

Original Research Article

Management of open fractures of the lower limb during the COVID-19 pandemic: are the standards of treatment being maintained? A study from a major trauma centre in England

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ABSTRACT

Background: Coronavirus disease 2019 (COVID 19) has created an immense strain on the NHS. During the height of the pandemic, trauma services were affected by redeployment, reduced theatre capacity and staff illness, and COVID BOAST guidelines were introduced.

Methods: This retrospective study aimed to evaluate the standards of management of open fractures of the lower limb at a Major Trauma Centre in the United Kingdom during the COVID-19 pandemic and compare the same with the pre-pandemic period. Patient demographics, mechanism of injury, timing and mechanism of initial debridement and definitive soft tissue and skeletal fixation were noted. Outcomes including duration of hospital stay, 30 day and 1 year mortality were also assessed.

Results: There was an overall 21% reduction in admissions with open lower limb fractures during the pandemic period with a 48% reduction during the first lockdown. There was a significant reduction in time taken from Emergency Department presentation to first debridement as well as a notable increase in operating outside of regular theatre hours. There was little difference in operative technique used for skeletal or soft tissue management at initial and definitive surgery, though fewer cases were performed as a two stage procedure. There was no difference in amputation rate in the two years. Length of stay was reduced from 21 days to 17, and 30 day mortality remained the same.

Conclusions: Our study shows this Major Trauma Centre was able to provide a trauma service in accordance to the BOAST4 guidelines despite the increased pressures of the COVID-19 pandemic.

Keywords: Open fracture lower limb, COVID-19, BOAST guidelines

INTRODUCTION

Coronavirus disease 2019 (COVID 19) has created a huge strain on the National Health Service of United Kingdom. At its peak during the second wave, 81,526 patients tested positive for COVID-19 in the UK on a single day, with 39,249 admitted, 4,077 intubated and ventilated, and the maximal death rate peaking at 1359 a day.¹

In an effort to control the spread of the SARS-CoV-2 virus, the first lockdown was initiated on 23 March 2020 until 10 May 2020, followed by a second lockdown on 5 November.² Along with other public health measures, this was successful in reducing the infection rate of the virus amongst the general population, in turn achieving the primary aim of reducing hospital admission and preventing the health service from being overwhelmed by excessive patient load. Despite this, provision of medical

and surgical care was impacted during the pandemic, including trauma management.

Open fractures are managed at major trauma centres in the United Kingdom, as per the BOAST4 guidelines.³ To manage the anticipated increase in admission of medical COVID patients, as well as reduce inpatient stay and operative requirements for orthopaedic patients, all non-urgent elective orthopaedic surgery were postponed, and special COVID-19 BOAST guidelines introduced for management of trauma patients during these unprecedented times.⁴ This prioritised admission for patients who could not be managed non-operatively, favoured single stage procedures, and early amputation in cases where limb salvage was questionable and necessitated multiple operations.

Unfortunately, clinical pressures on medical wards and intensive care units resulted in re-deployment of anaesthetic and nursing staff to manage critically unwell COVID patients. Increases in ITU and medical ward requirements, as well as record numbers of simultaneous staff leave, due to COVID-19 infection and self-isolation, together resulted in decreases in theatre capacity for all surgical specialties and affected the volume of trauma patients that could be processed. This was further compounded by new COVID protocols, including the necessitation of COVID status prior to theatre, at a time when widespread PCR testing was not established, recovering all patients in theatre, and cycling the theatre air for a minimum of 20 minutes between cases. The focus on COVID prevention came at the expense of available theatre time and placed a strain on the combined surgical services at our major trauma centre.

The aim of this study was to review the management of patients with open lower limb fractures admitted to a Level 1 Major Trauma Centre in the West Midlands region of the UK, and compare the time taken from admission to first debridement and definitive skeletal and soft tissue cover during the COVID-19 pandemic in 2020 and non-pandemic functioning in 2019 and determine if the COVID-19 pandemic affected the orthoplastics service provided at our major trauma centre.

METHODS

This was a retrospective study performed in a single Level 1 Major Trauma Centre in the West Midlands, UK. Inclusion criteria were all patients admitted for open lower limb fractures between 01 March to 31 December 2020 (case group); these dates were chosen as the starting month of the UK lockdown to the end of the 2020 year. The control group was matched by dates, 01 March to 31 December 2019. Patients with open phalangeal fractures were excluded.

