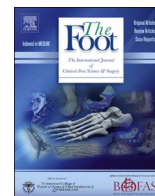




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Ankle fractures: Getting it right first time

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ABSTRACT

Introduction: Ankle fractures are common injuries presenting to trauma departments and ankle open reduction and internal fixation (ORIF²) is one of the first procedures targeted in early orthopaedic training. Failure to address the fracture pattern with the appropriate surgical technique and hardware may lead to early failure, resulting in revision procedures or premature degenerative change. Patients undergoing revision ORIF are known to be at much greater risk of complications and many of these secondary procedures may be preventable. **Method:** A retrospective analysis of all patients attending our unit for ankle ORIF over a two year period was undertaken. Patients were identified from our Bluespier database and a review of x-rays was undertaken. All patients undergoing re-operation within eight weeks of the primary procedure were studied. The cause of primary failure was established and potential contributing patient and surgical factors were recorded. **Results:** 236 patients undergoing ankle ORIF were identified. 13 patients (5.5%) returned to theatre for a secondary procedure within eight weeks. Within this group, seven (54%) patients returned for treatment of a neglected or under treated syndesmotic injury, three (23%) for complete failure of fixation, two (15%) with wound problems and one (8%) for medial malleolus mal-reduction. Of the patient group, five (39%) were known type 2 diabetics. Consultants performed two (15%) procedures, supervised registrars five (39%) and unsupervised registrars six (46%) operations. **Conclusion:** Errors are being made at all levels of training in applying basic principles such as restoring fibula length and screening the syndesmosis intra-operatively. Appropriate placement and selection of hardware is not always being deployed in osteopenic bone resulting in premature failure of fixation and fracture patterns are not being fully appreciated. Patients are undergoing preventable secondary procedures in the operative treatment of ankle fractures.

1. Introduction

Ankle fractures have an incidence of 122/100,000 per year [1]. They account for 9% of all fractures, making them the fifth most common fracture [2]. Fractures of the ankle are most commonly caused by high energy injuries in younger men, such as sporting injuries, road traffic accidents or a fall from a height, and low energy injuries in older women, who are likely to have porotic bone [1,2]. A quarter of ankle fractures occur in patients over 60 years of age [3].

Open reduction and internal fixation has been the mainstay of treatment for unstable displaced ankle fractures [3,4]. However, more recent evidence has suggested that total contact casting may be an appropriate alternative for older patients if the reduction can be maintained [3,5].

Where surgical fixation is required, accurate anatomical reduction to include restoration of fibula length and reduction and stabilisation of

syndesmotic injuries is essential to minimise the risk of development of degenerative joint disease [6,7]. A postero-lateral approach to the posterior malleolus fragment, where present, is increasingly recognised as an important step in restoring ankle congruity and in stabilising the syndesmosis [8]. Analysis of the fracture pattern and the appropriate choice of implants and surgical approach is required in all cases to ensure the best possible outcome [6]. Lack of appreciation of the deforming forces may lead to inadequate fixation methods inviting early failure [7,9].

There is little in the literature specifically looking at complications following surgical fixation of ankle fractures and specifically on causes of early return to theatre or failure of fixation. It has been suggested that many of these complications are avoidable and that patients requiring revision ORIF experience high rates of subsequent complications. Barksfield et al. found there to be avoidable complications present in 61.5% of reoperation for ankle fractures [9].

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² ORIF: Open Reduction Internal Fixation.

The present study was carried out in a busy district general hospital serving a population of 320,000 in Greater Manchester. All consultants within the department have sub-specialty interest but do operate on general trauma. There was a feeling amongst the foot and ankle team that there was an increasing rate of referrals from colleagues for complications following primary ankle ORIF. The aim of this study was to identify whether there was an excessively high rate of primary failure of ankle ORIF, to identify the cause of failure and decide where return to theatre was preventable.

2. Material and methods

All patients attending our unit who underwent ankle ORIF between December 2012 and December 2014 were identified using the Bluespier database. A retrospective review of the clinical notes and x-rays for these patients was undertaken. Patients who required return to theatre within eight weeks of initial surgery were identified and clinical notes and x-rays of these patients were then assessed further. Patient identification number, date of birth, relevant co-morbidities and classification of ankle fracture were recorded. Regarding initial fracture fixation, the date of primary surgery, operating surgeon, consultant presence in theatre, tourniquet time, hardware used, screening of syndesmosis and bone quality were noted. Regarding re-operation, the date of return to theatre, operating surgeon and revision technique were recorded. Fractures were classified according to the Danis–Weber classification, where A describes a fracture inferior to the level of the syndesmosis, B describes a fracture at the level of the syndesmosis and C, superior to the syndesmosis [10,11]. Patient and surgical factors were reviewed with an aim to highlight risk factors for failure. The training level of the operating surgeon was also recorded. A review of all of the above information was performed with the aim of identifying the cause of failure of fixation and to determine whether or not this could have been prevented. The technique used for revision surgery was considered.

