Surgery Article

AMERICAN ASSOCIATION FOR HAND SURGERY

HAND
2024, Vol. 19(4) 614–621

DOI: 10.1177/15589447221131849
journals.sagepub.com/home/HAN

Infection Rate in Type I Open Distal Radius Fractures Surgically Treated >24 Hours Post-Injury: A Comparison Study

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Abstract

Purpose: To determine how time to surgical debridement and fixation affects infection and complication rate in type I open distal radius fractures by comparing patients treated within 24 hours with those treated >24 hours post-injury. **Methods:** A retrospective review identified 62 patients who sustained a type I open distal radius fracture that was treated surgically. Patients were stratified into groups based on time to surgical intervention. An additional analysis was performed on patients with an isolated type I open distal radius fracture treated as an inpatient or outpatient. The primary outcome measure was infection rate. Secondary outcome measures were complications, reoperations, and readmissions. **Results:** Thirty-eight patients underwent surgery ≤24 hours post-injury at an average of 14 hours. Twenty-four patients underwent surgery >24 hours post-injury at an average of 72 hours. There were a total of 9 complications in 8 patients (14.5%). The overall infection rate was 1.6%, with only 1 deep infection occurring in the group treated ≤24 hours post-injury. There were 7 reoperations (11.3%) and 1 readmission (1.6%). No differences were found between groups in any outcome measure. In the 27 patients with an isolated fracture, there were no differences in any outcome measure when treated as an inpatient or outpatient. **Conclusions:** We suggest that type I open distal radius fractures could be safely treated surgically >24 hours post-injury without increased risk of infection.

Keywords: distal radius, fracture/dislocation, diagnosis, open fractures, trauma, infection, outcomes, research and health outcomes

Introduction

Fractures of the distal radius are the most common fracture of the upper extremity with more than 640 000 fractures occurring annually in the United States[1] and accounting for up to 18% of fractures in the elderly population.[2] However, open fractures of the distal radius are much less common.[3] Open fractures are often caused by a high-energy mechanism, leading to soft tissue disruption that can potentially alter local host defenses that resist infection.[4,5] Gustilo and Anderson described type 1 open fractures as a clean wound less than 1 cm in size with minimal comminution that is associated with a low risk of infection.[6] However, this classification is specific to open long bone fractures and may not accurately predict infection in open fractures of the distal radius.[7] Complications of open distal radius fractures include wound infection or osteomyelitis, wound dehiscence, nonunion, delayed union, compression neuropathy, tendon irritation or rupture, synostosis, and stiffness.[8] To prevent these complications, prompt antibiotic administration and urgent operative irrigation and debridement (I&D) are historically accepted as the standard of care.[7-13]

There is a paucity of literature describing the outcomes and timing of management in type 1 open distal radius. Nearly all of the existing literature works on these injuries are not specific to type I open fractures and include all open fracture types.[7-11] In addition, most of these studies analyze patients urgently treated as an inpatient within 24 hours post-injury.[7-11] It has been shown that the severity of the initial soft tissue injury in open distal radius fractures, rather than the time to operative debridement, is highly predictive of infection and nonunion rates.[7-11] When treated with urgent surgical debridement and fixation, the infection rate in type I open distal radius fractures ranges from 0% to 4% compared with 12% to 32% in type III open fractures.[7,9,10] With such low potential for infection with urgent treatment,

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it has been postulated that type I open distal radius fractures have a similar complication profile compared with closed distal radius fractures.[11,14]

Some authors have suggested that a type I open fracture in any extremity may be treated with antibiotics alone without operative debridement.[5] It has been suggested that in low-grade open fractures, operative debridement itself can lead to increased soft tissue trauma, periosteal stripping, and osseous devascularization.[4] Given the minimal soft tissue injury and subsequent low infection rate in type 1 open distal radius fractures, the need for urgent operative debridement is questionable.

The purpose of this study was to determine how the time to surgical debridement and fixation affects infection and complication rate in type I open distal radius fractures by comparing patients treated within 24 hours with those treated >24 hours post-injury.

