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Tibiotalocalcaneal nail fixation and soft tissue coverage of Gustilo–Anderson grade 3B open unstable ankle fractures in a frail population; a case series in a major trauma centre

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ABSTRACT

Background: Gustilo–Anderson grade 3B open ankle fracture-dislocations requiring stable fixation and soft tissue coverage are increasingly common in frail populations.
Methods: We identified all patients with open ankle fracture-dislocations treated with a tibiotalocalcaneal nail and soft tissue coverage over a five-year period. We retrospectively recorded pre-morbid status, fracture and soft tissue injury pattern, surgical details, post-operative mobility, length of hospital stay, complication and re-operation rate and survival.
Results: 21 ankles (20 patients) are included, all grade 3B open fractures. All patients were permitted to mobilise by one to six weeks post-surgery. One patient required further soft tissue surgery. Six patients had superficial wound colonization/infection, none developed deep infections. None of the nails have required removal. We observed a 15% three-month mortality rate.
Conclusion: Tibiotalocalcaneal nail fixation and soft tissue coverage of unstable open ankle fractures in frail patients facilitates early return to ambulation with a low complication and re-operation rate.

1. Introduction

Open fracture-dislocations of the ankle are challenging injuries to treat in the frail and elderly population. They often occur following low-energy injuries. Soft tissues around the ankle fail when the fracture-dislocation occurs, resulting in significant soft tissue stripping. These injuries pose a challenge to the surgeon in view of poor quality bone and soft tissues [1]. This group of patients frequently have poor pre-operative health [2] in terms of medical co-morbidities, such as diabetes mellitus and circulatory disease, which further increase the risk of surgical complication. Their overall pre-morbid state can be compared to the neck of femur fracture patient population, and the priority – as in patients with neck of femur fractures – is to provide a surgical treatment that minimizes the complication rate and facilitates early ambulation. Traditional open reduction internal fixation in osteoporotic bone can involve a period of non-weight-bearing. This can be difficult for frail patients, in whom ambulation is paramount to managing their activities of daily living [3]. Poor hold in osteoporotic bone, and the need for further soft tissue insult in a heavily traumatized area can make plate and screw fixation an unattractive option in elderly co-morbid patients, and for this reason surgical treatment with a tibiotalocalcaneal nail has become more popular in the treatment of closed unstable fractures in frail elderly patients [1]. Emphasis is placed on achieving good fixation that allows the patient to mobilise as quickly as possible, and less on longer term outcomes in a population with a limited life expectancy. Here we present a case series of patients who have been successfully treated with a primary tibiotalocalcaneal nail in the context of open fracture-dislocation of the ankle, with a low rate of post-operative complication and a timely return to ambulation.

2. Methods

2.1. Participants

35 ankles were treated with a tibiotalocalcaneal nail for unstable ankle fractures between 1 July 2011 and 30 June 2016. 22 of these ankle fractures were open fractures requiring soft

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tissue coverage. All the open fractures were grade 3B as per the Gustilo–Anderson classification. One ankle was a revision procedure following failed open reduction internal fixation and was excluded from this study. In the remaining 21 ankles (in 20 patients), a tibiotalocalcaneal nail was used for primary fixation. Three patients were male and 17 female. The average age was 76 (range 48–98). Mechanisms of injury were a combination of low- and high-energy. Two patients (three ankles) had concomitant significant injuries. 18 patients had isolated injuries. 11 fractures were trimalleolar, four bimalleolar (medial and lateral), two bimalleolar (lateral and posterior), two lateral malleolus fractures, one lateral malleolus with anterior tibial Tillaux fractures and one lateral malleolus with ipsilateral talar neck fracture. See Table 1 for a summary of patient demographics and results.

2.2. Data collection

We retrospectively identified all patients on our trauma database (Bluespier International, Droitwich UK) who had been treated surgically for an ankle fracture within this time frame. We reviewed the ward-round entries and operation notes for all of these patients to establish which patients had an open ankle fracture and had been treated with a tibiotalocalcaneal nail and soft tissue coverage. We reviewed each patient's radiographs pre- and post-fixation, discharge summaries, Trauma & Orthopaedic follow-up clinic letters, and letters from the Plastic Surgery database. From these sources in combination, we ascertained patient age and comorbidities, pre-injury residence, mechanism of injury, concomitant injuries, fracture configuration, date of initial debridement, date of tibiotalocalcaneal nail, details of all surgeries, grade of open fracture, method of soft tissue coverage, post-op weight-bearing status, length of hospital stay, discharge destination, follow-up details, post-op complications, details of further surgery, and death rate. We cross-referenced our software sources to ensure accuracy of data.

