



Research Article

Managing Conventional Mass Casualty Incident during the COVID-19 Pandemic: Lessons Learned and Suggestions

Wei-Kuo Chou*, Fuh-Yuan Shih, Ming-Tai Cheng, Chien-Hao Lin, Chien-Hua Huang

Department of Emergency Medicine, National Taiwan University Hospital, Taipei, Taiwan

*Corresponding author: Wei-Kuo Chou, Department of Emergency Medicine, National Taiwan University Hospital, Taipei, Taiwan

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Abstract

Objectives: Following the outbreak of the coronavirus disease 2019 (COVID-19) pandemic, our Emergency Department (ED) modified its Mass Casualty Incident (MCI) protocol to manage patients with COVID-19. Another MCI occurred during this period, and we had to manage two disasters simultaneously. The objective of this report is to list the challenges we faced and provide suggestions for managing future incidents. **Methods:** Three areas were separated from the emergency room for patients with COVID-19. Moreover, the ED crew was divided into three teams for the care of patients with and without COVID-19. On April 26, 2020, a fire broke out at a karaoke club near our hospital. Eleven patients were sent to our emergency room within 1.5 hour. Nine ordinary patients and 14 COVID-19 protocol patients were treated during the same period. **Results:** Four main problems were noted after this event: 1) overlap of patients in the hospital information system; 2) overlap of operation areas; 3) overlap of responders; and 4) difficulty in the identification of responders. **Conclusions:** Other disasters may also occur concurrently with the COVID-19 pandemic. However, the modifications for COVID-19 may interfere with the response to other disasters, including MCIs. Modification of the MCI protocol should be performed to maintain efficient operation of the ED for the management of both COVID-19 and MCIs.

Introduction

The coronavirus disease 2019 (COVID-19) pandemic caused a patient surge in the Emergency Department (ED). Previous studies indicated that COVID-19 should be considered a Mass Casualty Incident (MCI) with different features from traumatic or chemical MCIs [1-3]. Specific plans and procedures were used to manage this pandemic. However, other disasters continued to occur during this pandemic, including MCIs [4]. Herein, we report the occurrence of an MCI during the COVID-19 pandemic and present lessons learned from this incident.

Material & Methods

To prevent nosocomial transmission, our ED applied the protocol for MCIs and planned three zones for the diversion and management of COVID-19 (Figure 1). Zone 1 (red) was inside

the ED with negative pressure and a separate room for high-risk and critical patients. Zone 2 (yellow) was also inside the ED and involved an independent air ventilation system for moderate-risk patients. This zone did not have negative pressure or a separate room. Zone 3 (green) was outside the ED for low-risk patients; this zone was utilized while waiting for chest X-ray examinations and virus screening. Triage staff were located outside the main entrance of the ED and assigned patients to their corresponding zone. The remaining areas of the ED were preserved for non-COVID-19 patients. Based on the protocol for MCIs, our ED physicians and nurses were divided into three teams. Team A was responsible for non-COVID-19, non-trauma patients. Team B was responsible for non-COVID-19 patients with trauma and those in zones 2 and 3. Team C managed non-COVID-19 critical patients and those in zone 1.

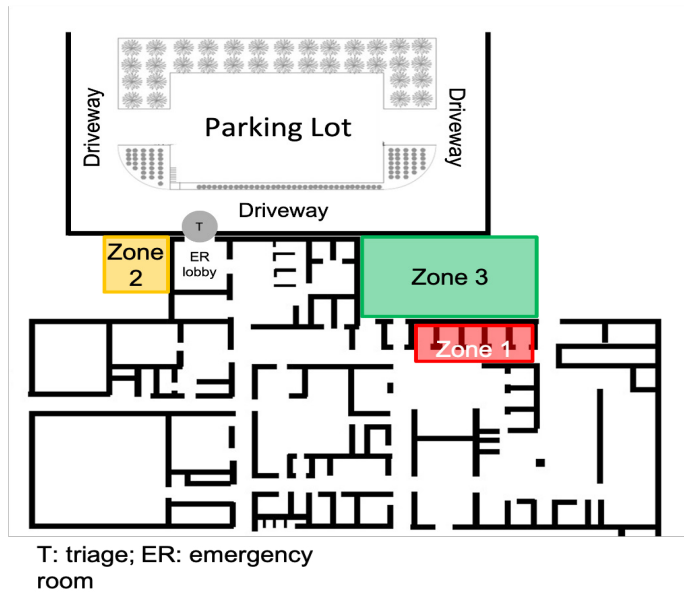


Figure 1: Layout of the Emergency Room (ER); T: Triage.