Data on patients with open fractures was obtained from the clinical coding team, and further data was obtained from

the hospital Electronic Patient Records system (iPortal, Bluespier), clinic letters and patient discharge letters.

Data parameters included age, gender, time and date of admission, mechanism of injury, fracture location, time, and date of first debridement, definitive skeletal fixation and soft tissue coverage, method of skeletal and soft tissue management. If definitive fixation was achieved at first debridement, the same technique was recorded for both the initial debridement and for the definitive fixation.

Patients with multiple open fractures were treated as independent cases. Patients who were discharged with temporary skeletal fixation and re-admitted at a later date for definitive fixation were treated as a single case requiring two stage procedure.

Anatomical area of injury was categorised into femoral, knee, tibia, tibia-fibula, ankle, and foot. Mechanism of injury was categorised into fall at ground level, fall from height, road traffic accident, crush injury, sports injury, assault, and unknown.

Time from admission to debridement was categorised into <24 hrs, 24-36 hrs and >36 hrs. Time from first debridement to definitive fixation was categorised into <72 hrs, 72 hrs – 7 days and >7 days. Cases that underwent first debridement between 2nd April and 25th June 2020 were categorised as 24-hour COVID theatres, between 2nd April and 25th June 2019 as Control theatres, and the remainder categorised as normal theatres.

Patients who received their initial debridement at another trauma centre were included for analysis of surgical technique, but excluded from analysis of time to debridement, definitive skeletal fixation, and soft tissue coverage. Patients who died prior to their first debridement were included for analysis of demographics and mechanism of injury but excluded from all other analysis.

Statistical analysis on time to initial debridement, definitive skeletal fixation, soft tissue coverage and duration of stay differentiated by year was carried out with the Mann-Whitney U test. The non-parametric status of data collected was determined by Shapiro-Wilk normalcy test. All statistical analysis was carried out on R version 4.0.4 (2021-02-15). The level of significance was determined at a $p < 0.05$.

RESULTS

Patient demographics

We identified 191 open fractures in 178 individual patients (107 cases in 2019, 84 cases in 2020). 6 patients were repatriated to our trauma centre following initial debridement and skeletal stabilisation at another site.

There was little difference in average age at presentation in 2020, 48.9 years compared to 50.4 in 2019 (t test

p=0.636), and a change in patient gender distribution, with a significantly greater number of male patients presenting with injuries (2019 -male 57%, female 43%, 2020 – male 64%, female 36%) (Table 1).

Table 1: Patient demographics.

Mechanism of injury	2019 (n=107)		2020 (n=84)	
	N	%	N	%
RTC	48	45	32	38
Fall ground	23	21	11	13
Fall from height	17	16	25	30
Assault	4	4	1	1
Crush and fall from height	3	3	0	0
Unwitnessed	3	3	1	1
Sports	2	2	3	4
Unknown	2	2	0	0
Fall unknown height	2	2	3	4
Crush	2	2	4	5
Sports injury from height	1	1	3	4
Workplace injury	0	0	1	1
Location of fracture				
Ankle	33	31	20	24
Tibia	28	26	26	31
Tibia/Fibula	20	19	19	23
Femoral	16	15	10	12
Patella	5	5	2	2
Traumatic Amputation	2	2	2	2
Foot	2	2	5	6
Fibula	1	1	0	0

During the period of first lockdown, between 25 March 2020 and 1 June 2020, there were only 18 patients admitted with open fractures. This was just over half of the admissions during the same period in 2019, 35 patients. The length of stay in hospital was not statistically significant between 2019 (21 days) and 2020 (17 days, p=0.4084)

Three patients had a 30-day mortality (average 8 days), with 10 suffering a 1-year mortality (average 77 days) in 2019. Only two patients admitted in 2020 suffered a 30-day mortality, and a third patient died at 75 days. It is not possible to determine a 1-year mortality for the 2020 patient population at the time of writing. One patient died prior to first debridement and was excluded from further analysis.

