A clinical analysis of causes of hand injuries and their countermeasures during the COVID-19 outbreak and work resumption period

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Research

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Abstract

Background: In the new circumstances created by the COVID-19 pandemic, fuller knowledge of hand injury patterns may help with the injury prevention in factories and the management of related medical institutions.

Methods: 95 patients were admitted to an orthopedics department with an emergent hand injury within half a year of the COVID-19 outbreak. Data was collected from January 23, 2020 to July 23, 2020. Information about demographics, types of injury, location of the injuries, side of the lesions, mechanism of the injuries, place where the injuries occurred, surgical management and outcomes was collected.

Results: The number of total emergency visits due to hand injury during the COVID-19 outbreak decreased 37% from the same period of the previous year. During the resumption of work it saw an increase of 40%. In comparison with the corresponding period of the previous year, most of the injured patients during the COVID-19 outbreak stage were women (60%) with a mean age of 56.7, while during the work resumption stage they were men (82.4%) with a mean age of 44.8. Most of the injuries in the work resumption period occurred at work (64.7%), significantly more than in the same period in 2019 (37.3%), and machine injury was the most frequent injury mechanism (58.8%). Cutting injuries of different degrees comprised the majority of the total cases (82.4%), far more than simple fractures and dislocations. Fingers were the most commonly injured body part. The majority of the injuries were classified as minor or moderate (90%) during the outbreak, and major (40%) during the work resumption. The proportion of major injuries during the work resumption stage in this year (40%) was almost double that of the previous year (pre-pandemic) (21.8%).

Conclusion: The resumption of work following the COVID-19 outbreak is a time of high risk for hand injuries. The overall number of patients with hand injuries admitted into our department has decreased compared to the corresponding period of last year. However, workplace injuries, especially machine injury increased greatly during the six months after the outbreak of COVID-19. The proportion of major injuries increased by a large margin. Emergency and surgical service provides should be aware of the pattern of hand injuries during this atypical time in order to prepare and plan services accordingly.

Introduction

In early December 2019, a series of pneumonia cases caused by a novel coronavirus emerged in Wuhan, Hubei, China. The coronavirus was first named the 2019 novel coronavirus (2019-nCoV) and widely recognized throughout the world under that name. On January 30, 2020, the World Health Organization (WHO) declared the virus to be a public health emergency of international concern and officially named it the Coronavirus Disease-2019 (COVID-19) on February 11, 2020. It has rapidly become a global disaster that has affected hundreds of countries. As of September 7, 2020, 26,994,442 confirmed cases and 880,994 deaths have been documented world-wide in 216 countries. China has effectively controlled the spread of the epidemic at the beginning of the outbreak and remains vigilant as the outbreak worsens.
globally. As of the date of writing, the pandemic has claimed the lives of 4,737 people and infected 90,551 on the Chinese mainland.

On February 19, the number of new infections dropped to three digits and on March 6, to two digits - where it has remained, with most cases being imported\(^4\). The city of Hangzhou has reported no new case of local infection for six months, since February 20. In China, a four-tier public health emergency response system was generally used in China, with level I being the highest. On January 23, the government of Zhejiang province officially launched a level I response. After strict prevention and control measures throughout the whole city, the response level was adjusted to level II on March 2nd, in a meeting of the standing committee of the provincial party committee, and on March 23, it was adjusted to level III\(^5\).

Almost all businesses were shut down during the outbreak, except for the medical materials manufacturing enterprises. According to local authorities, enterprises that met the "white list of enterprises" (i.e., those factories that are involved in the production of medical supplies and daily necessities, as well as the construction of key projects important to the national economy or people's livelihoods) in Hangzhou had resumed operations as of February 10th, with local employees going back to work. As of February 20th, most factories had started functioning and their workers were returning to work\(^6\). During this atypical year, many domestic companies, including GAC, BYD, SAIC-GM-Wuling and Changan, have transformed their businesses to provide medical supplies, such as face masks, for epidemic prevention and control\(^7, 8\).

Under these new circumstances, a change in the pattern of hand injuries has attracted attention. In our research, we summarized the pattern and epidemiology of hand injuries during the COVID-19 outbreak and during the work resumption period as the pandemic subsides. Our hypothesis is that hand injuries are more severe, and industrial machine injuries form the majority of injuries during the work resumption period. This study attempts to highlight the patterns of hand injuries after the COVID-19 outbreak, our management of these injuries, and outcomes in our hospital. As time progresses, other countries outside China are also launching economic recovery programs to mitigate unemployment and stabilize core industries\(^9\). It is hoped that this study may provide guidance for the prevention and management of hand injuries in the resumption of work in other regions.

