

Anesthetic and Operative Management in COVID-19 Related Patients, the First Two Cases Report in King Chulalongkorn Memorial Hospital

Sudapree Sorasuchart¹, Atikun Thonnagith², Anchalee Techanivate²

¹Department of Anesthesiology, King Chulalongkorn Memorial Hospital, Thai Red Cross Society, Faculty of Medicine, Chulalongkorn University, Bangkok, Thailand

²Department of Anesthesiology, Faculty of Medicine, Chulalongkorn University, Bangkok, Thailand

Since the SARS-CoV-2 viral infection, called COVID-19, emerged and made a huge effect to the healthcare system, there would be a chance of COVID-19 patients who needed surgical and anesthetic care. Perioperative management must be planned and prepared not only place, but also personnel, protective equipment and workflow system, mainly to prevent viral transmission to healthcare workers. By the hospital policy, the isolated

operating room was established with collaboration of the surgery, anesthesiology and infection control departments. We reported two cases of COVID-19 related patients underwent emergency surgery under anesthesia in King Chulalongkorn Memorial Hospital during January to April 2020 in the anesthesiologist point of view.

Keywords: anesthesia, case report, coronavirus, COVID-19, surgery

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Introduction

The cluster of patients with unknown pneumonia caused by Novel coronavirus, later called COVID-19, was reported in Wuhan, China in December 2019^{1,2}. The number of infected patients rapidly grew across countries throughout the world. On March 11th, 2020, the World Health Organization declared the COVID-19 outbreak a pandemic.³ As of April 30th, 2020, there were 3,090,445 cases and 217,769 deaths reported globally.⁴

In Thailand, the first case was reported on January 13th, 2020 which later rapidly spread to various provinces. Here at King Chulalongkorn Memorial Hospital (KCMH), the first case was intubated by an anesthesiologist on March 18th, 2020.⁵ The rising number of infections some of which are asymptomatic, increases the probability of encountering COVID-19 in the operating theatre. We reported two cases of

suspected and confirmed COVID-19 patients requiring emergency surgery at KCMH.

Case 1

A 40-year-old Thai female parturient at gestational age of 38⁺3 weeks with active labor pain and fever was admitted to the isolated labor ward at Kakanang building. She had history of close contact with foreigners and was classified as a patient under investigation (PUI) for COVID-19. This patient was screened for COVID-19 by rapid antibody screening test, nasopharyngeal and oropharyngeal swab for Real-time PCR (RT-PCR) for SARS-CoV-2. Although the result of rapid test was negative, the care team decided to treat this patient as PUI with pending RT-PCR result. The patient's weight was 58.6 kg (from 49 kg prior to pregnancy) and 158 cm height. Her baseline preoperative blood pressure was 122/68 mmHg, pulse rate 92 bpm regular,

Correspondence to: Atikun Thonnagith MD., E-mail: Atikun.T@chula.ac.th

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temperature 38.1°C, respiratory rate 20/minute and SpO₂ 98% on room air. Laboratory results showed: hemoglobin (Hb) 12.4 g/dL, hematocrit (Hct) 37.4%, white blood cells count (WBC) 21,640/ul (neutrophil 85.9%, lymphocyte 8.4%), and platelet count 157,000 /ul.

The primary plan was vaginal delivery with forceps extraction to shorten the second stage of labor and minimized risk of aerosol production during labor. However, anesthesiologists were later consulted urgently to provide anesthesia for a cesarean section due to cephalopelvic disproportion. The fetal heart rate was continuously monitored and remained stable. At that time, the result of RT-PCR for SARS-CoV-2 was still not yet reported. The consensus between obstetricians, anesthesiologists and infectious medicine team was to proceed cesarean section using COVID-19 protocol. This was the first operation in the specific operating room (OR) for COVID-19 in KCMH.

The anesthesia team, including two anesthesiologists and two nurse anesthetists, arrived at the COVID-19 OR within 5 minutes after the initial consultation. One anesthesiologist acted as primary anesthesiologist and the second was an assistant to help collecting information for improvement in the next operation in COVID-19 period. One nurse anesthetist assisted in the OR, and the other circulated outside in case additional items required. Donning personal protective equipment (PPE) took 15 minutes under assistance by Infection

Control nurses (IC nurses). Details of PPE were described in table 2. Surgeons and scrub nurse who worked with a sterile operative field also wore sterile gowns and gloves on top of what was previously described.

