

COMMENTARY

The Challenges and Strategies in Managing Intensive Care Unit for COVID-19 Pandemic in Malaysia

Calvin Ke-Wen Wong¹, Chii-Chii Chew², E-Li Leong², Lip-Han Chia³, Biing-Horng Lee¹, Andrew-Prakash Anthonymsamy³, Mageswary Gobalan³, Kah-Shuen Thong⁴, Siti-Rohayah Sulaiman³, Kit-Weng Foong³

¹ Medical Department, Hospital Raja Permaisuri Bainun, Ipoh, Ministry of Health, Malaysia

² Clinical Research Centre, Hospital Raja Permaisuri Bainun, Ipoh, Ministry of Health, Malaysia

³ Anaesthesiology and Intensive Care Department, Hospital Raja Permaisuri Bainun, Ipoh, Ministry of Health, Malaysia

⁴ Pharmacy Department, Hospital Raja Permaisuri Bainun, Ipoh, Ministry of Health, Malaysia

Corresponding author's email: chiichii.crcperak@gmail.com; Tel: +605-2085146 / 5148

ABSTRACT

The number of patients requiring intensive care has surged since the outbreak of the SARS-CoV-2 virus. This had rendered the intensive care unit (ICU) a huge challenge not only to provide care for the existing patients but also to support the COVID-19 patients. The ICU was restructured to ensure strict adherence to the infection control guidelines. The aspects of change in the ICU had been ranging from the clinical operation, medication equipment and facilities, medications supply, and staffing. Strategies required upon implementation of change include having contingency plans, being innovative, getting the collaboration from other ICUs, exchanging information, getting support from the health policymakers, and ensuring the safety of the healthcare workers. This article aimed to share the experience of challenges and strategies in managing an ICU for the COVID-19 pandemic in Malaysia.

Keywords: Intensive Care Units, Pandemics, COVID-19, Organization and Administration

INTRODUCTION

The exponential rise of COVID-19 cases in March 2020 had triggered a pandemic response nationwide causing all health departments in government-funded health service institutions to undergo a restructuring exercise to tackle the outbreak of this disease in Malaysia (1). The intensive care unit (ICU) in a hybrid COVID-19 hospital was not spared, as one of the critical areas that needed a substantial change in the many aspects of daily flow and function (2).

Given its highly infectious nature coupled with the absence of a vaccine against the SARS-CoV-2 virus, the main challenge for any ICU setting across different countries would be the ability to balance the care provided to the surging COVID-19 patients who develop severe disease requiring ICU care with the cohort of non-COVID-19 patients requiring ICU care, especially when the resources are scarce (3–6). This amounts to about 20% of COVID-19 patients who may develop severe disease needing hospitalization. Those needing ICU care represents about 5% of the infected cohort (7–11).

The strategy to implement best practice based on recommendations by various governing international and local bodies requires enormous effort from both

the clinical and non-clinical staff of the ICU (2,10,11), as well as the consideration of existing commodities and infrastructure (11). Also, the burden of each ICU varies tremendously based on the available number of patients it can care for with the availability and allocation of resources (10,12). Literature about how Malaysian ICUs have been restructured to overcome the challenges during the pandemic were limited. This article aimed to share the experience in overcoming challenges and developing strategies to prepare the ICU for the COVID-19 pandemic in a tertiary referral hybrid hospital in Perak State of Malaysia.

CLINICAL OPERATION

Admission Workflow

Early preparation and planning were the keys to kick-start the ICU preparation. Restructuring of the ICU in this tertiary hospital took place in February 2020 by adapting the one-way entry system for entry/exit to prevent cross-transmission. Designated donning and large doffing areas were separated from the patient care area to allow freedom of movement for safe doffing, and at the same time incorporating with the one-way entry system (Figure 1) (13). A concept of 'safety first' based on the principle that there is no emergency in a pandemic and the personal protection of oneself is the priority, was implemented in the ICU to ensure the safety of



Figure 1: One-way entry-exit floor plan for restricting of ICU during the pandemic COVID-19

healthcare workers.

Intubation

The focus of intubation during this pandemic is to minimize risk of exposure to respiratory droplets while performing the procedure (14,15). Intubation policy was adopted based on the recommendations from guidelines (2,10,16). Two qualified anesthetists were designated for intubation procedures to ensure a smooth intubation process and minimize contact time. Equipment for intubation were prepared in line with the difficult airway algorithm (17).

