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Time to Initialinitial Debridement and wound Excision (TIDE) in severe open tibial fractures and related clinical outcome: A multi-centre study

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ABSTRACT

Background: Recent national (NICE) guidelines in England recommend that initial debridement and wound excision of open tibial fractures take place within 12 h of the time of injury, a change from the previous target of 24 h. This study aims to assess the effect of timing of the initial debridement and wound excision on major infective complications, the impact of the new guidance, and the feasibility of adhering to the 12 h target within the infrastructure currently existing in four major trauma centres in England.
Methods: A retrospective review was performed of Gustilo-Anderson grade 3B open tibial fractures presenting acutely to four Major Trauma Centres (MTCs) in England with co-located plastic surgery services over a ten-month period. The incidence of deep infective complications was compared between patients who underwent initial surgery according to the new NICE guidance and those who did not. Patients warranting emergency surgery for severely contaminated injury, concomitant life-threatening injury and neurovascular compromise were excluded. Multi-variable logistic regression analysis was performed to assess the effect of timing of surgical debridement on development of deep infective complications.
Results: 112 patients with 116 fractures were included. Six fractures (5.2%) developed deep infective complications. 38% (n = 44) underwent primary debridement within 12 h and 90% within 24 h. There was no significant difference in the incidence of major infective complications if debrided in less than or greater than 12 h (4.5% *vs* 5.6%, $p = 1.00$). Logistic regression found no significant relationship between timing of wound excision and development of deep infection. There was no significant decrease in mean time to debridement following introduction of new national guidance (13.6 *vs* 16.1 h) in these four MTCs.
Conclusion: Overall, the rate of deep infection in high energy open tibial fractures managed within the four major trauma centes is low. Achieving surgical debridement within 12 h is challenging within the current infrastructure, and it is unclear whether adhering to this target will significantly affect the incidence of severe infective complications. Debridement within 24 h appears achievable. If a 12-h target is to be met, it is vital to ensure dedicated orthoplastic capacity is adequately resourced.

Background

Open tibial fractures are limb-threatening injuries that often affect a healthy and previously employed population [1–3]. Limb salvage is attempted as a standard of care in appropriately selected patients. Outcomes are affected by a complex interplay between patient, injury and surgical factors. Deep infection in patients who have undergone limb salvage can lead to significant adverse sequalae such as readmission to hospital, further surgery and delayed amputation [4]. Such complications prolong the rehabilitation period and potentially lead to worse clinical outcomes [5]. This can have a significant health-economic burden such as loss of income, reliance on social support, long-term use of medication and increased health service use [6,7].

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Advances in the approach to the management of open tibial fractures have focused on expedient, multidisciplinary management in specialist major trauma centres, to optimise fuctional outcome and minimise the risk of infection. In February 2016, the National Institute for Health and Care Excellence (NICE) reduced the recommended time to initial surgical debridement of high energy open tibial fractures (likely Gustilo-Anderson classification type IIIA or IIIB) that are not grossly contaminated, from 24 h, the previous target, to 12 h [1–3]. There is evidence supporting this and contradicting it: some studies have shown time to initial debridement to have a significant impact on clinical outcome, with one influential study, cited in the updated NICE guidance, calculating a 3% increase in risk of severe infection for every hour delay to surgery [8]. Other factors which are thought to be important, include time to antibiotics [9] and time to arrival at a specialist centre [10,11].

In the NHS, resources are finite, and the provision of plastic surgical care at Major Trauma Centres in England [11] and globally are varied. Combined consultant orthoplastic decision making at the initial debridement is crucial to ensure this key step is carried out comprehensively and a robust management plan is formulated. If the 12-h target is found to significantly affect clinical outcome, more resources would need to be made available to achieve this reliably. If it does not significantly affect clinical outcome, resources should be redirected to factors that do.

Previous studies on this topic have failed to isolate a homogeneous cohort of patients making it more difficult to draw meaningful conclusions to guide clinical practice. This study aims to assess the impact of time to initial surgical debridement in high energy open tibial fractures on incidence of deep infective complications in this high risk group. In addition, this study aims to assess the impact of the introduction of new national guidance on time to debridement at four Major Trauma Centres, and the feasibility of adhering to a 12-h target.