Materials and Methods

After institutional review board approval, a retrospective review was conducted to identify all patients aged >18 years who underwent surgical debridement and fixation for a type I open distal radius fracture at a large tertiary hospital system from 2010 to 2020. The cohort of patients was identified via query of the electronic medical record (EMR) for the International Classification of Diseases, Tenth Revision Current Procedural Terminology codes of 11010 (debridement including removal of foreign material associated with open fracture[s] and/or dislocation[s]); skin and subcutaneous tissue, 11011 (debridement including removal of foreign material associated with open fracture[s] and/or dislocation[s]); skin, subcutaneous tissue, muscle fascia, and muscle, 11012 (debridement including removal of foreign material associated with open fracture[s] and/or dislocation[s]); and skin, subcutaneous tissue, muscle fascia, muscle, and bone, 25607 (open treatment of distal radial extra-articular fracture or epiphyseal separation), 25608 (open treatment of distal radial intra-articular fracture or epiphyseal separation, 2 fragments), or 25609 (open treatment of distal radial intra-articular fracture or epiphyseal separation, 3 or more fragments). Patients with type II or III open fractures, ballistic fractures, ipsilateral upper extremity open fractures, lack of follow-up of at least 6 weeks, and lack of appropriate surgical or follow-up documentation were excluded. Patients with an ipsilateral upper extremity closed fracture were included.

Demographic, clinical, and radiographic data were collected via EMR review by authors at a postgraduate year (PGY) 2-4 level of training, and any discrepancies were confirmed by a hand fellowship–trained senior author. Demographic characteristics included age, sex, race, ethnicity, smoking status, and comorbid disease. Clinical characteristics included mechanism of injury, side of injury, whether the injury was isolated, whether the patient received antibiotics and underwent a bedside I&D upon initial presentation, date and time of injury, date and time of surgery, whether the surgery was performed as an inpatient or outpatient, type of fixation used, and date of most recent orthopedic follow-up. Bedside I&D was defined as the manual removal of gross contamination without the use of instruments and thorough irrigation using sterile saline at any site outside of the operating room at the time of initial presentation. Radiographic characteristics included a description of the fracture after review by authors. Fractures were determined as Gustilo-Anderson open injuries by the operating surgeon's operative note and initial consultation documentation.

The primary outcome measure was infection rate. A superficial infection was defined as any infection requiring oral antibiotics. A deep infection was defined as any infection requiring intravenous antibiotics and/or surgical debridement. Secondary outcome measures included rate of nonunion, delayed union, tendon rupture, symptomatic hardware, median neuropathy, reoperation related to open distal radius fracture, and readmission related to open distal radius fracture. Nonunion was defined as a lack of cortical continuity on 3 of 4 cortices by 6 months postoperatively. Delayed union was defined as a lack of cortical continuity on 3 of 4 cortices by 3 months postoperatively. Nonunion and delayed union were determined by review of the treating surgeon's clinical notes, by radiographic review by authors at a PGY2-4 level of training, and confirmed by a hand fellowship–trained senior author. The time of injury was defined as the time of the first documentation at initial presentation for injury. The time of surgery was defined as the time of procedure as documented in the operative note. Patients were then stratified into groups based on time to surgical intervention: ≤24 hours post-injury and >24 hours post-injury. An additional subgroup analysis was performed on patients with an isolated type I open distal radius fracture and whether they were treated as an inpatient or outpatient. Patients treated as an inpatient were admitted immediately after presentation. These patients received intravenous antibiotics initially and through the time of surgery. Patients treated as an outpatient were discharged after initial presentation, and their procedure was performed at a later date. These patients received 1 dose of intravenous antibiotics initially and then were given a 5- to 10-day course of oral antibiotics.

A comparative analysis was performed for all groups. Descriptive statistics were used for overall cohort analysis. Comparative statistical analyses were performed using mean values and standard deviations for continuous variables and frequencies and percentages for categorical

