

The impact of a dedicated orthoplastic operating list on time to soft tissue coverage of open lower limb fractures

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ABSTRACT

An observational study was conducted of 105 patients presenting with an open fracture of the tibia or ankle to determine the impact of a dedicated orthoplastic operating list on our management of these injuries over the time period January 2012 to July 2014. There were 51 patients before and 54 after the introduction of the orthoplastic list. Significant improvements were noted in our ability to deliver a service in line with national guidelines across all Gustilo–Anderson grades of injury.

Among patients with the most severe grades of injury (Gustilo types IIIB and IIIC), there was a trend towards an improved time to first skeletal stabilisation (29.5 vs 14.2 hours, $p=0.068$), an improvement in time to soft tissue coverage (173.6 vs 88.1 hours, $p=0.009$) and a trend towards a reduced length of inpatient stay (32.6 vs 23.2 days, $p=0.138$). Where the 72-hour target had been breached, there was a significant improvement in the proportion of patients covered within 7 days of injury (48.2% vs 83.3%, $p=0.017$).

Our compliance with national management standards increased significantly to reflect these improvements in care. These results support the implementation of dedicated orthoplastic operating sessions to meet the growing burden of patients presenting with open fractures at specialist centres.

KEYWORDS

Open fracture – Soft tissue coverage – Compound fracture

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Since the establishment of the major trauma network in England, the treatment of patients with the most severe injuries (such as open fractures of the lower limb) has been concentrated into specialist trauma centres with a resultant increased pressure on resources.¹ Open fractures of the tibia and ankle account for 5–10% of all open fractures but are associated with particularly complex soft tissue problems.²

Clear management standards exist for these injuries, issued jointly by the British Orthopaedic Association and British Association of Plastic, Reconstructive and Aesthetic Surgeons, in which emphasis is placed on early combined orthoplastic management.³ The surgical aspects of these standards are based on evidence of improved outcomes with early definitive management.^{4–6} The standards include initial skeletal stabilisation within 24 hours and definitive soft tissue coverage within 72 hours of the initial injury (and no later than 7 days following injury where the 72-hour target is breached).⁵

In order to meet the growing burden of open fractures presenting to our major trauma centre and to improve compliance with national guidelines, a dedicated weekly multidisciplinary operating list was introduced staffed by

consultant surgeons with an interest in trauma from both the orthopaedic and plastic surgery specialties. In this paper, we evaluate the impact of introducing such a service on the management of open fractures in a major trauma centre.

Methods

An observational study was carried out to establish the impact of a dedicated weekly orthoplastic operating list on our management of open lower limb fractures. This operating session is staffed by consultant surgeons with an interest in trauma from both the orthopaedic and plastic surgery departments. It is additional to the daily trauma theatre session, and is reserved for patients with open fractures and complex soft tissue injuries.

Consecutive patients with an open fracture of the tibia or ankle presenting to our centre between 1 January 2012 and 14 July 2014 were included in the analysis. A retrospective analysis was conducted of patient records between January 2012 and July 2013 (ie before the introduction of the orthoplastic operating list in July 2013) and data were collected prospectively thereafter.

This study sought to establish whether a dedicated operating list significantly impacts on the quality of care received by this patient group. The hypothesis was that such a service would most greatly impact the second and subsequent operative interventions, at which the majority of these patients receive definitive skeletal stabilisation and soft tissue cover. In our institution, initial skeletal stabilisation (eg temporary external fixation) occurs typically on the next available trauma operating list (usually the following day) depending on urgency, which is generally based on the degree of wound contamination and severity of injury. Definitive skeletal stabilisation methods were predominantly intramedullary nailing or open reduction and internal fixation with plates and screws. The initial procedures were planned with senior plastic surgery input so as not to jeopardise subsequent soft tissue coverage procedures.

The delivery of care was analysed before and after the introduction of the orthopaestic operating list in line with national guidelines (eg time to definitive soft tissue coverage from initial injury, time to first stabilisation procedure, percentage compliance with national guidelines, length of hospital stay). In addition, basic epidemiological data were examined (eg age, sex, Gustilo–Anderson grade of injury⁷ and injury type, injury severity score [ISS]⁸ and type of soft tissue coverage procedure).

