



Cohort Study

The effect of the COVID-19 pandemic lockdown measures on plastic, reconstructive and hand surgery emergency presentations – A comparative retrospective study in a regional referral center in Germany

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ABSTRACT

Background: The global COVID-19 pandemic has led to social constraints and changes in injury patterns during the government-imposed restrictions. The aim of this study was to evaluate the effects of the lockdown period on the pattern of emergency presentations in a plastic, hand and reconstructive surgery department in a German referral center.

Methods: A retrospective cohort study was conducted comparing patients presenting during the enforced lockdown period in 2020 and the same pre-pandemic period during the previous year 2019. All emergency presentations in the emergency unit requiring treatment by plastic, hand and reconstructive surgery were included. Patient demographics, reason for presentation, need for hospital admission, body region affected, location of injury and/or occurrence of first clinical symptoms and injuries of anatomical structures were considered.

Results: Demographics were comparable among both groups. A 42.7% reduction in emergency cases was observed during the lockdown period. A significant elevation of domestic injuries and symptoms in the pandemic group (51.54% vs. 66.15%, $p = 0.007$) was registered. Concurrently, a decrease in recreational injuries (27.31% vs. 15.38%, $p = 0.009$) and workplace injuries (10.57% vs. 7.69%, $p = 0.37$) was noted. Hospital admission rates and length of stay were comparable. Similarly, no statistically significant differences could be detected regarding injuries of functional anatomical structures. The same holds true for crush injuries, animal bites, fall injuries, finger amputations, disc saw injuries, and distortion injuries. Fractures of the phalanges, the metacarpus/carpus and the forearm exhibited an increase.

Conclusions: In spite of decreasing total emergency caseloads, there was an unchanged need for plastic, hand and reconstructive in-patient surgery and care during the lockdown period. Resource allocation has to be considered in future pandemic waves. Prevention strategies are warranted and should focus on finding measures to counteract domestic injuries.

1. Introduction

On March 11, 2020 the World Health Organization assessed that COVID-19 can be characterized as a pandemic [1]. This resulted in restrictions of societal interaction and day-to-day life in all segments of the population. From the 16th of March until the 16th of April 2020, the German government initiated prevention measures and a countrywide lockdown to counteract increasing COVID-19 infections [2]. During the

German lockdown period, citizens were instructed to stay at home and only leave their residence to purchase crucial items. Citizens were encouraged to relocate their job and work from home whenever possible. Within hospital settings, surgical departments limited elective operations and reduced their caseloads to high priority and emergency procedures in an effort to maintain resources [3–6].

The confinement of the population allowed the assumption of a shift in the epidemiology, etiology and injury patterns sustained by patients

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during their residence.

Given the exceptional and immense societal impact of the pandemic, an analysis of emergency cases in a plastic, reconstructive and hand surgery unit was sought out to understand these patterns in order to ameliorate resource allocation in the future in case of comparable outbreaks or societal restrictions, particularly in overstretched healthcare systems.

We hypothesized that the lockdown imposed with its restrictions of daily-life, recreation and work life may have led to decreasing caseloads throughout the spectrum of emergency presentations in our plastic, reconstructive and hand surgery department.

To examine this hypothesis, we performed a retrospective analysis of emergency cases presented during the COVID-19 pandemic in a German hospital. Given that hand injuries may constitute up to 30% of all acute injuries treated at emergency units [7], care was given to analyze these injuries in particular.

2. Methods

This retrospective single-center cohort study examined the charts of all patients presenting at the emergency unit of the plastic, reconstructive and hand surgery department at Hannover Medical School during the lockdown period from March 16th to April 16th 2020. Hannover Medical School presents a level 1 trauma and referral center located in Lower Saxony, Germany.

Data were reviewed and parameters including age, gender, reason for presentation, need for hospital admission and body region affected were collected. Location of injury and/or occurrence of first clinical symptoms were categorized into home, recreational, work, and post-intervention/post-treatment. Besides, fracture locations and injuries of anatomical structures (e.g. nerves, arteries and tendons) were considered.

Patients presenting in the emergency unit during the same time period in 2019, the previous year, were used as pre-pandemic controls.

