The Journal of Foot & Ankle Surgery 56 (2017) 30–33

Contents lists available at ScienceDirect

The Journal of Foot & Ankle Surgery

journal homepage: www.jfas.org

Early Protected Weightbearing After Ankle Fractures in Patients With Diabetes Mellitus

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ARTICLE INFO

Level of Clinical Evidence: 4

Keywords:
ankle fracture
diabetes mellitus
early weightbearing

ABSTRACT

The traditional protocol for treatment after ankle fracture in the diabetic patient involves a period of prolonged non-weightbearing to reduce the incidence of complications. The goal of the present study was to identify the risk factors and complications associated with early protected weightbearing after closed ankle fractures in patients with diabetes. The data from 73 diabetic patients with operatively and nonoperatively treated ankle fractures were retrospectively reviewed. All patients were allowed to begin protected weightbearing in a cast or removable boot at 2 weeks after the index injury or surgery. The mean follow-up period was 51 (range of 26 to 480) weeks. Complications occurred in 25% of the operative cases and 8% of the nonoperative cases. In both categories, the complication rate was less than that from existing reports using prolonged non-weightbearing. Wound dehiscence was the most common complication in the operatively treated patients (18.8%). A statistically significant difference was found in the complications rates for the patients aged >60 years ($p = .0403$). No statistically significant differences were identified according to hemoglobin A1c, the presence of peripheral neuropathy, smoking status, fracture type, or the presence of end-stage renal disease. The results of the present study suggest that early protected weightbearing after closed ankle fractures in diabetic patients is fairly safe, with an acceptable complication rate. However, the patients selected for early weightbearing had low comorbidity profiles, which might have accounted, in part, for the low complication rate.

Although early protected weightbearing has been gaining acceptance in the management of ankle fractures, this trend has not been embraced for diabetic patients (1–4). A prolonged period of non-weightbearing is common practice after ankle fractures in this population owing to the greater risk of loss of reduction and wound complications and propensity for Charcot arthropathy (5–12). It has been estimated that there is nearly a threefold increase in the incidence of complications in diabetic patients with ankle fractures, irrespective of the weightbearing protocol used after injury (6,7). The likelihood of poor outcomes is further potentiated by independent risk factors such as obesity and renal disease (13).

However, prolonged periods of immobilization and non-weightbearing are detrimental to any patient, particularly those with poor baseline functional capacity from comorbidities (14). Early ambulation might facilitate their functional recovery and reduce the risk of cardiovascular complications (14,15).

Jones et al (8) made attempts at risk stratification of diabetic patients by dividing them into subpopulations according to the presence of identifiable diabetic comorbidities, including peripheral neuropathy, vasculopathy, and Charcot arthropathy (8). In their case-controlled series, no significantly different overall complication rate was found statistically between diabetic and nondiabetic patients without comorbidities. However, they did find a greater rate of complications in patients with certain comorbidities and suggested that the patients with diabetes represent a more diverse group than

Financial Disclosure: None reported.
Conflict of Interest: None reported.
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http://dx.doi.org/10.1053/j.jfas.2016.09.010

originally thought. However, their risk stratification did not include the postinjury weightbearing status.

Because of the undisputed notion of a greater complication rate for diabetic patients with comorbidities, it has been presumed that early weightbearing might actually potentiate an even greater incidence of complications in the diabetic population at large. To our knowledge, no studies have investigated the consequences of early weightbearing after ankle fractures in patients with diabetes. Data to help establish sensible rehabilitation protocols for these patients would be beneficial.

The goal of the present study was to determine the incidence of complications associated with early protected weightbearing in diabetic patients with operatively and nonoperatively treated ankle fractures. We also sought to determine the effect of comorbidities, fracture type, and fixation type on the incidence of complications. We hope that our study will offer insight into the feasibility of early weightbearing for diabetic patients with ankle fractures.

Patients and Methods

The study subjects were selected from the electronic database of Kaiser Permanente Northern California from January 1, 2000 to December 31, 2011. Patients with an ankle fracture (International Classification of Diseases, 9th revision, codes 824.2 to 824.9), and diabetes mellitus (International Classification of Diseases, 9th revision, codes 250.00 to 250.93) and aged 18 to 85 years were included. Patients with open fractures, a history of a previous episode of Charcot arthropathy in any joint, pilon fractures, and/or polytrauma injuries were excluded. Patients with a minimum follow-up duration of 26 weeks (6 months) were included in the present study. The institutional review board approved the present study.

Two authors (I.B. and R.A.P.) reviewed the medical records to find those patients who had been allowed to bear weight on the injured extremity within 2 weeks of the injury or surgical intervention. Other variables, including glycated hemoglobin A1c (HbA1c), palpable pulses, current tobacco use, peripheral neuropathy, end-stage renal disease, and congestive heart failure, were recorded if these diagnoses were on the active problem list at the time of injury. HbA1c was recorded as <7% or ≥7% using the value nearest to the date of injury.

The same 2 authors reviewed the radiographs and recorded the type of fracture (unimalleolar, bimalleolar, or trimalleolar), syndesmotic stability, and the type and location of internal fixation. Syndesmotic stability was determined from the injury radiographs and operative notes.

