Changes in the Treatment for Out-of-Hospital Cardiac Arrest During the Initial Stage of the COVID-19 Outbreak in Japan

Kenji Numata 1, 2, Chinami Sakurai 2, Michiko Mizobe 2, Yosuke Homma 2, Jin Takahashi 2, Hiraku Funakoshi 2

1. Emergency Department, St. Marianna University Hospital, Kawasaki, JPN
2. Department of Emergency and Critical Care Medicine, Tokyo Bay Urayasu Ichikawa Medical Center, Urayasu, JPN

Corresponding author: Kenji Numata, kenjinumata777@hotmail.co.jp

Abstract

Introduction: Cardiopulmonary resuscitation (CPR) for out-of-hospital cardiac arrest (OHCA) patients during the coronavirus disease 2019 (COVID-19) pandemic carries an added risk of COVID-19 infection for healthcare workers. However, because of the shortage of medical supplies and limited evidence of COVID-19 in the initial stages of the pandemic, strategies for the management of OHCA patients may have varied across hospitals.

Method: A web-based questionnaire was used. The first section collected data about physician characteristics. In the second section, participants responded “Yes” or “No,” if they had made changes in the areas of ‘personal protective equipment (PPE)’ or ‘CPR Algorithm’ for OHCA patients (these changes were the personal views of the surveyed respondents). The questionnaire was sent to the members of the Emergency Medicine Alliance mailing list. The response period was from May 22 to June 5, 2020 (the first state of emergency related to COVID-19 was declared on April 7, 2020, in Japan). Participants were asked to indicate their stress level resulting from these changes using the Likert scale ranging from 1 to 10, where 1 = “no stress” and 10 = “severe stress.”

Result: A total of 110 physicians responded during the study period. The majority of participants reported changes in ‘PPE’ (n = 106, 96.4%) and “CPR Algorithm” (n = 86, 78.2%). The reported stress level due to changes in PPE was 8 (IQR 6-9) and due to changes in the CPR algorithm, it was 7 (IQR 5-8).

Conclusion: Findings of this study suggest that physicians experienced changes in care for OHCA patients and felt stress during the initial stage of the COVID-19 pandemic. Thus, it would be better to list the actual measures that can be undertaken to prepare for any future pandemics.

Introduction

In late 2019, infection with a novel beta coronavirus, subsequently named the severe acute respiratory syndrome coronavirus 2, was reported in individuals who had visited a wet market in Wuhan, China. Since then, the virus has spread rapidly, which has led to the coronavirus disease 2019 (COVID-19) pandemic [1]. The first case in Japan was diagnosed on January 28, 2020. COVID-19 was qualified as a global pandemic by the WHO on March 11, 2020.

Cardiopulmonary resuscitation (CPR) for out-of-hospital cardiac arrest (OHCA) patients during the COVID-19 pandemic carries an added risk of COVID-19 infection for healthcare workers [2]. Physicians were recommended to wear personal protective equipment (PPE) to prevent the risk of COVID-19 infection during Advanced Life Support [3]. However, because of the shortage of medical supplies and limited evidence of COVID-19 in the initial stages of the pandemic, strategies for the management of OHCA patients may have varied across hospitals. This study aimed to investigate and clarify changes in the treatment of OHCA patients during the initial stage of the COVID-19 pandemic in Japan.

Materials And Methods

This was a web-based questionnaire study. The response period was from May 22 to June 5, 2020 (the first state of emergency related to COVID-19 was declared on April 7, 2020, in Japan). This study was approved by the Ethics Committee of the Tokyo Bay Urayasu/Ichikawa Hospital (approval number: 540).

Participants

The questionnaire was sent to the members of the Emergency Medicine Alliance
(https://www.emalliance.org/) mailing list (a total of 3,233 physicians who engage in emergency room care were registered as of May 23, 2020). We included those who responded to the questionnaire.

**Questionnaire**

A web-based questionnaire was used (Appendices). The questionnaire consisted of two sections and 23 questions. The first section collected data about physician characteristics. In the second section, participants responded ‘Yes’ or ‘No’ if they had made changes in the areas of ‘PPE’ or ‘CPR Algorithm’ for OHCA patients (these changes were the personal views of the surveyed respondents). If they answered ‘Yes,’ details about these changes were asked. Participants were asked to indicate their stress level resulting from these changes using the Likert scale, ranging from 1 to 10, where 1 = ‘no stress’ and 10 = ‘severe stress.’ We included physicians who answered the questionnaire. Values were given as percentages and median (interquartile range [IQR]).

