Case study

Transfer of a critically ill coronavirus disease patient

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<https://doi.org/10.33151/ajp.17.864>

Abstract

Coronavirus disease (COVID-19) is an infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Acute respiratory distress syndrome (ARDS) is a feature of SARS-CoV-2, and transferring patients with severe ARDS is challenging owing to their condition and risk of infection during the transfer process.

The hemodynamic instability of critically ill patients adds to the challenge of safe transfer, which requires thorough preparation of personnel, medication, equipment, and communication and transport methods, all of which must be organised within the infection control framework.

In this case report we discuss a woman, 37 years of age, with suggested COVID-19, intubated due to severe ARDS. Owing to the hospital referral policy in Indonesia, the patient was transferred to a specialist infectious disease hospital by land ambulance, with a special transfer team formed to adhere to infection control protocols and critical patient transfer procedures.

Keywords:

COVID-19; coronavirus; ambulance; transfer; decontamination; personal protective equipment (PPE)

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Introduction

Coronavirus disease (COVID-19) is an infectious disease caused by severe acute respiratory syndrome corona virus 2 (SARS-CoV-2) (1). Most patients experience mild to moderate symptoms, but some experience greater severity of symptoms, including acute respiratory distress syndrome (ARDS) (2,3). In certain cases, severely affected COVID-19 patients require transfer to a specialist referral hospital, a facility that is assigned by the government to manage and contain the case. Transferring COVID-19 patients with severe ARDS is challenging because of their condition and the need for infection control measures during the process.

To date, there are no published case reports regarding the transfer of critically ill COVID-19 patients by land ambulance. This process carries increased risks in addition to those of conventional critically ill patient transfer, along with risk of infection transmission from the patient to the transfer team. Here, we discuss a COVID-19 patient with unstable hemodynamic and on mechanical ventilation due to severe ARDS, who was transferred to a specialist infectious disease referral hospital.

Case report

A woman, 37 years of age, attended the emergency department (ED) and was diagnosed with severe ARDS due to pneumonia and categorised as a patient under investigation for COVID-19 (4). The patient was admitted to the ED's negative pressure isolation zone, then intubated and mechanically ventilated. All healthcare personnel used personal protective equipment (PPE) for airborne transmission precautions during all procedures. Ventilator mode was set to pressure control, pressure inspiration 20 cmH₂O, PEEP 8 cmH₂O, respiratory rate (RR) 12 per minute, and oxygen fraction (FiO₂) 100%. This resulted in tidal volume of approximately 225–250 mL and peripheral oxygen saturation (SpO₂) of 82–92%. After adding a muscle relaxant (rocuronium) because of dyssynchrony, tidal volume increased to 300 mL and peak inspiratory pressure was approximately 30 cmH₂O. The patient was sedated with midazolam at 2 mg/hour and morphine at 1 mg/hour. PaO₂ was 152 mmHg. Blood pressure was approximately 90/60 mmHg after administration of norepinephrine (vasopressor) at 0.2 mcg/kg/minute and dobutamine (inotrope) at 20 mcg/kg/minute. Heart rate was approximately 130 bpm.

Due to the hospital's limited intensive care capabilities for suspected COVID-19 and the need for continuous, rigorous treatment, the ED manager decided to transfer the patient to a hospital dedicated to clinical management of COVID-19. The transfer procedure was facilitated by the Jakarta Provincial Health Office's public emergency ambulance service. The transfer team comprised two doctors (an emergency physician consultant and a general physician) and three nurses (certified ambulance nurses specialising in infectious cases).

All personnel wore PPE (Figure 1) comprising a water-resistant coverall suit (eg. made of polyethylene fabric), goggles, respirator (N95 mask or higher level of respirator), non-sterile nitrile latex gloves, and boots and shoes covers (5).

Figure 1. Personal protective equipment
Source: Jakarta Provincial Emergency Ambulance Services

The donning and doffing procedure of the PPE was performed according to infection control protocols.

The patient was transferred in an infectious disease-dedicated emergency ambulance following clearance from the referral hospital. During transfer, the patient was monitored in five-minute cycles to reduce risk of unmonitored deterioration. SpO₂ decreased to 85% because of dyssynchrony, at which point the patient received an additional 3 mg bolus of midazolam.

On arrival, the patient was directly admitted to the isolation room. The doctors and nurses performed handover of the patient while other personnel accompanied the ambulance to the decontamination area. The patient's condition deteriorated during the handover process, requiring simultaneous resuscitation and stabilisation from the transferring and receiving medical personnel. Sputum examination at the referral hospital revealed a positive result for SARS-CoV-2.

The decontamination procedure for ambulance interiors is air decontamination with a hydrogen peroxide 5–35% aerosolised dry mist device for 30 minutes. Surface cleaning using sodium hypochlorite 5.25% dissolved in water (1:9) (6,7), and general cleaning for soil and visible dirt should also be carried out (Figure 2).

