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Original article

Injury patterns of patients with upper limb and hand trauma sustained during the COVID-19 pandemic lockdown in the UK: a retrospective cohort study



Profils des blessures des patients présentant un traumatisme du membre supérieur et de la main pendant le confinement de la pandémie COVID-19 au Royaume-Uni: une étude de cohorte rétrospective

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ABSTRACT

This work aimed to identify the lead causes of upper limb injury presenting to a busy hand and major trauma unit during the UK COVID-19 domestic lockdown period, in comparison to a cohort from the same period one year previously. Hand and upper limb injuries presenting to the host organization during a pre-lockdown period (23rd March 2019–11th May 2019) and the formal UK lockdown period (23rd March 2020–11th May 2020) were compared, using data collated from the host institution's hand surgery database. The UK lockdown period was associated with a 52% fall in the number of patients presenting to the service with hand and upper limb injuries (589 pre-lockdown vs. 284 during lockdown). There was a significant increase in the proportion of injuries due to machinery use during lockdown (38, 6.5% pre-lockdown vs. 33, 11.6% during lockdown, $P = 0.009$), other etiologies were consistent. The proportion requiring surgical management were similar ($n = 272$, 46.2% pre-lockdown vs. $n = 138$, 48.6% during lockdown, $P = 0.50$). The proportion requiring overnight admission fell ($n = 94$, 16.0% pre-lockdown vs. 29, 10.2% during lockdown, $P = 0.022$). COVID-19 related lockdown in the UK resulted in a reduction in the presenting numbers of hand related injuries; however almost half of these patients still required surgery. These data may be of use to other hand surgery centers for resource planning during future lockdown periods, and for injury prevention strategies in the post-COVID-19 world.

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R É S U M É

Ce travail visait à identifier les principales causes de lésions aux membres supérieurs se présentant dans une unité de traumatologie de la main pendant la période du confinement domestique britannique COVID-19, par rapport à une cohorte de la même période un an auparavant. Les lésions à la main et aux membres supérieurs se présentant dans l'unité lors période de confinement (23 mars 2019–11 mai 2019) et la période officielle de confinement britannique (23 mars 2020–11 mai 2020) ont été comparées en utilisant les données recueillies à partir de la base de données de chirurgie de la main de l'établissement d'accueil. La période de confinement au Royaume-Uni a été associée à une baisse de 52% du nombre de patients se présentant dans le service avec des lésions à la main et aux membres supérieurs (589 hors confinement contre 284 pendant le confinement). Il y avait une augmentation significative de la proportion de lésions dues à l'utilisation de machines pendant le confinement (38, 6.5% hors confinement vs 33, 11.6% pendant le confinement, $P = 0.009$), les autres étiologies étaient cohérentes. La proportion nécessitant une prise en charge chirurgicale était similaire ($n = 272$, 46.2% hors confinement

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vs $n = 138$, 48.6% pendant le confinement, $P = 0.50$). La proportion nécessitant une admission pour la nuit avait diminué ($n = 94$, 16.0% avant le confinement vs 29, 10.2% pendant le confinement, $P = 0.022$). Le confinement lié à la COVID-19 au Royaume-Uni a entraîné une réduction du nombre de lésions de la main, mais près de la moitié de ces patients ont eu besoin d'une intervention chirurgicale. Ces données peuvent être utiles à d'autres centres de chirurgie de la main pour la planification des ressources pendant les futures périodes de confinement, et pour les stratégies de prévention des lésions dans le monde après la COVID-19.
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1. Introduction

On 11th March 2020, the World Health Organization declared COVID-19 (coronavirus disease 2019) secondary to the SARS-CoV-2 coronavirus (severe acute respiratory syndrome coronavirus 2) a pandemic [1]. A review of the practices of hand surgeons worldwide during late March 2020 showed substantial modifications to the practice of hand surgery as a result of the COVID-19 pandemic [2]. Modifications to both the conduct of surgery and an increase in the use of conservative management took place [2]. The British Society for Surgery of the Hand (BSSH) released several documents to guide both surgeons and patients on preventing and managing hand trauma during this period, when the environment for delivery of safe surgical services was expected to be more austere [3].

On March 23rd 2020, the government of the United Kingdom introduced measures to prevent further spread of COVID-19 infection [4]. These measures comprised instructions to citizens of the UK to only leave their place of residence to buy essential food, exercise once a day, or work, and only if they were absolutely unable to work from home. On May 11th 2020 these restrictions were eased, allowing return to work and unlimited exercise [4].