**Results**

A total of 110 physicians responded during the study period (Table 1). Of these, there were 90 males (81.1%), and the median age at post-graduation was 12 years (interquartile range [IQR]: 7–19 years). Regarding specialization, 86 participants were emergency physicians (78.2%), 16 were internists (14.5%), and 3 were intensivists (2.7%). The number of beds at the hospitals where the participants worked was most commonly ≥500 beds (reported by 55 participants [50.0%]). The most common month in which COVID-19 was first noticed in real practice was February 2020 (reported by 49 participants [44.5%]).

| Participant characteristics (n = 110) |       |
|-------------------------------------|-------|
| Postgraduate year, year, median (IQR) | 12 (7–19) |
| Male sex, n (%)                     | 90 (81.8%) |
| Specialty, n (%)                    |       |
| Emergency physicians                | 86 (78.2%) |
| Internists                           | 16 (14.5%) |
| Intensivists                         | 3 (2.7%) |
| Other specialties                    | 5 (4.5%) |
| Number of beds at the hospital where they work, n (%) |       |
| 20–99 beds                           | 5 (4.5%) |
| 100–199 beds                        | 6 (5.5%) |
| 200–299 beds                        | 3 (2.7%) |
| 300–499 beds                        | 41 (37.3%) |
| ≥500 beds                           | 55 (50.0%) |
| The month in which COVID-19 was first noticed in practice, n (%) |       |
| December, 2019                       | 1 (1.0%) |
| January, 2020                        | 12 (10.9%) |
| February, 2020                       | 49 (44.5%) |
| March, 2020                          | 34 (30.9%) |
| April, 2020                          | 12 (10.9%) |
| May, 2020                            | 2 (1.8%) |

**TABLE 1: Characteristics of participant**

Table 2 shows the results of a questionnaire regarding the treatment of out-of-hospital cardiac arrest during the COVID-19 outbreak. The majority of participants reported changes in ‘PPE’ (n = 106, 96.4%) and ‘CPR Algorithm’ (n = 86, 78.2%). The most frequent response to the change in PPE was ‘full PPE with N95 filtering
facepiece respirator” (n = 77, 77.0%), and the most common change to the CPR algorithm was “early intubation” (n = 33, 30%). The reported stress level due to changes in PPE was 8 (IQR 6–9) and due to changes in the CPR algorithm, it was 7 (IQR 5–8).

| Questionnaire about PPE |  |
|-------------------------|--|
| **Changes in PPE, Yes, n (%), (n = 110)** | 106 (96.4%) |
| **Details of PPE changes, n (%), (n = 106)** |  |
| *Full PPE (with N95 respirator)* | 75 (70.8%) |
| Full PPE (with surgical mask) | 20 (18.9%) |
| Gloves with N95 respirator | 4 (3.8%) |
| Gloves with a surgical mask | 5 (4.7%) |
| Depends on the situation | 2 (1.9%) |
| **Stress from changes in PPE, median (IQR), (n = 106)** | 8 (6–9) |
| Questionnaire about CPR algorithm |  |
| **Changes in CPR algorithm, yes, n (%), (n = 110)** | 86 (78.2%) |
| **Details of CPR algorithm changes (participants can select multiple answers), n (%), (n = 78)** |  |
| Early intubation | 33 (42.3%) |
| Early termination of resuscitation | 12 (15.4%) |
| Reduced number of resuscitation team members | 10 (12.8%) |
| Interruption in chest compression during intubation | 9 (11.5%) |
| Changes in resuscitation room (isolation room) | 9 (11.5%) |
| Use of intubation box | 5 (6.4%) |
| Intubation only performed by an expert | 4 (5.1%) |
| Hands-only CPR | 2 (2.6%) |
| **Stress from changes in CPR algorithm, median (IQR), (n = 86)** | 7 (5–9) |

**TABLE 2: Results of a questionnaire regarding the treatment of out-of-hospital cardiac arrest during the COVID-19 outbreak**

**Discussion**

Most physicians reported changes in the PPE and CPR algorithms after the COVID-19 pandemic. However, the details of PPE changes and CPR algorithm changes were different among physicians. These differences might have been caused by a shortage of resources and a lack of evidence regarding best practices for COVID-19 at that time [4,5]. In the United States, perhaps the earliest example was the near-immediate realization that there were insufficient high-filtration N-95 masks for healthcare workers, prompting contingency guidance on how to reuse masks designed for single use [6]. A shortage of personal equipment has also been reported in Japan [7]. We considered that these factors might affect the results.