The patient was initially kept in a separate holding area. Once the anesthesia team already prepared the anesthetic machine, monitoring equipment and medication, the patient was then transferred into the OR, wearing a surgical mask at all times. Standard monitoring: NIBP, EKG and SpO₂, were placed. Her blood pressure was 117/65 mmHg, pulse rate 94 bpm regular, and SpO₂ 97%.

Only the anesthesia staffs were present in the OR during spinal block procedure. The primary anesthetist performed spinal anesthesia in left lateral decubitus position using 2.2 ml of 0.5% hyperbaric bupivacaine added with 0.2 mg of morphine intrathecally, anesthesia level was confirmed at T4 dermatome. Six milligrams of intravenous ephedrine was given to maintain normotension. After completion of spinal anesthesia, surgeons and scrub nurse entered into the OR and started the procedure. A 2,970 gm, female newborn was delivered uneventfully, APGAR score was 9, 10 at 1 and 5 minutes, and was instantly transferred to an isolated care unit for the newborn. Operative duration was 40 minutes. Estimated blood loss was 400 ml and 1,500 ml of crystalloid was given intraoperatively.

Table 1 Details of COVID-19 related patients underwent emergency operation

	Case 1	Case 2
Age (years old)	40	32
Sex	Female	Female
Operation	Cesarean section	Appendectomy
Choice of anesthesia	Spinal anesthesia	Spinal anesthesia
Anesthetic agent	0.5% Bupivacaine 2.2 ml + morphine 0.2 mg	0.5% bupivacaine 3.6 ml
Level of sensory after spinal anesthesia	T4	T4
Number of anesthesia personnel/ total personnel in OR	3/7	2/7
Number of PAPR used	4	5
Operative time (minutes)	40	50
Blood loss (ml)	400	20
Hospital length of stay (days)	4	14

Table 2 Personal protective equipment (PPE) used by staff presented in the operating room

Personnel	Personal protective equipment (PPE)								
	Coverall Suit	Legs cover	Boots	Goggles	Face shield	N95 mask	PAPR*	Double gloves	Disposable plastic gown
Case 1									
Anesthesiologist 1	✓	✓	✓				✓	✓	✓
Anesthesiologist 2	✓	✓	✓				✓	✓	✓
Nurse anesthetist	✓	✓	✓				✓	✓	✓
Surgeon 1	✓	✓	✓				✓	✓	✓
Surgeon 2	✓	✓	✓	✓	✓	✓		✓	✓
Scrub nurse	✓	✓	✓	✓	✓	✓		✓	✓
Circulating nurse	✓	✓	✓	✓	✓	✓		✓	✓
Case 2									
Anesthesiologist 1	✓	✓	✓			✓	✓	✓	✓
Anesthesiologist 2	✓	✓	✓			✓	✓	✓	✓
Surgeon 1	✓	✓	✓				✓	✓	✓
Surgeon 2	✓	✓	✓				✓	✓	✓
Scrub nurse	✓	✓	✓				✓	✓	✓
Circulating nurse 1	✓	✓	✓	✓	✓	✓		✓	✓
Circulating nurse 2	✓	✓	✓	✓	✓	✓		✓	✓

*PAPR = powered air-purifying respirator

✓ = PPE used

After the procedure finished, all personnel except primary anesthesiologist left the OR and doffed PPE under IC nurse's instruction. The primary plan indicated one anesthesiologist to stay with the patient in the OR for postanesthetic care for 30 minutes, then transfer the patient to COVID-19 ward through a specific pathway. During the time of postanesthetic care, the result of RT-PCR was reported negative. The care team agreed to transfer this patient to a regular ward.

The patient's body temperature returned to normal (36.2-37 °C) after surgery. Her baby was healthy and both were discharged from the hospital together on postoperative day 4.

