



■ GENERAL ORTHOPAEDICS

The effects of a UK lockdown on orthopaedic trauma admissions and surgical cases

A MULTICENTRE COMPARATIVE STUDY

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Aims

The current global pandemic due to COVID-19 is generating significant burden on the health service in the UK. On 23 March 2020, the UK government issued requirements for a national lockdown. The aim of this multicentre study is to gain a greater understanding of the impact lockdown has had on the rates, mechanisms and types of injuries together with their management across a regional trauma service.

Methods

Data was collected from an adult major trauma centre, paediatric major trauma centre, district general hospital, and a regional hand trauma unit. Data collection included patient demographics, injury mechanism, injury type and treatment required. Time periods studied corresponded with the two weeks leading up to lockdown in the UK, two weeks during lockdown, and the same two-week period in 2019.

Results

There was a 55.7% (12,935 vs 5,733) reduction in total accident and emergency (A&E) attendances with a 53.7% (354 vs 164) reduction in trauma admissions during lockdown compared to 2019. The number of patients with fragility fractures requiring admission remained constant (32 patients in 2019 vs 31 patients during lockdown; $p > 0.05$). Road traffic collisions (57.1%, $n = 8$) were the commonest cause of major trauma admissions during lockdown. There was a significant increase in DIY related-hand injuries (26% ($n = 13$)) lockdown vs 8% ($n = 11$ in 2019, $p = 0.006$) during lockdown, which resulted in an increase in nerve injuries (12% ($n = 6$ in lockdown) vs 2.5% ($n = 3$ in 2019, $p = 0.015$) and hand infections (24% ($n = 12$) in lockdown vs 6.2% ($n = 8$) in 2019, $p = 0.002$).

Conclusion

The national lockdown has dramatically reduced orthopaedic trauma admissions. The incidence of fragility fractures requiring surgery has not changed. Appropriate provision in theatres should remain in place to ensure these patients can be managed as a surgical priority. DIY-related hand injuries have increased which has led to an increased in nerve injuries requiring intervention.

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Introduction

On 11 March 2020, the World Health Organization (WHO) declared the outbreak of the SARS-CoV-2 (COVID-19) virus a global pandemic. The rising number of new cases and hospital admissions in the UK resulted in increased pressures on hospitals within the

NHS. In a pre-emptive response to this, on 16 March 2020 the UK government released measures to try and reduce pressures on the NHS. These included social distancing and advising people to avoid busy public venues. The requirements for a UK national lockdown were issued on 23 March 2020, whereby

people were told that they should only go outside to buy food, to exercise once a day, or go to work if they absolutely cannot work from home.

The COVID-19 pandemic has led to all non-urgent elective orthopaedic surgery in the UK being postponed for the foreseeable future. The British Orthopaedic Association (BOA) and the NHS have released guidance to advise on management of orthopaedic trauma during these unprecedented times.¹⁻³ The guidance favours non-operative management of fractures where appropriate. The goal of this is to reduce the demand on anaesthetic services during the pandemic and to minimize patient exposure to COVID-19 in a hospital setting. Furthermore, this reduces the risk of disease transmission to staff through aerosol-generating procedures (AGP), such as intubation and extubation of patients for general anaesthesia. Similarly, surgical techniques such as the use of high-speed drills and reamers are classed as aerosol-generating due to their potential to aerosolise blood particles thus increasing risk of transmission.⁴

To ensure optimal patient flow, reduce the risk of viral transmission and allow for healthcare workforce shortages due to viral infection, all non-urgent elective orthopaedic clinic lists were either reduced or changed to telephone/video consultations where appropriate. These measures have enabled orthopaedic staff to be redeployed to help our colleagues in accident and emergency (A&E) departments, medical inpatient wards and intensive therapy units (ITUs) where the intensity of work has significantly increased while caring for patients with COVID-19.

Despite these actions, trauma admissions and cases continue to present to orthopaedic departments. The exact effects of social distancing and lockdown on the orthopaedic workload within the UK remains unknown.

The aim of this multicentre study is to gain a greater understanding of the impact that a nationwide lockdown has had on the rates, mechanisms, and types of injuries together with their management across a regional trauma service.