The referral team and ambulance were decontaminated at the referral hospital. After decontamination, all personnel returned to their own institution.

Figure 2. Surface cleaning of ambulance interior
Source: Jakarta Provincial Emergency Ambulance Services

Discussion

As one of the epicentres of the COVID-19 outbreak in Indonesia, transfer of suspected COVID-19 patients is mandatory in Jakarta. Few hospitals in Jakarta have the capacity to manage patients comprehensively because of limited resources. At the time of this case, only three hospitals were designated COVID-19 referral hospitals in Jakarta.

Our patient was suspected to have viral pneumonia because she had moderate ARDS based on the Berlin criteria and had no comorbidity that could produce similar symptoms. Viral pneumonia due to SARS-CoV-2 can exhibit a cytokine storm syndrome that leads to ARDS (8,9).

Transfer of this patient must be weighed for risks and benefits. Considerations for this case included hemodynamic status, transfer process (physiological changes during transfer, type of vehicle, transfer team), infection control and legal elements. Decision to transfer was based on bed and treatment availability for this case, ability of the transfer team to maintain patient condition throughout the transfer process, available infection control precautions and family consent. The patient was declared transportable with advance supportive measures and considered a high-risk transfer.

Preparation is a major component in the pre-transfer process. Components such as risk assessment, preparation of the ambulance and transfer team, logistics, communication between referring and referral hospitals, and ethics and legal issues all require careful consideration.

Risk assessment includes medical and technical concerns, and potential for human error (10). Advance use of hemodynamic supporting devices increases the probability of technical error (11). Medications should be prepared before departure, ensuring complete doses of resuscitation medication are connected to a fully charged syringe pump during transfer. Power sources for medical devices should be readily available throughout transfer. The oxygen source should be sufficient to cover the transfer duration and unexpected events such as traffic jams.

The standard team for emergency ambulance transfers in Indonesia is three personnel (one driver, and two nurses in the patient's cabin). Based on the risk assessment for this case, we expanded the team by assigning an additional emergency physician consultant and a general physician. This measure was based on the critical condition of the patient and the complex devices and continuous medication needed during transport. Studies have shown that specialised transfer teams reduce the risk of adverse events, technical errors, and acute physiological disturbances and mortality (12). The patient cabin is designed to facilitate three healthcare personnel; therefore, the remainder should travel with the driver.

Land ambulance is the primary emergency transport in Jakarta because of its accessibility (number of units, routes of travel and economic viability) (13). For transporting infectious disease cases with a risk of airborne transmission, land ambulances should have additional specifications, such as one access point only for patient entry, and separate compartments and air circulation for the driver's cabin and patient's cabin (Figure 3). The air filtration system should comprise three layers of high-efficiency particulate air filters plus germicidal ultraviolet (14,15).

However, this air filtration system is not widely available because of cost constraints. Instead, the ambulance provider covered portable medical devices with transparent plastic to reduce exposure and help facilitate the decontamination process. A communication device (eg. walkie-talkie) was used between the driver and patient cabins. During the SARS pandemic in 2003, the Centers for Disease Control and Prevention (CDC) in the United States issued a guideline for ambulances to set the vehicle's ventilation system to non-recirculating mode to maximise the volume of outside air brought into the vehicle. The CDC also suggested using vehicle rear exhaust fans to draw air away from the driver's cabin toward the patient care area and out through the back of the vehicle (16). These measures are also applicable for SARS-CoV-2.

Figure 3. Ambulance interior

Source: Jakarta Provincial Emergency Ambulance Services

Due to hemodynamic instability, we also provided an automatic chest compression device in case cardiopulmonary resuscitation (CPR) was needed, reasoning that manually performing CPR in a moving ambulance could compromise personnel safety because of vehicle momentum (17,18).

Receiving personnel must wear the same level of PPE with the transferring personnel. Handover process occur in isolation room and under constraint condition (wearing PPE) makes communication challenging. Some method in patient handover communication could be employed (eg. Situation-Background-Assessment-Recommendation [SBAR] and Subjective-Objective-Assessment-Plan [SOAP]). All the process is documented and recorded.

Ambulance decontamination is part of infection control in any healthcare facility and is mandatory before an ambulance returns to services after transferring an infectious patient. It does not require a sophisticated facility to carry this out; but does require a protocol (and special device to vaporise the disinfecting agent) with principles that correspond to infection control guidelines, such as the Ministry of Health Indonesia guidelines and adaptation of CDC guidelines (6,16).

In summary, transferring critically ill COVID-19 patients has several considerations. It comprises infection control to the healthcare personnel and ambulance, personnel safety, and possible patient deterioration during transfer.

Competing interests

The authors declare no competing interests. Each author of this paper has completed the ICMJE conflict of interest statement.

Acknowledgements

Approval for publication was obtained from the patient's next of kin.

We would like to thank Editage for English language editing.