On April 26, 2020, a fire broke out at a karaoke club approximately 2 km from our hospital. The fire department was called at 10:57 AM, and our ED was notified of a MCI at approximately 11:00 AM. The MCI response protocol and team were immediately activated. In the meantime, the protocol and team responsible for the management of patients with COVID-19 remained unaltered. The first and last MCI patients arrived at our ED at 12:16 PM and 1:58 PM, respectively. Eleven MCI patients were treated at our ED, including one patient with out-of-hospital cardiac arrest and three critically injured patients. During the same period, 19 non-casualty patients and 14 COVID-19 protocol patients were treated at our ED (Figure 2).

	MCI	COVID-19	Non-MCI, non-COVID-19
11:00	Notify ER		
	0	7	9
12:16	1 st MCI patient		
	11 (ICU: 4; Ward: 3; Discharge: 4)	7	10
13:58	Last MCI patient		

Figure 2: Number of patients during the MCI response period. COVID-19: Coronavirus Disease 2019; ER: Emergency Room; ICU: Intensive Care Unit; MCI: Mass Casualty Incident.

Results

Following this event, an after-action meeting was held. Four main problems were identified in this emergency that coincided

with the COVID-19 pandemic.

Firstly, there was overlap of patients in the Hospital Information System (HIS). For ED personnel to gather information and apply different protocols, suspected and confirmed patients with COVID-19 are specially registered in our HIS, which is designed for MCIs. However, when patients from the fire MCI were registered in our hospital, the system was being utilized for patients with COVID-19. This complicated the classification of patients who belonged to the COVID-19 and MCI protocols, leading to the temporary adjustment of the HIS by our information technicians.

Secondly, there was overlap of operation areas. According to our MCI protocol, zone 2 was planned to be used as a waiting area for families and visitors. The MCI triage staff were located at the lobby of the ED. However, the COVID-19 triage was located before the MCI and ordinary ED triage. The zone for the treatment of critical MCI patients overlapped with zone 1, resulting in three problems: lack of space for families and visitors; mixing of possible COVID-19 and critical MCI patients in the same area; and inability to distinguish possible COVID-19 patients among MCI patients.

Thirdly, there was overlap of responders. Our hospital uses an MCI command structure for the management of COVID-19. Following the event, teams B and C had to treat MCI, COVID-19, and non-COVID-19 patients at the same time. This resulted in confusion in the command system, particularly for non-ED MCI responders who could not identify other responders.

Finally, there was difficulty in the identification of responders. In our hospital, we use vests to identify roles in MCI management. However, on this occasion, the vests were not used to prevent the potential transmission of the virus. This complicated the identification of staff belonging to the MCI management team; all medical personnel wore Personal Protective Equipment (PPE) without name. This problem resulted in further confusion in the command system.

Discussion

Most hospitals prioritize preparedness for the management of the COVID-19 pandemic and MCIs. Nevertheless, the diffusion and presentation of the COVID-19 MCI was unconventional [1,5]. Plans for overcoming the problems we encountered in this incident are proposed below.

Information gathering and analysis are vital in the management of disasters. Information regarding the medical situation and hospital capacity for both COVID-19 and non-COVID-19 patients was used in decision making by those responsible for the management of incidents [2]. The same principles apply to the management of MCIs. Special settings

for the collection of information concerning MCIs are used in numerous hospitals. However, these settings have been used to collect information on only one MCI at a time. When faced with two MCIs, the HIS special settings may not adapt to the complex situation. Therefore, we propose building additional flexibility into the HIS. While dealing with disasters, the HIS should be simultaneously adjusted to fit the needs of users. The information for the MCI, COVID-19, and non-COVID-19 patients should be gathered independently, and the HIS should be set prior to or rapidly after the occurrence of the disaster.

ED space planning is one of the essential components of COVID-19 management [2]. Diversion of patients to different areas of the ED is necessary to lower the risk of virus transmission [6]. However, the ED space is limited. The same ED areas could be used for different purposes in different disasters, with possible conflict. Areas utilized for the admission of COVID-19 patients may overlap those used for other patients (including MCI patients), because the surge of COVID-19 patients may be managed as an MCI [6]. Patients from a non-COVID-19 MCI can be admitted to hospital areas without applying standard precautions, simplifying the requirements for the ED areas [6]. Nevertheless, the ED spaces for COVID-19 patients should not be arbitrarily changed due to the possibility of increasing the nosocomial transmission of the virus. Therefore, the areas for COVID-19 should be maintained unaltered, regardless of the concurrent management of other emergency disasters. Considering the long period required for the management of the COVID-19 pandemic, it is proposed to plan the management of other emergencies in the areas of the ED without changing the setting for COVID-19 patients. Moreover, responders to disasters should be promptly notified of the arrangement of areas for the management of COVID-19 and the MCI.

