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Anaesthesia and intensive care medicine in a COVID-19 pandemic

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Singapore Med J 2020, 1–9

<https://doi.org/10.11622/smedj.2020094>

Published ahead of print: 26 June 2020

Online version can be found at
<http://www.smj.org.sg/online-first>

INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic has affected millions and resulted in countless deaths worldwide. Healthcare systems have been overwhelmed in many countries, including China, Italy,⁽¹⁾ Spain, the United Kingdom⁽²⁾ and the United States. This is particularly so for critical care medicine, where infrastructure, drugs, equipment and skilled staff may be in short supply.

Singapore was one of the first countries to be affected by the early wave of infections connected to Wuhan, China. All restructured hospitals and some private hospitals have played major roles in Singapore's pandemic response so far, including screening for COVID-19, caring for afflicted patients, boosting manpower in the National Centre for Infectious Diseases and sending teams into the community to screen for the virus. Anaesthesiologists and intensive care physicians have been an integral part of Singapore's healthcare response. This article describes the potential and real contributions by anaesthesiologists and intensivists in the pandemic response efforts.

SAFETY IN THE OPERATING THEATRE

An anaesthesiologist's routine work involves multiple aerosol-generating procedures, including intubation, extubation and suctioning of the airway. Experience during the severe acute respiratory syndrome outbreak in 2003 has shown that endotracheal intubation carries the highest risk of viral transmission to the healthcare worker.⁽³⁾

The Division of Anaesthesiology in Singapore General Hospital (SGH) was quick to respond to the initial outbreak of the novel respiratory pathogen by preparing a set of guidelines for anaesthesia and perioperative care of patient to minimise potential transmission of

infection.⁽⁴⁻⁶⁾ Traditionally considered leaders in patient safety, we also created new processes and systems in our operating theatres (OT), designating an isolation OT that was physically separated from the main OT complex. With strong support by OT nursing staff, *in situ* simulation sessions were performed early to ensure all team members were prepared for the eventuality of a COVID-19 patient requiring surgery. COVID-19 coordinators were present at all operations performed on suspected or confirmed COVID-19 patients, providing guidance to all staff, including surgeons, nurses and healthcare attendants, to ensure a safe environment for both patients and healthcare workers. Since then, anaesthesiologists the world over have come up with many different guidelines for anaesthetic and airway management for COVID-19 patients. Similar guidelines have been created by various medical specialties across Singapore.⁽⁷⁻¹¹⁾

SAFETY IN EMERGENCY DEPARTMENT AND PRIMARY CARE

As the outbreak spreads globally into a pandemic, Singapore experienced a second wave of imported infections, with a rise in number of COVID-19-related attendances at the emergency department. Armed with our airway expertise, the division sent teams to the emergency department and fever screening areas to assist in obtaining nasopharyngeal and throat swabs for patients suspected to have COVID-19. Through this experience, innovative minds have come together and created the SG-Swab Assurance for Everyone booths to protect doctors as they perform swabs.⁽¹²⁾ Further work has been done to create protective boxes and screens for intubation to reduce droplet spread of the virus during airway manipulation.⁽¹³⁾ Acceleration of these developments was possible due to the availability of emergency funds that could be rapidly disbursed for COVID-19-related projects. Furthermore, throughout these efforts, philanthropy was encouraged to support safety and innovation in healthcare.

Creating surge capacity for intensive care

Current evidence indicates that 5%–9% of all COVID-19 patients will require intensive care.^(14,15) As the number of infected patients rises in Singapore, it is imperative to create critical care surge capacity.⁽¹⁶⁾ The team from the Department of Surgical Intensive Care, SGH, comprising anaesthesiologist-intensivists, has been involved in preparations for a surge in critically ill patients as part of coordinated efforts by the national intensive care unit (ICU) committee. Significant work has been put in to map the expansion of our isolation ICU, including the conversion of general ward beds to critical care beds. On top of our usual clinical work, ICU teams, comprising a consultant intensivist, a senior anaesthesiology resident and medical officers, have been assembled to care for critically ill COVID-19 patients. Our nurses in the OT are well placed for rapid training to serve as ICU nurses during a surge.