The decision for operative or nonoperative care was made at the discretion of the attending surgeon. In general, nonoperative care was prescribed for stable, isolated lateral malleolar fractures and for patients who refused surgery or were not suitable candidates for surgery. These patients were kept non-weightbearing for ≤14 (range 0 to 14) days and then allowed to begin weightbearing as tolerated in a nonremovable cast for additional 4 to 6 weeks until they were ready to transition into regular shoes.

Open reduction with internal fixation was performed for patients with unstable ankle fractures, including bimalleolar equivalent, bimalleolar, and trimalleolar injury patterns. A wide variety of internal fixatives were applied, including one-third tubular plates, 3.5-mm locking plates, tension band wiring, and screws. The patients were kept in a non-weightbearing posterior splint for ≤2 weeks until the first postoperative visit. A short leg walking cast or boot was applied for 4 to 6 additional weeks, followed by regular shoe gear.

Complications were identified, including postoperative infection, surgical wound dehiscence, loss of reduction, Charcot arthropathy, nonunion or delayed union, thromboembolic events (deep venous thrombosis/pulmonary embolism), the need for additional surgery, and death within 6 months of the index injury or surgery. Syndesmotic screw removals were not considered complications, unless they were associated with infection.

Fisher's exact test was used to compare the incidence of postoperative complications in patients with and without the select identifiable risk factors of smoking, HbA1c ≥7%, age ≥60 years, nonpalpable pulses, peripheral neuropathy, congestive heart failure, and end-stage renal disease. Additional statistical determinations were made for the various fracture patterns, fixation constructs, and syndesmotic stability. The level of significance was set at $p < .05$.

Results

A total of 73 patients met the inclusion criteria. Of the 73 patients, 26 were male (36%) and 47 were female (64%). The mean patient age at injury was 64 (range 27 to 85) years, with 47 patients (64%) aged ≥60 years. Twenty-six patients (36%) had an HbA1c level of ≥7%. Peripheral neuropathy was present in 38 patients (52%). Seven patients (9%) were smokers at the time of injury. The mean follow-up time was 51 (range 26 to 480) weeks from the date of injury or surgery. The distribution of these variables between the operatively treated and nonoperatively treated patients is listed in Table 1.

Table 1
Patient demographics

Demographic data	Operative ankle fractures (n = 48)	Nonoperative ankle fractures (n = 25)	Total (n = 73)
Gender			
Male	15 (31)	11 (44)	26 (36)
Female	33 (69)	14 (56)	47 (64)
Age (yr)			Mean 64
<60	16 (33)	10 (40)	26 (36)
≥60	32 (67)	15 (60)	47 (64)
Neuropathy	28 (58)	10 (40)	38 (52)
Current tobacco use	6 (13)	1 (4)	7 (9)
HbA1c			
<7%	32 (67)	15 (60)	47 (64)
≥7%	16 (33)	10 (40)	26 (36)
ESRD	1 (2)	2 (8)	3 (4)
Nonpalpable pulses	1 (2)	1 (4)	2 (2.7)
CHF	3 (6.3)	3 (12)	6 (8.2)

Abbreviations: CHF, congestive heart failure; ESRD, end-stage renal disease; Hb1Ac, glycated hemoglobin 1Ac.

The fracture characteristics of the 73 patients are given in Table 2. The operatively treated fractures consisted of 19 unimalleolar (40%), 18 bimalleolar (37%), and 11 trimalleolar (23%) ankle fractures. Syndesmotic instability was present in 24 (50%) of these injuries. The nonoperatively treated ankle fractures consisted of 22 unimalleolar (88%) and 3 bimalleolar (12%) fractures. No syndesmotic instability was noted in any of these fractures.

The complications that occurred in the entire cohort are listed in Table 3. Several of the surgically treated patients experienced >1 complication, with 22 complications observed in 12 operatively treated patients (25%). Nine patients (18.8%) had wound dehiscence, which was the most common postoperative complication. Postoperative infection occurred in 6 patients (12.5%), including 2 patients (4.2%) with deep infection requiring intravenous antibiotics. Five of these patients with a postoperative infection also developed wound dehiscence. Three patients (6.3%) have undergone 1 additional surgical procedure, which included hardware removal and skin grafting, revision open reduction internal fixation, and arthroscopic gutter debridement. Loss of reduction occurred in 2 patients (4.2%). One involved a stress fracture through the distal tibia necessitating revision open reduction internal fixation, and the other involved progressive ankle valgus deformity managed with bracing. One patient (2.1%) developed bilateral deep venous thromboses, and 1 patient (2.1%) had asymptomatic nonunion of the medial malleolus. None of the patients treated surgically developed Charcot arthropathy or died within 6 months of surgery.

Two complications (8%) occurred in the nonoperatively treated group, including loss of reduction in 1 patient (4%) and nonunion in 1 patient (4%). Both complications were asymptomatic and managed conservatively. None of the nonoperatively treated patients

Table 2
Fracture characteristics in operatively and nonoperatively treated ankle fractures

Variable	Operatively treated ankles (n = 48)	Nonoperatively treated ankles (n = 25)
Type of ankle fracture		
Unimalleolar	19 (40)	22 (88)
Bimalleolar	18 (37)	3 (12)
Trimalleolar	11 (23)	0 (0)
Syndesmosis instability	24 (50)	0 (0)

Data presented as n (%).