Funding

No funding was received for this work.

References

1. Gorbalenya AE, Baker SC, Baric RS, et al. The species severe acute respiratory syndrome-related coronavirus: classifying 2019-nCoV and naming it SARS-CoV-2. *Nat Microbiol* 2020;5:536-44. doi.org/10.1038/s41564-020-0695-z
2. Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet* 2020;6736:1-10. doi:10.1016/S0140-6736(20)30183-5
3. Wang D, Hu B, Hu C, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. *JAMA* 2020;323:1061-9. doi:10.1001/jama.2020.1585
4. Kementerian Kesehatan Republik Indonesia, Direktorat Jenderal Pencegahan dan pengendalian penyakit (P2P). Pedoman pencegahan dan pengendalian coronavirus disease (COVID-19). Revisi ke-4. Jakarta: Kementerian Kesehatan RI. Maret 2020; p.136. Available at: <https://covid19.kemkes.go.id/situasi-infeksi-emerging/info-coronavirus/dokumen-resmi-kesiapsiagaan-menghadapi-novel-coronavirus-covid-19-revisi-ke-4/#.XsIKFGzaUk> [Accessed

- 8 April 2020].
5. World Health Organization [Internet]. Rational use of personal protective equipment for coronavirus disease 2019 (COVID-19): interim guidance [updated 19 March 2020]. Available at: <https://apps.who.int/iris/handle/10665/331215> [Accessed 1 April 2020].
6. Kementerian Kesehatan Republik Indonesia. Peraturan menteri kesehatan nomor 27 tahun 2017: pedoman pencegahan dan pengendalian infeksi di fasyankes. Available at: http://hukor.kemkes.go.id/uploads/produk_hukum/PMK_No._27_ttg_Pedoman_Pencegahan_dan_Pengendalian_Infeksi_di_FASYANKES_.pdf [Accessed 8 April 2020].
7. EPA.gov [Internet]. Washington DC: United States Environmental Protection Agency. List N : products with emerging viral pathogens and human coronavirus claims for use against SARS-CoV-2 [updated 14 May 2020]. Available at: www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2 [Accessed 8 April 2020].
8. Mehta P, McAuley DF, Brown M, et al. COVID-19: consider cytokine storm syndromes and immunosuppression. *Lancet* 2020;395:1033-4. doi:10.1016/S0140-6736(20)30628-0
9. Ranieri VM, Rubenfeld GD, Thompson BT, et al. Acute respiratory distress syndrome: the Berlin definition. *JAMA* 2012;307:2526-33. doi:10.1001/jama.2012.5669
10. Sethi D, Subramanian S. When place and time matter : how to conduct safe inter-hospital transfer of patients. *Saudi J Anaesth* 2014;8(1). doi:10.4103/1658-354X.125964
11. Luster J, Yanagawa FS, Bendas C, Ramirez CL, Cipolla J, Stawicki SP. Interhospital transfers: managing competing priorities while ensuring patient safety. In: Firstenberg MS, Stawicki SP, editors. *Vignettes in patient safety*, Vol 2. Croatia: Intech; 2018, p.85–104. doi:10.5772/intechopen.72022
12. Droogh J, Smit M, Absalom A, Ligtenberg J, Zijlstra J. Transferring the critically ill patient: are we there yet? *Crit Care* 2015;19:62. doi: 10.1186/s13054-015-0749-4
13. Aitken P, Elcock M, Ballard N, Hooper M. Retrieval and transport. In: Nutbeam T, Boylan M, editors. *ABC of Prehospital Emergency Medicine*. Oxford: Wiley-Blackwell 2013; p.174.
14. Ministry of Health of Republic of Indonesia. Pedoman Teknis Ambulans. Available at: www.academia.edu/41837745/PEDOMAN_TEKNIS_AMBULANS [Accessed 6 April 2020].
15. Pemerintah Provinsi DKI Jakarta. Peraturan gubernur provinsi Daerah Khusus Ibukota Jakarta no 120 tahun 2016 tentang pelayanan ambulans dan mobil jenazah. Available at: https://jdih.jakarta.go.id/himpunan/produk hukum_detail/5781 [Accessed 8 April 2020].
16. CDC.gov [Internet]. Atlanta: Centers for Disease Control and Prevention. Public health guidance for community-level preparedness and response to severe acute respiratory syndrome (SARS), version 2 [updated 3 May 2005]. Available at: <https://www.cdc.gov/sars/guidance/i-infection/prehospital.html> [Accessed 1 April 2020].
17. Slattery D, Silver A. The hazards of providing care in emergency vehicles: an opportunity for reform. *Prehosp Emerg Care* 2009;13:388-97. doi:10.1080/10903120802706104
18. Chadkirk R, Gander B. Performing cardiopulmonary resuscitation during ambulance transport: safety and efficacy. *Resuscitation* 2017;116:e15. doi:10.1016/j.resuscitation.2017.04.027