

Study of Functional Outcomes and Complications of Internal Fixation of Pott's Ankle Fractures in Diabetic Patients

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ABSTRACT

Background: Both diabetes mellitus (DM) and ankle fractures are becoming more common. Patients who have both diabetes and an ankle fracture have a higher risk of complications, some of which can be fatal.

Objective: The aim of the current study was to evaluate functional outcomes and complications of internal fixation of Pott's ankle fractures in diabetic patients.

Patients and methods: During this prospective study, 30 patients with ankle Pott's fractures were recruited from Orthopedic Out-patient Clinic in Zagazig University Hospital, from January 2022 to January 2023. Operative fixation was done through Open Reduction Internal Fixation (ORIF) by plate and screws or tension band according to AO principles of periarticular fracture fixation.

Results: The mean age of participants was 40.09 (SD 13.2) years and 60% were males. The high union rate occurs mainly at week 10 at higher percent (74%) in controlled diabetic patients, while union rate in uncontrolled diabetic patients was delayed till 6 months with higher complication rates.

Conclusion: Both open and closed therapy of ankle fractures are associated with greater complication rates in patients with DM. Patients with poorly controlled diabetes who have high HbA1C levels experience more complications than patients with well-controlled diabetes. The best method of treating unstable ankle fractures in diabetes patients under control is open reduction and internal fixation.

Keywords: Pott's fractures, Diabetes mellitus, Internal fixation, Prospective study, Zagazig University.

INTRODUCTION

Even though ankle fractures are a typical occurrence for orthopedic surgeons, they can be complicated in diabetic patients and have challenging treatment options while having an easy diagnosis and excellent results with either conservative or surgical therapy ⁽¹⁾.

Diabetics make up about 1 in 8 patients who have rotational ankle fractures need surgical treatment. Diabetes patients have been found to have between 26% to 47% more problems following ankle fracture surgery than non-diabetic patients in comparable control groups ⁽²⁾. After treating ankle fractures, a recent large-scale analysis found that diabetes mellitus had the highest risk of amputation. Diabetics are more likely to need additional procedures and have worse outcomes following surgery due to the increased risk of infection and other serious surgical consequences results in terms of the activity limitation score ⁽³⁾.

The aim of the current study was to assess the functional results and complications of internal fixation of Pott's ankle fractures in diabetic patients.

PATIENTS AND METHODS

During this prospective study, 30 patients with ankle Pott's fractures were recruited from Orthopedic Out-patient Clinic in Zagazig University Hospital, from January 2022 to January 2023. Operative fixation was done through Open Reduction Internal Fixation (ORIF)

by plate and screws or tension band according to AO principles of periarticular fracture fixation.

Inclusion criteria: Recent isolated Pott's fracture, adults patients (patients aged 20 years or older), diabetic patients, Bimalleolar or Trimalleolar Pott's fractures.

Exclusion criteria: Poly-trauma patient, patients that are older than 70 years old or younger than 20 Old Trauma, non-diabetic patients with Charcot arthoneuropathy, patients with peripheral vascular disease, pathological fractures.

Pre-operative: Anteroposterior, lateral, mortise were used, other optional views or CT scans were used if needed to evaluate ankle fractures. HbA1C and blood glucose levels were measured randomly and after fasting in the lab. In addition, blood count, liver and kidney function evaluations, HIV, HBV, and HCV screening were done before surgery.

Operative technique: All procedures were performed on supine patients while the patients were under spinal anesthetic (except patients with trimalleolar fractures surgery was done prone (on a regular table), pneumatic, and tourniquet used around the mid thigh without exsanguination in diabetic cases and tourniquet deflation before wound closure and start hemostasis.

1. In Open Reduction Internal Fixation (ORIF) straight lateral route to the distal fibula from the lateral malleolus (30 patients) was used and posterolateral

approach in the cases with trimalleolar fractures, lateral malleolus was fixed with one-third tubular plate (26 patients) anatomical distal fibular locked plate in 4 patients.

2. In ORIF of the medial malleolus, direct medial approach is used. Four mm cancellous lag screws were used to secure the medial malleolus 2 screws in 21 patients, with tension band in 7 patients, and antiglide plate in 2 patients.
3. A total of 6 patients had trimalleolar fracture; only 2 of them underwent ORIF of posterior malleolus with screws.

Post-operative follow-up:

All patients were immobilized with short-leg posterior slab, antibiotics and anticoagulants were prescribed to all patients and postoperative x-ray was done for all patients to assess the reduction and fixation, and the patients were discharged within 2-3 days postoperatively.

