to its rarity, there is a paucity of information regarding the management of deep infection after ORIF. Similarly, the impact of deep infection on overall outcomes after distal radius ORIF is underreported.

In an effort to expand the current understanding, the purpose of this case series is to present the treatment courses and outcomes of patients with surgically-managed deep infections after distal radius fracture ORIF.

Materials and Methods

A database search was conducted to first identify all patients within a single orthopaedic group between 2009–2019 who underwent ORIF of a distal radius fracture

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(CPT codes: 25607, 25608, 25609). This produced a cohort of 5,673 patients. We further stratified this group by selecting patients with an associated irrigation and debridement (I&D) code within 18 months of their initial ORIF, which produced 155 patients. The electronic medical records of the remaining patients were reviewed to identify those who underwent re-operation for an isolated deep infection after ORIF. Exclusion criteria included initial open fracture (91), loss to follow-up (1), and radiocarpal fracture/dislocation (1). A total of four patients with clinical follow-up through completion of antibiotic therapy were included.

Electronic medical records were further reviewed to collect demographic variables including age, sex, injury laterality, and comorbidities, diagnostic and treatment variables, and available outcome data including range of motion (ROM), Disabilities of the Arm, Shoulder, and Hand (DASH and Quick-DASH) scores, and radiographic measures at final follow-up. All data was collected, and descriptive statistics reported.

Results

Summary

Descriptive characteristics of the patients within this series are summarized in Table 1. Final radiographs after hardware removal were available for three patients, and measurements are reported in Table 2. The determination of infection resolution was made clinically in all cases. There were no further complications, infection recurrence, or unplanned reoperations within the cohort.

Case One

This was a 72-year-old female with a history of rheumatoid arthritis on Methotrexate and Prednisone. The patient sustained an AO Type C distal radius fracture, which was treated with volar plating and allograft bone grafting. Nineteen days after surgery, the patient presented to the office with cellulitis and ulcerations surrounding the incision site. The patient was started on oral Clindamycin and topical Mupirocin. Initially, the presumed superficial infection improved, but 1 month later, it acutely worsened. At that time, radiographs demonstrated a healing fracture with incorporating bone graft [Figure 1]. However, due to concern for deep infection, the patient underwent I&D with ROH 63 days after the index surgery. High-viscosity bone cement mixed with 500 miligrams of vancomycin powder was placed within the open screw holes and around a metaphyseal void to avoid the need for supplemental fixation. A deep drain was placed. Intra-operative cultures grew Methicillin-sensitive Staphylococcus aureus (MSSA), and the patient received a six-week course of intravenous (IV) cefazolin. Two months after surgery, range of motion was near symmetric to the contralateral side with only a minor deficit in supination. Radiographs taken seven months post-operatively demonstrated satisfactory position of the spacer with surrounding bone consolidation [Figure 1]. Therefore, the spacer was left in place indefinitely.Quick-DASH score recorded nine months after hardware removal was 34. The patient died one year after I&D from an unrelated

Table 1. Descriptive characteristics of the study cohort

Characteristic	Range
Age	36 – 74 years old
Body Mass Index	26 – 36
Time from ORIF to Infection Presentation	5 days – 5 months
Time from Infection Presentation to I&D	3 – 44 days
Duration of Post-operative Antibiotics	4 – 8 weeks
	Number of Patients
Current Tobacco Users	1
Dominant-sided Fractures	2
Presenting Symptom	
Skin changes	3
Altered Mental Status	1
ESR Obtained at Infection Presentation	2 (Both WNL)
Radiographic Changes at Infection Presentation	1 (Screw Displacement)
Bacterial Species	
MSSA	2
MRSA	2
Route of Post-operative Antibiotics	
Intravenous	3
Oral	1
Type of Postoperative Antibiotics	
Vancomycin	2
Cefazolin	1
Cephalexin	1
Repeat I&D Required	2

ESR = Erythrocyte sedimentation rate, WNL = Within normal limits, MSSA = Methicillin-sensitive Staphylococcus aureus, MRSA = Methicillin-resistant Staphylococcus aureus.

