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## Original Research

## A surgeon's role in fighting a medical pandemic: Experiences from the unit at the epicentre of COVID-19 in Singapore – A cohort perspective



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## ABSTRACT

**Importance:** Although Singapore was one of the first countries outside of China to be affected by COVID-19, for the first 2.5 months since its first reported case on January 23, 2020, it remained one of the few nations with successful containment of spread of the pandemic with little mortality and zero intra-hospital transmissions, without instituting a major lockdown of the country. In times of an infectious epidemic where medical subspecialties lead the frontline, a surgeon's role becomes rather vague. However, the only obstacle that stands in between the surgeon and fighting in the frontline of an infectious disease outbreak, is the traditional perception of what a surgeon can do. By presenting the strategies employed by our institution and its surgical unit, which remains the epicenter of the COVID-19 fight in Singapore, together with our medical counterparts, we hope to be able to improve our practices to respond and prevent the pandemic from escalating further as a collective community of surgeons across the globe.

**Observations:** Contingencies should be in place for prioritization of existing patients, triaging and treatment of suspected patients, infection control, manpower management and novel strategies for inter-disciplinary communications and education in a hospital's surgical unit during a pandemic. Working in a high risk environment with manpower and resource limitations for prolonged periods of time has effect on morale and affects surgeon burn-out. Transparent communication, avenues to address psychological needs of surgeons and leadership by example are key strategies in ensuring a sustainable fight against the pandemic.

**Conclusions and Relevance:** With the various strategies implemented, every surgical discipline and every surgeon should be unified and place their desire to operate aside. There should not be any differentiation between surgeon and physician, but instead, everyone has to work together as one united health care front battling the common enemy – COVID-19.

### 1. Introduction

Together with the United States, Thailand, Japan, Vietnam and South Korea, Singapore was one of the first countries outside of China, to be affected by COVID-19 and apart from China, remained the country with the highest number of cases from the Feb 5 to Feb 18, 2020 [1]. For the first 2.5 months since its first reported case on January 23, 2020, Singapore remained one of the few nations with successful containment of spread of the COVID-19 pandemic with little mortality and without instituting a major lockdown of the country. As of April 12, 2020, the number of COVID-19 deaths worldwide exceeded 100,000 while Singapore had only seen 8 deaths and no intra-hospital transmission of the disease [1]. This has only been made possible by a collaborative effort from an echelon of bodies from the government to the

hospitals to the various medical, surgical and allied health divisions of each hospital and down to each doctor, patient and citizen playing their part.

The role of a surgeon is clear in national emergencies involving mass casualties like terrorist attacks, natural disasters, mass transportation motor vehicle accidents etc. However in times like an infectious epidemic, Infectious Diseases (ID) specialists, public health physicians, epidemiologists and emergency physicians seem to lead the frontline battle. The perceived role of a surgeon during an infectious disease outbreak is questionable. However, it is only this perception that limits the surgeon in fighting the invisible enemy together with their medical comrades. We highlight the strategies employed by our institution and our surgeons to combat this invisible enemy together.

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## 2. Command centre

The focus and strategy adopted by the Singapore Ministry of Health (MOH) was for early screening, containment, strict isolation and stringent contact tracing of identified COVID-19 cases. These strategies were some of the learning points MOH adopted from Singapore's experience with the SARS outbreak in 2003 which also included building the National Centre for Infectious Diseases (NCID) [2], which currently remains the epicenter in the fight against Singapore's COVID-19 outbreak. The NCID is located in the same premises as Tan Tock Seng Hospital (TTSH), one of the largest acute care hospitals in Singapore. The NCID comprises of a Screening Center (SC) which effectively functions as an Emergency Department (ED) for any suspected COVID-19 case, wards with negative pressure isolation rooms, Intensive Care Unit (ICU) and Operation Theatres (OT).

The Integrated Outbreak Coordinating Platform (IOCP) comprising of the medical, surgical and administrative heads of TTSH and NCID was formed at our institution immediately after Singapore saw its first locally transmitted case on February 4, 2020. The IOCP remained the heart of the command center in TTSH for battling the outbreak and was where all procedures and workflows for the management of COVID-19 was disseminated from.