Statistical analysis

Statistical analysis was performed using StatPlus (AnalytSoft, Walnut, CA, US). An unpaired t-test was used for normally distributed data, a Mann–Whitney U test for non-normally distributed data and a chi-squared test for data with binary outcomes. A *p*-value of <0.05 was considered to be statistically significant.

Results

Table 1 shows the group characteristics for patients presenting before (*n*=51) and after (*n*=54) the introduction of the orthopaestic operating list. There was no significant difference (*p*>0.05) in the mean age (44.2 vs 48.6 years) or median ISS (9 in both groups) between the groups. Road traffic accident was the most common mechanism of injury and open tibial fractures accounted for the majority of cases in both groups (69% before vs 67% after). The proportion of patients with the most severe grades of injury (Gustilo types IIIB and IIIC) increased over the time period studied (39% vs 52%, *p*=0.194) and although this did not reach statistical significance, a subsequent significant reduction in the proportion of injuries undergoing direct closure was observed (59% vs 37%, *p*=0.025) along with a significant rise in the proportion of patients closed with a local flap (12% vs 28%, *p*=0.040).

Tables 2 and 3 summarise the improvements observed since the introduction of the orthopaestic operating list. There was a significant reduction in the mean time to definitive soft tissue coverage from 112.8 to 65.4 hours (*p*=0.019) across all Gustilo–Anderson grades of injury. This reduction in time to soft tissue coverage is reflected by a trend towards an increase in the percentage of patients (from

Table 1 Details of patient groups before and after the introduction of the orthopaestic operating list

	Before orthopaestic operating list (n=51)	After orthopaestic operating list (n=54)
Mean age (95% confidence interval)	44.2 (38.4–49.9)	48.6 (42.5–54.8)
Male-to-female ratio	35:16	32:22
Median injury severity score (range)	9 (9–43)	9 (9–38)
Gustilo type I/II	8/8	6/5
Gustilo type IIIA/B/C	15/18/2	15/26/2
Mechanism of injury:		
Road traffic accident	31	28
Fall <2m	15	14
Fall >2m	2	4
Crush	1	5
Blow	1	2
Other	1	1
Injury type:		
Open tibia	35	36
Open ankle	16	18
Definitive soft tissue coverage procedure:		
Direct closure	30	20
Split skin graft	8	10
Local flap	6	15
Free flap	5	6
Amputation	2	3

47.1% to 68.5%, *p*=0.061) meeting the 72-hour soft tissue coverage target although this did not reach statistical significance. Of those patients not receiving soft tissue coverage within 72 hours, the percentage subsequently covered within 7 days rose from 48.2% to 83.3% (*p*=0.017). Furthermore, there was a trend towards a reduced length of inpatient stay following the introduction of the orthopaestic list (25.2 vs 20.3 days) although this was not statistically significant (*p*=0.240).

Taking just the most severe injuries (Gustilo types IIIB and IIIC), which typically present the biggest challenge both clinically and in terms of resources, a similar improvement in the quality of care was observed with a reduction in mean time to soft tissue coverage from 173.6 to 88.1 hours (*p*=0.009), a rise in the percentage of patients meeting the 72-hour target from 20.0% to 53.6% (*p*=0.019) and an increase from 37.5% to 77.0% (*p*=0.034) in the percentage of patients receiving soft tissue coverage within 7 days where the 72 hour target was breached. In this group, the mean time to first skeletal stabilisation fell from 29.5 to 14.2 hours although this was not statistically significant (*p*=0.068). A trend towards a reduction in the mean length of inpatient stay from 32.6 to 23.2 days was also observed (*p*=0.138).