3. Results

A total of 236 patients were treated with ankle ORIF at our unit between December 2012 and December 2014. Of these patients, two (1%) had fractures consistent with Type A Danis–Weber, 168 (71%) with Type B, 43 (18%) with Type C. 23 (10%) fractures were not classifiable to Weber (Table 1).

13 (5.5%) of these patients returned to theatre within eight weeks. The mean age for these patients was 53 years, ranging from 22 years to 78 years. Eight patients (66%) had sustained Weber B fractures and five (33%), Weber C fractures. This means that 0% of Weber A fractures undergoing ORIF required further surgery, 5% of Weber B fractures and 12% Weber C fractures. A further 11 (4.7%) patients experienced complications but did not undergo further surgery. The complications experienced were radiological non-union, mal-union, syndesmosis diastasis and mal-placed metalwork.

A neglected or under-treated syndesmosis injury was the most common reason for revision of the primary fixation, affecting seven patients (54%). Three (23%) patients experienced complete failure of fixation. An example of this can be seen in Figs. 1–3. Two patients (15%) returned to theatre for wound problems and one (8%) for medial malleolus mal-position (Chart 1).

Table 1
Ankle fractures classified according to the Danis–Weber classification.

Weber	Number of patients
A	2
B	168
C	43
Not classifiable to Weber	23

Of the seven patients with insufficient treatment of a syndesmosis injury, four were Weber B fractures with undiagnosed syndesmosis injury, one Weber B fracture required re-siting of the screw as in the initial fixation the screw had missed the tibia and two were Weber C fractures which had continued diastasis although a syndesmosis screw had been placed (Fig. 4).

On reviewing the operating surgeons for those returning to theatre, two (15%) had their primary open reduction internal fixation performed by an orthopaedic consultant, five (39%) by an unsupervised specialist trainee (registrar) and six (46%) by a supervised specialist trainee (registrar). All trainees operating independently were Specialist Trainee year six or above except one (Chart 2). For the initial surgery mean tourniquet time was 88 min, screening of the syndesmosis was not documented for any of the 13 patients and bone quality was documented in 17%, which in both instances was noted to be poor. Regarding comorbidities, five (38%) of the 13 patients who returned to theatre had pre-existing type 2 diabetes mellitus, four (31%) were known to have hypertension, two (15%) were documented as being obese and three (23%) had pre-existing osteoarthritis.

Revision techniques used were revision ORIF including placement of one or two syndesmosis screws in four cases (33%), one case (8%) required revision without placement of syndesmosis screw(s), placement of syndesmosis screw(s) only in three cases (25%), debridement and washout in two cases (17%), removal of metalwork only in one case (8%) and other form of fixation in one case (8%). A locking plate was applied in two cases to improve fixation (17%) (Fig. 3).

One of the patients (8%) who required return to theatre had experienced further trauma and another (8%) had not complied with non-weight-bearing. After analysis of reasons for return to theatre the authors estimate that nine (69%) of these patients experienced an avoidable complication.

4. Discussion

There is no defined acceptable reoperation rate for orthopaedic trauma [9]. SooHoo et al. found a 90-day re-operation rate of 0.82% [12], while Barksfield et al. found a 28-day re-operation rate following primary ankle ORIF of 1.86% and found that over 61.5% of these complications were preventable [9]. The authors re-operation rate of 5.5% is therefore significantly higher than in the literature, while our avoidable complication rate was also high, at 69% compared to 61.5%. There is no clear reason as to why this is. The hospital serves a deprived area of the UK with high rates of medical co-morbidities, smoking and obesity. The authors also wonder whether there may still be a lack of understanding of basic principles by trainees despite a comprehensive regional teaching programme.

As seen in the results, the most common reason for needing further surgery was shown to be neglected or undertreated syndesmosis injury at 54%. None of these patients had intra-operative screening of the syndesmosis documented in the operation notes. This is not unusual. The rates of syndesmosis injury in the literature are variable and damage to the syndesmosis is commonly missed [1,13]. This leads to the fixation being unstable and can lead to the need for revision surgery. In Fig. 4, a Weber C fracture in a young patient is demonstrated which was treated with ORIF. The syndesmosis injury was identified but under treated, with screw sited too high and short. This led to continued diastasis.

There were three occurrences of complete failure of fixation, one of which is demonstrated in Figs. 1–3. This is the case of an elderly lady with osteoporotic bone in whom the posterior malleolar fracture was overlooked. Fig. 1 demonstrates the original x-ray revealing fracture-dislocation of the left ankle with involvement of the posterior malleolus. Fig. 2 demonstrates the primary fixation, with the use of a 1/3 tubular plate in neutralisation mode for the fibular fracture and a cancellous screw for the medial malleolar fracture. The posterior malleolus has not been fixed and the ankle has re-dislocated. This is a clear

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