The level of reported stress caused by both the changes was high, despite the difference in changes in PPE and CPR algorithms. It is known that such changes lead to stress, especially when the consequences of the changes are uncertain [8]. Moreover, during the COVID-19 pandemic, physicians had to make several unusual decisions, such as reducing the duration of CPR, as aerosols generated during CPR procedures for patients with COVID-19 could infect medical professionals. Hence, the CPR status must be determined early so that patient prognosis, provider safety, and PPE can be considered. Consequently, the earlier “do it all” approach for resuscitation probably no longer applies to OHCA patients [9]. Furthermore, although efforts have been initiated to contain the number of cases and extraordinary measures have been put in place, the dramatic increase in ICU admission of patients with COVID-19 abruptly overwhelmed the ICU capacity in Italy. Physicians have proposed directing crucial resources, such as intensive care beds and ventilators, to patients with COVID-19 who can benefit most from treatment during the pandemic [10]. These factors may
have caused uncertainty and induced severe stress.

Sutherland and Cooper conducted a cross-sectional survey to compare general physicians’ stress and job satisfaction before and after the introduction of the new contracts [11]. General practitioners are increasingly required to work and cooperate within multidisciplinary teams with other independent professionals after starting the contraction. The survey revealed that general practitioners reported more stress, anxiety, and depression following the commencement of the contract (the highest mean change in stress was 0.85; stress was rated on a scale of 1 to 5). In our study, participants reported high stress change. It has been reported that physicians often fail to recognize symptoms of burnout or depression; moreover, they seek help less often [12]. It is important that the impact of change is carefully monitored to avoid any adverse impact (like depression or burn out).

This study had several limitations. First, the sample size was small, and the response rate was low, which can be attributed to the fact that the respondents were volunteers. The second concerns the external validity because we chose Emergency Medicine Alliance mailing list members to serve as participants; therefore, the risk of selection bias should be considered.

**Conclusions**

Findings of this study suggest that physicians experienced changes in care for OHCA patients and felt stress during the initial stage of the COVID-19 pandemic. This stress might be caused by uncertainty. It is said that burnout is a state of emotional, physical, and mental exhaustion caused by excessive and prolonged stress. Thus, it would be better to list feasible measures (e.g., stocking of medical supplies and establishing contingency plans for healthcare workers) that can be undertaken and propose solutions to increase work satisfaction among physicians, to prepare for any future pandemic.

**Appendices**
Questionnaire for evaluating changes in the treatment for out-of-hospital cardiac arrest during the initial stage of COVID-19 outbreak

This questionnaire is for T&A minor emergency course's registered questionnaire. The results of this study will be used for scholarly purposes only. The procedure involves filling an online survey that will take approximately 20 minutes. Agreement of the research have the answers to the questionnaire. Your participation in this research study is voluntary.

If you decide to participate in this research survey, you may withdraw at any time. If you decide not to participate in this study or if you withdraw from participating at any time, you will not be penalized. Our responses will be confidential. Please answer the following question assuming your hospital.

Are you doctor *

- Doctor
- No

1. Post graduated year

Your answer

2. Gender

- Male
- Female

FIGURE 1: English questionnaire for evaluating changes in the treatment for out-of-hospital cardiac arrest during the initial stage of COVID-19 outbreak, Page 1
3. Prefecture of working place *

Choose

4. Specialty *
- Internal medicine
- Surgery
- Emergency medicine
- Others

5. The number of working in emergency room in a month. *

Your answer

6. The number of your hospital bed

Choose

7. Are you working in tertiary hospital?
- Yes
- No

FIGURE 2: English questionnaire for evaluating changes in the treatment for out-of-hospital cardiac arrest during the initial stage of COVID-19 outbreak, Page 2
8. The month in which COVID-19 was first noticed in practice.
   - November, 2019
   - January, 2020
   - February, 2020
   - March, 2020
   - April, 2020
   - May, 2020

9. Questionnaire about personal protective equipment (PPE). Is there any changes in PPE for out of hospital cardiac arrest patients (OHCA) after COVID-19 pandemic?
   - Yes
   - No

10. (This question is for participant who answered “Yes” in question 9) When the changes were started?
    - December, 2019
    - January, 2020
    - February, 2020
    - March, 2020
    - April, 2020
    - May, 2020

FIGURE 3: English questionnaire for evaluating changes in the treatment for out-of-hospital cardiac arrest during the initial stage of COVID-19 outbreak, Page 3
11. What type of PPE do you use when you see OHCA patient.

- Only glove
- Glove with surgical mask
- PPE (mask is surgical mask)
- Glove with N95 mask
- Full PPE (mask is N95 mask)
- Other:

12. (This question is for participant who answered "Yes" in question 9) How do you rate stress from changes in PPE?

