Kamhieh et al., J Trauma Treat 2015, 4:3
DOI: 10.4172/2167-1222.1000261

Journal of Trauma & Treatment

Research Article Open Access

# Operative Fixation of Ankle Fractures: The Effect of Time to Surgery on Length of Stay and Soft Tissue Complication Rates

**Yasmine Kamhieh, Dimitra Leivadiotou*, Dimitrios Manoukian and William Williams**

*Broomfield Hospital, Chelmsford, Essex, UK*

## Abstract

**Introduction:** There is little evidence consensus on the optimum timing for surgical fixation of closed ankle fractures. This powered study compared rates of soft tissue complications in patients operated on within 24 hrs, at 24-48 hrs, or beyond 48 hours from injury.

**Materials and methods:** In this retrospective study, N=160 adults with closed ankle fractures were categorised by time to surgery (<24 hrs, 24-48 hrs, and >48 hrs), and post-operative complication rates were compared (power 0.85).

**Results:** Soft tissue complications were higher following surgery at 24-48 hrs (15%) vs. surgery after 48 hrs (3.6%), *P* 0.051. There was no other significant difference in any complication rates. The length of hospital stay post-operatively did not differ between groups.

**Conclusion:** Surgery within 24-48 hours from injury resulted in higher rates of minor soft tissue complications. Further research is necessary to confirm these findings, and to quantify soft tissue swelling and its effect on post-operative complications.

**Keywords:** Ankle fractures; Ssurgical fixation; Operative repair; Timing of surgery; Post-operative complications; Wound healing; Soft tissues; Length of admission

## Introduction

Ankle fractures are the second most common trauma presentation of the lower limb [1], with a yearly incidence of approximately 187 per 100,000 [2]. Predominantly affected are adults of working age, although there is an increasing incidence in elderly females [2]. As such, optimising the management of ankle fractures is of significant clinical importance to individual patients and to health services. One aspect in which there is little evidence-based consensus is the optimum timing for surgical fixation of closed ankle fractures. Traditional teaching at one time advocated surgery within 6-8 hours or else not for 4 days [3], to allow soft tissue oedema to resolve. Relevant literature contains wide-ranging definitions of 'early' surgery, from within 8 hours [4] to within 4 days [5]. As a result current practice varies widely. This is the first powered study of patients operated on within 24 hrs, at 24-48 hrs, or beyond 48 hours from time of injury, comparing post-operative rates of soft tissue complications as the primary outcome. A secondary outcome is the difference in length of inpatient stay post-operatively.

## Materials and Methods

This is a retrospective cohort study of all ankle fractures managed by ORIF in a district general hospital between January 2012 and March 2014. Exclusion criteria consisted of open fractures, fractures treated conservatively, patients younger than 18 years, and patients lost to follow-up before 6 weeks post-operatively. In total N=160 patients were included in the study, aged 18-89 years. Surgery was performed by different surgeons with standard peri-operative antibiotic prophylaxis and varying skin closure methods. Case notes and the local trauma database were reviewed to establish time to surgery, categorised as <24 hours (group 1, N=49), 24-48 hours (group 2, N=26), and >48 hours (group 3, N=85). Potential confounding factors were also assessed, including ASA score, presence of local pathology, diabetes mellitus, alcohol excess and smoking. Fracture classification was determined by senior surgeon review of patient radiographs, blinded to the patient grouping. The outcomes measured were the rate of soft-tissue complications, the rate of all complications, total length of inpatient stay, and the length of stay post-operatively. Post-operative complications were extracted from follow-up clinic letters at 2 weeks ('early' complications) and 6 weeks ('late' complications) after surgery. Complications were classified as fracture-related (fracture union, satisfactory alignment) and soft tissue–related (delayed healing, superficial infection, and deep infection). Superficial infections resolved with oral antibiotics therapy, while deep infections were defined as requiring parenteral antibiotics or revision surgery. Major complications were those necessitating re-admission for any cause, while minor complications were managed in the community. Statistical analysis was carried out using IBM SPSS version 17. The data was not normalized. A student t-test was used for parametric values, a Mann-U Whitney test for non-parametric values, and a Fisher's exact test for nominal data. The group sizes yielded a study power of 0.85 for the primary outcome of post-operative soft tissue complication rates.

