Complications of Open Reduction and Internal Fixation of Ankle Fractures in Patients With Positive Urine Drug Screen

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Abstract

We conducted a study to identify complications associated with open treatment of ankle fractures in patients who tested positive for illicit drugs on urine drug screen (UDS). We hypothesized that patients who had a history of positive UDS and underwent open reduction and internal fixation of an ankle fracture would have a higher incidence of major and minor complications.

We retrospectively reviewed the cases of 142 patients who had surgical stabilization of an ankle fracture during a 3-year period. Patients with a history of positive UDS were compared with matched controls with negative UDS. Outcomes measures included nonunion, malunion, and superficial or deep infection. Fisher exact test, Wilcoxon rank sum test, and univariate logistic regression were used to determine statistical significance.

There were no significant differences in age, sex, fracture type, incidence of diabetes, or incidence of open fracture between the groups. Incidence of nonunion was higher in patients with positive UDS ($P = .01$), as was incidence of deep infection ($P = .05$). Incidence of pooled major complications was also higher in positive UDS patients ($P = .03$).

Patients with a history of illicit drug use, as evidenced by positive UDS, are at increased risk for perioperative complications during treatment for ankle fracture.

Open treatment of ankle fractures is one of the most common procedures performed by orthopedic surgeons.[1] Among the younger patient population, ankle fractures represent a significant proportion of orthopedic injuries.[2] The reported incidence of illicit drug and alcohol use in the urban trauma population ranges from 36% to 86%,[2] and medical and anesthetic complications associated with illicit drug use have been well documented in surgical patients.[2] However, patients with a recent history of drug abuse may be subject to a separate but related set of complications of open treatment of ankle fractures.

The perioperative complications associated with open treatment of ankle fractures in patients with diabetes mellitus have been well described.[3-6] Similarly, previous studies have suggested that peripheral vascular disease, complicated diabetes, and smoking are risk factors for poor outcomes in patients who require open reduction and internal fixation (ORIF) in lower extremity trauma.[7-9] However, there are few data on the complications specifically associated with illicit drug use and orthopedic surgery. Properly identifying these high-risk groups and being cognizant of commonly associated complications are likely important in ensuring proper perioperative care and may alter follow-up protocols in these patients.

We conducted a study to identify the complications associated with open treatment of ankle fractures in patients who tested positive for illicit drugs on urine drug screen (UDS). We hypothesized that patients who had a history of positive UDS and underwent ORIF of an ankle fracture would have a higher incidence of major and minor complications.

Materials and Methods

After obtaining institutional review board approval, we retrospectively reviewed the cases of 142 patients who underwent open treatment of an ankle fracture between 2006 and 2010. Data sources included patient demographic information, radiographs, preoperative UDS, attending surgeons' clinical office notes, and clinical laboratory data. Our institution's standard protocol for ankle fractures was followed for all patients in the study. All patients were evaluated by an orthopedic physician, in either the emergency department or the office, during application of a well-padded Jones splint before surgery. Oral narcotic pain medication was routinely prescribed. All patients were seen, within 10 days of injury, for surgery planning. A board-certified orthopedic surgeon surgically stabilized the ankle fractures. The postoperative treatment regimen, per protocol, included non-weight-bearing in a padded Jones splint dressing; oral narcotic pain medication; physical therapy; and routine scheduled follow-up. In open fracture cases, patients were taken urgently to the operating room for irrigation and débridement with stabilization. Which treatment would be initially used—external fixation or ORIF—was determined on a case-by-case basis.

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The sample consisted of adults (age, >18 years) who had undergone definitive ORIF of a lateral malleolar, bimalleolar, or trimalleolar ankle fracture during the study period. Polytrauma patients, patients with external fixation as definitive treatment, and patients with nonoperative treatment were excluded. Before surgical management, all patients were tested for recent illicit drug use by UDS (standard protocol at our institution). UDS, measured for cocaine, marijuana, PCP (phencyclidine), opiates, and barbiturates, was obtained in the office setting or emergency department or on day of surgery. The patients were divided into 2 groups, positive and negative UDS. Patients with documented receipt of narcotic pain medication before UDS were excluded.

Table 1. Number of Ankle Fractures by Injury Pattern

	Ankle Fractures	
Injury Pattern	n	Positive UDS, n
Lateral malleolus	16	5
Bimalleolar	99	18
Trimalleolar	27	2

Abbreviation: UDS, urine drug screen.