Whilst trends in upper limb and hand trauma in the UK have been well described recently [5], data on the etiologies of upper limb trauma are not as common. As a result of the UK lockdown, there has been a 49-day period where a large proportion of the UK population were confined to their residential settings. This period posed a potential interval in which to examine the etiology of hand injuries sustained when a population is confined to a domestic environment by law. Examination of upper limb trauma sustained during the above period could potentially allow better public health interventions to prevent such injuries during lockdown, which pose an additional burden to overstretched health services whose resources are directed toward treating those with COVID-19. Data gathered from this interval will also be of particular value to hand surgery units in countries where lockdown has yet to be instated or when second or third peaks of COVID-19 occur, to aid with resource planning. Little is written about the epidemiology of hand injuries in general and such data may be of use for injury prevention when COVID-19 restrictions are eventually lifted.

The study aim was to identify the lead causes and diagnoses of hand and upper limb injuries sustained by patients during the UK lockdown period in comparison to a period before domestic confinement took place. The primary hypothesis was that temporary confinement of the UK population to their domestic residences would result in an alteration in the etiology of upper limb trauma sustained by patients.

2. Patients and methods

This work was written in compliance with the Strengthening the Reporting of Cohort Studies in Surgery (STROCCS) and the Strengthening the Reporting of Observational Studies in Epide-

miology Statement (STROBE) guidance for the reporting of observational studies [6,7]. This work was registered with the host institution's department for clinical audit and the department was provided with a study protocol *a priori*, and is thus compliant with the Declaration of Helsinki.

2.1. Data sources

The host institution receives secondary and tertiary referrals for hand surgery, and is also a major trauma center. The institution uses an electronic patient record (EPR) for all patient episodes. A bespoke hand trauma EPR called "eHands" has been developed over the last ten years to collect data prospectively for hand and upper limb patients. All hand trauma data are directly and contemporaneously entered into eHands as part of the patient pathway, comprising assessment, operation notes and more recently, therapy outcomes. This allows management of the patient pathway, robust prospective collection of data, and automatically feeds into other EPR systems used by the institution. The eHands EPR database was retrospectively reviewed.

Data for the primary and secondary outcomes were extracted for two time periods when patients sustained injuries: pre-lockdown (23rd March 2019–11th May 2019) and during lockdown (23rd March 2020–11th May 2020). The pre-lockdown time period was selected for the same date interval as during lockdown, but one year earlier. This was to mimic seasonal injury patterns, and to avoid using a time period too close to when lockdown commenced when some patients may already have begun their own isolation behaviors. Data were collated onto a pre-formatted spreadsheet using Microsoft Excel Software (Version 2007; Microsoft Corp, Redmond, WA).

2.2. Primary and secondary outcomes and definitions

For the two discreet time periods, before, and during the UK lockdown, the primary outcome was the etiology of upper limb trauma injuries sustained. Etiology is recorded prospectively by the reviewing clinician into the hand surgery database at the time of patient evaluation and clerking by the hand surgery team. If there was any doubt as to the etiology from review of the hand surgery database, a study author (SB) further examined the free text of the presenting encounter to confirm the injury etiology.

For the two discreet time periods, before, and during the UK lockdown, the secondary outcomes were:

- Number of patients presenting to the host organization unit (presentation defined as the presence of an electronic clerking note on the unit hand surgery database, with an injury date recorded as within either of the two time periods).
- Diagnoses of upper limb trauma injury sustained (as recorded on the hand surgery database, from the operation note if present, using the most significant operation if more than one operation

took place, or from the clinical examination if no operation was performed).

- Proportion requiring surgical treatment (surgical treatment was defined as the presence of a formal electronic operation note. This excluded minor washouts under local anesthetic for which an operation note would not normally be recorded, e.g., dog bite washouts under local anesthetic in the emergency department, which are part of first aid management at the primary review).
- Proportion requiring overnight admission (as defined by admission and discharge dates occurring on separate days. Data was sourced from the host organization’s admissions database).
- The location of the patient at the time of injury was added as a *post-hoc* secondary data outcome after the original analysis was performed. (This was defined as the location of the patient at the time of the injury, as recorded on the hand surgery database at the first assessment by a member of the hand surgery team). This was to provide further detail on the circumstances of the injuries sustained.

2.3. Inclusion and exclusion criteria

Inclusion criteria were:

- Patients presenting to the host organization’s hand surgery team with an injury that occurred within the specified time interval.
- Patients with hand and upper limb injury.
- Infections (whilst not always secondary to trauma, infections form a significant part of the emergency hand service)

Exclusion criteria were:

- Patients who presented with injury before the study time window, but who had surgery within the study period.
- Burn injuries to the upper limb and hand (managed by a separate service at the host organization).
- Children aged under 16 years (managed by a separate institution).