Methods

Retrospective data for the study was collected from an adult major trauma centre (aMTC), a paediatric major trauma centre (pMTC), a district general hospital (DGH) and a regional hand trauma centre (HTC) all within the UK. Data on A&E attendances and orthopaedic admissions were collected over three, two-week periods, to correspond with the two weeks leading up to government advised lockdown in the UK (10 March 2020 to 23 March 2020), two weeks during lockdown (24 March 2020 to 7 April 2020), and the same two-week period the year previously as a control (24 March 2019 to 7 April 2019).

Medical records and electronic trauma handover lists were used to identify patients who had been referred to each of the individual units over these time points.

All patients admitted under the orthopaedic team were included in the study, irrespective of the treatment received. Patients who were not seen by the accepting team but had telephone advice provided were not included. Likewise, patients seen in the minor injuries department and not admitted under orthopaedics were excluded from the study, as the aims of the study were specifically to gain an understanding on trauma admissions and surgical cases.

The HTC receives acute hand trauma from both the local area and as tertiary referrals from throughout the region. As the requirement for admission to hospital is rare for acute hand injuries, we collected data on all hand trauma referrals to the HTC which underwent assessment during the study periods.

Demographic data were collected along with nature of injury, mechanism of injury, treatment provided and whether it was a fragility-related injury. Any patients with incomplete data for analysis were excluded from the study.

Patients were grouped into three broad categories including adult orthopaedic trauma (aMTC and DGH), paediatric orthopaedic trauma (pMTC and DGH), and hand trauma (HTC). Injury type was subcategorized into hip fracture, upper limb injury, lower limb injury, atraumatic spinal pathology, spinal trauma, suspected or confirmed infection and multiply injured patients.

Mechanism of the injury was subcategorized into fall (including slip, trip), do it yourself (DIY)-related injury (including manual work and gardening), animal or human bite, infection, assault (including documented punching), accidental laceration, crush injury, road traffic collisions (RTCs), sports-related injury, and atraumatic. Patients who presented as a major trauma to the regional major trauma centre were also analyzed independent of adult orthopaedic trauma admissions.

Treatment given was subcategorized into surgical intervention in theatre, antibiotics as primary treatment, further orthopaedic investigation, splintage or casting, wound care or minor procedure out of theatre, and transfer of care to a different speciality or another unit.

Statistical analysis. The data were checked for normal distribution with the D'Agostino and Pearson normality test. Data are presented as median (inter-quartile range) for non-normally distributed data and mean (standard deviation) for normally distributed data. The differences between the groups for continuous data were compared using the Kruskal-Wallis test and Dunn's test that corrects for multiple comparisons. Grouped categorical data were compared with the Pearson's chi Squared test. The Fisher's exact test (FET) was used to compare two groups of categorical data. All analyses were completed on GraphPad Prism version 8.4.2 (San Diego,

Table I. Total number of cases presenting to the A&E departments of each centre in the time period in 2019, pre-lockdown, and during lockdown.

	2019	Pre-lockdown	Lockdown	% decrease 2019 vs lockdown
Adult MTC	6,397	4,362	3,100	51.5%
DGH	4,089	2,913	1,820	55.5%
Paediatric MTC	2,449	1,843	873	64.4%
Total	12,935	9,118	5,733	55.7%

MTC, major trauma centre; DGH, district general hospital.

Table II. Total number of cases admitted to adult, paediatric and hand services in the time period in 2019, pre-lockdown, and during lockdown.

	2019	Pre-lockdown	Lockdown	% decrease 2019 vs lockdown
Adult services (n = 459)	198	160	101	49
Hand services (n = 279)	130	99	50	61.5
Paediatric services (n = 67)	26	28	13	50
Total	354	287	164	53.7

California, USA). Results were considered significant for $p < 0.05$.

Results

There was a reduction in the total number of patients who attended A&E during lockdown (Table I). The total number of patients across all centres dropped from 12,935 patients in 2019 to 5,733 patients during the lockdown period, representing a 55.7% reduction.