Case 2

A case of 32-year-old Thai female presented with abdominal pain for 3 days. Physical examination and imaging revealed appendicitis with appendicolith. She was then scheduled for an emergency appendectomy. Twenty-three days before this presentation, she had been diagnosed with COVID-19 infection. She had mild

upper respiratory tract symptoms, received only supportive treatment with no oxygen supplement. She had been admitted to hospital for 6 days and planned to be quarantined at home for 30 days. On the day she presented with appendicitis, her nasopharyngeal swab test RT-PCR for SARS-CoV-2 was still positive. Her chest radiograph showed no abnormality.

The patient's weight was 45 kg and 155 cm height. Blood pressure was 103/65 mmHg , pulse rate 93 bpm regular, temperature 38.5 °C, respiratory rate 20 /minute and SpO₂ 97% on room air. Laboratory results showed: Hb 12.4 g/dL, Hct 35.9% WBC 14,600/ul, Platelet 131,000/ul. Her electrolyte and coagulation factors were normal.

The operation performed in the same isolated operating theatre as the first case. There were only two anesthesiologists, two surgeons, one scrub nurse and two circulating nurses allowed in the OR. Details of PPE described in table 2 and showed in Figure 1.



Figure 1 Anesthesia and surgical team with PPE in case 2

When the whole team was ready, the patient was transferred into the OR, wearing a surgical mask all the time. Standard monitoring showed blood pressure 100/60 mmHg, pulse rate 90 bpm regular and SpO₂ 99%. Spinal anesthesia was done using 3.6 ml of 0.5% hyperbaric bupivacaine and anesthesia level was at T4 dermatome. Patient developed hypotension 88/56 mmHg. Ephedrine was given for a total of 30 mg for the entire case. Surgery lasted about 50 minutes. Seven hundreds ml of Ringer's acetate was given intraoperative. She was shivering at the end of the case. Twenty-five milligrams of intravenous pethidine was given then symptoms subsided.

After the operation, surgeons, scrub and circulating nurses exited the OR and performed PPE doffing under IC nurse instruction. One anesthesiologist stayed with the patient in the OR for postanesthetic care for 30 minutes, then transferred to cohort ward.

The patient's nasopharyngeal swab for RT-PCR for SARS-CoV-2 was finally negative on postoperative day 12, or 35 days after her first diagnosis of COVID-19. She was discharged from hospital on the following day.

Discussion

During the era of the emerging COVID-19 infection, it would be inevitable for healthcare personnel to face

COVID-19 infected patients who require surgical procedures. All hospitals have to prepare and allocate resources for managing every aspect of COVID-19 cases, not only the OR nor anesthesia team. The KCMH director had established protocols for COVID-19 cases requiring urgent surgical procedures including separated ward and operating theatre for COVID-19 and PUI cases.

Operating room perspective

Ideal operating room for COVID-19 should be an airborne infection isolation room (AIIR). Due to limited time for preparation during this pandemic, we could not provide AIIR in time. However, the isolated positive pressure OR were reconstructed using the temporarily closed gynecology OR in Kakanang Building.

In anesthesiologists' point of view, we concerned about gas supply and air ventilation in the OR to be more than 15 air changes per hour according to the Centers for Disease Control and Prevention recommendation as well.⁶ We also separated the area for donning and doffing PPE with a strict pathway in and out.

Since our isolated OR was not an AIIR, healthcare workers outside were still at risk when opening the OR door. We need to avoid unnecessary door opening. All personnel in front of the OR must wear N95 masks.

Limited exposed person

The number of personnel in the OR should be limited to decrease the risk of transmission. Only the most experienced were assigned to present in the OR. Trainees, medical students and residents were not allowed in the COVID-19 OR due to their lack of experience in order to protect them from viral transmission.

In the first case, there were three anesthesia members inside the OR. Two surgeons, one scrub, and one circulating nurse. All three anesthetic members and one main surgeon wore PAPR with PPE. After the case, we discussed and revised our own guideline. In non-complicated cases, only two anesthesia member (one main anesthesiologist and another assistant who could be an anesthesiologist or nurse anesthetist), two surgeons, one scrub nurse and two circulating nurses were a suitable number of staff involved in the OR. As the numbers of PAPRs were limited, two anesthesiologists, two surgeons and one scrub nurse were expected to wear PAPR. Job description of each person was written. Our own guideline was adapted from the first case experienced and several suggestions and recommendations^{7,8} and this guideline was later utilized in the second case.