2.4. Analysis

Statistical comparison took place using SPSS statistical software (IBM Corp. Released 2019. IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp.) For the pre-lockdown and during lockdown periods, the primary and secondary outcomes were compared using a Z score test. The test statistic generated

was used to calculate if there were any significant differences between the two time periods for each individual categorical variable. A chi-square test of independence was performed to test for significant differences in the proportion of injuries sustained at home or at work when comparing pre-lockdown and lockdown periods. A P-value of <0.05 was considered significant.

3. Results

The UK lockdown period (23rd March 2020–11th May 2020) was associated with a 52% fall in the number of patients presenting to the service with hand and upper limb injuries compared to the same period one year previously (23rd March 2019–11th May 2019) (589 pre-lockdown vs. 284 during lockdown). The etiologies of injuries are shown in Table 1, comparing pre-lockdown and lockdown injury incidence as a proportion of the total injuries that presented to the unit.

“Non-trauma” related etiologies included unprovoked infections or acute exacerbations of chronic medical hand pathology, e.g., arthritis, Raynaud’s disease or dermatological conditions referred to the hand service. “Other” instead refers to soft tissue strains, hyperextension injuries, cases where the patient could not recall the mechanism of injury, extravasations or unspecified etiologies that could not be further identified from the electronic database. Finally, “machinery” etiologies related to industrial machines, engines or mechanized presses; “Power tools” were motorized hand tools, and “Non-power tools” were due to e.g., hand-held saws, chisels, and hammers. Not presented in the above results are patients who presented with deliberate self-harm (DSH) injuries during lockdown (because the etiology was classified according to the instrument that caused the injury e.g., glass, knife, other laceration). There were 13 patients that presented to the service with DSH in 2019, and 6 in 2020, an equal proportion. Injury diagnoses are shown in Table 2.

Patient locations at the time of injury are shown in Table 3.

The proportion of presenting injuries requiring surgical management were similar pre-lockdown (n = 272, 46.2%) and during lockdown (n = 138, 48.6%, P = 0.50). The proportion requiring overnight admission fell (n = 94, 16.0% pre-lockdown vs. 29, 10.2% during lockdown, P = 0.022), and this was significant.

Table 1
Etiologies of pre-lockdown and lockdown related hand and upper limb injuries (significant changes in proportion of each injury cause are shown in bold).

	2019 (Pre-COVID-19)		2020 (Lockdown)		P-value
	n	%	n	%	
Fall	114	19.35%	64	22.54%	0.276
Knife	71	12.05%	39	13.73%	0.484
Machinery	38	6.45%	33	11.62%	0.009
Crush	88	14.94%	30	10.56%	0.077
Glass	43	7.30%	22	7.75%	0.81
Fight/punch	54	9.17%	21	7.39%	0.379
Bite	36	6.11%	20	7.04%	0.596
Power tool	18	3.06%	15	5.28%	0.105
Laceration - other	18	3.06%	12	4.23%	0.373
Other	67	11.38%	11	3.87%	0.001
Road traffic collision	9	1.53%	8	2.82%	0.197
Non-power tool	8	1.36%	6	2.11%	0.407
Explosive	2	0.34%	3	1.06%	0.19
Non-trauma	23	3.90%	0	0.00%	0.001
Total	589	100%	284	100%	

Table 2

Diagnoses of pre-lockdown and lockdown related hand and upper limb injuries (significant changes in proportion of each diagnosis are shown in bold) (“N/A” diagnoses included acute exacerbations of chronic hand pathology such as arthritis, or other closed soft tissue injuries such as extravasations).

	2019 (Pre-COVID-19)		2020 (Lockdown)		P-value
	n	%	n	%	
Closed fracture	149	25.30%	70	24.65%	0.834
Dermal breach only	93	15.79%	57	20.07%	0.116
Extensor tendon	69	11.71%	31	10.92%	0.726
Amputation	16	2.72%	19	6.69%	0.005
Nerve	23	3.90%	18	6.34%	0.112
Nailbed	33	5.60%	15	5.28%	0.849
Flexor tendon	7	1.19%	14	4.93%	0.001
N/A	41	6.96%	12	4.23%	0.112
Closed dislocation	6	1.02%	10	3.52%	0.01
Open fracture	26	4.41%	9	3.17%	0.379
Multi-structure	25	4.24%	9	3.17%	0.441
Infection managed with surgery	36	6.11%	6	2.11%	0.01
Infection managed without surgery	26	4.41%	5	1.76%	0.048
Vascular injury requiring revascularization of finger	5	0.85%	3	1.06%	0.764
Deep fascial breach/ muscle belly only	25	4.24%	2	0.70%	0.005
Open joint	2	0.34%	2	0.70%	0.453
Soft tissue defect requiring graft/ flap	7	1.19%	2	0.70%	0.509
Total	589	100%	284	100%	

Table 3

Location of the patient at the time of injury for specific etiologies, for pre-lockdown and lockdown related hand and upper limb injuries (significant differences in the proportions of patients at each location at the time of injury between pre-lockdown and lockdown periods are shown in bold).