There was a decrease in patients admitted as a result of road traffic accidents (48 versus 32) and fall at ground level (23 versus 11), with an increase in falls from height, notably from ladders and stepladders (17 versus 25). The distribution of injury location did not differ considerably

between 2019 and 2020 for tibial fractures (48 versus 45) or femoral fractures (16 versus 10), with a slight decrease in ankle fractures between the two years (33 versus 20).

Timeline of operative management

In 2019 it took on average 1308 minutes (21 hrs 48 min) for a patient to reach theatre for first debridement after presentation to the Emergency Department (ED). There was a statistically significant 47% decrease in average time to reach theatre in 2020 to 709 minutes (11 hrs 49 min, Mann Whitney U p=0.01763) (Table 2).

The mean time for a patient to achieve skeletal fixation following first debridement in 2019 was 8 days 17 hours, which reduced to 4 days and 4 hours in 2020 (Mann Whitney U, p=0.7999). The mean time to soft tissue coverage in 2019 was 9 days 8 hours, which also reduced to 3 days 12 hours in 2020 (Mann Whitney U, p=0.3657). Despite significant reductions in mean times, neither was statistically significant.

Table 2 Timeline of operative management.

Time from injury to first debridement	2019 cohort (n=104)		2020 cohort (n=80)	
	N	%	N	%
<24 hrs	88	85	76	95
24-36hrs	8	8	0	0
>36 hrs	8	8	4	5
P value	p=0.01763			
Time from first debridement to:	Definitive skeletal fixation			
72hrs	58	56	49	61
72hrs - 7 days	28	27	15	19
7 Days +	18	17	16	20
p value	p=0.7999			
Time from first debridement to:	Definitive soft tissue fixation			
72hrs	53	51	47	59
72hrs - 7 days	32	31	22	28
7 Days +	19	18	11	14
p value	p=0.3657			
Out of hours operating at initial debridement				
Normal Hours	88	85	54	68
Out of Hours	16	15	26	33
Skeletal fixation managed in				
Two Stage	57	55	44	55
One Stage	47	45	36	45
Soft tissue coverage managed in				
Two Stage	65	63	48	60
One Stage	39	38	32	40

6 patients were excluded from this data set as their initial operation was performed at a separate centre prior to repatriation to our MTC. 1 patient was excluded as they died prior to first debridement.

After presentation, 85% (n=88) of our patients achieved first debridement within 24 hours in 2019, whilst 95% (n=76) achieved it in 2020. There was a similar increase in patients achieving definitive skeletal and soft tissue management within 72 hours of first debridement. Skeletal fixation was achieved within 72 hours in 61% (n=49) of cases in 2020, compared to 56% (n=58) in 2019. Definitive soft tissue coverage also had an increase to 59% (n=47) from 51% (n=53).

There was a notable increase in out of hours operating in 2020 at initial debridement. Patients were operated on outside of regular theatre hours, from 8am to 8pm, in 15% of cases in 2019 (n=16), and 33% of cases in 2020 (n=26).

Skeletal fixation was surgically managed in two stages in 55% of cases in 2019 (n=57), and 2020 (n=44). Soft tissue cases were managed as part of a two-stage procedure in 63% of cases in 2019 (n=65) and 60% in 2020 (n=48).

24-hour COVID trauma theatres

18 patients were admitted between the dates of 2nd April and 25th June 2020 during 24-hour COVID Trauma theatres, with 35 patients admitted between 2nd April and 25th June 2019 as a control group. Mean time to initial debridement took 17 hours 17 minutes in the control group, and 9 hours 52 minutes in the 24-hour group (Mann Whitney U, p=0.1972).

Mean time for a patient to achieve skeletal fixation following first debridement in the control group was 18 days 2 hours, which reduced to 1 day 23 hours in the 24-hour Theatre group (Mann Whitney U, p=0.7999). The mean time to soft tissue coverage in the control group was 20 days 23 hours, which also reduced to 1 day 20 hours in the 24-hour Theatre group (Mann Whitney U, p=0.009631).

100% of the patients admitted in 2020 received their initial debridement within 24 hours of presentation to ED, with only 83% of those in the control group achieving this. Definitive skeletal fixation was achieved within 72 hours of initial debridement in 67% of the 2020 patient cohort, and only 46% of the 2019 control cohort. Similarly definitive soft tissue coverage after initial debridement was achieved within 72 hours in 78% of patients in the 2020 cohort, compared to 57% in the 2019 control cohort.