## 3. Surgical team segregations

Learning from our 2003 SARS experience, a slew of initiatives were implemented to ensure that there was no transmission of disease amongst healthcare staff [3,4]. All surgical teams were divided into individual teams with members of key sub-specialty capabilities, seniority, experiences and a recognized chain of command. Rosters were planned such that these teams with similar capabilities, would have minimal contact in the wards, operating theatres and clinics. Spatial segregation in canteens and break areas augmented this temporal segregation.

At an individual level, it was mandatory for hospital staff to wear surgical face masks, undertake twice daily temperature surveillance and self-reporting of respiratory symptoms through a centralized online system. Mandatory 5 days of medical leave with stay home notice were issued to all symptomatic staff due to their high risk of secondary transmission of any respiratory illness which may result in further depletion of the healthy manpower pool. This approach allowed for continuity in clinical work and minimized risk of intra-hospital transmission of COVID-19.

## 4. Leave and rostering

All leave except for maternity leave and those on compassionate grounds were frozen from the end of January 2020 indefinitely. For those who had not left the country, all planned surgical fellowships were cancelled. Those who were overseas were requested to cut short their travels and return back to work at the soonest time. All surgeons were required to be in Singapore and contactable such that they could be activated and deployed according to governmental needs in case the situation got out of control rapidly. Roster planners were working extra hard during this period where manpower shuffling and daily disruptions in schedules were becoming increasingly challenging due to staff falling sick from non COVID-19 illness and contacts being put on mandatory home leave.

## 5. Manpower management

As the number of patients being seen at NCID SC with respiratory symptoms skyrocketed, ED staff could no longer handle the volume and thus major manpower mobilizations were required. While the physicians and anesthetists were channeled to the NCID wards and ICU respectively, the surgical departments fueled manpower to the SC. The

surgeons in SC were to work alongside, and under the purview of the ED and ID physicians in assessing and screening suspect cases of COVID-19. This was done after a 'Just-In-Time training' refresher course by ED physicians. The surgical division (comprising of general surgery, orthopaedics, urology, ophthalmology, otorhinolaryngology, hand microsurgery and neurosurgery) and even the radiology and pathology department from the ambulatory medicine division sent a total of 52 doctors to SC within 3 days of activation. These doctors were rotated on a 10 day shift roster and thereafter, returned back to their departments without segregation nor any cooling off period due to manpower constraints. If one doctor fell sick, the entire team on shift was required to self-isolate at home for several days till the sick doctor tested negative for COVID-19.

Initially, only trainees were rostered to SC with the believe that younger doctors could adapt better to a shift cycle as well as to allow the senior surgeons to continue clearing cases in OTs and in clinics. Mindful that repetitive deployment could lead to physical and psychological burnout, as well as compromise on training, senior surgeons, including heads of surgical departments decided to step down and help out in SC once they had postponed their administrative and elective work. This helped tremendously in reducing fatigue and through solidarity, lifted the morale of all the surgical trainees. It was a demonstration of leadership by example at first hand. Surgeons older than 60 years were excused from being rotated through the SC due to evidence of higher risk of mortality after contracting the disease [5].

## 6. OT listings

When the crisis started, while emergency and cancer surgeries continued, all elective surgeries requiring potential intensive care and hospitalization such as total joint arthroplasties, spinal surgery in patients with chronic stable compressive symptoms, bariatric surgery, non-cancerous thyroid surgery etc. were initially postponed. This was to free up as many general ward as well as ICU beds/resources for the expected influx of COVID-19 patients during the initial stages. We also predicted that pharmaceutical supply chains around the world would be disrupted and wanted to conserve anesthetic drugs to be used instead on potential ventilated patients in the ICU.

The primary surgeon in charge contacted each patient, informed them about the situation, explained why their surgeries had to be postponed and reassured them that they would be rescheduled to the next possible date. The difficulty was in managing the anxiety, fear and disappointment in patients who had made extensive arrangements for their surgeries to proceed on the initially planned date. However, many did understand and some, in fact, called the hospital to have their surgeries postponed due to fear of nosocomial COVID-19 transmission.