Patients requiring consultation of other subdivisions for treatment and in-hospital referrals were excluded from this analysis. Data analysis and descriptive statistics were performed using GraphPad Prism 9 (GraphPad Software Inc, San Diego, CA) and Microsoft Excel. Pearson chi-square test or Fisher's exact test were used for comparative analyses. P-values < 0.05 were considered significant. Ethical approval for this study was obtained from the Hannover Medical School Ethics Committee. The study was reported in line with the STROCSS criteria [8]. This research was retrospectively registered in the German Clinical Trials Register (UIN: DRKS00029403, https://www.drks.de/drks_web/navigation.do?navigationId=trial.HTML&TRIAL_ID=DRKS00029403).

3. Results

Table 1 summarizes all patient data of the pandemic and the pre-pandemic groups.

In total, 357 patients presented in our plastic, reconstructive and hand surgery emergency unit during the investigated study periods. 130 patients presented during the lockdown period after the start of the pandemic. During the corresponding time in the year 2019, 227 patients presented, accordingly. Thus, a 42.7% decrease in emergency caseload was observed within the pandemic group compared to the non-pandemic group the preceding year.

The two groups were similar with regard to demographics, in particular to gender distribution and age groups, as well as body area affected, except for the affection of the face, neck and scalp area (2.64% vs. 8.46, $p = 0.013$) (see **Table 1**). During both periods, mostly young-to-middle-aged patients between the ages 20-59 were affected.

Concerning the reason for presentation, traumatic injuries entailed the most commonly encountered cases prior and after the beginning of the pandemic (53% and 49%, respectively).

There was no statistically significant reduction in patients presenting

Table 1
Demographic and clinical characteristics.

	2019 (n = 227)		2020 (n = 130)		p-value
	Mean	SD	Mean	SD	
Age (years)	42.65	20.11	38.75	18	0.068
Length of stay total (days)	8.9	18.7	6.16	6.5	0.107
	n	%	n	%	
In-hospital Admissions	42	18.5	25	19.23	0.865
Gender					
Male	84	37	46	35.38	0.757
Female	143	63	84	64.62	0.757
Age Group (years)					
1-19	28	12.33	20	15.38	0.418
20-39	81	35.68	46	35.38	0.952
40-59	72	31.72	44	33.85	0.682
60-79	36	15.86	20	15.38	0.904
>80	10	4.41	0	0	0.016
Emergency Reason					
Trauma	121	53.3	64	49.23	0.459
Burn	39	17.18	22	16.92	0.952
Infection	48	21.15	23	17.69	0.43
Wounds	9	3.96	8	6.15	0.352
Wound control/Change of dressing	10	4.41	13	10	0.038
Postoperative Complications	7	3.08	8	6.15	0.165
Body Area Affected					
Face/Neck/Scalp	6	2.64	11	8.46	0.013
Arms	20	8.81	17	13.08	0.204
Hands	176	77.53	92	70.77	0.156
Legs	22	9.69	9	6.92	0.373
Feet	13	5.73	3	2.31	0.185
Thorax	6	2.64	3	2.31	0.999
Abdomen	9	3.96	4	3.08	0.776
Back/Flanks	9	3.96	6	4.62	0.772
Genital area	2	0.88	2	1.54	0.624
Place of Accident/First clinical symptoms					
Home	117	51.54	86	66.15	0.007
Recreational	62	27.31	20	15.38	0.009
Workplace	24	10.57	10	7.69	0.373
Post-Intervention/Post-Treatment	24	10.57	14	10.77	0.952

for burns and infections in comparison with the pre-pandemic control group, however we noted a slight decreasing trend (17.18% vs. 16.92%, and 21.15% vs. 17.69%, respectively). In contrast, an increasing trend was noted for presentations due to wounds or postoperative complications.

A statistically significant increase of cases presenting for wound control or change of dressing was noticed for the pandemic group compared to the pre-pandemic group (10% vs. 4.41%, $p = 0.038$).

We detected a significant elevation of domestic injuries and symptoms in the pandemic group (51.54% vs. 66.15%, $p = 0.007$). Also, a significant decrease in recreational injuries was noted (27.31% vs. 15.38%, $p = 0.009$). Concurrently, a noteworthy decrease in the rate of workplace injuries was observed (10.57% vs. 7.69%, $p = 0.37$) albeit with no statistical significance. The hospital admission rates (18.5% vs. 19.23%, $p = 0.865$) and length of stay (8.9 days vs. 6.16 days, $p = 0.107$) were similarly comparable.