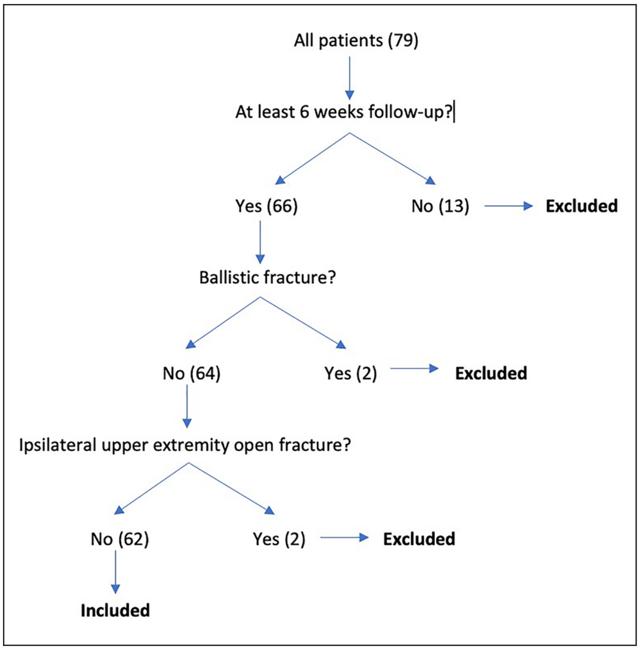

Figure 1. Patient selection. Illustration of the number of patients included and excluded from the initial patient population. Patients with <6 weeks of follow-up, ballistic fractures, and ipsilateral upper extremity open fractures were excluded.

variables. Cohorts of patients stratified by time to surgery and inpatient versus outpatient treatment were compared using the Student *t* test for continuous variables and Fisher exact tests for categorical variables. All comparative analyses were 2-tailed and used an α of 0.05 to determine statistically significant findings. A post hoc power analysis was performed assuming a power of 0.8 and a medium effect size of 0.5.

Results

A total of 190 patients were identified, and 111 were excluded with either type II or III open fractures or a lack of description of the open fracture grade in the operative or consultation notes. Seventy-nine patients who underwent I&D with fixation of a type I open distal radius fracture remained. Thirteen patients with a lack of documented follow-up of at least 6 weeks, 2 patients with ballistic fractures, and 2 patients with concomitant ipsilateral upper extremity open fractures were excluded. Sixty-two patients met inclusion criteria and were subsequently included in this analysis (Figure 1). Thirty-eight patients underwent surgery ≤24 hours post-injury at an average of 14 hours (range, 3-23 hours). Twenty-four patients underwent surgery >24 hours post-injury at an average of 72 hours (range, 25-242 hours).

The mean age was 59 years (range, 19-87), and 66% were women. The median follow-up time was 14 weeks (range, 6-154 weeks). Medical comorbidities were similar between groups. Isolated injuries comprised 44%, and 18% had an ipsilateral upper extremity closed fracture that was not different between groups ($P > .05$). No patient with an ipsilateral upper extremity closed fracture developed an infection (Table 1).

Thirteen patients (21%) underwent outpatient surgery versus 49 patients (79%) who were admitted for inpatient surgery. Twelve patients (50%) in the group treated >24 hours post-injury underwent outpatient surgery versus 1 patient (3%) in the ≤24-hour group. There were 90% of patients with a documented bedside I&D, and 100% were administered antibiotic treatment immediately upon presentation (Table 1). All patients treated as an outpatient had a bedside I&D and received an average of 6 days of oral antibiotics (range, 5-10 days). There was no difference in infection rate between types of antibiotics given ($P > .05$). Intravenous antibiotics included cefazolin (77%), ceftriaxone (15%), or clindamycin (8%), whereas oral antibiotics included cefalexin (62%), trimethoprim-sulfamethoxazole (23%), clindamycin (8%), or doxycycline (8%). No differences were found in any outcome measures regarding fixation method ($P > .05$).

Of the 38 patients treated ≤24 hours post-injury, there were 6 complications in 5 patients (15.8%). One patient developed a deep infection, for an infection rate of 2.6%. This was confirmed with culture-positive *Enterococcus, Enterobacter*, and *Aeromonas.* This patient later sustained an extensor pollicis longus (EPL) rupture. There were 6 reoperations with a reoperation rate of 15.8%. The one patient with deep infection required I&D, and later required an extensor indicis proprius (EIP) to EPL tendon transfer. The one patient with deep infection required readmission for intravenous antibiotics, yielding a 2.6% readmission rate (Table 2). Of the 24 patients treated >24 hours post-injury, there were 3 complications (12.5%). There were no infections in this group. One patient underwent a planned removal of hardware (ROH) for a dorsal spanning plate, yielding a reoperation rate of 4.2% (Table 2). No differences were found between groups in any outcome measure ($P > .05$) (Table 2). A post hoc power analysis of the complication rates showed that the current study is underpowered, and 283 patients would be required in each group to significantly establish equivalence. Table 3 describes all complications and their management.