1 2 3 4 5 6 7 8 9 10
No stress

13. Questionnaire about cardiopulmonary resuscitation (CPR). Is there any changes in CPR after COVID-19 pandemic?

- Yes
- No

FIGURE 4: English questionnaire for evaluating changes in the treatment for out-of-hospital cardiac arrest during the initial stage of COVID-19 outbreak, Page 4
14. (This question is for participant who answered “Yes” in question 13) When the changes were started?

- December, 2019
- January, 2020
- February, 2020
- March, 2020
- April, 2020
- May, 2020

15. (This question is for participant who answered “Yes” in question 13) What type of changes were caused? Free writing.

Your answer

16. (This question is for participant who answered “Yes” in question 13) How do you rate stress from changes in CPR?

1 2 3 4 5 6 7 8 9 10

No stress Strong stress

17. What type of stress do you feel? Free writing.

Your answer

**FIGURE 5:** English questionnaire for evaluating changes in the treatment for out-of-hospital cardiac arrest during the initial stage of COVID-19 outbreak, Page 5
18. Questionnaire about family support. Is there any changes in family support for out of OHCA patients family after COVID-19 pandemic?

- Yes
- No

19. This question is for participant who answered “Yes” in question 18) What type of changes were caused? Free writing.

Your answer

20. (This question is for participant who answered “Yes” in question 18) How do you rate stress from changes in OHAC patient’s family support?

1 2 3 4 5 6 7 8 9 10
No stress

21. What type of stress do you feel? Free writing.

Your answer

22. Do you think the total number of not accepting emergent patients were increasing after COVID-19 pandemic?

- Yes
- No

FIGURE 6: English questionnaire for evaluating changes in the treatment for out-of-hospital cardiac arrest during the initial stage of COVID-19 outbreak, Page 6
23. (This question is for participant who answered “Yes” in question 20) Why it is caused? Free writing
Your answer

FIGURE 7: English questionnaire for evaluating changes in the treatment for out-of-hospital cardiac arrest during the initial stage of COVID-19 outbreak, Page 7

FIGURE 8: Japanese original questionnaire for evaluating changes in the treatment for out-of-hospital cardiac arrest during the initial stage of COVID-19 outbreak, Page 1
3. 職場の所在地 *

選択 ▼

4. 主たる診療科 *

○ 内科系
○ 外科系
○ 救急科
○ その他:

5. 月に救急外来に従事する回数 *

回答を半角、整数で答えてください。

回答を入力

6. あなたが勤いている病院の規模

選択 ▼

7. あなたが勤いている病院は高度救命救急センターですか？

○ はい
○ いいえ

FIGURE 9: Japanese original questionnaire for evaluating changes in the treatment for out-of-hospital cardiac arrest during the initial stage of COVID-19 outbreak, Page 2
8. 患者を診療する際にCOVID19感染の可能性を考え始めた月はいつ頃ですか？
- 2019年12月
- 2020年1月
- 2020年2月
- 2020年3月
- 2020年4月
- 2020年5月

9. COVID19感染の可能性を考え、病歴が不明な患者が心肺停止で搬送されてきた際の個人防護に変化がありますか（回答時点を想定してください）。
- はい
- いいえ

10. （7に「はい」と答えた方のみ対象）COVID19感染の可能性を考え、病歴が不明な患者が心肺停止で搬送されてきた際に装着する個人防護が変更になったのはいつ頃ですか？
- 2019年12月
- 2020年1月
- 2020年2月
- 2020年3月
- 2020年4月
- 2020年5月

FIGURE 10: Japanese original questionnaire for evaluating changes in the treatment for out-of-hospital cardiac arrest during the initial stage of COVID-19 outbreak, Page 3
FIGURE 11: Japanese original questionnaire for evaluating changes in the treatment for out-of-hospital cardiac arrest during the initial stage of COVID-19 outbreak, Page 4
14. (13に「はい」と答えた方のみ対象) COVID19の可能性を考え、院外心肺停止患者対応のアルゴリズムに変化が生じたのはいつ頃ですか？

- 2019年12月
- 2020年1月
- 2020年2月
- 2020年3月
- 2020年4月
- 2020年5月

15. (13に「はい」と答えた方のみ対象) COVID19の可能性を考え、院外心肺停止患者対応のアルゴリズムにどのような変化（個人防護以外）が生じましたか？

回答を入力

16. (13に「はい」と答えた方のみ対象) COVID19の可能性を考え、院外心肺停止患者対応のアルゴリズムに変化（個人防護以外）が生じることによりストレスを感じていますか？

