Experiences in Management of a Severe Trauma Patient Suspected as Coronavirus Disease-2019 Infection/Patient under Investigation (COVID-19/PUI) Scheduled for Angioembolization Outside Operating Room Setting

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Only emergency cases are allowed during COVID-19 outbreak in our hospital. This case report described a 37-year-old man with blunt abdominal injury and hemorrhagic shock. The patient was resuscitated and immediately scheduled for angioembolization under general anesthesia regardless of COVID-19 result. Personal protective equipment was used during patient transfer and throughout the procedure. Although the procedure was uneventful, drawbacks included lack of negative pressure room, unfamiliarity with the equipment and lack of patient's coverage during transfer. In conclusion, management of the COVID-19 suspected case required multidisciplinary team cooperation for safety of the patient and healthcare team.

Keywords: Coronavirus disease-2019 (COVID-19), Patient under investigation (PUI), Personal protective equipment (PPE), Radio intervention (RI), Trauma

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Introduction

At present, the coronavirus disease-2019 (COVID-19) outbreak has spread all over the world and the World Health Organization (WHO) has declared COVID-19 as a pandemic since March 2020. A substantial number of COVID-19 infected cases are asymptomatic yet they can transmit the virus to others, especially healthcare personnel.[1] Khazaee et al.[2] found that several patients had incidental evidences of COVID-19 infection in chest computed tomography (CT) scans acquired for trauma management. Samsami et al.[3] reported 8 cases of COVID-19 pneumonia from chest CT scan of multiple trauma patients who did not develop any respiratory symptoms. These aforementioned studies suggest trauma patients who undergo emergency operation/intervention are defined as suspected COVID-19 cases or patients under investigation (PUI) due to uncertain history. However, the operations cannot be delayed whether or not the patients are COVID-19 infected.

Case Report

A 37-year-old Thai male was transferred to trauma unit of Siriraj hospital with a history of motorcycle-car accident. He was diagnosed with grade 4 splenic and pancreatic tail injury. Additionally, he had left hemopneumothorax with flail chest and mild head injury, classified as high risk. The vital signs upon arrival at the emergency room showed blood pressure (BP) 120/94 mmHg, pulse rate (PR) 140/min, respiratory rate (RR) 24/min and O_2 saturation 98% with 3 liters per minute (LPM) of O_2 cannula. The left-sided chest drain was inserted then the entrapped air and approximately 200 ml of blood were released. No active bleeding was observed. The trauma surgery team planned to transfer

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the patient to chest and abdominal CT scans for definite diagnosis and further management. During patient preparation for transfer, the BP dropped to 63/43 mmHg and the patient exhibited stuporous condition (Glasgow coma scale (GCS) E2V2M3) and aspirated a small amount of gastric content. This clinical deterioration, compatible with Class 4 of hemorrhagic shock, concerned the trauma staff therefore emergency intubation was performed to prevent further aspiration as well as patient resuscitation with balanced salt crystalloid solution. Formerly, trauma staff decided to perform exploratory laparotomy and also to activate massive transfusion protocol (MTP) for prompt treatment in case there was a situation which active bleeding could not be controlled. (The first set of laboratory investigation was still in progress at that time). Almost 1,000 ml of crystalloid solution was administered intravenously, however, the BP was still not stable. After having received 4 units of packed ted cells (PRC) and 500 ml of fresh frozen plasma (FFP), BP escalated to 120/80 mmHg and PR declined to 110/min indicating responsiveness to volume resuscitation. After hemodynamic stability was ensured, the patient was transferred to CT scan which displayed grade 4 splenic and pancreatic tail injury. As a result of improved hemodynamic parameters, the trauma staff consulted the radio interventionist (RI) for angioembolization instead of exploratory laparotomy. Laboratory results (after blood component transfusion) were as followed; Hemoglobin 15 g/dl, Hematocrit 46% (increased from 41% preoperatively to 46% after the transfusion), Platelet count 195,000/µl, Creatinine level 1.38 mg/dl, Prothrombin time 12.3 (PT) sec, Activated partial thromboplastin time (APTT) 24.5 sec and Lactate 5.5 mmol/L. The vital signs of the patient were well stabilized by volume resuscitation. High hematocrit, however, might be according to acute blood loss state, dehydration or over transfusion of PRCs.