Of the 27 patients with an isolated fracture, 16 were treated as an inpatient. Fourteen (88%) of these patients were admitted solely for their open fracture, whereas only 2 (12%) were admitted for observation due to traumatic mechanism. There was no difference between isolated fractures treated as an inpatient or as an outpatient in their

Table 1. Demographic and Clinical Characteristics of Patients Grouped by Time to Surgical Debridement and Fixation.

Demographic	Overall (n = 62)	≤24 h (n = 38)	>24 h (n = 24)	P value
Age, mean (range)	59 (19-87)	58 (19-87)	61 (27-85)	.49
Sex, No. (%)				
Male	23 (37)	13 (34)	10 (42)	.6
Female	39 (63)	25 (66)	14 (58)	.6
Ethnicity, No. (%)				
Caucasian	57 (92)	35 (92)	22 (92)	1
African American	2 (3)	1 (3)	1 (4)	1
Hispanic	3 (5)	2 (5)	1 (4)	1
History of smoking, No. (%)	25 (40)	17 (45)	8 (33)	.43
Comorbidities, No. (%)				
HTN	33 (53)	23 (61)	10 (42)	.19
DM	13 (21)	6 (16)	7 (29)	.34
CVD	7 (11)	2 (5)	5 (21)	.1
CHF	3 (5)	2 (5)	1 (4)	1
CKD	1 (2)	1 (3)	0	1
COPD	7 (11)	6 (16)	1 (4)	.23
RA	1 (2)	1 (3)	0	1
Hepatitis C	3 (5)	2 (5)	1 (4)	1
None	22 (35)	11 (29)	11 (46)	.28
Mechanism of injury, No. (%)				
MVC	13 (21)	10 (26)	3 (13)	.22
MCC	6 (10)	2 (5)	4 (17)	.19
FFS	27 (44)	19 (50)	8 (33)	.29
FFH	16 (26)	7 (18)	9 (38)	.14
Isolated injury, No. (%)	27 (44)	15 (39)	12 (50)	.44
Ipsilateral closed fracture, No. (%)	11 (18)	7 (18)	4 (17)	1
Side of injury, No. (%)				
Right	25 (40)	18 (47)	7 (29)	.19
Left	37 (60)	20 (53)	17 (71)	.19
Fracture pattern, No. (%)				
Extra-articular	20 (32)	16 (42)	4 (17)	.05
Intra-articular	42 (68)	22 (58)	20 (83)	.05
Simple	4 (6)	3 (8)	1 (4)	.65
Comminuted	58 (94)	35 (92)	23 (96)	.65
Bedside irrigation, No. (%)	56 (90)	34 (89)	22 (92)	1
Antibiotics on initial evaluation	62 (100)	38 (100)	24 (100)	1
Outpatient surgery, No. (%)	13 (21)	1 (3)	12 (50)	.00001
Inpatient surgery, No. (%)	49 (79)	37 (97)	12 (50)	.00001
Fixation type, No. (%)				
Volar locking plate	56 (90)	35 (92)	21 (88)	.67
Dorsal locking plate	2 (3)	1 (3)	1 (4)	1
Dorsal spanning plate	2 (3)	1 (3)	1 (4)	1
External fixation	2 (3)	1 (3)	1 (4)	1
Follow-up, wk, median (range)	14 (6-154)	14 (6-152)	14.5 (6-154)	.75

Note. HTN = hypertension; DM = diabetes mellitus; CVD = cardiovascular disease; CHF = congestive heart failure; CKD = chronic kidney disease; COPD = chronic obstructive pulmonary disease; RA = rheumatoid arthritis; MVC = motor vehicle collision; MCC = motorcycle collision; FFS = fall from standing; FFH = fall from height.

demographic characteristics, with the exception of the outpatient group being more likely to have diabetes (P = .02). No difference was found between these groups in any outcome measure ($P > .05$). One infection occurred in the group with isolated fractures treated as an inpatient, and none occurred in the outpatient group (P = 1.0) (Table 4).