Operative techniques

There was little difference in technique used for skeletal fixation at first debridement between the two cohorts of patients (Table 3).

Fixation was managed by external fixation in 58% of cases in 2019, 57% in 2020 (n=48, n=62), temporary casting in 8% and 11% of cases (n=9, n=9), treatment with ORIF from 7% to 10% (n=7, n=8). There was a small decrease

in patients managed with intramedullary nailing from 18% to 17% (n=19, n=14).

Table 3: Operative techniques.

Initial skeletal fixation type	2019		2020	
	N	%	N	%
External fixation	62	58	48	57
Intramedullary nail	19	18	14	17
Backslab and immobilisation	9	8	9	11
ORIF	7	7	8	10
None	6	6	1	1
Wire fixation	2	2	0	0
Amputation	1	1	2	2
Internal fixation	0	0	2	2
Initial soft tissue fixation type				
Direct closure	55	52	45	54
Vacuum assisted closure	34	32	25	30
Conventional dressing	9	8	5	6
NA	4	4	4	5
Split thickness skin graft	2	2	2	2
None	1	1	0	0
Full thickness skin graft	1	1	0	0
Local flap	0	0	2	2
Free flap	0	0	1	1
Definitive skeletal fixation type				
Intramedullary nail	43	41	31	37
ORIF	33	31	26	31
External fixation	14	13	13	15
Amputation	6	6	7	8
Backslab and immobilisation	4	4	6	7
None	3	3	0	0
Distal femoral replacement	1	1	0	0
Wire fixation	1	1	0	0
Ex Fix + IM Nail	1	1	0	0
Ex-Fix + ORIF	0	0	1	1
Definitive soft tissue fixation type				
Direct closure	71	67	61	73
Free flap	15	14	8	10
Split thickness skin graft	10	9	7	8
Local flap	6	6	7	8
NA	3	3	0	0
Full thickness skin graft	1	1	0	0
Vacuum assisted closure	0	0	1	1

There was also little difference in technique for definitive skeletal fixation between 2019 and 2020. Intramedullary nails accounted for 41% and 37% of cases (n=43, n=31),

ORIF 31% and 31% (n=33, n=26), external fixation 13% and 15% (n=14, n=13), amputation 6% and 8% (n=6, n=7) of cases.

Initial soft tissue fixation was managed by direct closure in 52% (n=55) of cases in 2019, compared to 54% (n=45) in 2020. Vacuum assisted closure (VAC) was used in 32% and 30% (n=34, n=25), managed with conventional dressings in 8% and 6% (n=9, n=5). There was little difference in technique for definitive soft tissue fixation between the two years, with most cases managed by direct closure, 67% in 2019, 73% in 2020 (n=71, n=61). Free flaps were used in 14% and 10% of cases respectively (n=15, n=8), split thickness grafts in 10% and 8% of cases (n=10, n=7), and local flaps in 6% and 8% of cases (n=6, n=7).

DISCUSSION

We compared our findings to similar studies looking at management of lower limb fractures in the UK and worldwide during the COVID pandemic. Three studies were identified, all published in 2020; Campbell et al (Royal London Hospital, East London), Gupta et al (Government Medical College, Chandigarh) and Berner et al (a multicentre study comparing results from 15 centres across 9 countries).⁵⁻⁷

Our study compares patients admitted over a 305-day period in 2020 to a similar period in 2019, significantly more than the 48-day period seen in the Campbell study, 5 months in the Berner multicentre study, and the 118 days in the Gupta study, though unlike the Berner study we only reviewed patients in a single centre.

There was a 21% decrease in number of patients admitted under our Orthopaedics team with open fractures between 2019 and 2020. Comparing the period of first lockdown in 2020 to an equivalent period in 2019 (23rd March to 1st June), there was a drastic 66% decrease in open fracture presentations. This is comparable across the studies comparing 2020 and 2019 data, with an 18% reduction in the London cohort and 42% in Chandigarh.