## Results

The patient sub-groups were similar in age and gender. Group 1, surgery within 24 hours, had a median age of 45 years, group 2 (24-48 hours) had a median age of 56.5 years, and group 3 (>48 hours) had a median age of 47. These were not significantly different (P>0.5 for all comparisons). All groups had a slight female predominance

***Corresponding author:** Dimitra Leivadiotou, Broomfield Hospital, Chelmsford, Essex, UK, Tel: +44 1245 36200; E-mail: dimitral@hotmail.co.uk

**Received** August 04, 2015; **Accepted** September 19, 2015; **Published** September 27, 2015

**Citation:** Kamhieh Y, Leivadiotou D, Manoukian D, Williams W (2015) Operative Fixation of Ankle Fractures: The Effect of Time to Surgery on Length of Stay and Soft Tissue Complication Rates. J Trauma Treat 4: 261. doi:10.4172/2167-1222.1000261

(57% in group 1, 61% in group 2, and 51% in group 3 – $p$ >0.3 for all comparisons). Potential confounding factors were assessed (diabetes mellitus, smoking, relevant conditions such as osteoporosis or peripheral vascular disease) with no significant difference between groups (Table 1). Group 2 had a median ASA score of 2, compared to 1 in groups 1 and 3 ($p$ 0.035).

The first measured outcome was the rate of post-operative complications at 2 weeks and at 6 weeks. The overall complication rate in the whole cohort was 13%, and the rate of major complications (i.e. requiring further intervention) was 1.8% (3 patients). There was no significant difference between the total complication rate for each sub-group (see Supplementary information for full list). Soft tissue complications (7.5% in total) were categorised as delayed wound healing (wound healed within 3 months with community nurse dressings), superficial infection (resolved with oral antibiotics) and deep infection (requiring intravenous antibiotics and revision surgery). Complications at 2 weeks are shown in Table 2, and at 6 weeks in Table 3.

Soft tissue complication rates at 2 weeks did not differ significantly between group 1 and group 2 (6.12% vs. 15%, $p$ 0.23). However, the powered comparison between group 2 (15%) and group 3 (3.6%) approached significance ($p$ 0.05). Soft tissue complications at 6 weeks did not vary significantly between the groups ($p$ 1 for all comparisons).

| | Group 1 | Group 2 | p-value | Group 3 | p-value |
|---|---|---|---|---|---|
| Diabetes mellitus (1+2) | 8.2% | 3.8% | P 0.6 | 4.7% | P 1.0 |
| Smoking | 14% | 23% | P 0.4 | 24% | P 1.0 |
| Alcohol excess | 4.1% | 7.7% | P 0.6 | 5.9% | P 0.7 |
| Obesity | 10% | 3.8% | P 0.6 | 0 | P 0.2 |
| Osteoporosis | 2% | 3.8% | P 1.0 | 1.2% | P 0.4 |
| Steroids | 0 | 3.8% | P 0.3 | 1.2% | P 0.4 |
| Median ASA score | 1 | 2 | P 0.3 | 1 | P 0.03 |

**Table 1:** Demographic details of patients in each group; the median ASA score of 2, for patients in group 2, was significantly higher than that in Group 3 (P 0.03). The groups were otherwise well matched.

| | All soft tissue complications | Surgical site infection | Description of the complications |
|---|---|---|---|
| Group 1 (<24 hrs) | 6.1% (3 patients) | 2% (1 patient) | 1 delayed wound healing. 1 superficial infection. 1 small area necrosis lateral wound requiring eventual removal of screw (see Table 3). |
| Group 2 (24-48 hrs) | 15% (4 patients) | 0 | No major complications. All small areas of delayed healing, resolved with community wound care. |
| Group 3 (>48 hrs) | 3.6% (3 patients) | 0 | All small areas of delayed healing, resolved with community wound care. |

**Table 2:** Post-operative soft tissue complications in 2nd week; the rate of soft tissue complications in group 2 (24-48 hrs) was 15%, vs. 3.6% in group 3 (>48 hrs), approaching significance (*P=0.051)*. There was no other significant difference between the groups.

| | All soft tissue complications | Surgical site infection | Description of the complications |
|---|---|---|---|
| Group 1 (<24 hrs) | 4.1% (2 patients) | 2% (1 patient) | 1 delayed wound healing. 1 major complication: persistent 2 mm gape lateral wound requiring re-admission and removal of screw. |
| Group 2 (24-48 hrs) | 3.8% (1 patient) | 0 | 1 delayed wound healing. |
| Group 3 (>48 hrs) | 3.5% (3 patients) | 1.2% (1 patient) | 2 delayed wound healing. 1 major complication: wound infection requiring washout, removal of screws and parenteral antibiotics. |

**Table 3:** Post-operative soft tissue complications in 6th week; there was no significant difference in complication rates between the groups.