Table 2. Primary and Secondary Outcomes of Patients Grouped by Time to Surgical Debridement and Fixation.

Outcome	Overall (*n* = 62)	≤24 h (*n* = 38)	>24 h (*n* = 24)	*P* value
Complication, No. (%)	9 (14.5)	6 (15.8)	3 (12.5)	1
Infection, No. (%)	1 (1.6)	1 (2.6)	0	1
Superficial (n)	0	0	0	
Deep (n)	1	1	0	
Nonunion, No. (%)	2 (3.2)	2 (5.3)	0	.52
Delayed union, No. (%)	2 (3.2)	0	2 (8.3)	.15
Symptomatic hardware, No. (%)	1 (1.6)	1 (2.6)	0	1
EPL rupture, No. (%)	2 (3.2)	2 (5.3)	0	.52
Median neuropathy, No. (%)	1 (1.6)	0	1 (4.2	.39
Reoperation, No. (%)	7 (11.3)	6 (15.8)	1 (4.2)	.23
I&D, No. (%)	1 (1.6)	1 (2.6)	0	1
ROH, No. (%)	1 (1.6)	1 (2.6)	0	1
Planned ROH, No. (%)	1 (1.6)	0	1 (4.2)	.39
Revision ORIF, No. (%)	2 (3.2)	2 (5.3)	0	.52
EIP to EPL transfer, No. (%)	2 (3.2)	2 (5.3)	0	.52
Readmission, No. (%)	1 (1.6)	1 (2.6)	0	1

Note. EPL = extensor pollicis longus; I&D = irrigation and debridement; ROH = removal of hardware; ORIF = open reduction and internal fixation; EIP = extensor indicis proprius.

Table 3. Description of Complications in All Patients.

Age, sex	Time to surgery	Complication	Treatment	Inpatient or outpatient surgery	Fixation type	Ipsilateral injury
69, F	≤24 hours (8)	Nonunion	Revision ORIF	Inpatient	Dorsal spanning plate	Scaphoid fracture
46, F	≤24 h (9)	Symptomatic hardware	ROH	Inpatient	Volar locking plate	None
52, F	≤24 h (12)	Osteomyelitis	I&D	Inpatient	Volar locking plate	None
		EPL rupture	EIP to EPL transfer/ROH			
63, F	≤24 h (14)	Nonunion	Revision ORIF	Inpatient	Volar locking plate	None
48, M	≤24 h (23)	EPL rupture	EIP to EPL transfer	Inpatient	Volar locking plate	Radial shaft fracture
80, F	>24 h (49)	Median neuropathy	Steroid injection	Outpatient	Volar locking plate	None
59, M	>24 h (51)	Delayed union	Observation	Inpatient	Volar locking plate	None
57, M	>24 h (95)	Delayed union	Observation	Outpatient	Volar locking plate	None

Note. ORIF = open reduction and internal fixation; ROH = removal of hardware; I&D = irrigation and debridement; EPL = extensor pollicis longus; EIP = extensor indicis proprius.

Discussion

To our knowledge, this is the largest study to date of 62 patients comparing the infection and complication rate in type I open distal radius fractures treated surgically ≤24 hours and >24 hours post-injury. Our findings could not detect a difference in the risk of infection, complication, or readmission when these injuries are treated beyond 24 hours post-injury. The rate of infection seen in this study of type I open distal radius fractures is comparable to historical rates of surgically treated closed fractures, which ranges from 0.8% to 2.8%.[15-17] The one patient who developed a deep infection requiring I&D who underwent surgery ≤24 hours post-injury potentially developed this complication due to water-borne contamination. The patient was a 52-year-old woman with a history of smoking who sustained a fall from standing onto a wet floor, resulting in a type I open injury without gross contamination on presentation. Given that she developed a polymicrobial infection with both hydrophilic and gram-negative organisms, we can postulate that her fracture came into contact with contaminated water. Although she received immediate intravenous cefazolin, a more broad-spectrum antibiotic regimen may have been considered at that time.