Follow Up and evaluation of the patients In the First follow up, all patients reviewed at 14 days for stitch removal, and changed the immobilization into short-leg cast for 6 to 8 weeks. In the second follow up, at 6 weeks after surgery, clinical & radiological examination was done. The beginning of weight bearing started when there were clinical and radiological evidences of union. Follow up was done with all patients at 3 and 6 months postoperatively clinically and radiologically. The scoring methodology used was the American Orthopedic Foot and Ankle Society to evaluate the results. To ensure that DM was under control during the follow-up period, laboratory tests such as fasting blood sugar and HBA1C were performed.

Ethical consideration:

This study was ethically approved by the Institutional Review Board [IRB] of the Faculty of Medicine, Zagazig University (ZU-IRB#9123). Written informed consent was obtained from all participants. This study was executed according to the code of ethics of the World Medical Association (Declaration of Helsinki) for studies on humans.

Statistical analysis

The collected data were introduced and statistically analyzed by utilizing the Statistical Package for Social Sciences (SPSS) version 20 for windows. Qualitative data were defined as numbers and percentages. Chi-Square test and Fisher’s exact test were used for comparison between categorical variables as appropriate. Quantitative data were tested for normality by Kolmogorov-Smirnov test. Normal distribution of variables was described as mean and standard deviation (SD), and independent sample t-test was used for comparison between groups. P value ≤0.05 was considered to be statistically significant.

RESULTS

In the current study, the mean age of participants was 40.09 (SD 13.2) years. **Table 1** showed that the majority of the patients were males, with M:F ratio of 3:2.

Table (1): Gender and mode of injury of the participants.

Variable	N	%
Sex		
Male	18	60
Female	12	40
Mode of injury		
Road traffic accident	9	30
Fall	7	23.3
Twist injury	14	46.6

Table 2 showed that the most common fracture type is supination-external rotation type.

Table (2): Fracture type (Lauge Hansen) of the 30 participants.

Lauge Hansen type	N	%
Supination-external rotation type	15	50
Supination-adduction	8	26.6
Pronation-abduction	4	13.3
Pronation external rotation	3	10

Table 3 showed that 50% of patients were excellent, 30% were good and 20% were fair.

Table (3): Functional results of the studied patients.

Functional score	No	%	Mean ± SD
Excellent	15	50%	97.5 ± 9
Good	9	30%	84.2 ± 6
Fair	6	20%	67.5 ± 5

Table 4 showed that only 9 patients suffered from complications. Superficial infection occurred in 3 (10%) of cases and deep infection in 1 (3%) case. Both types of infection were treated by debridement, antibiotics and improved totally. There were 4 cases (12%) with delayed union that than 16 weeks but the patient completely healed later on within the follow up period, and one patient (3%) suffered from arthritis we found that all of these complications occurred in the patients with poorly controlled HBA1C.

Table (4). Complications of the studied group patients.

Variable	No	%
Delayed union	4	12%
Superficial Infection	3	9%
Deep Infection	1	3%
Stiffness	0	0%
Charcot	0	0%
Arthritis	1	3%

CASE PRESENTATION

A Female patient 53 years old, diabetic type 2, after twisting injury she presented with bimalleolar fracture, type B denis-weber, supination-adduction injury, ORIF was done after 2 days no complication was reported, in the follow up AOFAS after 6 months was 84.



Figure (1): Preoperative Ap, lateral and x-ray.



Figure (2): Immediate post-operative x-ray.