Across all four units including each time period, there were 805 orthopaedic trauma patients available for final analysis. This included 459 (57%) adult trauma cases, 67 (8.3%) paediatric trauma cases, and 279 (34.7%) hand trauma cases. There were 467 (58%) male patients and 338 (42%) female patients. All patients had complete datasets.

There was a 53.7% reduction in the number of cases from the two-week period in 2019 to the 2 week period in 2020 corresponding to the national lockdown (2019 group $n = 354$ vs lockdown group $n = 164$). A similar reduction in cases was seen across all subcategories of patients (Table II).

A change in patients' age at time of presentation was observed in the adult trauma group ($H(2) = 11.54$, $p = 0.003$). The median age of patients admitted with adult trauma was greater in the lockdown group versus the 2019 control group (2019 median group age = 55 (interquartile range (IQR) 35.8 to 78.3) versus lockdown 66 (IQR 46.5 to 83.5), mean rank difference 71.3, $z = 3.40$, $p = 0.002$). The opposite was seen in paediatric trauma patients, with the median age decreasing from 9 (IQR = 5 to 15 years) years in 2019 to 5 (IQR 2 to 10.5 years) years during lockdown ($H(2) = 6.41$, $p = 0.04$, Table III). There was a trend in the hand trauma centre to observe a similar pattern to that of the

adult trauma centre with age. However, this was not significant (2019 group median age = 38.5 years (IQR 25.0 to 59.5) versus 51.5 years (IQR 26.8 to 64) during lockdown, $p > 0.05$).

Adult orthopaedic trauma. The total number of adult trauma cases decreased from 198 patients in 2019, 160 patients pre-lockdown, to 101 patients in lockdown.

Although we have seen a dramatic decrease in the volume of adult trauma during the first two weeks of lockdown, the incidence of fragility fractures remains constant with 43 fractures seen in 2019 compared to 48 during lockdown. Hip fractures accounted for the majority of fragility fractures seen during each two-week period (32 patients 2019 vs 31 patients during lockdown). Given the persistence of these injuries, they now account for a greater proportion of our admission and operative caseload compared with 2019 (21.7% in 2019 compared to 47.5% during lockdown, $p < 0.0001$). Despite a decrease in total numbers, the overall percentage of other injury types admitted remain constant over each time period (Table IV).

Mechanism of injury differed between time periods (Table V). During lockdown, there was an increase in proportion of low energy falls from standing height with 67% ($n = 68$) of patients sustaining an injury from falls during lockdown compared to 44% ($n = 87$) of patients in 2019 ($p < 0.0001$). There was a reduction in RTCs causing trauma admissions, 6.9% ($n = 7$) in lockdown versus 18% ($n = 35$) in 2019 ($p = 0.01$). There was also a reduction in orthopaedic infections requiring admission, 2.9% ($n = 3$) during lockdown compared to 11% ($n = 21$) in 2019 ($p = 0.002$). Other mechanisms were similar between the groups ($p > 0.05$ for all).

We also observed that a higher proportion of patients admitted to hospital required surgical intervention during the lockdown period. During lockdown 68% ($n = 69$) patients admitted required surgery compared to 48% ($n = 95$) in 2019 ($p < 0.001$). There was a significant reduction in patients admitted who required no intervention during their inpatient stay during lockdown (3.9% ($n = 4$) lockdown vs 17% ($n = 33$) 2019, $p = 0.0013$).

Adult major trauma. There was a reduction in major trauma cases which presented to the aMTC, 51 patients in 2019, 21 pre-lockdown and 14 during lockdown. During lockdown, 57.1% ($n = 8$) of major trauma cases were due to RTCs, all of these patients sustained multiple orthopaedic injuries requiring extensive surgery. Other reasons for major trauma admissions during lockdown were three elderly fall downstairs (21.4%), two assaults (14.3%), and a single suicide attempt (7.1%).

Paediatric trauma. Paediatric trauma cases also decreased with 26 patients in 2019; 28 pre-lockdown and 13 in lockdown. There were no significant changes in injury types during time periods. Due to the numbers being low it is difficult to draw conclusions on a change in mechanism of injury, however there was a trend towards

Table III. Median age (interquartile range) by adult, hand and paediatric groups across the three time points. Kruskal-Wallis test used to compare the three surgical groups for difference.