Table 2 Overall results for all Gustilo–Anderson grades of injury

	Before orthoplastic operating list (n=51)	After orthoplastic operating list (n=54)	p-value
Mean time to first stabilisation*	18.5 hours	13.4 hours	0.160
Mean time to soft tissue coverage*	112.8 hours	65.4 hours	0.019
Fractures covered within 72h	47.1%	68.5%	0.061
Of those not covered within 72h, fractures covered within 7 days	48.2%	83.3%	0.017
Mean length of inpatient stay	25.2 days	20.3 days	0.240

*refers to time from sustaining the injury to surgical intervention

Table 3 Results for Gustilo–Anderson grades IIIB and IIIC only

	Before orthoplastic operating list (n=20)	After orthoplastic operating list (n=28)	p-value
Mean time to first stabilisation*	29.5 hours	14.2 hours	0.068
Mean time to soft tissue coverage*	173.6 hours	88.1 hours	0.009
Fractures covered within 72h	20.0%	53.6%	0.019
Of those not covered within 72h, fractures covered within 7 days	37.5%	76.9%	0.034
Mean length of inpatient stay	32.6 days	23.2 days	0.138

*refers to time from sustaining the injury to surgical intervention

Discussion

The main finding of this study is a significant reduction in mean time to definitive soft tissue coverage following the introduction of the orthoplastic operating list. A number of concurrent improvements were observed in the quality of service delivered, such as increased compliance with national guidelines (ie percentage of patients achieving definitive soft tissue cover within 72 hours and no later than 5 days following injury) and a trend towards a reduced length of inpatient stay. However, despite these significant improvements, the 72-hour soft tissue coverage target was still only met in 69% of all open fractures (and just 54% of those with Gustilo types IIIB and IIIC). It is clear that achieving early coverage presents a considerable challenge, particularly in those with the most severe injuries, and there will always be a minority of patients (eg polytraumatised patients requiring intensive care) for whom early definitive treatment is not possible.

Not all of the benefits of integrated orthoplastic management can be related directly to the operating list. Our centre has experienced a number of secondary benefits from the increased dialogue between the specialty groups prompted by the creation of a dedicated orthoplastic operating list. Regular meetings to discuss cases have improved our management of other injuries (for example, in the cross-over subspecialty of hand surgery, complex soft tissue injuries and in non-trauma patients with wound

complications following elective surgery). Anecdotally, trainees are more aware of the national guidelines for the management of open fractures and now work more closely with their counterpart specialist trainees in planning surgery. Indeed, this has promoted a culture of joint orthoplastic care for patients with these injuries.

Comparison with other work is difficult owing to a lack of studies directly evaluating the impact of a dedicated orthoplastic operating list on the management of open fractures in an established trauma centre. Stammers *et al* report similar improvements in open fracture management in the eight-month period directly following trauma centre designation.⁹ The authors observed a reduction in time to soft tissue coverage approaching statistical significance from 199 to 89 hours ($p=0.06$). They attribute this to increased senior surgeon input, a dedicated major trauma theatre and prioritisation of joint cases.

Study limitations

The main limitations of this study are the retrospective nature of the data collection prior to the introduction of the orthoplastic operating list and the possibility that factors other than the operating list contributed to the observed improvements in patient care. Our unit became a major trauma centre on 26 March 2012 and the data inclusion period precedes this date, raising the possibility that these early data have skewed our results.

Trauma centre designation has in itself been associated with improved management of open fractures.⁹ The improvements in care observed may reflect a maturation of the major trauma centre, as care protocols, staff experience and processes become more effective, which drives down delays in definitive management and improves outcomes.^{10,11} We believe that the intervention studied (a dedicated orthopaedic operating list) is part of the trauma centre maturation process, and separating the individual component effects of this and other procedural improvements on the management of open fractures becomes difficult. Certainly, our unit has seen a year-on-year rise in the number of open fractures treated since it became a major trauma centre with 25 patients in 2012, 50 in 2013 and 50 at the midyear point in 2014.

It has been proposed that trauma centre maturation requires a much longer lead-in time than the study period of this work, with previous studies suggesting timescales of up to ten years before significant improvement in processes and outcomes are observed.^{10–12} There are still considerable improvements to be made. Our centre is now introducing a second weekly orthopaedic operating list to increase the orthopaedic capacity in line with the growing numbers of patients with open fractures treated at our centre.

Conclusions

Our results demonstrate the impact of a dedicated weekly orthopaedic operating list on the definitive management of open fractures of the tibia and ankle. This study adds to the evidence base in favour of early combined senior orthopaedic input in the management of open fractures and supports the commissioning of such dedicated combined specialty operating sessions.

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