Figure (3): 6 weeks postoperative mortise and lateral view

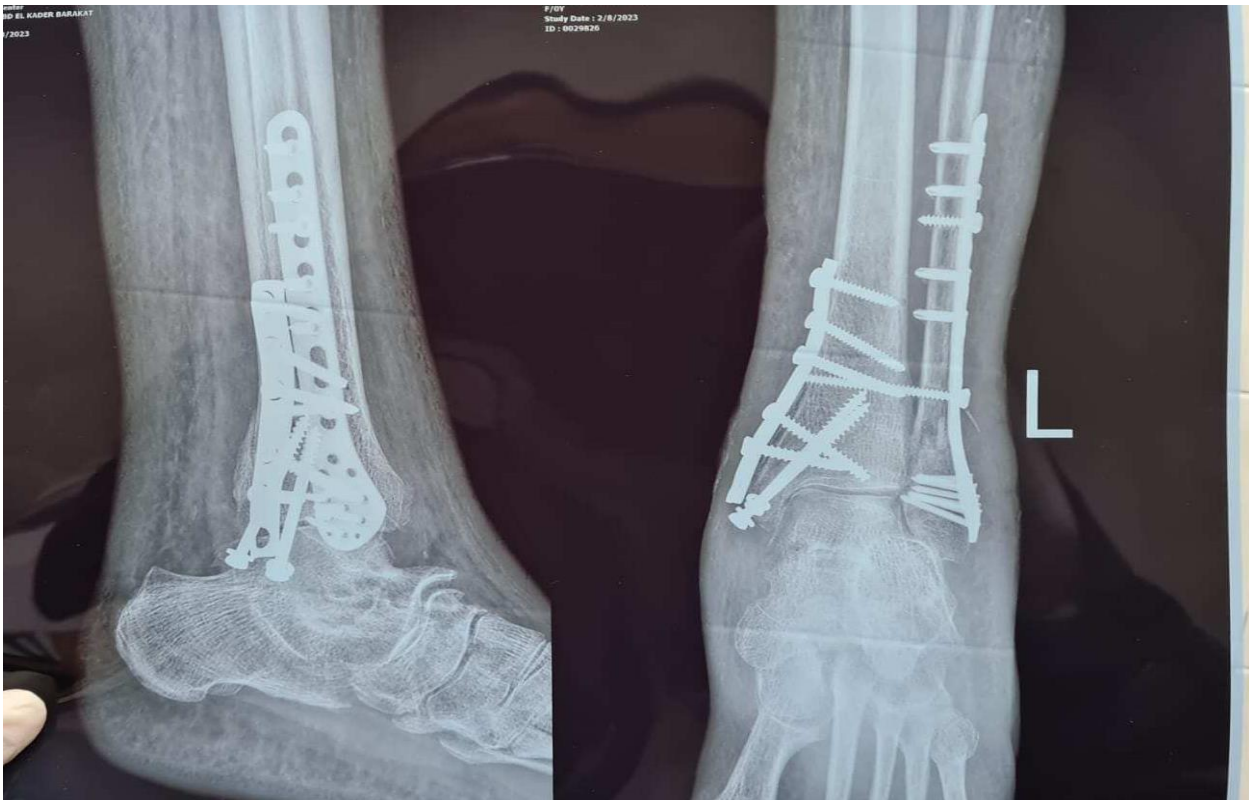


Figure (4): AP and lateral views after 3 months follow up.



Figure (5): AP and lateral views after 6 months follow up.



Figure (6): Follow up of participants after treatment.

DISCUSSION

In our study, 30 diabetic individuals with ankle bimalleolar fractures underwent surgical treatment at a tertiary referral hospital. The majority of the patients were between the ages of 41 and 60 years.

In the study by **Malhotr et al.** ⁽⁴⁾ 109 prospective and 33 retrospective Patients with ORIF and ankle fractures were included. Young, energetic individuals who sustain high energy trauma most frequently develop ankle fractures, and the mean age described in the literature ranges from 32.3 to 64 years.

Fractures were frequent among individuals between the ages of 21 and 30 in **Motwani et al.** ⁽⁵⁾ studies with a 39.28 year average age. The study's subjects were primarily male (82.5%) with a 5:1 male to female ratio.

Among our 30 patients twisting injuries were the most frequent type of trauma, followed by RTA, while falling from a height caused the least frequent type of trauma.

In **Motwani et al.** ⁽⁵⁾ study and in **Elsoe et al.** ⁽⁶⁾ study, car crashes accounted for the bulk of incidents.

The bulk of research in the literature found that roadside incidents, falls, and twisting injuries were the main causes of malleolar fractures. Sometimes they are associated with assaults, sports injuries, or industrial accidents ⁽⁶⁻⁹⁾. According to **Malhotr et al.** ⁽⁴⁾ the majority of patients (91.6%) suffered injuries from twisting injuries or falls from height, which were most likely caused by the area's steep environment and difficulty traveling there because patients frequently experience falls from height and slides on uneven surfaces.

Among our 30 cases the lauge Hansen classification showed that most of our patients were of supination-external rotation type, then patients with supination-adduction and the least common types were pronation-abduction, and pronation external rotation.

In concordance with our study, **Motwani et al.** ⁽⁵⁾ in their study on 68 patients, 42%, 34%, 17%, and 7% of the patients, respectively, had fractures with pronation abduction, pronation external rotation, supination adduction, and pronation.

Supination and external rotation injuries were the predominated form of injury. According to **Beris et al.** ⁽¹⁰⁾ and **Baird et al.** ⁽¹¹⁾ pronation-external rotation injuries made up the second-highest percentage of all reported injuries at 27.5%.