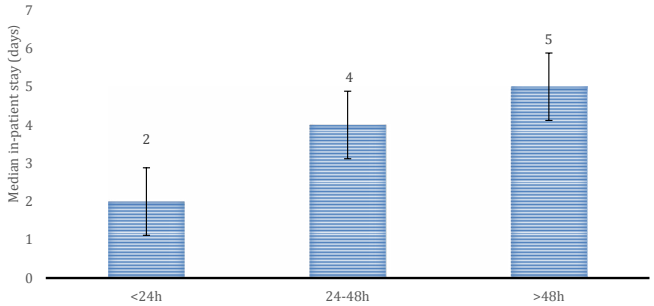


**Figure 1:** Median length of total hospital stay. The median stay for patients in group 1 (<24 hrs to surgery) was 2 days, vs. 4 days for group 2 (24-48hrs) (P 0.002), vs. 5 days for group 3 (P 0.015).

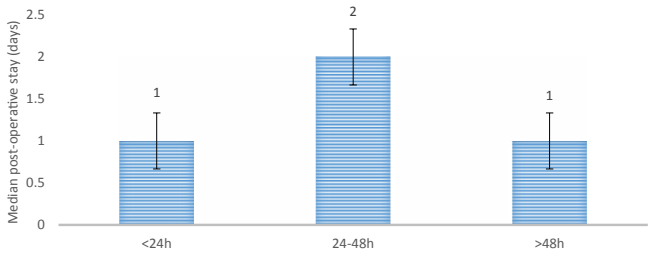


**Figure 2:** Median length of post-operative stay. There was no significant difference in length of post-operative stay between then group.

Combining the groups, there was no significant difference, at either 2 or 6 weeks, in soft tissue complications rates between patients operated on <24 hours vs. >24 hours, or <48 hours vs. >48 hours (see Supplementary information for full analysis). This study was not powered to detect a difference in rates of infection between the groups; the rates observed did not differ significantly between groups.

The second measured outcome was length of admission. Earlier surgery was associated with a significantly shorter total inpatient stay (Figure 1); group 1 (<24 hours) were inpatients for a median of 2 days, group 2 for a median of 4 days ($p$ 0.002), and group 3 for a median of 5 days ($p$ 0.015). Patients operated on within 48 hours were hospitalised for a median of 3 days, compared to 5 days for those operated on after 48 hours ($p$ <0.001).

However, the length of the post-operative stay alone did not differ between the groups (Figure 2). The median stay post-operatively for group 1 was 1 day versus 2 days for group 2 ($p$ 0.313), and 1 day for group 3 ($p$ 0.8).

## Discussion

The best time to operate on a closed ankle fracture is a subject of much debate; one concern is that operating before tissue swelling subsides would lead to more soft tissue complications post-operatively. Current practice in many units is to keep the limb elevated and review daily to decide if the swelling will allow surgery; this is, however, subjective and widely varied between surgeons. In the relevant literature, several studies tested the traditional maxim, and found surgery within 8 hours [4,6] had better outcomes than after 5 days. Schepers et al. [7] compared surgery within 24 hours vs. after, and within 1 week vs. after 1 week. They found complications increased as