The methodology of performing intubation in the general wards during the pandemic was also modified in line with the above focus. While many literatures listed the first aids material and medicine for intubation (14,18–20), extra effort was made such that the airway equipment were specifically packed and labeled Pack 1 to 6 based on the difficult airway algorithm to aid for smooth intubation in the ward, and also to serve as visual cues if a difficult airway situation arises (17). The bags were strategically placed at the entrance of ICU for easy pickup by the ICU doctors when attending to patients who requires intubation in the general ward.

An innovative invention that surfaced during this pandemic was the intubating box. This invention was invented by medical personnel and modified by engineers across the world to increase its efficacy and making it more ergonomic (21). Therefore, there were many different versions of the intubating box (21,22). The ones used in the hospital were equipped with a suction mechanism to generate a negative pressure environment inside the intubation box to minimize the exposure of the ICU doctors to respiratory droplets.

Communication

Communication among staff was hampered due to the physical barriers across different parts of the ICU (18). This includes communication between the staff inside isolation rooms and outside, as well as staff stationed within and outside of the ICU. Point-to-point walkie-talkies were used by the staff within ICU to overcome this problem.

To prevent cross contamination from ICU, paperless system was enforced. Hospital Information System (HIS), a centralized computer system for patient management, was used to order laboratory tests. The double-packed lab samples were placed at the designated area to be collected for transfer from ICU to lab. Medications were prescribed via Pharmacy Information System (PhIS) for each patient and packed individually in the pharmacy before delivering to a designated area which then collected by ICU nurse.

Similar to the policies of other health facilities (13,18,19,23), the ‘no visit’ policy by the hospital was the bane of building good clinical rapport with family members. The team overcame this by nominating a next of kin that will be updated daily on admission itself, having phone call updates on stipulated time frame as well as flexibility in allowing family members to visit non-COVID-19 cohort patients when necessary.

Information update

Clinicians are flooded with dynamic changes in information ranging from pathophysiology until therapy. Therefore, it is pertinent that everyone must be updated with the latest information in disease process, therapies, workflow changes and government directives (18). To improve patient outcome, the unit has to work in unison and that includes being on the same page when it comes to patient management.

WhatsApp Messenger groups were created for rapid dissemination of information while providing an opportunity to share new information and answer queries. The Morning Passover sessions were created to update the receiving team with regards to patient’ progress overnight and clinical investigations. The ICU Task Force Room was created as a hub for clerical work and communication. A whiteboard was used to constantly record updated information such as the number of staff working, and preparation of equipment required before entering the ICU.

Infection control in the ICU

Effective infection control is crucial in preventing the spread of COVID-19, especially in the ICU (2,11,24). The infection control team was tasked to conduct continuous surveillance on the compliance of ICU staff to standard infection control procedures (2). This included coming in for clinical rounds, observation and reprimanding those who flout the Standard Operating Procedures (SOPs). Regular meetings were held to refine the SOPs and boost compliance among staff. The team also observed ICU staff for any signs of physical or mental illness. Any staff who were found to be unwell would be referred to their respective clinical manager, who would then take the appropriate steps as stipulated in the guidelines (2,16). Surface decontamination was key of infection prevention (23). Cleaning of ICU was done by trained cleaner, under supervision of infectious

control unit.

MEDICAL EQUIPMENT AND FACILITIES

ICU Bed

Estimation of the number of beds required is the most important step in preparing the ICU for the pandemic. The hospital was restructured as a hybrid COVID-19 hospital with an estimated capacity to admit 100 COVID-19 patients. According worldwide data, it was estimated that 20% of the cases would develop severe disease (7,8,10–12,16). Hence, the number of ICU beds in this hospital was increased from 23 to 32 during the pandemic to cater for both COVID and non-COVID patients.

The mean length of ICU stay among COVID-19 patients was 7.3 days (range: 4 - 19 days) (10,12). Meanwhile, the mean day of ICU stay in this hospital was 11.8 days. This longer period of stay translates to further strain on the ICU bed requirement. The contingency plans were conversion of general wards into temporary ICUs to admit severe acute respiratory infection (SARI) patients and conversion of maternity ICU into non-COVID ICU wing. The provision of intensive care outside of ICU was required due to limited space and risk of increasing nosocomial infection if add beds to pre-existing ICU (23). This is to ensure patient care, especially for both COVID and non-COVID patients would not be substandard during this pandemic crisis. The contingency plan of converting the operating theatres into isolation rooms was also in place should the need arises.