	2019	Pre-lockdown	Lockdown	p-value
Adult services	55 (35.8 to 78.3)*	62 (43.3 to 82.8)	66 (46.5 to 83.5)*	0.003 [†]
Hand services	38.5 (25 to 59.5)	35 (27 to 51)	51.5 (26.8 to 64)	0.2
Paediatric services	9 (5 to 15)	10 (7 to 12.8)	5 (2 to 10.5)	0.04 [†]

*Dunn's test corrected for multiple comparisons $p < 0.05$.

[†] $p < 0.05$.

Table IV. Adult admissions by injury type.

	2019 (%), n = 198	Pre-lockdown (%), n = 160	Lockdown (%), n = 101
Fragility injury*	43 (21.7)	56 (35)	48 (47.5)
Non-fragility injury*	102 (51.5)	70 (43.8)	37 (36.6)
Hip fracture	32 (16.2)	35 (21.9)	31 (30.7)
Upper limb injury	20 (10.1)	18 (11.3)	9 (8.9)
Lower limb injury	47 (23.7)	52 (32.5)	24 (23.8)
Spine pain	25 (12.6)	17 (10.6)	13 (12.9)
Spine trauma	7 (3.5)	3 (1.9)	1 (0.9)
Infection	15 (7.6)	13 (8.1)	5 (5)
Major trauma multiple injuries	51 (25.8)	22 (13.8)	17 (16.8)

Chi-squared test to compare proportion of fragility and non-fragility related admissions.

* $p = 0.0002$, $\chi^2 = 16.69$.

Table V. Mechanism of adult trauma admissions.

	2019 (%) n = 198	Pre-Lockdown (%) n = 160	Lockdown (%) n = 101
Fall/slip/trip*	87 (43.9)	90 (56.3)	68 (67.3)
DIY-related/gardening/work	4 (2.0)	3 (1.9)	4 (4)
Animal bite	1 (0.5)	0 (0)	0 (0)
Infection*	21 (10.6)	13 (8.1)	3 (3.0)
Assault/punching/violence	9 (4.5)	11 (6.9)	4 (4.0)
Knife accident/laceration	1 (0.5)	0 (0)	0 (0)
Crush injury/trapped finger/other	0 (0)	1 (0.6)	0 (0)
RTC*	35 (17.7)	13 (8.1)	7 (6.9)
Sports-related injury	8 (4.0)	3 (1.9)	0 (0)
No trauma	32 (16.2)	26 (16.3)	15 (14.9)

*Fisher's exact test for 2019 versus lockdown group $p < 0.05$.

RTC, road traffic collisions

reduction in number of sports-related injuries during the lockdown period (Table VI). Common injuries admitted were upper limb fractures to the distal radii, forearm and supracondylar elbow fractures. There was no difference between percentage of cases admitted which required surgical intervention between time periods.

Hand trauma. The same trend of overall decrease in case volume was observed with hand trauma cases, we saw 130 patients in 2019, 99 pre-lockdown and 50 in lockdown. There was an observed difference in the causes of hand injuries between periods (Table VII). During lockdown there was a significant increase in hand injuries caused by DIY-related injuries (26% (n = 13) lockdown vs 8% (n = 11) 2019, $p = 0.006$) and animal bites (14% (n =

Table VI. Paediatric mechanisms of injury observed between the groups.

	2019 (%), n = 26	Pre-lockdown (%), n = 28	Lockdown (%), n = 13
Fall/slip/trip	11 (42.3)	12 (42.9)	4 (30.8)
Animal bite	1 (3.8)	0 (0)	0 (0)
Infection	1 (3.8)	3 (10.7)	4 (30.8)
RTC	1 (3.8)	2 (7.1)	0 (0)
Sports-related injury	8 (30.7)	10 (35.7)	3 (23.1)
No trauma	4 (15.4)	1 (3.6)	2 (15.4)

7) lockdown vs 5% (n = 6) 2019, $p = 0.049$). Conversely, there was a decrease in sports-related injuries (0% lockdown vs 13% (n = 17) 2019, $p = 0.0038$) and crush injuries (6% (n = 3) vs 19% (n = 25) $p = 0.037$). There was no difference in injuries caused by assaults/punches, falls, or accidental lacerations sustained at home ($p > 0.05$ for all).