This can be taken in context with figures for patients presenting to Emergency Departments. NHS England reported 16.2 million people visiting ED in 2019 between January and December, with only 12.9 million reported during the same time period in 2020, a 20.5% decrease.⁸ There was a similar reduction of patients admitted from ED as an inpatient, from 6.53 million to 5.48 million (16.1%).

We can also demonstrate similarities in injury presentation and mechanism of injury across all cohorts, with the majority of fractures involving tibia/fibula, caused by road traffic accidents. These findings did not change between 2019 and 2020 despite national lockdowns in the UK and other represented countries. In our data the percentage of RTC induced injuries decreased (45% to 38%), and this

was compensated with nearly a two-fold increase in injuries sustained by falls from heights (16% to 30%). These injuries include falls downstairs and ladders and are likely a consequence of people staying indoors during lockdown and work from home situations, or participating in home improvement do-it-yourself projects to occupy time.

Unlike the other cohorts we appear to have an older patient population, with mean age of 48.9 years (London 37 years, Chandigarh 34.8 years, Multicohort 43.6 years). This appears to reflect the Median and mean age of local population covered by these major trauma centres; Staffordshire having an average age of 41.9 years, East London and Essex 33.9 and 41.2 years respectively, and Chandigarh a youthful 28.5 years.^{9,10}

Our Major Trauma Centre was able to significantly improve on the time taken for our open fracture patients to reach theatre for first debridement of their injuries by 47%, and improve the percentage that were achieving this within 24 hours of presentation to ED. All studies showed similar improvements in time to first debridement, though not to such a high degree (14% and 23% improvement for high and low energy cases in London respectively, 21% improvement in Chandigarh).

These results may partially be explained by the increased out of hours operating during 2020; from the 2020 cohort 33% were operated out of hours, more than double the 15% of patients operated out of hours in 2019. Though out of hours operating is discouraged under normal circumstances following evidence from NCEPOD audits and the BOAST guidance, 24 hour COVID theatres were set up between 2 Apr 2020 and 25 June 2020, in an effort to provide a major trauma service despite reductions in available theatres and redeployment of theatre staff to ICU and COVID surge roles.^{3,4}

In fact, our data does show that our cohort had significantly improved adherence to BOAST guidelines during these 24-hour COVID trauma theatres, achieving 100% of first debridement within 24 hours of admission. The 24-hour theatres were only temporary and implemented at a time when the infectivity and mortality of SARS-CoV-2 was not known, and so emergency measures were implemented to manage trauma patients quickly and reduce duration of stay. During the second wave in November 24-hour trauma theatres were not re-implemented.

Whilst there was no statistically significant improvement in time taken for patients to have definitive skeletal and soft tissue fixation, there was a small improvement in percentage of patients that achieved this within 72 hours of first surgical debridement, though this still falls below BOAST guideline recommendations.⁴ The London and Chandigarh trauma centres reported greater improvements in their cohorts achieving definitive fixation within 72 hours, and this is an area we should aim to improve on in the future.

BOAST guidelines

The COVID BOAST guidelines emphasise use of single stage procedures where possible, with the aim of preventing repeated theatre admissions and minimise duration of inpatient stay. In cases where limb salvage had an uncertain outcome necessitating multiple operations and prolonged inpatient stay, consideration for early amputation was advised.

Looking at our data, the number of patients requiring one stage vs two stage fixation for their definitive fracture and soft tissue management did not change significantly between 2019 and 2020. There also did not appear to be a significant difference in method used for skeletal and soft tissue management between 2019 and 2020, both on initial debridement and the definitive operation. This shows our operative management for lower limb fractures was not affected by COVID.

Unfortunately, the other studies do not show separate data on skeletal and soft tissue fixation at initial debridement and definitive surgery. The Gupta cohort show an increase in external fixator application use in 2020 (71% from 51%) with subsequent reduction in use of plating and nailing, 6 whereas the London cohort shows an increase in use of direct closure for soft tissue management (83% versus 73%) with a decrease in use of free flaps (6% versus 14%), local flaps and split skin grafts.

All studies show a similar rate of amputations, and amputation rate does not appear to increase in 2020, suggesting the BOAST guidelines recommendations on early amputations are either not necessary, were not required due to reduced incidence of such injuries or were not followed by the trauma centres.