2.3. Staging of surgery

All patients received treatment as per the British Orthopaedic Association Standards for Trauma 4 [4] for open fracture management. The decision on whether to stage the surgery or carry out debridement, fixation and soft tissue coverage in a single sitting was made during the first visit to theatre. Two ankles were treated in a single stage, having debridement, tibiotalocalcaneal nail and coverage with a medial plantar flap and split skin grafting in the same session. The remaining 19 open ankle fractures had an initial washout, debridement and stabilization followed by definitive fixation and coverage on average 1.5 days later (range 0–4 days). Three of our patients had the primary debridement performed before transfer to our major trauma centre, and one of these had a further debridement (and application of external fixation) before the definitive surgery. Of the 19 ankles having staged surgery, six were stabilised with temporary external fixation, one with a tibiotalocalcaneal Steinman pin, one with Kirschner wires and a fibula nail and 11 with plaster applied in theatre. Nine ankles had vacuum-dressings applied, and ten had standard dressings.

2.4. Operative technique

Three different tibiotalocalcaneal nails were used in total over the five years; fixation was achieved in 10 ankles with the T2 Ankle Arthrodesis Nail (Stryker Trauma GmbH, Schönkirchen, Germany), nine with the Versanail (DePuy ACE Orthopaedics, Inc., Warsaw, USA) and two with the Titanium Cannulated Hindfoot Arthodesis Nail (Synthes, West Chester, PA, USA). The diameter of nail ranged from 10 to 12 mm and the length 150 to 300 mm. All nails were locked proximally and distally. None of the ankles had joint surface preparation before nailing. All required soft tissue coverage performed by a Plastic Surgeon, and this was achieved with either a local flap or free flap and split skin graft (SSG). 12 ankles had a medial plantar flap, two dorsalis pedis flap, two free gracillis flap, one free anterolateral thigh flap, one free scapula flap, one myocutaneous flap, one bilobed transposition flap, and one patient had SSG alone without a flap. Intravenous antibiotics were started on admission. Patients having coverage with local flaps had the flap raised prior to the tibiotalocalcaneal nailing. After the flap was raised, the nail was inserted by the Trauma & Orthopaedic Surgeon using the technique recommended by the implant manufacturer. Patients having coverage with an anterolateral thigh free flap had the flap raised from the contralateral thigh at the same time as the nailing. A below-knee backslab was applied to limit movement to protect the flap. The patients were transferred post-operatively to the Plastic Surgery ward, where they were monitored on a strict flap protocol. Please see Figs. 1 and 2.

2.5. Ethical approval

We referred to the NHS Health Research Authority online information and decision-making tool. We did not require ethical approval from the NHS Research and Ethics Committee (NHS REC) for this study.

3. Results

3.1. Return to ambulation and discharge destination

15 patients (16 ankles) lived in their own home prior to their injury, one in a warden-controlled flat, two in a residential home, one in a care home and one in a nursing home. 14 patients (15 ankles) were repatriated to their local hospitals for ongoing rehabilitation, two were transferred to community hospitals, one to a care home and three discharged home. Only two patients from home managed to return home directly from our hospital. The average length of stay in the major trauma centre was 18 days. The majority of our patients were non-weight-bearing through the operative ankle for two weeks to allow flap healing (range one to six weeks). After this weight-bearing as tolerated was advised. One patient had limited mobility at four months post-operatively, but this was related to frailty rather than to ankle fixation complications.

3.2. Complications and re-operation

One patient required further surgery to their ankle. This was undertaken during the same admission as their ankle fracture surgery and was a soft tissue procedure to re-perfuse a threatened flap. To date, none of the patients included in this series have required re-operation for implant-related reasons (mean time from surgery 13 months; range 5–35 months, four patients died with the implants in situ) and none have undergone amputation. One patient developed cellulitis over the flap—this was successfully treated with antibiotics. Five other patients had wound swabs taken from the operative leg, which were positive for various bacteria. This gives an overall superficial post-op wound colonisation/infection rate of 29%. One patient had a positive wound swab from the donor site on the contralateral leg. None of our patients required return to theatre due to deep infection. One patient had failure of the SSG over donor site of the dorsalis pedis flap, but went on to heal following a period of observation.

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