During lockdown there was a significant increase in both nerve injuries (12% (n = 6) lockdown vs 2.5% (n = 3) 2019, $p = 0.015$) and infections (24% (n = 12) lockdown vs 6.2% (n = 8) 2019, $p = 0.002$). There was a decrease in hand fractures presenting to the HTC (18% (n = 9) lockdown vs 45.4% (n = 59) 2019, $p < 0.001$). Rates of soft tissue injury, tendon injury, tip injury, and amputation were similar ($p > 0.05$ for all comparisons). Although fewer patients presented to the HTC during lockdown, there was a greater proportion of patients who required surgical intervention for their injuries (38% (n = 19) lockdown vs 16% (n = 21) 2019, $p = 0.0025$).

Discussion

Attendances to the emergency department in the UK have decreased considerably since lockdown began. Figures from Public Health England showed week 14 attendance of 156,717 patients during 2019⁵ compared to 57,993 in 2020.⁶

This multicentre study demonstrates that the enforced UK national lockdown has so far led to a 53.7% reduction in orthopaedic trauma admissions in comparison to the same time period in 2019. Prior to this, the social distancing measures led to a 18.9% decrease in orthopaedic admissions. This reduction in volume has been invaluable to the NHS, allowing orthopaedic staff to become available for redeployment to help hospital departments struggling with COVID-19. The reduction in trauma, along with cancellation of elective workload, has allowed for increased presence of senior orthopaedic clinicians in minor injuries

Table VII. Hand trauma mechanisms and injuries observed between the groups.

Mechanism of injury	2019 (%) n = 130	Pre-Lockdown (%) n = 99	Lockdown (%) n = 50
Fall/slip/trip	37 (28.5)	23 (23.2)	13 (26)
DIY-related/gardening/work*	11 (8.5)	17 (17.2)	13 (26)
Animal bite*	6 (4.6)	3 (3)	7 (14)
Infection	0 (0)	6 (6.1)	5 (10)
Assault/punching/violence	19 (14.6)	19 (19.2)	5 (10)
Knife accident/laceration	9 (6.9)	11 (11.1)	3 (6)
Crush injury/trapped finger*	25 (19.2)	10 (10.1)	3 (6)
RTC	2 (1.5)	2 (2)	0 (0)
Sports-related injuries*	17 (13.1)	8 (8.1)	0 (0)
No trauma	4 (3.1)	0 (0)	1 (2)
Type of injury			
Soft tissue	32 (24.6)	23 (23.2)	10 (20)
Nerve*	3 (2.3)	6 (6.1)	6 (12)
Tendon	17 (13.1)	18 (18.2)	9 (18)
Fracture*	59 (45.4)	33 (33.3)	9 (18)
Fingertip	11 (8.5)	10 (10.1)	5 (10)
Infection*	8 (6.2)	8 (8.1)	12 (24)
Traumatic amputation	0 (0)	1 (1)	2 (4)

*Fishers exact test for 2019 versus lockdown group $p < 0.05$.

units,¹⁻³ which in turn has diminished the requirement for new patient fracture clinics. Early senior decisions and interventions are also likely to be contributory towards reduced admissions during the lockdown period. We saw an increase in the proportion of patients admitted who required surgical intervention (68% lockdown vs 48% 2019), but a reduction in patents requiring no intervention (4% lockdown vs 17% 2019). We postulate that this is multifactorial, due to early senior decision-making, reduction in injuries sustained during lockdown and a possible reluctance of patients to present to hospitals during the COVID-19 pandemic.

Although we have seen a dramatic reduction in trauma admissions, the amount of fragility fractures, predominantly proximal femoral fractures, has remained constant. There are clear benefits to performing early surgery in patients with hip fractures, delaying surgery in these patients increases the number of serious complications encountered, increases length of stay and mortality.⁷⁻¹¹ This is supported by the updated BOA guidance for management of trauma during COVID-19, stating that fragility fractures should still be managed as a surgical priority.¹⁻³ It is therefore important that despite the significant pressures on anaesthetic and theatre departments there should still be urgent provision to manage patients with fragility fractures.