1 2 3 4 5 6 7 8 9 10

全く感じない ○ ○ ○ ○ ○ ○ ○ ○ ○ 非常に強く感じる

17. 院外心肺停止患者対応のアルゴリズムに変化により具体的にどのようなストレスを感じていますか？

回答を入力

FIGURE 12: Japanese original questionnaire for evaluating changes in the treatment for out-of-hospital cardiac arrest during the initial stage of COVID-19 outbreak, Page 5
18. COVID19の可能性を考え、院外心肺停止患者対応のアルゴリズムに変化が生じることにより、患者家族の対応に変化が生じましたか？

○ はい
○ いいえ

19. （17に「はい」と答えた方のみ対象）COVID19の可能性を考え、院外心肺停止患者対応のアルゴリズムに変化が生じることにより、患者家族の対応にどのような変化が生じましたか？

回答を入力

20. （18に「はい」と答えた方のみ対象）COVID19の可能性を考え、院外心肺停止患者対応における家族対応に変化が生じることによりストレスを感じていますか？

1 2 3 4 5 6 7 8 9 10
全く感じない ○ ○ ○ ○ ○ ○ ○ ○ 非常に強く感じる

21. COVID19の可能性を考え、院外心肺停止患者対応における家族対応に変化が生じることにより、具体的にどのようなストレスを感じていますか？

回答を入力

22. COVID19が流行したため、院外心肺停止患者の受け入れ困難事例が増加しましたか？

○ はい
○ いいえ

FIGURE 13: Japanese original questionnaire for evaluating changes in the treatment for out-of-hospital cardiac arrest during the initial stage of COVID-19 outbreak, Page 6
Additional Information

Disclosures

**Human subjects:** Consent was obtained or waived by all participants in this study. Ethics Committee of the Tokyo Bay Urayasu/Ichikawa Hospital issued approval 540. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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References

1. Huang C, Wang Y, Li X, et al.: Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet. 2020, 395:497-506. 10.1016/S0140-6736(20)30185-5
2. Baldi E, Scehi GM, Mare C, et al.: Out-of-hospital cardiac arrest during the Covid-19 outbreak in Italy. N Engl J Med. 2020, 383:496-8. 10.1056/NEJMec2010418
3. Edelson DP, Sasson C, Chan PS, et al.: Interim guidance for basic and advanced life support in adults, children, and neonates with suspected or confirmed covid-19: from the Emergency Cardiovascular Care Committee and get with the guidelines-resuscitation adult and pediatric task forces of the American Heart Association. Circulation. 2020, 141:e933-43. 10.1161/CIRCULATIONAHA.120.047463
4. Nogee D, Tomassoni AJ: Covid-19 and the N95 respirator shortage: closing the gap. Infect Control Hosp Epidemiol. 2020, 41:958. 10.1017/ice.2020.124
5. Reisman J, Wexler A: Covid-19: exposing the lack of evidence-based practice in medicine. Hastings Cent Rep. 2020, 50:77-8. 10.1002/hast.1144
6. Zahoor M, Haq IU: Airway management for emergent surgeries during COVID-19 pandemic. J Coll Physicians Surg Pak. 2021, 30:S33-7. 10.29271/jcpsp.2021.01.S33
7. Inaba M, Naito H, Sakata T, Nakao A: COVID-19 pandemic and shortage of personal protective equipment in Tokyo clinics. Acute Med Surg. 2020, 7:e527. 10.1002/ams2.527
8. Wisse B, Schild E: When change causes stress: effects of self-construal and change consequences. J Bus Psychol. 2016, 31:249-64. 10.1007/s10869-015-9411-z
9. Ramzy M, Montrief T, Gottlieb M, Brady M, Singh M, Long B: COVID-19 cardiac arrest management: a review for emergency clinicians. Am J Emerg Med. 2020, 38:2695-702. 10.1016/j.ajem.2020.08.011
10. Vergano G, Bertolini G, Giannini A, et al.: Clinical ethics recommendations for the allocation of intensive care treatments in exceptional, resource-limited circumstances: the Italian perspective during the COVID-19 epidemic. Crit Care. 2020, 24:165. 10.1186/s13054-020-02891-w
11. Sutherland VI, Cooper CL: Job stress, satisfaction, and mental health among general practitioners before and after introduction of new contract. BMJ. 1992, 304:1545-8. 10.1136/bmj.304.6841.1545
12. Yates SW: Physician stress and burnout. Am J Med. 2020, 138:160-4. 10.1016/j.amjmed.2019.08.054