Trauma surgery team consulted Infectious Disease (ID) staff to co-evaluate the patient according to the fact that the patient was admitted as an emergency case thus the history might be obscured. The patient was considered as patient under investigation (PUI). Nasopharyngeal (NP) swab was then performed for COVID-19 by using Reverse transcription polymerase chain reaction (RT-PCR). Subsequently, the patient was transferred to the intervention suite and the procedure proceeded immediately even though RT-PCR was still in progress.

Operating theater and personnel preparation

The intervention team including two interventionists, a scrub nurse and a circulating nurse and the anesthesia team comprised an anesthesiologist and an anesthesia resident. Members from both teams wore maximal personal protective equipment (PPE) (Figure 1 and 2) and were assigned to work in the dedicated intervention room. Other two circulating nurses dressed in airborne PPE sets (disposable caps, face shields, goggles, N95 respirators, waterproof long-sleeve gowns and gloves) (Figure 3) and were allocated to work outside the procedural field. They were responsible for delivering any extra medication or equipment and dispatching urgent investigations (e.g. arterial blood gas analysis). Putting on a maximal PPE over a lead apron used for radiation shielding was relatively difficult due to the heaviness of the shielding and an unfamiliarity of the PPE outfit (Figure 4).

Airway equipment and drug carts were arranged in the preparation room to avoid contamination. Pre-prepared medication trays and a modified airway cart containing necessary disposable medical supplies and video laryngoscope with disposable blades were placed in the intervention room. The anesthetic machine and monitor were covered by disposable plastic sheets to prevent contamination. Breathing circuit filters (HME filter) were installed between the proximal end of the endotracheal tube and the distal end of the expiratory limb of the circuit. For the reason that the intervention suite was not designed as standard operating room, the air filtration system was inadequate. Therefore, mobile HEPA air purifier was used in lieu of the central HEPA filter in the operating theater. Air conditioners were also turned off.

Figure 1 Recommended steps for putting on maximal PPE following the Infectious Control Practice Guideline in Anesthesia, Faculty of Medicine Siriraj Hospital.[13] Briefly, medical personnel should follow the guideline sequentially; 1. proper hand hygiene with 70% alcohol, 2. putting on shoe covers, 3. putting on 1st layer of sterile surgical gloves, 4. putting on sterile protective gown, 5. putting on N95 mask by placing the upper and lower strap above and below the ears, respectively, 6. performing the negative fit check by observing mask inflation/deflation during exhalation and inhalation, 7. performing the positive fit check by observing air leakage during forced expiration, 8. putting on the hood, 9. putting on plastic apron, 10.putting on 2nd layer of sterile surgical gloves, 11. putting on the face shield, 12. final PPE fitting check.

Figure 2 Medical staff wearing a maximal PPE following institutional guidelines.

Figure 3 Recommended steps for putting on airborne PPE following Centers for Disease Control and Prevention guideline.[14]

Figure 4. The trained nurse anesthetist assisted the anesthesiologist putting on a maximal PPE over a lead apron.

Management in intervention suite

After the team had finished putting on PPE, the patient arrived at intervention suite with transport monitor and ventilator. The atmosphere of the intervention suite was demonstrated in figure 5. The vital signs displayed BP 89/59 mmHg and PR 140/min upon arrival to the intervention suite. Therefore, 6 units (300 ml) of platelet concentrate were given by the interventionist request prior to the procedure. The patient was still cooperative and able to follow commands. Then he was transferred by log-roll maneuver. Endotracheal tube was clamped before being disconnected from the transport ventilator. Standard monitoring was applied and ventilation was checked by visualization of adequate chest movement and end-tidal CO_2 without using the stethoscope to avoid contamination. Anesthetic agents, 50 µg of fentanyl and 5 mg of midazolam, were administered for induction followed by 50 mg of rocuronium for muscle relaxation. Sevoflurane was used for maintenance of anesthesia. Endotracheal tube position was inspected with the assistance of fluoroscopy. Volume control ventilation mode was set after the patient was fully paralyzed. Peak airway pressure was approximately 22-23 cmH_2O. Balanced crystalloid solution was rapidly administered for volume resuscitation. Arterial blood pressure was intermittently monitored from the femoral artery.