Interpretation

From the data we collected at our Major Trauma Centre we can demonstrate that our centre was able to maintain the same degree of compliance with BOAST guidelines on management of open lower limb fractures during the COVID-19 pandemic as it had in 2019 pre-pandemic, and in some cases exceeded our pre-pandemic capabilities.⁴

This is likely due to the reduction in patients presenting with open fractures as a result of strict lockdown rules, in turn reducing the number of road traffic accidents that were the main cause of open lower limb fractures in 2019. Whilst the reduction in operating capacity due to staff redeployment, sickness and reduced available theatres is likely to have had a negative impact, our major trauma centre was still able to manage the patient workload presented to it.

This appears to be comparable to the other studies published at time of writing comparing their management of lower limb fractures before and during the COVID-19 pandemic. The presentation of trauma arriving at our

major trauma centre, including demographics, mechanism of injury, fracture pattern and management of fractures appear to correlate well with the other studies.

Despite BOAST COVID guidelines suggesting a change in management of open lower limb fractures may be required to reduce operative load and discharge patients early, we did not find any significant change in practice when managing these cases pre-pandemic and during the pandemic, with regards to initial and definitive fixation of skeletal and soft tissue injury. We also found there to be little need for early amputation in complex fracture patterns, and our amputation rate between the two time periods remained relatively unchanged.

CONCLUSION

Despite the significant strain on the healthcare system the world over during the COVID-19 pandemic, our Major Trauma Centre has been able to sustain the same acceptable standard of care with respect to the management of patients with open lower limb fractures when compared to the pre-pandemic period. This is similar to the conclusion reached in other similar studies worldwide. The increased efficiency of out of hours trauma theatres have helped in achieving this in our case. It can hence be concluded that with adherence to standard surgical COVID-19 precautions and routine use of personal protective equipment, it would be possible to follow standard pre-COVID guidance and expect similar results in the management of these patients during any subsequent waves of the pandemic.

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REFERENCES

1. Cases in the UK. Coronavirus in the UK. Available at: <https://coronavirus.data.gov.uk/details/cases>. Accessed on 1st May, 2021.
2. COVID-19 Response - Spring 2021 (Summary) - GOV.UK. Available at: <https://www.gov.uk/government/publications/covid-19-response-spring-2021/covid-19-response-spring-2021-summary#roadmap-out-of-lockdown>. Accessed on 10th May, 2021.
3. BOAST - Open Fractures. Available at: <https://www.boa.ac.uk/resources/boast-4-pdf.html>. Accessed on 10th May, 2021.
4. BOAST - Management of patients with urgent orthopaedic conditions and trauma during the coronavirus pandemic (Archived). Available at: <https://www.boa.ac.uk/resources/covid-19-boasts-combined1.html>. Accessed on 10th May, 2021.
5. Campbell E, Zahoor U, Payne A, Popova D, Welman T, Pahal GS, et al. The COVID-19 Pandemic: The effect on open lower limb fractures in a London

- major trauma centre - a plastic surgery perspective. *Injury*. 2021;52(3):402-6.
6. Gupta R, Singhal A, Kapoor A, Dhillon M, Masih GD. Effect of COVID-19 on surgical management of open fractures and infection rates: A tertiary care experience in Indian set-up. *J Clin Orthop Trauma*. 2021;12(1):16-21.
 7. Berner JE, Chan JK, Gardiner MD, Rakhorst H, Ortega-Briones A, Nanchahal J, et al. RSTN COVID - INTELLECT Collaborative. Standards for treatment of open lower limb fractures maintained in spite of the COVID-19 pandemic: Results from an international, multi-centric, retrospective cohort study. *J Plast Reconstr Aesthet Surg*. 2021;74(7):1633-701.
 8. Statistics. A&E Attendances and Emergency Admissions 2020-21. Available at: <https://www.england.nhs.uk/statistics/statistical-work-areas/ae-waiting-times-and-activity/ae-attendances-and-emergency-admissions-2020-21/>. Accessed on 10th May, 2021.
 9. Office for National Statistics. 2011 Census: Aggregate Data. 2020.
 10. Census of India Website: Office of the Registrar General & Census Commissioner, India. Available at: https://censusindia.gov.in/2011census/population_enumeration.html. Accessed on 10th May, 2021.

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