The incident command structure plays an important role in the management of disasters. For a comprehensive management of a pandemic and mass critical care, hospitals require appropriate incident command structures [2]. The management period for the COVID-19 pandemic could span months to years. Unlike a conventional MCI, for which a finite number of patients is admitted to hospital at an initial peak period, the number of patients with COVID-19 can vary between different stages of the pandemic [6]. Most of the time, ED staff need to manage COVID-19 and non-COVID-19 patients without the assistance of non-ED staff. Hence, the ED should adjust its command structure accordingly.

Following the occurrence of an MCI, non-ED staff may participate in disaster management. These personnel are usually not familiar with MCI protocols. This may cause problems, which could be solved by implementing a robust incident command structure, especially during the COVID-19 pandemic. Previous experiences also emphasized the need for continuous improvement

of the different branches of the incident command structure [5]. Therefore, we propose building additional flexibility into the incident command structure. Hospital staff can be preassigned and trained to deal with disasters, such as an MCI, during the COVID-19 pandemic. In case of an MCI, the branches dealing with COVID-19 can remain unaltered, while activating other responders to manage the MCI. After effectively managing the MCI, these MCI responders can return to their previous duties. This approach may assist staff in dealing with a single source of patients and allow for a more efficient use of human resources.

During the COVID-19 pandemic, ED personnel require PPE to protect themselves and prevent nosocomial transmission [2]. However, the use of PPE posed several challenges to responders managing the MCI, such as difficulty in using radio communication systems, impairment of hearing voices, and poor personnel identification [7]. It is difficult to identify responders based on their role and labels, and the problem is exacerbated when engaging responders from different departments [7]. According to a previous report, this leads to repeated assessments and reviews of the patients [7]. Nevertheless, wearing a tabard or vest outside the PPE may impair the control of transmission. Thus, we propose that MCI responders continue to wear vests for identification. For those not conducting aerosol-generating procedures, the vest-wearing practice should remain the same as that for the MCI protocols. Medical staff who perform aerosol-generating procedures under level 3 PPE should wear the identification vests outside the PPE. The PPE could be collected specifically after the MCI and washed for transmission control.

Conclusions

Although COVID-19 should be considered an MCI of the highest degree, most medical and disaster response systems are actually unprepared to face such events [1]. While MCI protocols and plans exist for traumatic events, there are no equivalent considerations for incidents of infectious disease [3].

While managing a large number of patients with COVID-19, we used an MCI protocol to manage the pandemic. However, we did not expect the co-occurrence of two MCIs. The concurrent management of an additional MCI alongside COVID-19 and ordinary patients may compromise the precautions for the prevention of virus transmission and the care of other patients. This may be attributed to the competition for limited resources [5,8]. Hence, hospitals should develop methods to adapt to the needs of the pandemic and maintain effective operation. Furthermore, the prolonged period required for the management of COVID-19 may coincide with other disasters in the future. For the ED, the modification of MCI protocols and plans is necessary to effectively manage MCIs during this pandemic.

Limitations

The number of patients admitted to hospital because of this MCI was small. In case of an MCI with a larger number of patients, the confusion could be worse. None of the MCI patients was tested for COVID-19. If the COVID-19 test was added to MCI management, the MCI protocol should be further modified. The improvement plans proposed herein were based on the resources of a medical center with 2,000 beds. Therefore, application of these improvement plans to other smaller hospitals should be tailored to the capabilities of each hospital. Although similar problems may occur in all EDs, each ED team should plan their own MCI management strategy during the COVID-19 pandemic.

Authors' Contributions

Wei-Kuo Chou: Conception and design of the work, drafting of the work, final approval of the work, and first author.

Fuh-Yuan Shih: Conception and design of the work, drafting of the work, and revision of the work.

Ming-Tai Cheng: Conception and design of the work, drafting of the work, information gathering, and responder to the fire MCI at the scene.

Chien-Hao Lin: Conception and design of the work, drafting of the work, and final approval of the work.

Chien-Hua Huang: Conception of the work, revision of the work, and corresponding author.

All authors agree with all aspects of the work. The authors all read and approved the final version of the manuscript.

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Conflict(s) of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this paper.

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