The procedure consumed roughly 1 hour and 30 minutes to complete uneventfully. The patient was well responsive to volume resuscitation as determined by a reduction in heart rate and more stabilized blood pressure. A total of 2,000 ml of balanced crystalloid solution was given during the procedure. Around 200 ml of urine was measured and 50 ml of estimated blood loss was observed throughout the procedure. The patient was then sedated and paralyzed before transferring to surgical intensive care unit (SICU) which was a dedicated ICU for postoperative COVID-19/PUI patients according to Siriraj COVID-19/PUI work flow. The endotracheal tube was clamped before disconnection from the anesthetic machine before transfer and unclamped when connected to the transport ventilator. The closed-suction technique within endotracheal tube was utilized to minimize the risk of aerosolization of tracheal secretion.

Figure 5 A view from the control room demonstrating medical staff performing the operation in the radio intervention suite.

Medical personnel subsequently removed the PPE in front of intervention room because the anteroom was unavailable at the intervention suite. Removing the PPE was difficult regarding the unfamiliarity of the outfit and lack of prior experience. A trained nurse anesthetist assisted the medical staff following institutional guidelines to remove maximal PPE and put on the new one before patient transfer. Decontamination of lead aprons was performed by using 80% ethanol.

During transfer, the patient was not covered by disposable plastic/operating sheet assuming that his respiration was circulating in a closed system under transport ventilator. Emergency code (Code E) was activated to facilitate the patient transfer. The recommended steps for removing maximal PPE and airborne PPE are demonstrated in the figures 6-7.

Figure 6 Recommended steps for removing maximal PPE following the Infectious Control Practice Guideline in Anesthesia, Faculty of Medicine Siriraj hospital.[13] Briefly, medical personnel should follow the guideline sequentially; 1. proper hand hygiene with 70% alcohol, 2. removing plastic apron/taking off shoe covers/hand hygiene, 3. taking off 2nd layer of sterile surgical gloves/hand hygiene, 4. taking off face shield/hand hygiene, 5. taking off hood/hand hygiene, 6. taking off the upper part of the gown by bending forward then grabbing the inner surface of the shoulders and pulling forward until the sleeves are removed from both arms, 7-8. taking off the lower part of the gown and shoe covers without contacting the contaminated area on the outer surface of the gown and shoe covers/hand hygiene, 9. taking off 1st layer of sterile surgical gloves/hand hygiene/moving out of the operating room, 10.putting on new pair of sterile surgical gloves, 11. taking off N95 mask by lifting the lower strap over the head without letting the hands contact with the face/lifting the upper strap over the head then disposing the mask in dedicated waste container, 12. taking of the gloves/performing 6-step hand washing.