**Methods**

This is a retrospective study of 95 cases in one designated hospital. The cases were all hand injuries registered and assessed in our hospital during the epidemic from January 23, 2020, when the coronavirus outbreak began throughout country, to July 23, 2020, when urban work returned to normal after half a year since the outbreak. Data were extracted and collected from the emergency department and orthopedics department databases. A descriptive analysis was carried out. The collected data of interest included demographics (age and gender), profession, residence location, time and date of event and treatment. The following variables were further collected from each hand injury case admitted to the hospital: type of injury, location of the injury, side of the lesion, mechanism of the injury, place where the
injury occurred, surgical management and outcome. The injuries were classified with the Modified Hand Injury Severity Score (MHISS).

**Results**

A total of 1,357 cases of hand injury emergency visits were recorded from January 23, 2020 to July 23, 2020, including 46 cases during the outbreak from January 23th, 2020 to February 9, 2020 and 1,311 cases during the resumption of work from February 10, 2020 to July 23, 2020. Data from the same period in the previous year was 73, and 939, respectively. There were 37% fewer cases of emergency visits during the outbreak when compared to the same period the previous year, and 40% more cases during the resumption of work than in the same period the previous year. Of all patients reviewed, 95 (7%) patients were admitted to hospital and treated in our department, including 10 (21.7%) during the outbreak phase, and 85 (6.5%) during the resumption phase.

Most of the patients in the outbreak phase were middle-aged and elderly housewives. Injured patients had a mean age of 56.7 years (10.9). In 4 cases (40%) during the outbreak, the injuries occurred at home. The percentage of hand injuries at home during the outbreak was 26.3% more than in the previous year (40% vs 16.7%). Knife lacerations were the most common injury. Finger injuries constituted approximately 9 (90%) of the total injuries. Due to the traffic controls, 80% of patients were nearby residents. Most of the injuries were mild to moderate (90%), except for one case of a high-pressure disinfectant liquid injection injury of the finger (Figure 1).

In contrast, during the resumption of work from February 9, 2020 to July 23, 2020, hand injuries sustained at work were 27.4% more common than in the previous year (64.7% vs 37.3%), and occurred overwhelmingly in middle-aged males. Injured patients had a mean age of 44.8 (13.4) years. Machine injuries made up the majority (58.8%). During this period, such injuries became a common occurrence admitted to our department. Many of these injuries resulted in muscle, tendon, nerve, and vascular damage. Palm, wrist, and arm injuries constituted about 34.1% of the total injuries. In this period, hand injuries tended to be more severe and even disabbling, and required emergency operations. The majority of the injuries were classified as major (40%) in the work resumption phase. This was almost double that of the previous year (21.8%). The amputation rate in this phase reached 8.2%, which was triple the level from the previous year (2.7%). Fractures and dislocations were comparable to the previous year (21.2% vs 22.7%). The mean range of stays was 20.3 days during the outbreak and 7.9 days during the resumption of work. Table 1 shows the results of the patients during the outbreak of pandemic and the period of work resumption compared to the same period of the previous year.

There was one case of a crush injury sustained during delivery of medical supplies (Figure 2), and another case of forearm injury that was caused by a cutting machine in a mask factory (Figure 3). Special cases of hand injuries directly related to the pandemic are listed in Table 2. They occurred mainly in the production and delivery of the medical supplies.
Discussion

The COVID-19 has shattered the daily routines and disrupted businesses, schools, lifestyles, and economies around the globe. Social distancing and self-quarantine aim to slow the increase of new infections, thereby avoiding a surge in demand for health care systems. Some measures such as telemedicine, are now recommended to reduce hospital visits for some mild injuries. But even in a time of social distancing, patients with severe injuries require urgent treatment, and the number of such injuries has not decreased as was supposed. The economic recovery is accelerating all over the world after a long time of social distancing and economic stagnation. Workers have successively begun to return to their workplaces. Our study is pioneering in that it describes unique patterns of injuries during this non-typical time. It highlights spikes in hand injuries during the work resumption following the COVID-19 pandemic.

Trauma at home, accounts for the majority of all hand injuries during the time of the outbreak. This was an inevitable result of people staying at home. Nonlocal patients visits were significantly reduced because of traffic restrictions. With the resumption of work in industries, we have observed a distinct change in patterns of hand injuries. High social demand after a long shutdown has motivated workers to throw themselves into high-intensity work. As a result, workplace injuries, especially manufacturing traumas, increased rapidly during the work resumption period. Thus, the proportion of major injuries has tended to increase. Our research illustrates this through comparison with the same period of the previous year. As a result of pandemic and economic stagnation, members of the public have been experiencing an increase in psychological problems. It is supposed that anxiety, depression, and stress in workers may increase the risk of unintentional injuries during the resumption of work. One type of hand injury was relatively typical in this non-standard year, namely, injuries sustained in the medical supplies manufacturing industry which was the first to return to work. Compared with a control group, the study group had a longer length of stay on average. This does not necessarily reflect worse injuries. It could be due to the situation in which these injuries occurred during an atypical time when the medical services are slowed down.