With regard to injuries of functional anatomical structures, no statistically significant differences could be detected between pre-pandemic and pandemic cohorts: tendon injuries (10.13% vs. 11.54%), nerve injuries (7.05% vs. 6.92%) and arterial injuries (6.61% vs. 5.38%) (see **Fig. 1**). The same holds true for crush injuries, animal bites, fall injuries, finger amputations, disc saw injuries, and distortion injuries (see **Fig. 2**). Fractures of the phalanges, the metacarpus/carpus and the forearm exhibited an increase (see **Fig. 3**).

4. Discussion

The COVID-19 pandemic has significantly induced changes in the caseloads and injury patterns throughout the spectrum of emergency presentations in plastic, reconstructive and hand surgery departments

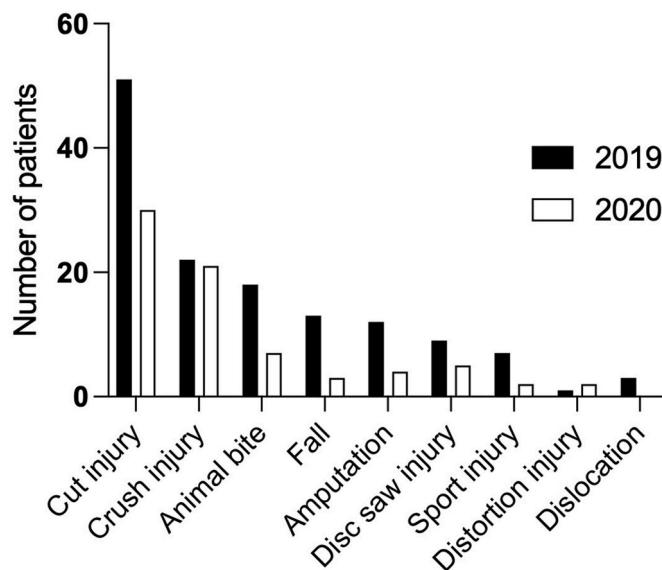


Fig. 1. Injury etiologies during the lockdown and pre-pandemic periods.

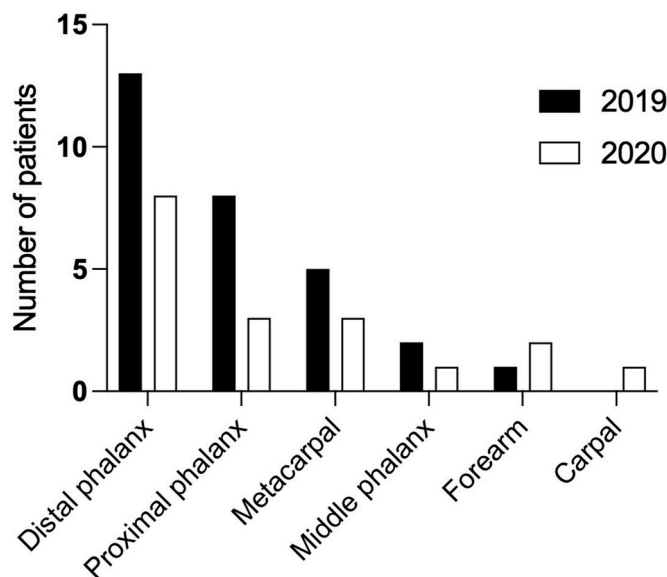


Fig. 2. Fractures during the lockdown and pre-pandemic periods.

[9–11]. Possible explanations could be the restrictions enforced by the lockdown measurements, resulting in a reduction of manual labor and recreational activities, and reduced presentation to the emergency department out of fear of disease contraction. Still, with 130 presentations during the lockdown period, this presented a substantial burden in addition to the inherent fatigue that the pandemic has instigated to healthcare personnel.

Similar caseload reductions have been noted internationally with regard to plastic surgery trauma admissions [12,13], as well as within other specialties [14–16]. Nonetheless, this finding was frequently met with an increase in disease severity and requirement for surgical treatment, highlighting an alarming trend.