Table 2. Demographics (N = 142 Patients)

	Negative UDS Group (n = 117)		Positive UDS Group (n = 25)		
Demographic	Absolute Value	%	Absolute Value	%	*P*
Age	41.49	—	45.2	—	.09
Sex					
Males	40	—	12	—	.08
Females	63	—	12	—	—
Open fracture	5	4.27%	4	16.00%	.25
Smoker	37	31.62%	13	52.00%	.003
Diabetes	10	8.50%	6	24.00%	.37
Days to surgery	13.9	—	9.6	—	.48

Abbreviation: UDS, urine drug screen.

The outcomes identified as dependent variables included nonunion, malunion, superficial or deep infection, amputation, delay in treatment, days to healing, repeat surgery, long-term bracing, and loss to follow-up. A nonunion was defined as lasting longer than 9 months and not showing radiographic signs of progression toward healing for 3 consecutive months. These complications were identified with use of attending surgeon clinical progress notes, laboratory values, radiographic parameters, and inpatient readmissions/surgeries associated with these outcomes. Nonunion, malunion, superficial or deep infection, and amputation were then grouped as major complications and analyzed as pooled major complications.

The Fisher exact test was used to analyze categorical variables with respect to UDS. The Wilcoxon rank sum test was used to determine statistical significance for continuous variables. Univariate logistic regression examined both continuous and categorical variables to evaluate predictors for a selected outcome. Statistical significance was set a priori at $P \leq .05$, with significant factors indicating an increase (or decrease) in the outcome variable being tested.

Results

We retrospectively reviewed the cases of 142 patients. **Table 1** lists the number of cases by fracture type. Bimalleolar fractures were most common, accounting for 99 (69.8%) of the 142 cases. Isolated lateral malleolar fractures accounted for 16 cases (11.2%), and trimalleolar fractures accounted for 27 cases (19%).

Twenty-five (18%) of the 142 patients tested positive for illicit drugs. Mean age was 45.2 years for positive UDS patients and 41.5 years for negative UDS patients. Open fracture cases represented 4.3% of negative UDS patients and 16% of positive UDS patients. Fifty-two percent of positive UDS patients and 32% of negative UDS patients were also tobacco users. These data were statistically significant ($P = .003$) There were no significant differences in age, sex, incidence of diabetes, incidence of open fracture, or time to surgery between the groups (**Table 2**).

Incidence of nonunion was higher in positive UDS patients (n = 5; $P = .01$), as was incidence of deep infection (n = 4; $P = .05$) (**Table 3**).

Mean time to radiographic healing was 50.7 days in negative UDS patients and 82.8 days in positive UDS patients ($P > .99$). Incidence of nonunion was 3.5% in negative UDS patients and 20% in positive UDS patients ($P = .01$). There were no malunions in negative UDS patients and 2 malunions in positive UDS patients. Incidence of deep infections was 2.5% in negative UDS patients and 16% in positive UDS patients ($P = .04$). No significant differences were found in incidence of malunions, superficial infections, amputations, need for repeat surgery, continued bracing, or loss to follow-up.

Major complications were defined as superficial or deep infections, amputations, malunions, and nonunions. The rate of major complication was significantly ($P = .03$) higher in positive UDS patients (24.24%) than in negative UDS patients (7.69%) (**Table 4**).

Discussion

In the present study, we retrospectively reviewed the cases of patients treated with ORIF for varying types of ankle fractures. Important major and minor complications were analyzed. The

overall incidence of major complications in negative UDS patients was only 7.69%, consistent with previously reported results in patients with ankle fractures.[6,10] However, a statistically significant ($P = .03$) increased incidence of major complications—an alarmingly high rate of almost 1 in 4—was found in positive UDS patients. Our results also demonstrated a significantly higher rate of nonunion and deep infection in positive UDS patients. Calculated odds ratios were 7.37 and 4.27 for nonunion and deep infection, respectively—arguably 2 of the most devastating postoperative complications in positive UDS patients.

Previous studies have found that open fractures, age, and medical comorbidities are significant predictors of short-term complications, such as wound healing, infection, persistent pain, and delayed union.[3-6] Levy and colleagues[11] examined the incidence of orthopedic trauma in positive UDS patients. These patients had orthopedic injuries that were more severe and required longer hospitalization. However, the study did not address patients with ankle fractures or the incidence of major complications. Diabetes and peripheral vascular disease are significant risk factors for many surgical procedures in orthopedic surgery.[3,7-9,12,13] Tight glycemic control and optimization of medical comorbidities decrease postoperative complications.[12,13] SooHoo and colleagues[6] found that history of diabetes and history of peripheral vascular disease were significant predictors of short-term complications of mortality, infection, reoperation, and amputation. The rate of infection in the complicated diabetes group was statistically higher as well. The effect of illicit drug use was not analyzed in that study. We think the findings of the present study highlight the importance of screening for high-risk populations (eg, patients with diabetes, patients with peripheral vascular disease, drug abusers) before orthopedic surgery, especially during definitive treatment of ankle fracture.