Findings of this study parallel those of existing literature on these fractures. Henry et al retrospectively compared 24 type I open distal radius fractures treated with open reduction and internal fixation (ORIF). Seventeen patients underwent fixation within 24 hours, and 7 patients were treated as an outpatient at an average of 7 days post-injury. They

Table 4. Demographic Data and Outcome Measures of Patients With Isolated Type I Open Distal Radius Fractures Treated Either as an Inpatient or as an Outpatient.

Demographic/outcome	Overall (*n* = 27)	Isolated inpatient (*n* = 16)	Isolated outpatient (*n* = 11)	*P* value
Age, mean (range)	63 (27-87)	66 (87-43)	60 (27;80)	.36
Sex, No. (%)				
Male	8 (30)	4 (25)	4 (36)	.68
Female	19 (70)	12 (75)	7 (64)	.68
Ethnicity, No. (%)				
Caucasian	23 (85)	14 (88)	9 (82)	1
African American	2 (7)	1 (6)	1 (9)	1
Hispanic	2 (7)	1 (6)	1 (9)	1
History of smoking	11 (41)	6 (38)	5 (45)	.71
Comorbidities, No. (%)				
HTN	14 (52)	8 (50)	6 (55)	1
DM	4 (15)	0	4 (36)	.02*
CVD	4 (15)	3 (17)	1 (9)	.62
CHF	1 (4)	1 (6)	0	1
COPD	4 (15)	3 (17)	1 (9)	.62
RA	1 (4)	1 (6)	0	1
Hepatitis C	1 (4)	0	1 (9)	.41
None	8 (30)	4 (25)	4 (36)	.68
Mechanism of injury, No. (%)				
MVC	2 (7)	1 (6)	1 (9)	1
FFS	17 (63)	12 (75)	5 (45)	.22
FFH	8 (30)	3 (17)	5 (45)	.21
Complication, No. (%)	6 (22.2)	4 (25)	2 (18.2)	1
Infection, No. (%)	1 (3.7)	1 (6.3)	0	1
Superficial (n)	0	0	0	
Deep (n)	1	1	0	
Nonunion, No. (%)	1 (3.7)	1 (6.3)	0	1
Delayed union, No. (%)	1 (3.7)	0	1 (9.1)	.41
Symptomatic hardware, No. (%)	1 (3.7)	1 (6.3)	0	1
EPL rupture, No. (%)	1 (3.7)	1 (6.3)	0	1
Median neuropathy, No. (%)	1 (3.7)	0	1 (9.1)	.41
Reoperation, No. (%)	5 (18.5)	4 (25)	1 (9.1)	.37
I&D, No. (%)	1 (3.7)	1 (6.3)	0	1
ROH, No. (%)	1 (3.7)	1 (6.3)	0	1
Planned ROH, No. (%)	1 (3.7)	0	1 (9.1)	.41
Revision ORIF, No. (%)	1 (3.7)	1 (6.3)	0	1
EIP to EPL transfer, No. (%)	1 (3.7)	1 (6.3)	0	1
Readmission, No. (%)	1 (3.7)	1 (6.3)	0	1

Note. HTN = hypertension; DM = diabetes mellitus; CVD = cardiovascular disease; CHF = congestive heart failure; COPD = chronic obstructive pulmonary disease; RA = rheumatoid arthritis; MVC = motor vehicle collision; FFS = fall from standing; FFH = fall from height; EPL = extensor pollicis longus; I&D = irrigation and debridement; ROH = removal of hardware; ORIF = open reduction and internal fixation; EIP = extensor indicis proprius.

found no difference in the rate of infection, complication, reoperation, or functional outcome between delayed and urgent fixation groups. They agreed that complications in type I open distal radius fractures are comparable to closed fractures, and that these patients may be treated as an outpatient with semi-elective ORIF.[18] The current study drew similar conclusions; however, we analyzed a larger patient population of 62 patients. A study by Kurylo et al examined the effect of immediate versus delayed surgery on infection rate and secondary procedures in 32 open distal radius fractures (59% type 1, 34% type II) treated with external fixation or ORIF. All patients were treated as an inpatient, with 10 undergoing surgery <6 hours from admission and 22 undergoing surgery at an average of 20 hours. They found no difference in infection or reoperation rate between immediate and delayed fixation groups, nor between fixation methods.[12] Our study also included all fixation methods and found no difference in infection or reoperation rate when comparing time to surgery; however, our primary focus was on patients treated beyond 24 hours post-injury.