Equipment

Inadequate essential equipment required for each functional ICU bed was a common problem encountered by most of the ICU globally (8,25). In our experience, communication barriers were the most important stumbling stone in procurement of equipment. The intensivist was constantly communicating with the hospital and state directors to obtain speedy approval in procuring equipment. A nationwide integrated system for ICU equipment procurement was deemed important when resources were scarce during the pandemic. WhatsApp Messenger group comprising of all the ICU managers from different hospitals across the nation was created to aid the process of sourcing equipment. Through this method, this hospital was able to procure adequate powered air-purifying respirator (PAPR) for use.

Personal Protective Equipment (PPE)

Another challenge encountered by all health facilities during the pandemic was the shortage of PPE (24). In order to maximize the use of the limited PPE, several strategies were implemented: (i) limiting the number of staff entering the ICU; (ii) daily stock check to ensure sufficient stock and projection of time frame; (iii) constant communication with the supply store and clear

algorithms to maintain supplies; and (iv) donation from non-government organizations.

Another innovative adaptation was using a modified scuba diving mask with a 3D-printed connector if non-invasive ventilation masks were to run low (26). Many individuals in the community took their time to sew PPE gowns and assemble face shields with household material contributed by public donations. This duty was taken up by the members of the community as well as the ICU staff.

Medication supplies

Since COVID-19 was a novel disease, medications used were via off-label indications and some medications were not available in the country. The pharmacy department needed to arrange with the Ministry of Health to obtain special approval to import the medication. The ICU clinical pharmacists needed to constantly gather updated information regarding the medication including dosage and method of administrations to file for such approval.

ICU infrastructure

The management of ICU infrastructure is as important as the clinical management of the patient. To minimize risk of exposure to respiratory droplets attributing to air conditioning, the hospital engineer and intensivist agreed to cordon off and relocated common areas which were sharing air conditioning system with the ICU. Additional staff rest rooms were re-allocated away from patient care area.

Equipment which are highly contaminated with respiratory droplets were ventilators, airway devices and PAPR. The assistant medical officers re-looked into the respiratory laboratory location, created a new pathway and room scheme by adapting new disinfection protocols to ensure all the medical devices were safe to be used.

Staffing

Prevention of burnout amongst the clinical staff is vital and reflects on good clinical governance in the ICU (27,28). Approximately 60% of existing ICU nurses were assigned to provide nursing care to COVID-19 patients, after excluding nurses who were deemed high risk. Nurses with at least 6 years of ICU experience were sent from other departments were retrained in providing care for ICU patients who were not diagnosed with COVID-19, guided by ICU-trained nurse. The nurses-to-patient ratio in the ICUs during the pandemic remained as 1: 1 (29). Meanwhile, the traditional on-call system for the ICU doctors was changed to a 12-hour shift system to ensure a sufficient number of ICU doctors were working at any time point and ensuring work-rest balance.

Tremendous stress, both physical and mental was experienced by ICU staff (11,24,28). The Depression

Anxiety Stress Scale (DASS) questionnaire was administered to all ICU staff regularly by the psychiatry team to screen for any staff who were mentally affected by the changes in the work environment. About 50% of staff in the ICU were found to be in that category mainly due to the inability to participate in family events as well as being isolated from their family. Arrangements of counseling, accommodations, redeployment to non-COVID ICU ward, and longer period of rest day were

conducted by the team managers to ensure staff overall well-being (Table I).

CONCLUSION

This commentary outlines the preparation of a ICU in tertiary referral hospital since the outbreak of COVID-19 in China. Early preparation and planning of the ICU required the efforts of all relevant parties to overcome the challenges. These were mainly seen in the process