Accounting for absolute reduction in emergency cases, when observing all injury etiologies, the rates of causes were comparatively consistent between the lockdown and pre-pandemic periods with regard to trauma, burns and infections. There was a trend towards an increase in patients presenting with wounds, for wound control or change of dressing and postoperative complications. This may partially be

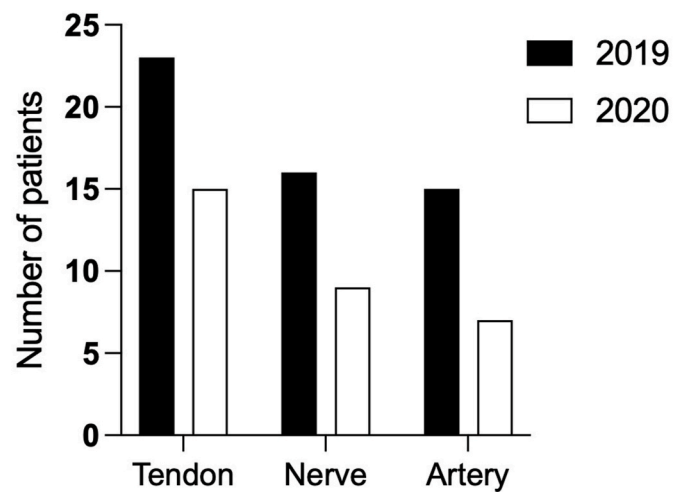


Fig. 3. Injuries of functional structures observed during the lockdown and pre-pandemic periods.

explained by restrictions and overextension of ambulatory patient care by general practitioners during the pandemic, driving patients to present in emergency rooms instead.

Besides, we observed that particularly complex hand injuries remained unaffected, reflected by similar rates of nerve, arterial and tendon injuries, and similar rates of traumatic finger amputations. This finding was in line with previous reports showing no decrease in complexity of injuries and extent of severity [17–19].

Of note, admission rates and length of stay showed no statistically significant difference at our institution. Thus, in spite of the detected reduction in emergency caseloads during the lockdown period, our results underline the significance of steady resource allocation to emergency presentations requiring surgery and in-patient treatment.

Domestic injuries presented the majority of emergency cases, followed by recreational injuries, workplace injuries and post-intervention or post-treatment medical conditions. During the pandemic, we noted a reduction in recreational injuries (15.38% vs. 27.31%, $p = 0.009$), as well as workplace injuries (7.69% vs. 10.57%, $p = 0.37$). As expected, the ratio of domestic injuries registered a significant increase (66.15% vs. 51.54%, $p = 0.007$). Again, this emphasizes the importance of resource allocation to plastic surgery emergency units, given that the greatest cost burden in domestic injuries, e.g. lacerations, falls and burns, frequently necessitate plastic and reconstructive surgical treatment.

The increase in the rates of domestic injuries may likely reflect the relative reduction in recreational and workplace injuries as a consequence of adhering to ‘the stay at home’ message during the lockdown period. Secondly, social isolation and recreational restrictions may have been a driving factor for the increase in manual activities, tasks and maintenance work around the house which may have otherwise been undertaken by professionals.

During lockdown, we experienced no significant increase in sports injuries. In spite of this fact, we still noted a relative increase of closed fractures of the phalanges, the metacarpus, the carpus and the forearm. This may be explained by the circumstance that, despite common misconception, closed hand injuries most frequently occur domestically and not within the frame of sports injuries [20].

Lockdown measures induce an alteration in social behavior. Based on our results, particularly middle-aged females were at high risk to sustain injuries and symptoms, requiring plastic, hand and reconstructive surgical treatment during lockdown periods. This may have implications for prospect hand injury prevention strategies, calling on public health interventions to counteract domestic injuries in the future and to avoid overextension of emergency resources. Indication to back the claim that

this advantage would persevere during a lockdown period is shown by the fact that particularly hand injuries showed consistent severity and that hospital admission rates, as well as length of stay, remained unaffected by the pandemic. Therefore, the authors encourage administrations and governments to advance injury prevention policies to reduce domestic hand injuries particularly during lockdown.

Our study has several limitations. Our results are based on a very specific single-center patient cohort and retrospective data; hence they may only partially reflect the epidemiological characteristics of emergency presentations. Treatments that have been applied by external hospitals and practitioners were not considered in our analysis. Besides, annual fluctuations in emergency presentations naturally exist, thus using the year 2019 as a pre-pandemic control may not be ideal.

5. Conclusion

In spite of a reduction in total caseloads during the government-imposed lockdown period, trauma, infections and burns requiring plastic, hand and reconstructive surgical in-patient treatment did not substantially decrease. A shift in injury location was noted, with an increase in domestic injuries and a decrease in recreational and work-related injuries.