	2019 (Pre-COVID-19)		2020 (Lockdown)		P-value
	Domestic	Work	Domestic	Work	
Machinery	16	22	18	15	0.295
Power tool	8	10	12	3	0.037
Non-power tool	7	1	5	1	0.825

4. Discussion

4.1. Summary of results

Overall, the UK lockdown period was associated with a major decline in injuries to the hand and upper limb presenting to the institution’s hand surgery service. However, with 284 presentations during lockdown, this was still a significant burden on the service.

Accounting for the absolute reduction in presenting injuries, when examining all injury etiologies, the proportion of causes of hand and upper limb injury were relatively consistent between the pre-lockdown and lockdown periods. Machinery injury was the only etiology that significantly increased proportionately. The proportion of machinery related injuries sustained at home, compared to those sustained at work, however, did not differ between the pre-lockdown and lockdown periods. Taken together, this can be interpreted as a rate of both domestic and work-related machinery injuries that remained relatively unaffected by lockdown, against a backdrop of a reduction in almost all other causes of upper limb injury.

Again, when accounting for the absolute reduction in presenting injuries during lockdown, the proportion of closed dislocations, amputations and flexor injuries increased significantly. The proportion of muscle belly lacerations and infections managed either conservatively or with surgery significantly reduced.

The same proportion of presenting injuries needed surgery during lockdown, compared to pre-lockdown, consisting of 138 operations, and 48.9% of the presenting patients. Notably, those admitted to hospital overnight fell significantly to just 10.2% of presenting patients (n = 29).

4.2. Effects of lockdown on hand injuries observed by other studies

The literature has begun to report more widely on the implications of a lockdown period on hand injuries in the wake of COVID-19. The most detailed report to date on the effect of a lockdown period on hand surgery was described in Paris, France (lockdown from March 17th to May 10th 2020), where lockdown resulted in a 65% reduction in presentations of upper limb injury to one major orthopedic unit [8]. This reflects a similar pattern to that observed by the present study. However, this is not universal and other units in Italy [9] and Singapore [10] saw little change in the numbers of hand injuries presenting during the pandemic period, representing an appreciable burden on the healthcare system.

The Paris report showed a significant reduction in injuries relating to work, sport and leisure accidents, and a doubling in the proportion of domestic accidents [8]. Whilst comparison with the findings of the present study is impaired by variation in outcome reporting for hand injury etiologies throughout the literature, machinery injury was the only etiology that significantly increased proportionately in the cohort reported in this study. There was no increase in assault/fight/punch related injuries, which reduced only slightly. Road traffic collision injuries still occurred with a similar proportionate incidence to the pre-lockdown period, as was also demonstrated in France [8]. The finding that deliberate self-harm injuries to the hand and upper limb did not increase, must be interpreted alongside recent data from the same hospital, that deliberate drug overdoses *did* increase during the same period [11]. This is suggestive of a broader increase in psychiatric morbidity that took place during

lockdown, but that did not manifest as an increase in hand and upper limb injury.

The Paris report also demonstrated an increase in lacerations and infections during lockdown [8], whereas in the present study muscle belly lacerations and infections significantly reduced, and closed dislocations, amputations and flexor injuries significantly increased, with other diagnoses remaining consistent. A potential reason for the observed reduction in infections in the host institution during the lockdown was the adoption of a consultant-led care model [12]. At the host unit, this was part of a coordinated, necessary transition in workforce arrangements; details of which have been described and published previously [12]. This has occurred at other units mandating senior clinician “step down” on calls to cope with COVID-19 [10]. As a result of early senior decision making, fewer speculative diagnoses of “possible infection” may have been made. More non-infective (e.g., inflammatory arthropathies) diagnoses may have thus been more accurately detected at presentation. Similarly, consultant-led care may have contributed to the fall in admissions, as inpatient admission became a consultant-led decision during lockdown. In terms of quantifying injury severity, finger revascularizations were necessary and still took place during lockdown at the host institution, and at those of others’ during the COVID-19 pandemic [2].