Table 1: Challenges and Rectifying Strategies during the Pandemic

Challenges	Strategies
Clinical Operation	
Admission Workflow	<ul style="list-style-type: none"> Restructuring the Intensive Care Unit (ICU) admission workflow to safeguard the staff from respiratory droplets exposure and to ensure the safety of the patients who are admitting into the ICU. Donning and doffing area was designated separate from the patient care area but incorporating with the one-way entry system.
High risk of transmission from aerosol-generating procedures	<ul style="list-style-type: none"> Modification of workflow, emphasizing on safeguarding oneself from any risk of respiratory droplet exposure. Modifying the intubation Standard of Procedures (SOPs) based on updated recommendations from guidelines pertaining to the pandemic period. Simulation sessions to test out the workflow and simultaneously innovate to deal with the shortcomings. Use of innovations especially the intubating box designed to reduce risk of respiratory droplets exposure further.
Physical barriers and communication barriers	<ul style="list-style-type: none"> Use of walkie-talkies to enable communication between staff at different locations. Nomination of the patients' next of kin on admission to receive daily updates via phone call. Hospital Information System (HIS) was used to order laboratory tests. Pharmacy Information System (PhIS) was used for prescribing and ordering of medication for each patients.
Ineffective information dissemination to ground staff	<ul style="list-style-type: none"> WhatsApp Messenger groups as the main platform of communication across different ranks. Daily Morning Passover session every morning to update patients' condition to the receiving team. ICU-COVID Task Force Room as the main hub for documentation and communication.
Safeguarding compliance to SOPs during work.	<ul style="list-style-type: none"> Role of Infection Control Team to maintain standard infection control compliance. Role of Infection Control Team to detect staff who were physical or mentally unwell for further management. Training and supervising designated cleaners to adhere to the SOPs. Role of clinical managers to ensure all staff adhere to their respective SOPs.
Limitations in daily role ICU Clinical Pharmacists	<ul style="list-style-type: none"> Streamlining and consolidating the role of the ICU Clinical Pharmacists Use of the hospital information system (HIS) as a platform for supplying and monitoring medication use Implementing modifications in medication supply to heed infection control measures.
Medical Equipment & Facilities	
Inadequate ICU space to cope with the pandemic	<ul style="list-style-type: none"> Creating a flexible bed system in the ICU to cater for the need of the pandemic. Conversion of an open ward into a temporary ICU Conversion of the Maternity ICU to nurse the Non-COVID cases. Conversion of operating theatres into isolation rooms if needed Inspection and maintenance by the hospital engineers to ensure optimal functional status of the ICU areas with contingency plans during a malfunction.
Inadequate medical devices	<ul style="list-style-type: none"> Involvement of the Intensivist in the COVID task force at the State Health Department and the Hospital Level Communication via WhatsApp Messenger System to air concerns and expedited approval from the stakeholders. Empowering clinical managers to source for the deficit in equipment. Creating a National Integrated Communication System on WhatsApp Messenger to enhance equipment support systems between hospitals across the nation. User training for newer version of powered air-purifying respirator (PAPR) and medical devices virtually by local and overseas trainers.
Inadequacy of Personal Protective Equipment (PPE) and lack of a system of sustainability	<ul style="list-style-type: none"> Rationalizing the amount of PPE needed via meticulous planning and communication between the doctors, nurses, and assistant medical officers during the Morning Passover session. Having a daily stock check and emergency alert system when supplies are low Creating a workflow system with the hospital store to procure PPE if in need. Handmade PPE
Medications	
Off-label used and unavailable medications in treating COVID-19 patient	<ul style="list-style-type: none"> Arranging procurement of emergency drugs used for COVID-19 which needed special approval and import permit Developing a surveillance system to prevent medication error
Staffing	
Inadequate trained ICU nurses to meet the demands of the pandemic	<ul style="list-style-type: none"> Establishing a workable ratio of staff by the clinical managers Inclusion of Hospital and State Matron to obtain more staff nurses to man the ICU Creation of teams to enhance teamwork and flexible working hours to reduce burnout Mentorship system to guide the inexperienced nurses from other departments to handle non-COVID ICU patients.
Work exhaustion stemming from the fear of the unknown among ICU staff	<ul style="list-style-type: none"> Changing the doctors' working system into a shift system. Assessment of staff using Depression Anxiety Stress Scale (DASS) and having clear algorithms if staff were detected to be at risk of burnout. Strategies for supporting the staff during this difficult period include: <ol style="list-style-type: none"> Counselling by team managers to help rationalize and allay fears. Arrangement for counselling by the Psychiatry Team if needed. Arrangement for accommodation for those who did not want to return home after work. Redeployment to non-COVID ICU ward Extra rest days if needed Additional staff rest rooms were re-allocated away from patient care area.

of procurement for essential devices, PPE, change of workflow, rapid treatment update, and staffing for potential patients' influx. A support system created by the team manager was vital to ensure the well-being of ICU staff. Innovative adaptations were also required to tackle the issues of resource shortages. It is recommended that future study or clinical audit could consider measure the outcome of the strategies applied prepare the ICU for pandemic.

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