Table 2. Radiographic measurements at final follow-up after hardware removal for deep infection after distal radius ORIF

Case	Radial Tilt	Volar Tilt	Radial Height	Ulnar Variance
One	17°	14°	7 mm	- 1 mm
Three	20°	- 6°	10 mm	- 1 mm
Four	26°	19°	13 mm	- 2 mm

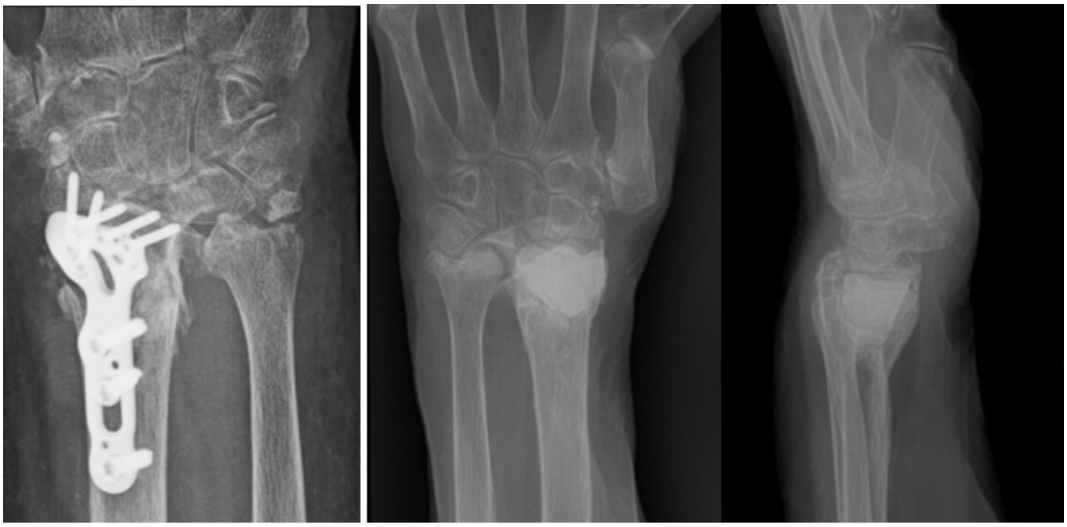

Figure 1. Radiographs at the time of presentation in a patient experiencing cellulitis and ulceration around the incision site one month after ORIF with allograft bone grafting (left) and nine months after hardware removal and antibiotic cement spacer placement (center and right).

illness, without infection recurrence.

Case Two

This was a 36-year-old male without any medical co-morbidities who sustained an AO Type B fracture that was treated with volar plating. At 2 months post-operatively, the fracture was healed, and ROM was improving with physical therapy. However, 3 months after surgery, the patient presented with serosanguinous drainage from the incision. Radiographs demonstrated a healed fracture with a single displaced locking screw [Figure 2]. The patient was started on Cephalexin and subsequently underwent I&D with ROH ten days later (112 days after index ORIF). Intra-operative cultures grew MSSA, and the patient was maintained on Cephalexin for one month after surgery. Post-operatively, active ROM at 3 weeks was 24° of flexion, 18° of extension, 10° of ulnar deviation, and 8° of radial deviation. The patient failed to follow-up after two months, by which point there were no signs of residual infection.

Case Three

A 74-year-old female with a history of hypertension and diabetes mellitus underwent ORIF with a volar plate and a temporary spanning plate after suffering an AO Type C fracture. Five days after surgery, the patient presented to the emergency department with fever, tachycardia, altered mental status, blood glucose level greater than 600, purulent drainage from the volar wrist incision and a suspected urinary tract infection. The patient was started on empiric IV antibiotics. Once stabilized, eight days after the index ORIF, the patient underwent I&D, which revealed gross purulence. The volar plate was removed, but the dorsal spanning plate was maintained. A repeat I&D was performed three days after the first. Deep and superficial drains were placed within the volar-sided wound. Intra-operative cultures grew Methicillin-resistant Staphylococcus aureus (MRSA), and the patient received an eight-week course of IV vancomycin. The spanning plate was removed five months after the index ORIF without complication. Eight weeks after spanning plate removal the patient demonstrated excellent ROM with a DASH score of 36. Nineteen months after I&D, the patient remained free of infection.