The above comparisons must be made whilst considering that lockdown strategies between all countries vary considerably in their timing, character and stringency [13,14]. For those seeking further detail, comparison is aided heavily by the Oxford COVID-19 Government Response Tracker (OxCGRT) stringency index [14]. The UK lockdown described in this work includes the period where citizens could go to work if they absolutely could not work from home [4]. Thus, UK workers at offices and factories without public interaction may have been at work during the UK lockdown period [15], a lockdown strategy that differs from other countries. This may serve in part as an explanation for those hand and upper limb machinery related injuries that continued to take place at work.

It is expected that further reports from centers worldwide will emerge in the future. As a benefit of the above data, countries that have yet to experience domestic lockdown, or are in the early phases, may be better able to plan their own responses to the expected burden of hand injury. The COVID-19 pandemic has been unprecedented and the learning from it may aid hand surgery service planning for other international crises should they occur in the future.

4.3. Implications for hand injury prevention strategies

Domestic lockdown in the UK, enforced residential confinement, along with a raft of public health announcements, including from organizations such as the BSSH [16], were associated with a major decline in hand injury patients presenting to the host organization.

There was a non-significant increase in the proportion of injuries that occurred due to powered and unpowered tool use during lockdown. There was a significant difference between pre-lockdown and lockdown periods in the proportion of power-tool related injuries, with a greater number sustained in a domestic setting than at work during lockdown. It is suspected that the UK lockdown may have led to an increase in injuries relating to home improvement projects, handiwork, and DIY (do-it-yourself) work. Public health interventions to prevent domestic injury could potentially benefit from focus in this area in the future. Such calls have been made before due to the considerable public health and economic benefit of hand injury prevention [17]. Evidence to support that this benefit would persist during a lockdown is

demonstrated by the fact that finger revascularization continued to take place at the host institution, that 48.9% of patients still required surgery and 10% were admitted overnight. The authors would encourage organizations and governments to further develop injury prevention strategies to reduce hand injuries secondary to machinery and tool use both during lockdowns and in the future.

4.4. Study strengths and limitations

Presented are the results of a retrospective cohort study conducted at one of the busiest hand surgery and major trauma centers in the UK, with a diverse population. Data capture was complete and detailed, owing to the prospective nature of the electronic database used by the unit clinicians. The data presented form a cohort of an equivalent size to other major publications in the field [8]. Part of the focus of this work was on how injuries can be avoided when services and human behaviors return to normality after lockdown. Whilst the timescale for this is unpredictable, the benefits of the learning attained have the potential to be long lived. The injuries presenting during this period will guide countries that have yet to experience a lockdown or are in its early stages.

As a consequence of the use of retrospective data collection, there are some known limits to the above work. Some patients will have presented to the hand and upper limb surgery team as a result of major polytrauma, where the upper limb injury may not have mandated admission if it were the only presenting injury. Thus, the admission rate may be biased by this and appear higher than if these patients had been excluded.

5. Conclusions

Other countries still yet to experience a COVID-19 related lockdown could expect to see a reduction in hand related injuries were such conditions imposed. However, the injuries that do present could continue to be severe, with up to 50% requiring surgery, and demonstrating a spectrum of diagnoses similar to pre-lockdown conditions. Domestic confinement increased injuries due to machinery use and injury prevention strategies could focus on this in the post-COVID-19 world.

Human and animal rights

The authors declare that the work described has not involved experimentation on humans or animals.

Informed consent and patient details

The authors declare that this report does not contain any personal information that could lead to the identification of the patient(s) and/or volunteers.

Disclosure of interest

The authors declare that they have no known competing financial or personal relationships that could be viewed as influencing the work reported in this paper.

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Author contributions

All authors attest that they meet the current International Committee of Medical Journal Editors (ICMJE) criteria for Authorship.

TEP: Concept and study design, methodology, data analysis and interpretation, drafting and revision of manuscript.

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PM: Concept and study design, data analysis and interpretation, revision of manuscript.

MF: Concept and study design, data analysis and interpretation, revision of manuscript.

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Availability of data and material

All available on request.

Ethical approval

Not applicable. Conducted in compliance with the Declaration of Helsinki.

Protocol

The protocol for this review was registered *a priori* with the host institution's department for quality improvement.

List of all products, devices, drugs, etc., used

Microsoft Excel Software (Version 2007; Microsoft Corp, Redmond, WA).

SPSS statistical software (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp.).

Prior presentations

Nil.

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Nil.

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