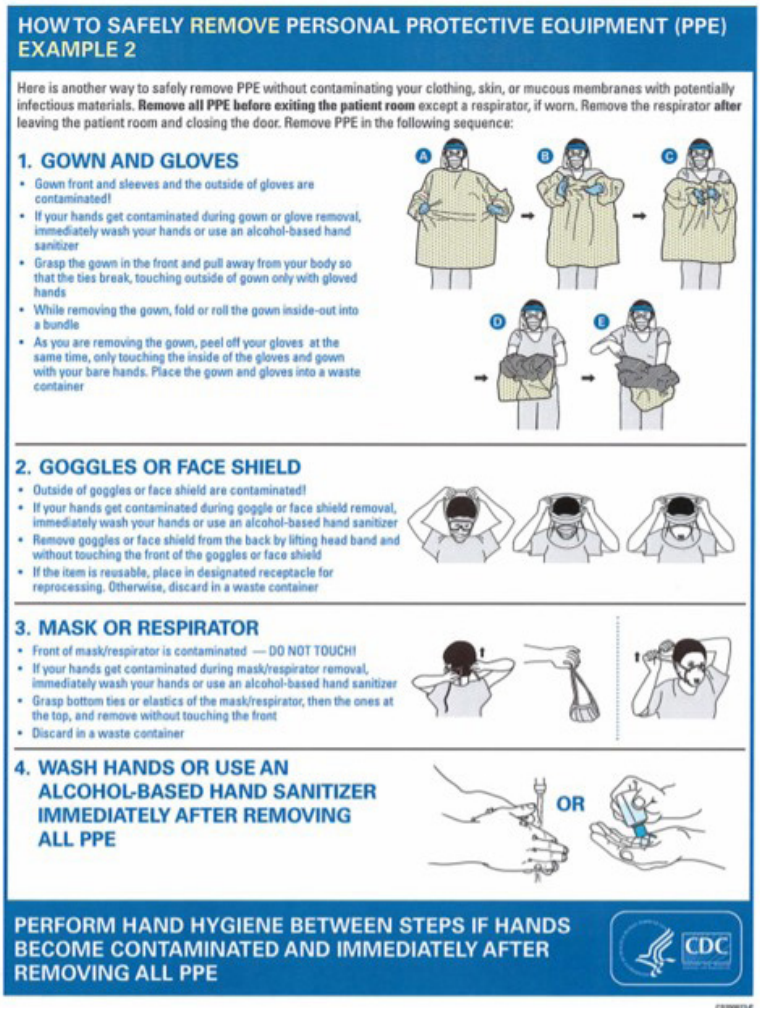

Figure 7 Recommended steps for removing airborne PPE following Centers for Disease Control and Prevention guideline.[14]

Discussion

From the literature reviews, there potentially are several points of improvement related to the management of COVID-19/PUI suspected case undergoing an operation or intervention. Firstly, this case had to wait for ID staff consultation thus causing a delay and NP swab was performed by surgical trauma staff for RT-PCT before transferring the patient to the intervention suite. Secondly, the patient was sent for abdominal and chest CT scans due to positive focus assessment sonography in trauma (FAST) and pneumohemothorax. Chest CT interpretation of the patient did not suggest any evidences for COVID-19 infection. Based on recent study, COVID-19 positive chest CT should demonstrate ground-glass opacities and consolidation, interlobular septal thickening and air bronchogram signs.[4] The rate of misdiagnosed of COVID-19 by chest CT scan was only 3.9% and therefore might be useful as a standard method for COVID-19 rapid diagnosis.[4] Nevertheless, an incapability to identify specific types of viruses or to distinguish between different viruses might be a limitation of chest CT scan. Medical personnel are recommended to observe and rehearse the steps of putting on and taking off the PPE (donning and doffing) prior to direct patient care.[5] Correct donning and doffing are keys to the prevention of viral transmission and accordingly should be performed with trained staff and

a buddy system following local guidelines. As mentioned earlier, the mobile HEPA air purifier was used in the intervention room while the recommendation suggested a proper negative pressure system which must be ensured within the operating theater and the anteroom. [6,7]

Hand hygiene and sterile technique are paramount. The person designated for direct patient care should wear new gown and gloves to reduce contamination of environmental surfaces.[5] Of note, during transfer, the circulating nurse and the anesthesiologist should wear proper PPE outside the operating room. The patient should be covered with one disposable operating sheet and then transferred to the negative pressure or isolation ward through a dedicated lobby and elevator. If the patient is kept intubated, a single-patient-use self-inflating bag must be used during transfer. It is not recommended to use a ventilator during transfer.[7]

WHO guidance of cleaning and disinfection of environmental surfaces in the context of COVID-19 recommends using 70-90% ethanol, chlorine-based products (e.g., hypochlorite) at 0.1% (1000 ppm) for general environmental disinfection or 0.5% (5000 ppm) for blood and body fluids large spills and > 0.5% hydrogen peroxide.[8] Minimum contact time of 1 minute is recommended for these disinfectants.[9]

In retrospective, it is very crucial to utilize our non-technical skills to manage the case and coordinate with the team in the outside operating environment. [10,11,12] Our case showed how important the anesthesiologist should have a situation awareness of how to manage the patient from the step of preoperative preparation in emergency setting until safely transferring to the intervention suite then the ICU postoperatively.

We outlined the proposed operation and its steps to our team during the patient preparation and found that the patient's COVID-19 status was not clearly identified. Then the ID physician was consulted and the NP swab was performed for COVID-19 RT-PCR. COVID-19 status of the patient needed investigation to ensure all required equipment had been sourced before proceeding further. The appropriate PPE was used according to the hospital guidelines. SICU for PUI patients was organized accordingly. Team management was important as we coordinated with surgeons, interventionists, scrub nurses, porters and ICU team by exchanging information through effective communication.