Our results highlight that injuries requiring emergency plastic, hand and reconstructive surgery persisted with substantial volume during the lockdown period, underlining the importance of safeguarding resource allocation with regard to operating facilities, personnel and equipment in future pandemic waves. Prevention strategies are warranted and should focus on finding measures to counteract domestic injuries in the near future.

Provenance and peer review

Not commissioned, externally peer reviewed.

Ethical approval

Ethical approval has been given by the ethics committee of Hannover Medical School (ref.: Nr. 10103_BO_K_2021).

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None.

Author contribution

Doha Obed: Conception of study, acquisition of data, analysis of data, interpretation of data, manuscript preparation, Mustafa Salim: Acquisition of data, analysis of data, interpretation of data, critical revision of manuscript, Tekoshin Ammo: Acquisition of data, interpretation of data, critical revision of manuscript, Maria M. Gildt: Acquisition of data, interpretation of data, critical revision of manuscript, Nicco Krezdorn: interpretation of data, critical revision of manuscript, Peter M. Vogt: interpretation of data, critical revision of manuscript, Khaled Dastagir: analysis of data, interpretation of data, critical revision of manuscript, All authors have given their final approval of the submitted version.

Consent

Consent to use data for scientific purposes was obtained from all patients.

Registration of research studies

1. Name of the registry: German Clinical Trials Register
2. Unique Identifying number or registration ID: DRKS00029403

3. Hyperlink to your specific registration (must be publicly accessible and will be checked): https://www.drks.de/drks_web/navigate.do?navigationId=trial.HTML&TRIAL_ID=DRKS00029403

Guarantor

Doha Obed, MD.

Declaration of competing interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.amsu.2022.104650>.