There has been a reduction in major trauma cases presenting to the aMTC as part of the regional major trauma network. The predominant mechanism during lockdown was RTCs, leading to multiply injured patients, all of whom required extensive surgical intervention. There is a significant morbidity and mortality associated with multiply injured patients secondary to trauma, it also places

a significant burden on the health system with prolonged surgical times, inpatients stay and increased risk of complications.^{12,13} This compliments the governments advice that travel by road should only be for essential trips.

Lockdown has seen a reduction in paediatric trauma admitted to the pMTC. Both the types and mechanisms of injury sustained have remained relatively constant, however we have noted the decrease in team sport-related injuries which may have led to a reduction in the average age of patients requiring admission. Paediatric trauma has the advantage of allowing for some incomplete reductions due to the remodelling potential of immature bone,¹⁴⁻¹⁷ but it will take many months to determine the true impact of the current guidance on this population. The reduction in surgical cases and admissions is only partly explained by the increased preference to nonoperative management of paediatric trauma. It is also apparent that the lockdown has had its desired effect in the paediatric population.

Despite the reduction in cases presenting to the HTC, we observed a significant change in the mechanisms of injury involved in sustaining hand injuries. There was a substantial increase in the proportion of DIY/garden-related injuries (26% in lockdown vs 8.5% in 2019) and animal bites (14% in lockdown vs 5% in 2019) during lockdown. This change in mechanism of injury also led to a change in the injury types treated. We saw a significant increase in nerve injuries requiring nerve repair (12% in lockdown vs 2.3% in 2019) and hand infections requiring surgical drainage and/or admission for intravenous antibiotics (24% in lockdown vs 6.2% in 2019) during lockdown. Hand lacerations sustained during gardening or DIY activities can undoubtedly be significant,

nerve injuries can cause extreme long-term dysfunction in the hand with suboptimal outcomes even with surgical repair.¹⁸⁻²⁰ The increase in hand infections can be explained by the increasing amount of animal bites during lockdown and increasing DIY activities leading to lacerations and foreign bodies. Delayed presentation of hand infections can lead to tissue damage and secondary functional disability of the hand.^{21,22} It is imperative that hand infections present to the hospital and are promptly identified and treated.

Although the large drop in both A&E attendances and orthopaedic admissions have been invaluable in helping the NHS during this pandemic, it is probable that the dramatic drop seen may only be partly due to the national lockdown measures. There are unquestionably concerns that patients may be refraining from presenting to the hospitals due to fear of catching COVID-19. This may have future implications and hidden burdens on the NHS while dealing with delayed presentations of a multitude of medical and surgical conditions.

This study does have limitations. The study includes a relatively small numbers of patients. By performing a multicentre study we believe adequate numbers have been included to achieve our aims of demonstrating the effects the UK lockdown has had on orthopaedic trauma workload. The retrospective nature of the study leads to potential difficulties in the data collection, however, given hospital records are stored electronically in each unit we believe this possibility to be small and our data set to be complete. This multicentre study examines the changes in trauma workload throughout a single region within the UK. However, we anticipate similar trends will have been experienced in all orthopaedic departments throughout the country. This study only accounts for the first two weeks of lockdown. It is not yet known how long it will go on for and how long the public remain compliant with the advised measures.

Conclusion

The national UK lockdown is designed to limit the spread of COVID-19. Due to the guidance measures in place it has had a secondary impact of reducing orthopaedic trauma requiring admission in our region by 53.7%. The incidence of fragility fractures being admitted and requiring surgery has not changed. Appropriate provision in theatres should remain in place to ensure these patients can be managed as a surgical priority. Road traffic collisions are still the main cause for major trauma admissions resulting in prolonged and complex surgeries. There has been a significant increase in hand trauma cases caused by DIY/garden-related injuries, which in turn has led to an increase in nerve injuries and hand infections.

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