The Infectious Control Practice Guideline (CPG) in Anesthesia, Faculty of Medicine Siriraj Hospital[13] includes proper management of medical personnel, putting on and removing of PPE[14], patient preparation for surgery/intervention, patient transfer, anesthesia management in dedicating operating/intervention room etc. Our team strictly followed the guideline when caring for the patient in emergency situation which COVID-19 status was not yet clarified.

Conclusion

Overall, the first PUI case in the setting of outside operating room went smoothly owing to good planning and preparation to provide and maintain standards of patient care and clarification of any potential concerns from a surgical and an anesthetic perspective amid unfamiliar situation and stress.

References

1. Yang Y, Lu Q, Liu M, et al. Epidemiological and clinical features of the 2019 novel corona virus outbreak in China. MedRxiv 2020. doi.org/10.1101/2020.02.10.20021675
2. Khazaei M, Asgari R, Zarei E, Moharramzad Y, Haghighatkhah H, Sanei Taheri M. Incidentally ฑiagnosed COVID-19 ร฀nfection in rauma ย฀atients; a ฟlinical xperience. Arch Acad Emerg Med 2020; 8:e31.
3. Samsami M, Zebarjadi Bagherpour J, Nematihonar B, Tahmasbi H. COVID-19 Pneumonia in Asymptomatic Trauma Patients: Report of 8 Cases. Arch Acad Emerg Med 2020;8:e46.
4. Li Y and Xi L. Coronavirus disease 2019 (COVID-19): ole of Chest CT in diagnosis and management. Am J Roentgenol 2020;214:1-7.
5. ASA's Committee on occupational health offers recommendations to effectively and safely care for and transport patients with known or suspected COVID-19 infection: American Society of Anesthesiologists [Internet]. 2020 [cited May 19]. Available from: https://www.asahq.org/about-asa/governance-and-committees/asa-commiees/committee-on-occupational-health/coronavirus

6. Wax RS and Christian MD. Practical recommendations for critical care and anesthesiology teams caring for novel coronavirus (2019-nCoV) patients. Can J Anaesth 2020;67: 568-76.
7. Chen X, Liu Y, Gong Y, Guo X, Zuo M. Perioperative management of patients infected with the novel Coronavirus : recommendation from the Joint Task Force of the Chinese Society of Anesthesiology and the Chinese Association of Anesthesiologists. Anesthesiology 2020;132:1307–16.
8. Cleaning and disinfection of environmental surfaces in the context of COVID-19; Interim guidance: World Health Organization [Internet]. 2020 [cited May 19]. Available from: https://www.who.int/publications-detail/cleaning-and-disinfection-of-environmental-surfaces-inthe-context-of-covid-19
9. Risk communication and community engagement (RCCE) action plan guidance COVID-19 preparedness and response; Geneva: World Health Organization [Internet]. 2020 [cited May 19]. Available from: https://www.who.int/publications-detail/risk-communication-and-communityengagement-(rcce)-action-plan-guidance
10. Ellis R, Hay-David AGC, Brennan PA. Operating during the COVID-19 pandemic: How to reduce medical error. Br J Oral Maxillofac Surg 2020. doi.org/10.1016/j.bjoms.2020.04.002
11. Raksamani K. Teaching non-technical skills in anesthesiology. Thai J Anesthesiol 2015; 41:47-52.
12. Raksamani K, Jirativanont T. Situation awareness in anesthesia. Thai J Anesthesiol 2019; 45:171-5.
13. แนวทางปฏิบัติ การป้องกันและควบคุมการแพร่กระจายเชื้อ COVID-19 ในการระงับความรู้สึก ภาควิชาวิสัญญี คณะแพทยศาสตร์ ศิริราชพยาบาล [Internet]. 27 มีนาคม 2563 [cited May 24]. Available from: https://www.si.mahidol.ac.th/Th/department/anesthesiology/anesthesia/form/CPG_การป้องกันและควบคุมการแพร่กระจายเชื้อ%20COVID-19%20ในงานบริการวิสัญญี%20edit%2027-3-2020.pdf
14. Sequence for putting on personal protective equipment (PPE): Centers for Disease Control and Prevention (CDC) [Internet]. 2020 [cited May 24]. Available from: https://wilburnmedicalusa.com/blog/cdcs-sequence-for-putting-on-personal-protective-equipment-ppe/