Case Four

This was a 40-year-old female smoker with no significant past medical history, who underwent ORIF with volar plating for an AO Type C fracture. The immediate post-operative course was unremarkable. Approximately three months after ORIF, the patient underwent breast

Figure 2. Radiograph at three months after distal radius ORIF in a patient presenting with serosanguinous drainage from the incision site.

surgery and developed an abscess at that surgical site post-operatively that was treated with bedside drainage and oral antibiotics. Two months later (5 months status post index wrist surgery), the patient presented to the clinic with a two-centimeter soft tissue mass over the dorsum of the wrist. Radiographs demonstrated a fully healed fracture. Given that the patient was experiencing tenderness over the volar aspect of the wrist as well, the decision was made to schedule ROH with I&D and mass exploration. Until the surgery, the patient was placed on oral Cephalexin. During the I&D, the dorsal mass was found to be a purulent collection that was communicating with the volar hardware. Two days later, the patient returned to the operating room for repeat I&D, which included debridement of devitalized bone surrounding many of the previous screw locations. Intra-operative cultures grew MRSA, and the patient was successfully treated with six weeks of IV vancomycin. No further surgery was required. At 20 months after surgery, clinical progress notes documented full passive ROM without pain and stable active ROM with some deficits compared to the contralateral side. Wrist rotation and digital ROM were full. The final DASH score was 35 and there was no recurrence of infection.

Discussion

Deep infection requiring surgery after distal radius fracture ORIF is a rare occurrence for which there is little data on treatment strategies and outcomes. In our series, the incidence of deep infection over a 10-year period was approximately 0.1% – slightly below the aforementioned rate of 0.8% reported in the literature (4). Our treatment involved surgical debridement and ROH, with post-operative antibiotics. Although this did result in eradication of the infections in all patients, functional deficits did persist, as reflected by final DASH scores.

Given its rarity, there is no well-defined treatment algorithm for patients with deep infection after distal radius ORIF. However, ROH and post-operative antibiotic therapy is consistent with the standard practices of treating infection after other orthopaedic surgeries. Hardware removal and IV antibiotics have long been mainstays in the treatment of infection after joint arthroplasty (5). Similar strategies have also been reported for infections after lower extremity fracture ORIF (6). In comparison to joint arthroplasty, a complicating variable in determining optimal hardware management after fracture is whether or not the injury has healed (7). Two of our four patients had complete radiographic union at the time of infection presentation, and in these cases, the implant was removed without complication or re-injury. In one patient who underwent ROH prior to complete healing, antibiotic cement was used to fill in remaining bony voids to augment fracture stabilization after hardware removal. This may be a useful strategy in acute infections with still healing fractures to allow for ROH without the need for adjunct fixation. This patient was immobilized within a thermoplastic splint for three weeks after hardware removal before resuming light ROM and eventually recovered near symmetric ROM at the affected wrist compared to the contralateral side.

Intravenous antibiotics were used in three patients. However, recent reports have questioned the necessity of IV antibiotics for such infections. In a randomized controlled trial of 1,054 participants with bone and joint infections, Li et al. demonstrated that six weeks of oral antibiotics were not inferior to IV antibiotics when assessing the rates of treatment failure at one year (8). Ninety-three percent of their population were also treated with surgical intervention and, consistent with our series, Staphylococcus aureus species were the most commonly identified causative organisms (8). Though only one patient was treated with oral antibiotics within our cohort, which limits the conclusions to be drawn from this regimen, oral antibiotics may be an alternative when combined with hardware removal.

As a retrospective case series, our study has inherent limitations. First, deep infection requiring surgery after distal radius ORIF is quite rare, which limits the size of our study and the scope of our findings. Second, while our incidence of deep infection is low, it is possible that patients with deep infection presented elsewhere for treatment and were not represented here. Similarly, although we assessed for infection up to 18 months after surgery, it is possible that deep infection could occur beyond this time frame and would not have been represented in our study. Our series of patients and reported incidence is perhaps most accurately representative of acute infection after surgery, as the initial search parameters did not capture sub-acute or chronic infections presenting after 18 months post-operatively. We suspect the frequency of this occurring would remain quite low. Finally, there may be particular injury characteristics or patient comorbidities that lead to an increased risk of deep infection, but we were not able to identify these in the present study.

In conclusion, deep infection after distal radius ORIF appears to be quite rare. Treatment includes operative debridement and a post-operative antibiotic regimen. Provided that the fracture has healed, hardware can be removed without need for supplemental support. In instances of more acute infection prior to fracture healing, additional stabilization of the fracture is warranted either through spanning fixation or antibiotic impregnated cement when feasible. These infections can be successfully eradicated with such treatment, but functional deficits can remain. Although it is uncommon, surgeons should maintain a high level of vigilance for deep infection in patients who present with wound drainage after surgery or with new-onset swelling and pain.

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