*Anesthesia perspective**Anesthetic environment*

Human to Human transmission is believed to occur from contact droplets and airborne in specific situations such as in aerosolized procedures.⁹ Perioperative setting might be the site that caused unrecognised transmission to healthcare workers.¹⁰ Anesthesia work surfaces and equipment might contain droplets and allow spreading of the virus. We covered anesthetic machines and equipment with clear plastic sheaths for easy decontamination after the operation.

Limited drug used

To avoid contamination, all of the unused drugs in the OR will be thrown away. Only necessary medications were brought into the OR to decrease waste and preserve critical resources. We prepared medication divided into two plastic packages, one for regional

anesthesia and another for general anesthesia. In case any other drugs and equipment are required, a circulating anesthesia assistant outside the OR is responsible for acquiring items.

Choice of Anesthesia

There was a recommendation from the Chinese Society of Anesthesiology and the Chinese Association of Anesthesiologists that general anesthesia would be the first choice in all cases except cesarean section.¹¹ However, in our practice, the choice of anesthesia would be discussed case by case regarding type of surgery and patient's condition and we preferred sole regional anesthesia to general anesthesia in the case that regional anesthesia was applicable throughout operation, such as spinal anesthesia for open appendectomy in case report 2, in order to avoid aerosol-generating procedure during general anesthesia.¹²

Normally, neuraxial anesthesia is the anesthesia of choice in the low transverse cesarean section¹³ and it is also suitable in the COVID-19 parturient. However, fetal wellbeing was the important factor to determine choice of anesthesia. In our first case, spinal anesthesia was performed uneventfully.

There was one case report showing successful conservative treatment of acute appendicitis in a COVID-19 patient.¹⁴ Nevertheless, our case needed operative management due to appendicolith. Since the patient's signs and symptoms revealed localized peritonitis, we chose spinal anesthesia. Whereas there had been signs of generalized peritonitis, general anesthesia would be more suitable.

Concerning general anesthesia, anesthesiologists must be aware of aerosol-generating procedures including manipulation of oxygen mask, tracheal intubation, suctioning and extubation. Odds ratio of aerosol production was the highest during tracheal intubation, but no existing data for extubation. Our recommendation for anesthesiologist was to use full PPE with PAPR, even the choice of anesthesia was regional anesthesia in case switching to general anesthesia intraoperatively.

In both cases, a back-up plan for converting to general anesthesia was promptly implemented. We also prepared the acrylic box for prevention of the secretion spill out during intubation and extubation in the area of anesthesia workstation.¹⁵

During spinal anesthesia, vomiting or coughing should be prevented due to potential of viral transmission. Our protocol indicated that the patient must wear a surgical mask all the time in the OR. Early detection and proactive treatment of hypotension was applied in both cases using intravenous ephedrine. Intravenous ondansetron for nausea and vomiting prophylaxis was also given intraoperatively. Regarding the recommendation by Anesthesia Patient Safety Foundation, antiemetic drugs were strongly recommended.¹⁰ Vasopressors must be available and promptly given to prevent the reduction of blood pressure which may aggravate nausea and vomiting.

Communication

From the first case, we experienced communication problems between the team inside and outside the OR. Verbal communication through PAPR was difficult even between personnel inside the OR. In the second case, we communicated by writing on the white board. We also prepared an intercom and internal phone in speaker mode with clear plastic coverage for communication to the outside of the OR.

Following the hospital policy and collaborative management, none of the healthcare personnel in KCMH has been reported of COVID-19 infection from the workplace.

Conclusion

COVID-19 patients with surgical condition need standard perioperative management. In this era, healthcare workers must consider proper perioperative workflow to prevent transmission of the virus. Though the rate of new infections seems to slow down right now, it is a good opportunity to improve the quality of perioperative management for patients with COVID-19 in the future, where a second wave of infection is likely. Still, SARS-CoV-2 virus is new and not fully understood.

Information from various countries might aid in guiding medical staff involved to provide better treatment and care.

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