There is significant overlap between care of the critically ill patient and care for the anaesthetised patient undergoing surgery. All anaesthesiologists have had valuable experience in the ICU as part of their specialty training and may be called upon to lead ICU teams in a surge. The skills that anaesthesiologists have developed will prove essential in the ICU. For example, we are experts in airway management and vascular access, especially for invasive lines. Ventilator management is second nature, and haemodynamic monitoring is *de rigueur*. Skills in certain procedures, such as turning a patient prone, have turned out to be an unexpected asset during this pandemic, where many of the patients suffering from acute respiratory distress syndrome require prone positioning as part of respiratory management. These skills allow anaesthesiologists to function well as leaders of procedural teams like airway or code teams, which may then be supported by clinicians and nurses who are not the domain experts in these fields.⁽¹⁷⁾

The OT is a place which can be quickly converted into a temporary ICU should the need arise.⁽¹⁸⁾ Both individual OTs and post-anaesthetic care unit (PACU) cubicles are readily suited to monitor critically ill patients, and come with oxygen source, wall-mounted suction and multiple power points. However, the conversion of such locations into an ICU is not without significant effort, as engineering modifications may be required to enhance the capabilities of the OT complex. For instance, taps and drainage outlets are required for haemodialysis, and these are not part of the usual features of an OT. Concessions may have to be made for the level of care depending on the capabilities of the location. For instance, although OTs normally have outlets for medical air, a PACU does not. As a result, the ventilators used in the PACU must be able to use entrained atmospheric air. In an OT that has no tap or drainage, continuous renal replacement therapy must be used instead of intermittent haemodialysis.

In a pandemic, vast quantities of supplies and drugs need to be prepared to cope with the surge in critically ill patients. Many physicians in acute medicine have attempted to think out of the box to enhance the utilisation of existing equipment to care for larger numbers of patients.⁽¹⁹⁾ Assessments on the safety of such modifications, however, fall back on basic understanding of physiology and ventilatory management; as such, these suggestions remain outside the scope of conventional critical care practice.⁽²⁰⁾ The intimate knowledge that anaesthesiologists possess about their equipment has been invaluable in engineering creative methods to substitute existing consumables for those that may run short. For example, with the help of our anaesthetic technicians, we have used circle circuits to replace single-limb breathing circuits in the transport ventilators. We have also reduced dependency on disposable items, preferentially choosing to use reusable alternatives. Furthermore, we are working closely with the sterile supplies unit to re-process certain single-use items to cope with the large numbers required. Apart from medical

equipment, anaesthesiologists are also involved in the conservation of personal protective equipment, which is of vital importance in protecting healthcare workers during an infectious disease outbreak.⁽²¹⁾

Anaesthesiologists' knowledge of pharmacology has been extremely useful in brainstorming alternative drugs and drug-conservation strategies to cope with the increase in demand for drugs used in the ICU. Drugs such as thiopentone and pancuronium, which had somewhat fallen out of favour in recent years, have reappeared in the anaesthesiologists' armamentarium to spare the use of propofol and atracurium in the OT. Anaesthesiologists are also now relying on central neuraxial and peripheral nerve blocks for similar reasons. Finally, our knowledge of gases and inhalational agents has led us to consider and examine the hospital's vacuum insulated evaporator and oxygen supply for their capacity to cope with a surge in demand for mechanical ventilation.⁽²²⁾

With the need to maintain safe distancing, we have come to embrace the use of technology for the continuation of education, peer-reviewed learning and administrative meetings in the department. Surgical intensivists have always been involved in training surgical residents to care for critically ill patients. In the current climate, as all available manpower is mobilised in the ICU surge, we have also ramped up education for our surgical colleagues to refresh their knowledge in intensive care. This enhances capability on the ground to take care of more patients. In collaboration with our colleagues in Respiratory and Critical Care Medicine, a set of lectures and ventilator demonstrations have been recorded as part of an online ICU refresher course.⁽²³⁾ This enables all physicians, surgeons and junior doctors to be quickly trained as non-intensivist members of the ICU team. Finally, as the most frequent users of powered air-

purifying respirators (PAPR), anaesthesiologists have also taken on the role of coaches to operating team members who may be unfamiliar with their personal protective equipment.

The COVID-19 pandemic threatens to last for a protracted amount of time. Although the pandemic remains a global crisis presently, it may give rise to opportunities to change our practice for the better and, at the same time, encourage collaboration and medical innovation to benefit our patients.^(24,25) To emerge victorious, we will require resilience. As leaders of a medical team, we should vigilantly look out for evidence of burnout among our fellow healthcare workers and provide one another with the necessary support systems to get through this difficult time together.⁽²⁶⁾

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