This study also suggests there is no increased risk of infection or complication when isolated type I open distal radius fractures are treated as an outpatient, as there were no infections in this group with a similar rate of complication to the inpatient group. Of the 16 patients with an isolated open distal radius fracture treated as an inpatient, 14 were admitted solely for their open fracture, whereas only 2 were admitted due to traumatic mechanism. These 2 groups did not differ in their demographics. While polytrauma with multiple injuries, medical comorbidities, socioeconomic factors, operating room availability, or simply convenience may necessitate admission, isolated type I open distal radius fractures appear to be amenable to outpatient surgery. At our institution, the only absolute indication for admission of these injuries is the development of acute carpal tunnel syndrome. We argue that many patients with isolated type I open distal radius fractures are being admitted for inpatient treatment unnecessarily when outpatient treatment may yield equivalent outcomes.

This study is not without limitation. Our sample size was relatively small consisting of 62 patients. This was partially due to the rarity of this injury, as well as the limited number of patients treated >24 hours post-injury (24 patients). The historical standard of care has been early debridement within 24 hours for these injuries,[7-11] and delayed outpatient treatment is not widely accepted. Also, patients were identified through EMR billing records, and there is a possibility that some type I open fractures may have been missed if the surgeon did not conduct or code for a debridement. The post hoc power analysis of complications found that 283 patients would be required in each arm to significantly establish equivalence between groups based on time to surgery; thus, our study is underpowered to make definitive recommendations on clinical care. In addition, due to limitations of retrospective chart review, it was not possible to obtain the exact time of injury. We defined time of injury as the time of first documentation at initial presentation for the open fracture, which likely underestimated the true time to surgery. However, EMR review did not show a delay in presentation for any patient. Another limitation was our minimum follow-up of 6 weeks for included patients. It is our protocol to have patients follow up on an as-needed basis after the 6-week visit if their distal radius fracture is healed and they have no issues. While we assume that if a patient develops a complication they will return for evaluation, some patients may not follow up at our institution; thus, our true complication rate may be underestimated. Six did not have documentation of an initial bedside irrigation of their wound. Although it is our protocol to do this for every open fracture wound, our retrospective chart review was limited by documentation of these data. Despite this, all patients who developed complications had a documented bedside irrigation, and this did not influence our complication rate. In addition, the classification of an open fracture was determined by intraoperative documentation, yet we recognize the difficulty in diagnosing type I open fractures. It is possible that an injury was treated as type I open when a wound was a laceration that did not directly communicate with the fracture. The type and duration of antibiotics administered in our study were variable. It is our institutional protocol to immediately initiate intravenous antibiotics upon presentation and either continue through the time of surgery for inpatients or transition to 5-10 days of oral antibiotics for outpatients. The type and duration of antibiotics were determined by the emergency department provider or operating surgeon, thus creating variability. Finally, this was a retrospective review, and there is inherent bias in this design. A larger prospective study is needed to investigate these injuries and provide further recommendations before a new standard of care can be adopted.

Conclusion

In conclusion, this study found no differences in the rate of infection, complication, or readmission when type I open distal radius fractures were treated ≤24 hours or >24 hours post-injury ($P > .05$). Time to surgery for type I open distal radius fractures did not affect the infection, complication, or readmission rate. Outpatient treatment for isolated fractures did not negatively affect outcomes, and inpatient admission for these injuries could be avoided. We suggest that type I open distal radius fractures could be safely treated surgically >24 hours post-injury without an increased risk of infection. However, our study is underpowered to establish equivalence or make clinical recommendations, and a larger prospective study is needed to investigate these injuries and provide further recommendations before a new standard of care can be adopted.

Acknowledgments

We acknowledge Kyle Jeray, MD, and Becky Snider, BS, for their assistance in the preparation of this manuscript.

Ethical Approval

This study was approved by our institutional review board.

Statement of Human and Animal Rights

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008.

Statement of Informed Consent

Written approval was obtained from the Prisma Health Upstate Institutional Review Board for this study prior to review and did not require written informed consent from each patient. All patient-identifying details were omitted in the current retrospective study with complete anonymity; thus, no individual patient informed consent was obtained.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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