As regarding the functional outcomes, we found that the mean total score was excellent (87.3 ± 12.1). Most of the patients were with excellent outcomes patients with mean score of 97.5

In **Colton et al.** ⁽¹²⁾ study, 75% of the patients in group one and 50% in group two had favorable to outstanding outcomes.

In their study of 132 patients with good diabetes management, **Burnwell et al.** ⁽¹³⁾ discovered that 102

(77.3%) of them got good grades, 16% got average grades, and 6% got bad grades results. This explains why improved post-operative outcomes are associated with better diabetic control.

Ankle fractures were treated in 150 cases in the study by **de Souza et al.** ⁽¹⁴⁾ utilizing open reduction and internal fixing with the AO/ASIF method, yielding 90% successful outcomes.

Only 9 of the investigated participants experienced problems, which were distributed as follows: 3 (9%) cases of surface infection and 1 (3%) case of deep infection were both successfully treated with antibiotics. In 4 (12%) case with a delayed union lasting longer than 16 weeks, the patient later recovered fully throughout the follow-up period.

Ankle fractures were treated surgically in 13 poorly controlled diabetic patients and 46 well-controlled diabetes patients in **Bibbo et al.** ⁽¹⁵⁾ retrospective's research. Six superficial infections, 3 episodes of deep infection, 1 delayed union, and 1 case of Charcot neuroarthropathy were among the complications. Six (46%) of the 13 poorly controlled patients with DM experienced complications, as opposed to 8 (17%) of the 46 patients with well-controlled DM.

When **Flynn et al.** ⁽¹⁶⁾ looked back on the treatment of closed ankle fractures in 73 diabetic patients with well-controlled DM and 25 patients with uncontrolled DM; they discovered that the risk of infection was 4 times higher in the group of uncontrolled diabetics with uncontrolled DM (32%) than it was in the well-controlled diabetic group (8%).

In an examination of 44 surgically repaired ankle fractures in 21 individuals with poorly controlled DM and 46 patients with controlled DM, **Blotter et al.** ⁽¹⁷⁾. Those with poorly treated DM had a statistically greater complication rate (43%) than those with properly managed DM (15%).

DM with an acute, closed, rotational ankle fracture was present in 42 patients retrospectively evaluated by **Jones et al.** ⁽¹⁸⁾ 21 patients did not have comorbidities, while 21 individuals did. Individual patient characteristics—such as 42 non-diabetic control patients were included as comparison groups for age, sex, the type of fracture, and whether or not to use surgical treatment. Aside from the fact that DM patients needed long-term bracing, the problems between the diabetic control patients without comorbidities were not noticeably different. However, compared to the non-diabetic control individuals (14%), the diabetes patients with comorbidities experienced greater problems (47%).

CONCLUSION

Both open and closed therapy of ankle fractures are associated with greater complication rates in patients with DM. Patients with poorly controlled DM who have

high HBA1C levels experience more complications than patients with well-controlled DM. The best method of treating unstable ankle fractures in diabetes patients under control is open reduction and internal fixation. Patients who have poorly controlled DM and a high HBA1C level are more likely to experience osseous and soft tissue problems, such as delayed union and nonunion. To have a successful result, careful soft-tissue management and firm, stiff internal fixation are essential. Following surgical treatment for ankle fractures in patients with DM, it is advised that they remain immobile for an extended period of time before transitioning to protected weight-bearing.

RECOMMENDATIONS

Nonoperative therapy can successfully treat isolated stable, nondisplaced fractures of either the medial malleolus or the distal section of the fibula. Close follow-up with regular radiographic and clinical examinations is essential for a favorable outcome. The rate of complications for both surgical and nonsurgical treatment of unstable ankle fractures in diabetic patients is high, and surgical treatment is more likely to lead to a stable, functional lower extremity. Additionally, many unstable fractures that are initially treated with closed methods will eventually need surgical intervention (either ORIF or arthrodesis). In diabetic patients without comorbidities, ORIF Using common orthopedic fixing methods can produce outcomes that are equivalent to those of people without DM. In patients with neuropathy and an ankle fracture, there is a tendency to use supplemental fixation, such as multiple syndesmotic screws, transarticular fixation, or supplemental external fixation devices. External fixation may be used as an off-loading device in patients who do not adhere to weight-bearing restrictions, but the data in the literature regarding the effectiveness of these supplemental fixation techniques are insufficient to make a firm recommendation. Whatever course of action is chosen for a diabetic patient with an ankle fracture, it is generally agreed that a prolonged period of non-weight-bearing followed by protected weight-bearing is advisable.

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