surgery was delayed, and advocated early repair. Carragee et al. also found favourable outcomes for surgery within 24 hours [8]. However, it is unclear what the median time to surgery was for patients after 24 hours. In contrast, Miller et al. [9] took 5 days as a cut-off for early surgery and found no difference in complication rates, however their mean time to surgery was 9 days. Several other studies found timing made no difference to post-operative complications [5,10]. Our study was the first comparison of surgery within 24 hrs, within 48 hrs and beyond, with the premise that 48 hours is a more achievable target given resource pressures. Our study shows that patients operated on within 24 hours and after 48 hours did equally well with regards to soft tissue healing. For those operated on after 48 hours, the median time to surgery was 72 hours, which contradicts recommendations of delaying surgery for 4 days or more. In this study patients operated on within 24-48 hours had a higher rate of minor soft tissue complications; this is a new finding and will need further exploration. This study re-iterates [11,12] that earlier surgery results in a shorter in-patient stay for all patients. This is of great financial importance to health services who are charged with wise use of resources. However, this study was the first to look at post-operative inpatient stay in particular; this did not differ significantly with earlier time to surgery. The strengths of the study are that it had power to detect a difference in soft tissue complications. Groups were similar in age, gender, and known risk factors such as fracture severity, diabetes mellitus, smoking, alcohol excess, and obesity [13,14]. Surgery was performed by surgeons of several levels making it more representative of daily practice. Observer bias was reduced as the primary endpoints were documented by clinicians not aware of the study. The limitations are that it is retrospective, that the ASA grade differed between the groups which could be a confounding factor, and that the soft tissue swelling itself was not assessed and correlated with outcome.

In conclusion, this study suggests surgery within 24-48 hours may result in greater rates of minor soft tissue complications. The authors advocate surgery within 24 hours as the ideal, as it carries no greater risk of complications, but significantly reduces length of inpatient stay. Where this is not possible, we feel surgery should take place as soon as possible after 48 hours from injury. Further research is necessary to confirm these findings, and also to quantify soft tissue swelling and its effect on post-operative complications.

## Acknowledgements

The authors wish to thank the staff of the Warner Library for their help with article retrieval and use of the IBM SPSS resource.

## References

1. Bugler KE, White TO, Thordarson DB (2012) Focus on ankle fractures. Journal of Bone and Joint Society.
2. Hasselman CT, Vogt MT, Stone KL, Cauley JA, Conti SF (2003) Foot and Ankle Fractures in Elderly White Women. Incidence and risk factors. J Bone Joint Surg Am 85: 820-824.
3. Muller ME, Allgover M, Schneider R, Willengger H (1992) Manual of Internal Fixation. Springer, Berlin, Germany.
4. Høiness P, Strømsøe K (1999) The influence of the timing of surgery on soft tissue complications and hospital stay. A review of 84 closed ankle fractures. Ann Chir Gynaecol 89: 6-9.
5. Konrath G, Karges D, Watson JT, Moed BR, Cramer K (1995) Early versus delayed treatment of severe ankle fractures: a comparison of results. J Orthop Trauma 9: 377-380.
6. Höiness P, Engebretsen L, Strömsöe K (2003) Soft tissue problems in ankle fractures treated surgically: a prospective study of 154 consecutive closed ankle fractures. Injury 34: 928-931.
7. Schepers T, De Vries MR, Van Lieshout EM, Van der Elst M (2013) The timing of ankle fracture surgery and the effect on infectious complications; A case series and systematic review of the literature. Int Orthop 37: 489-494.
8. Carragee EJ, Csongradi JJ, Bleck EE (1991) Early complications in the operative treatment of ankle fractures. Influence of delay before operation. J Bone Joint Surg Br 73: 79-82.
9. Miller AG, Margules A, Raikin SM (2012) Risk factors for wound complications after ankle fracture surgery. J Bone Joint Surg Am 94: 2047-2052.
10. Pietzik P, Qureshi I, Langdon J, Molloy S, Solan M (2006) Cost benefit with early operative fixation of unstable ankle fractures. Ann R Coll Surg Engl 88: 405-407.
11. Manoukian D, Leivadiotou D, Williams W (2013) Is early operative fixation of unstable ankle fractures cost effective? Comparison of the cost of early versus late surgery. Eur J Orthop Surg Traumatol 23: 835-837.
12. Breederveld RS, van Straaten J, Patka P, van Mourik JC (1988) Immediate or delayed operative treatment of fractures of the ankle. Injury 19: 436-438.
13. SooHoo NF, Krenek L, Eagan MJ, Gurbani B, Ko CY, et al. (2009) Complication rates following open reduction and internal fixation of ankle fractures. J Bone Joint Surg Am 91: 1042-1049.
14. Ovaska MT, Mäkinen TJ, Madanat R, Huotari K, Vahlberg T, et al. (2013) Risk factors for deep surgical site infection following operative treatment of ankle fractures. J Bone Joint Surg Am 95: 348-353.