References

- [1] WHO Listings of WHO's response to COVID-19. Available: <https://www.who.int/news/item/29-06-2020-covid-timeline> [Accessed 25 May 2022]., (n.d.).
- [2] S. Bönisch, K. Wegscheider, L. Krause, S. Sehner, S. Wiegel, A. Zapf, S. Moser, H. Becher, Effects of coronavirus disease (COVID-19) related contact restrictions in Germany, March to May 2020, on the mobility and relation to infection patterns, *Front. Public Health* 8 (2020), 568287, <https://doi.org/10.3389/fpubh.2020.568287>.
- [3] O. Cases-Perera, J. Losilla-Rodríguez, R. Rivera-Lopez, COVID-19 lockdown impact on plastic surgery activity in the emergency department, *Med. Clinica Engl. Ed.* 156 (2021) 139–140, <https://doi.org/10.1016/j.medcle.2020.08.006>.
- [4] F.R. Grippaudo, E. Migliano, U. Redi, G. Turriziani, D. Marino, G. D'Ermo, D. Ribuffo, The impact of COVID-19 in plastic surgery departments: a comparative retrospective study in a COVID-19 and in a non-COVID-19 hospital, *Eur. J. Plast. Surg.* 43 (2020) 645–650, <https://doi.org/10.1007/s00238-020-01725-w>.
- [5] M. Pignatti, V. Pinto, M.E.L. Miralles, F.A. Giorgini, G. Cannamela, R. Cipriani, How the COVID-19 pandemic changed the Plastic Surgery activity in a regional referral center in Northern Italy, *J. Plast. Reconstr. Aesthetic Surg.* 73 (2020) 1348–1356, <https://doi.org/10.1016/j.bjps.2020.05.002>.
- [6] J.E. Telich-Tarriba, D.F. Navarro-Barquin, Plastic surgery emergency surgical care during the COVID-19 lockdown at a Mexico City academic center, *J. Plast. Reconstr. Aesthetic Surg.* 74 (2021) 644–710, <https://doi.org/10.1016/j.bjps.2020.08.141>.
- [7] C.F. Larsen, S. Mulder, A.M.T. Johansen, C.F. Larsen, The epidemiology of hand injuries in The Netherlands and Denmark, *Eur. J. Epidemiol.* 19 (2003) 323–327, <https://doi.org/10.1023/B:EJEP.0000024662.32024.e3>.
- [8] G. Mathew, R. Agha, STROCSS Group, StrocSS 2021: strengthening the reporting of cohort, cross-sectional and case-control studies in surgery, *Int. J. Surg. Lond. Engl.* 96 (2021), 106165, <https://doi.org/10.1016/j.ijssu.2021.106165>.
- [9] M.K. Ho, C.Y.C. Chau, Plastic and reconstructive surgery during the COVID-19 pandemic: impacts on healthcare workers, financing, and governance, *Arch. Plast. Surg.* 49 (2022) 127–129, <https://doi.org/10.5999/aps.2021.00724>.
- [10] V.P.F. Pagotto, L. Abbas, D.C. Goldenberg, R.C. Lobato, B.B. do Nascimento, G.G. R. Monteiro, C.P. Camargo, F. de Freitas Busnardo, R. Gemperli, The impact of COVID-19 on the plastic surgery activity in a high-complexity university hospital in Brazil: the importance of reconstructive plastic surgery during the pandemic, *Eur. J. Plast. Surg.* 43 (2020) 819–824, <https://doi.org/10.1007/s00238-020-01729-6>.
- [11] S. Diamond, J.B. Lundy, E.L. Weber, S. Lalezari, G. Rafijah, A. Leis, B.L. Gray, I. C. Lin, R. Gupta, A call to arms: emergency hand and upper-extremity operations during the COVID-19 pandemic, *J. Hand Surg. Glob. Online.* 2 (2020) 175–181, <https://doi.org/10.1016/j.jhsg.2020.05.004>.
- [12] K. Hassan, H. Prescher, F. Wang, D.W. Chang, R.R. Reid, Evaluating the effects of COVID-19 on plastic surgery emergencies: protocols and analysis from a level I trauma center, *Ann. Plast. Surg.* 85 (2020) S161–S165, <https://doi.org/10.1097/SAP.0000000000002459>.
- [13] L.Z. Cordova, N. Savage, R. Ram, L. Ellis, V. Tobin, W.M. Rozen, M.A. Seifman, Effects of COVID -19 lockdown measures on emergency plastic and reconstructive surgery presentations, *ANZ J. Surg.* 91 (2021) 415–419, <https://doi.org/10.1111/ans.16625>.
- [14] H.R.E. Drysdale, S. Ooi, Geelong Surgical COVID-19 Response Team, S. Nagra, D. A. Watters, G.D. Guest, Clinical activity and outcomes during Geelong's general surgery response to the coronavirus disease 2019 pandemic, *ANZ J. Surg.* 90 (2020) 1573–1579, <https://doi.org/10.1111/ans.16207>.
- [15] I. Kuitunen, V.T. Pankilainen, A.P. Launonen, A. Reito, T.P. Hevonkorpi, J. Paloneva, V.M. Mattila, The effect of national lockdown due to COVID-19 on emergency department visits, *Scand. J. Trauma Resuscitation Emerg. Med.* 28 (2020) 114, <https://doi.org/10.1186/s13049-020-00810-0>.
- [16] V. Ojetti, M. Covino, M. Brigida, C. Petruzzello, A. Saviano, A. Migneco, M. Candelli, F. Franceschi, Non-COVID diseases during the pandemic: where have all other emergencies gone? *Med. Kaunas Lith.* 56 (2020) E512, <https://doi.org/10.3390/medicina56100512>.

- [17] T. Fortané, M. Bouyer, M. Le Hanneur, B. Belvisi, G. Courtiol, K. Chevalier, C. Dainotto, M. Loret, A. Kling, A. Bentejac, T. Lafosse, Epidemiology of hand traumas during the COVID-19 confinement period, *Injury* 52 (2021) 679–685, <https://doi.org/10.1016/j.injury.2021.02.024>.
- [18] S. Rinkoff, B. Jemec, Variation in volumes and characteristics of hand trauma patients seen during the early COVID-19 lockdown in a central London Plastic Surgery Unit, *Br. J. Surg.* 107 (2020) e571–e572, <https://doi.org/10.1002/bjs.11962>.
- [19] R. Pichard, L. Kopel, Q. Lejeune, R. Masmoudi, E.H. Masméjean, Impact of the CORonaVirus Disease 2019 lockdown on hand and upper limb emergencies: experience of a referred university trauma hand centre in Paris, France, *Int. Orthop.* 44 (2020) 1497–1501, <https://doi.org/10.1007/s00264-020-04654-2>.
- [20] A. Campbell, Hand injuries at leisure, *J. Hand Surg. Br. Eur.* 10 (1985) 300–302, [https://doi.org/10.1016/S0266-7681\(85\)80048-6](https://doi.org/10.1016/S0266-7681(85)80048-6).