Recently, Nåsell and colleagues[10] found that a well-implemented smoking cessation program was associated with a statistically significant reduction in complications 6 and 12 weeks after surgery. The target treatment groups were patients who underwent major lower extremity and upper extremity orthopedic surgery. The most common surgery performed in the study was ORIF of ankle fractures. The authors concluded that a smoking cessation intervention program during the first 6 weeks after acute fracture surgery decreases the risk for postoperative complications. However, no recommendations were made for treating patients with other addictions, such as alcohol and illicit drug addictions.

To our knowledge, our study is the first to critically examine postoperative complications in ankle fracture patients with a history of illicit drug abuse as determined by preoperative positive UDS. These data suggest the importance of critically evaluating this patient population. The rates of deep infection, nonunion, and pooled major complications were all notable. Furthermore, compared with negative UDS patients, positive UDS patients were more than 7 times likely to develop a nonunion and more than 4 times likely to develop a deep infection. The reasons are likely multifactorial but may involve factors such as injury severity, poor nutrition, suboptimal living conditions, difficulty complying with weight-bearing restrictions, and, possibly, poor compliance with wound-care recommendations. Determining the influence of each factor was beyond the scope of this study. However, further investigation is warranted.

The difference in incidence of smoking between the 2 groups was statistically significant. As smoking has been well documented as contributing to poor wound and bone healing,[14-16] it is likely to have been a contributory factor. However, nicotine levels are not routinely part of UDS, and people who quit smoking typically take 7 to 10 days to demonstrate a measurable drop in cotinine levels. On the other hand, screening for drugs takes only a few minutes and can provide useful information during the preoperative period. It was suggested that positive UDS patients were significantly likely to be tobacco users as well.

The 2 groups were not significantly different with respect to mean follow-up time or loss to follow-up. Although mean

Table 3. Postoperative Complications

Variable	Negative UDS Group		Positive UDS Group			
	Absolute Value	%	Absolute Value	%	*P*	Odds Ratio
Days to healing	50.7	—	82.8	—	>.99	—
Nonunion	4	3.42%	5	20.00%	.01	7.37
Malunion	0	0.00%	2	8.33%	.08	—
Superficial infection	4	3.42%	1	4.17%	>.99	—
Deep infection	3	2.56%	4	16.00%	.05	4.27
Amputation	0	0.00%	1	4.17%	.17	—
Repeat surgery	8	6.84%	6	24.00%	.15	—
Bracing	3	2.56%	0	0.00%	.58	—
Loss to follow-up	27	23.08%	9	36.00%	.14	—

Abbreviation: UDS, urine drug screen.

Table 4. Pooled Major Complications

Pooled Major Complications	Absolute Value	%
Negative UDS group	9	7.69%
Positive UDS group	8	24.24%

Abbreviation: UDS, urine drug screen.
P = .0335.

follow-up was longer in negative UDS patients, the standard deviation was large in both groups. Given the positive UDS patients' higher incidence of deep infection and nonunion, both of which typically prolong the course of treatment, the results were likely deceptive. Patients with a history of illicit drug use have confounding variables (eg, psychiatric disorders, financial strife) that make treatment compliance and follow-up difficult.[17]

Some of the weaknesses of this study are inherent to its retrospective design and limited sample size. Furthermore, patient satisfaction scores and ankle-specific outcome measures, such as AOFAS (American Orthopaedic Foot and Ankle Society) scores, were not considered. Prospective collection of data that include patient satisfaction scores and ankle-specific outcome measures would be optimal. Our current recommendation is to obtain preoperative UDS and illicit drug use history for all trauma patients. In addition, operating surgeons should exercise caution when caring for patients who test positive for illicit drugs.

Conclusion

We evaluated the incidence of complications experienced by positive UDS patients undergoing surgical treatment of ankle fractures. It is well documented that illicit drug users who receive general anesthesia have complications. However, little is known about the untoward effects of illicit drugs on postoperative complications. Furthermore, the efficacy of drug cessation programs in minimizing these complications has not been fully explored.

In conclusion, similar to patients with diabetes, patients with a history of recent illicit drug use, as evidenced by preoperative positive UDS, are at increased risk for complications during treatment for ankle fracture. These data suggest that practicing orthopedists should be more vigilant when caring for ankle fracture patients with preoperative positive UDS.

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