When considering factories, educational campaigns as well as an increase in the availability of professional workers during this atypical time are needed to reduce the incidence of hand injuries. In particular, in companies that have newly transformed to provide medical supplies, a lack of experience was a common phenomenon. It is recommended that the resumption of work proceeds sequentially and in segments. Local workers without a history of exposure to areas affected by the epidemic were allowed to return to work first.

Hospitals must gear health care resources during this special time to meet the actual injury burden. In order to reduce the risk of exposure in transit, patients were encouraged to seek treatment in nearby hospitals. Furthermore, preventive efforts should be put in place to avoid the risk of COVID-19 spreading. Measures, such as the registration of personal information, regular disinfection, body temperature monitoring, and a cap on daily visitors are strictly implemented in all departments in our hospital to lower
the risks of infection. Despite the necessity of ensuring effective inspection, the time of emergency preoperative preparation was not significantly prolonged during the period of the epidemic.

On February 11, Hangzhou was the first city in the nation to launch a health QR code system to curb the spread of infection as it tentatively restarted production\textsuperscript{16}. The health QR code and body temperature is checked at first contact upon entry into the hospital. Only patients with a green QR code and normal body temperature are allowed into the emergency department. Those with temperatures higher than 37.3 degrees Celsius are guided to the fever clinic first for infection screening. A nucleic acid test and a CT lung screening are performed simultaneously. In our hospital, patients who are suspected of being infected are examined in a separated CT room, different than the one used for other patients. Statements with a consensus agreement from an international Delphi process supported a distinction of surgery between protocols involving patients with suspected COVID-19 and those perceived to be free from infection\textsuperscript{17}. Patients are admitted to the ward only when pneumonia has been excluded by the sputum culture and CT. Preoperative preparation includes blood work, a medical evaluation, a chest x-ray, and an EKG – which are performed while waiting for the COVID-19 test results. The initial clinician is responsible for the diagnosis and preliminary management of the injuries throughout the whole process. As direct contact poses a high risk for healthcare professionals performing wound care, surgery, and resuscitation\textsuperscript{10,18}, the appropriate use of personal protective equipment, as well as strict disinfection and hand hygiene are required of every clinician\textsuperscript{10,19}. There are 105 patients with COVID-19 who are either undergoing intensive therapy or have been cured in our center. We have achieved substantial success with zero nosocomial infections and a zero mortality rate in our center. None of the staff in our center has been infected. Even in the isolation wards, no SARS-Cov-2 RNA was detected among the objective samples\textsuperscript{20}.

In this very particular time, medical workers may become anxious and may fear continuing their work. However, this is a time for solidarity, not fear. This outbreak is a test of solidarity in the political, financial, and scientific spheres – as stated by WHO Director-General Tedros Adhanom Ghebreyesus\textsuperscript{21}. In a show of solidarity, all doctors in our center have remained at their posts since the outbreak.

**Conclusion**

The resumption of work following the COVID-19 outbreak presents a higher-risk time for hand injuries. The overall number of hand injuries admitted into our department has decreased compared to the corresponding period last year. However, workplace injuries, in particular machine injuries, increased significantly during the six months after the outbreak of COVID-19. The proportion of major injuries increased by a large margin. Emergency and surgical service providers should be aware of this pattern of hand injuries during this non-typical time in order to prepare and plan services accordingly.

**Declarations**

**Ethics approval and consent to participate**
These study protocols were approved by the Medical Ethics Committee of the First Affiliated Hospital, Zhejiang University School of Medicine.

**Consent for publication**

All patients gave informed consent.

**Availability of data and material**

The dataset supporting the conclusions of this article is included within the article.

**Competing Interests**

The authors declare that they have no competing interests.

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**Authors’ contributions:** Qianjun Jin conceived of the study. Hui Lu and Haiying Zhou participated in the design of the study. Qianjun Jin and Haiying Zhou drafted the manuscript. All authors read and approved the final manuscript.

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**References**

1. Chen N ZM, Dong X, Qu J, Gong F, Han Y, Qiu Y, Wang J, Liu Y, Wei Y, Xia J, Yu T, Zhang X, Zhang L. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. Lancet 2020; 395: 507-513. DOI: 10.1016/S0140-6736(20)30211-7.

2. WHO Novel coronavirus (2019-nCoV) situation report 11. Jan 31, 2020.
   [https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200131-sitrep-11-ncov.pdf?sfvrsn=de7c0f7_4](https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200131-sitrep-11-ncov.pdf?sfvrsn=de7c0f7_4).