Methods

Study design

A retrospective study was performed of Gustilo-Anderson grade 3B open tibial fractures presenting acutely to four UK Major Trauma Centres (MTCs) with co-located plastic surgery services over a ten-month period spanning the introduction of updated NICE guidance in February 2016. Data were collected by local teams of clinicians at each study site from both case notes and the Trauma Audit and Research Network (TARN) national database.

Inclusion and exclusion criteria

Adult patients (>16 years old, no upper age limit) with acute Gustilo-Anderson grade 3B open tibial fractures were included. Gustilo-Anderson grading was performed after the first surgical debridement and wound excision. Patients were included if they presented directly to one of the four study sites, or if they received initial emergency management (including initial surgical debridement/wound excision and/or skeletal stabilization) at a regional referring centre and were transferred acutely (within 48 h of injury) to one of the four study sites for further wound excision, soft tissue coverage and definitive skeletal stabilisation. Time to first surgical debridement and wound excision was included in the dataset in an identical manner regardless of whether this performed at a regional referral centre or at the definitive MTC.

Patients were excluded from the study if they warranted emergency surgery for farmyard-, marine- or sewage-contaminated injury, concomitant life-threatening injury and neurovascular compromise (Gustilo-Anderson grade 3C injuries). Patients were excluded if they were lost to follow-up or died of causes not related to the tibial fracture(s) in less than ninety days post-injury, as not all deep infections are clinically apparent within a shorter timeframe (Fig. 1).

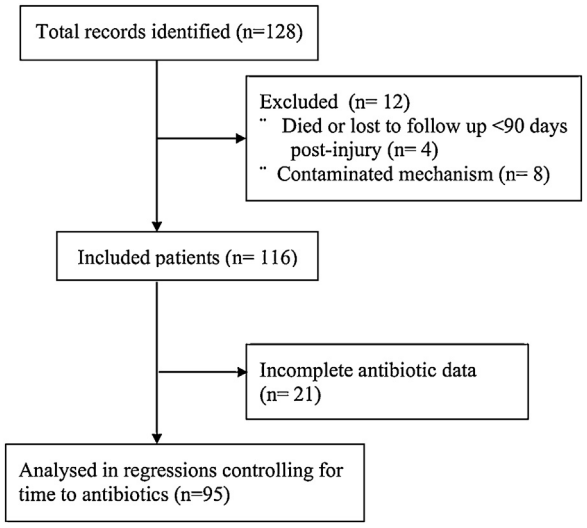

Fig. 1. Flow diagram of patients excluded from the study.

Clinical protocol

All four centres manage open tibial fractures according to a combined orthoplastic approach, with a plastic surgeon and an orthopaedic surgeon present at first surgical debridement and definitive reconstruction. Patients are followed up in designated combined orthoplastic clinics until clinical union occurs. The centres vary in the availability of a regular, designated orthoplastic operating list and in the availability of resident on-call orthopaedic and plastic surgery consultants out-of-hours.

Definitions

Time to debridement is calculated in hours from the time of injury to the induction of anaesthetic on the first surgical wound excision and debridement. Time to antibiotics is calculated in minutes from the time of injury to the time of administration of the first intravenous antibiotic recorded.

'Major deep infection' was defined as patients requiring removal or exchange of metalwork for infection, delayed flap failure (partial or complete) due to infection, or deep infected collection requiring surgical drainage. Clinically diagnosed superficial infections that resolved with the administration of antibiotics (*e.g.*, cellulitis) were not included.

Patients were categorized as having a risk factor for infection if case notes recorded one or more of the following: current smoking status, diabetes, peripheral vascular disease, or any immunosuppressive condition or medication.

Statistical analysis

Multi-variable logistic regression analysis (R version 3.3.3 [12]) was performed to assess the effect of timing of surgical debridement on development of deep infective complications. Time to administration of intravenous antibiotics, patient co-morbidities including diabetes and immunosuppressive conditions, current smoking status and ISS were controlled for statistically. Time to surgical debridement and time to administration of intravenous antibiotics were analysed as continuous

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