3. WHO. Coronavirus disease (COVID-19) outbreak situation, [https://www.who.int/emergencies/diseases/novel-coronavirus-2019](https://www.who.int/emergencies/diseases/novel-coronavirus-2019).
4. China Daily. Efficient measures key to containment. Available from, 
https://www.chinadaily.com.cn/a/202004/07/WS5e8bbf2da3101282172849d0.html.

5. Hangzhou News. Zhejiang Further Lowers Coronavirus Response, Available from: 
https://en.hangzhou.com.cn/News/content/2020-03/24/content_7701349.htm.

6. Bendibao. A list of the time and batch of enterprises to resume work in Hangzhou, Available from: 
http://hz.bendibao.com/news/202027/79293.shtm.

7. China Daily. Companies modify production to prioritize masks, protective clothing, Available from: 
https://www.chinadaily.com.cn/a/202002/08/WS5e3e85e1a310128217275fde.html.

8. China Daily. Automakers join fight against epidemic, Available from: 
https://www.chinadaily.com.cn/a/202003/02/WS5e5c72a7a31012821727b87a.html.

9. Rosenbloom D and Markard J. A COVID-19 recovery for climate. Science 2020; 368: 447. 
2020/05/02. DOI: 10.1126/science.abc4887.

10. Jessop ZM, Dobbs TD, Ali SR, et al. Personal Protective Equipment (PPE) for Surgeons during COVID-19 Pandemic: A Systematic Review of Availability, Usage, and Rationing. Br J Surg 2020 
2020/05/13. DOI: 10.1002/bjs.11750.

11. Hollander J and Carr B. Virtually Perfect? Telemedicine for Covid-19. New England Journal of 
Medicine 2020; 382. DOI: 10.1056/NEJMp2003539.

12. Tanaka MJ, Oh LS, Martin SD, et al. Telemedicine in the Era of COVID-19: The Virtual Orthopaedic 
Examination. J Bone Joint Surg Am 2020. DOI: 10.2106/JBJS.20.00609.

13. Xiang Y-T, Yang Y, Li W, et al. Timely mental health care for the 2019 novel coronavirus outbreak is 
urgently needed. The Lancet Psychiatry 2020; 7: 228-229. DOI: 10.1016/s2215-0366(20)30046-8.

14. Liu S, Yang L, Zhang C, et al. Online mental health services in China during the COVID-19 outbreak. 
The Lancet Psychiatry 2020; 7: e17-e18. DOI: https://doi.org/10.1016/S2215-0366(20)30077-8.

15. Tan W, Hao F, McIntyre RS, et al. Is returning to work during the COVID-19 pandemic stressful? A 
study on immediate mental health status and psychoneuroimmunity prevention measures of 
Chinese workforce. Brain Behav Immun 2020 2020/04/27. DOI: 10.1016/j.bbi.2020.04.055.

16. China Daily. Health QR code helps curb the spread of COVID-19, Available from: 
https://www.chinadaily.com.cn/a/202003/27/WS5e7dd30da310128217282956.html.

17. Abdelrahman T, Beamish AJ, Brown C, et al. Surgery during the COVID-19 pandemic: operating room 
suggestions from an international Delphi process. Br J Surg 2020 2020/05/13. DOI: 
10.1002/bjs.11747.

18. Iacobucci G. Covid-19: Doctors performing resuscitation need higher level of PPE, says royal college. 
BMJ 2020; 369: m1644. DOI: 10.1136/bmj.m1644.

19. Xiao Y and Torok ME. Taking the right measures to control COVID-19. Lancet Infect Dis 2020; 20: 
523-524. 2020/03/05. DOI: 10.1016/S1473-3099(20)30152-3.

20. Wang J, Feng H, Zhang S, et al. SARS-CoV-2 RNA detection of hospital isolation wards hygiene 
monitoring during the Coronavirus Disease 2019 outbreak in a Chinese hospital. Int J Infect Dis
21. Director-General WHO. WHO Director-General's remarks at the media briefing on COVID-2019 outbreak on 14 February 2020, Available from: https://www.who.int/dg/speeches/detail/who-director-general-s-remarks-at-the-media-briefing-on-covid-2019-outbreak-on-14-february-2020.

Tables

Please see the supplementary files section to view the tables.

Figures

Figure 1

Case 1. A 39-year-old female worker suffered high-pressure disinfectant liquid injection injury of the left ring finger and palm (a) Preoperative appearance of the injured finger. (b) Radiologic appearance of the injured hand.
Figure 2

Case 2. A 52-year-old male driver suffered crush injury while delivering medical supplies (a) Preoperative appearance of the injured hand. (b) Radiologic appearance of the injured hand.
Figure 3

Case 3. A 31-year-old male worker suffered forearm injury caused by the cutting machine in a mask factory (a) Preoperative appearance of the injured arm. (b) Radiologic appearance of the injured arm.

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