The heads of departments did understand that by delaying essential but non urgent surgeries, some conditions would get worse and complications from prolonged conservative treatment may render the subsequent surgery less effective. Some examples including bucket handle meniscus tears with locked knees may become permanently stiff; complications from prolonged tunneled catheter dialysis in end stage renal failure patients awaiting arteriovenous fistula creation; asymptomatic non-obstructive renal stones becoming symptomatic etc. However, we knew that we had to follow through with this necessary evil to address the more pertinent issue.

## 7. Operating amidst the pandemic

A few weeks after the situation had stabilized, the surgical division increased elective operations to about 50% of our original load. Consultant surgeons within the department had to work together to prioritize patients and share OT listings. Cases which were time sensitive (aneurysms, angioplasties of ischemic limbs, spine surgeries with nerve/cord compression) were rescheduled first.

Elective surgery on confirmed or suspected COVID-19 cases were

postponed. If emergency surgery had to continue for these cases, full surgical infection control protocols were undertaken. For prolonged surgery, greater than 4 h, loose-fitting Powered Air Purifying Respirators (PAPR) were used. This was due to the increased risk of transmission from prolonged exposure, potential loosening of N95 masks [6], increased dead space concentrations of carbon dioxide which may compromise work performance and considerable discomfort from prolonged usage of the N95s [7]. All surgeons remained outside the OT during intubation and extubation of patients due to considerable risk of infection transmission from aerosolized viral particles.

## 8. Specialist surgical outpatient clinics

All new referrals to our hospital's specialist outpatient clinics from general practitioners and community polyclinics were immediately halted. The number of clinic sessions and rooms available for consults were halved to restrict potential transmission of disease from unnecessary patient visits. Every surgical discipline had to look through their clinic lists for the weeks to come and reschedule routine follow ups and non-urgent cases. Doctors in the teams would review patient's electronic records, reason for follow up and decide on the next appropriate appointment date. For stable patients, requiring medications, arrangements were made to top up drugs till their next scheduled visit without having to see the specialist. TTSH even offered home delivery of medications.

Radiological, histological and laboratory investigations were reviewed and the results were conveyed over the phone for patients with normal or non-critical results. This allowed anxious patients to be more understanding and accepting when their clinic visits had to be postponed. For malignant biopsy results or critically abnormal test results, patients would be recalled earlier to the clinics to be counseled directly by a specialist. Clinic assistants were involved in rescheduling routine simple cases whereas doctors would call up complex patients personally.

Allied health professionals such as physiotherapists and occupational therapists are pivotal in surgical specialties such orthopaedics and hand surgery. However, seeing the need to minimize patient visits to the hospitals in the outpatient setting, plans are underway to incorporate tele-rehabilitation to our post-surgical patients after discharge as well as those conservatively managed from outpatient clinics. These sessions will have internet based real-time interaction with a physical therapist during which remote guidance of self-applied techniques, education and exercises are taught using only common household equipment such as towels, chairs and tape measures. Studies have shown results comparable to conventional rehabilitation [8].

## 9. Training and education

At a hospital level, all teachings and department meetings were cancelled. At the national level, surgical trainees' combined national teachings, inter hospital educational programs, specialist promotion exams and all other intermediary exams were cancelled. Trainees who were rotated to other hospitals during the outbreak period were not allowed to return to their parent hospital in an effort to prevent cross hospital cluster contamination. Likewise, surgical trainees who were in TTSH were not allowed to out-rotate to other hospitals to continue training in niche specialties which our hospital did not offer such as pediatric and cardiothoracic surgery. Specialist allowances, promotions and jobs of trainees were affected but all junior doctors accepted that this was necessary for the greater good of the country.

With the indefinite suspension of physical meetings and the need to maintain continual medical education, teleconferencing platforms such as Zoom, Google Hangouts and Microsoft Teams have become increasingly popular in TTSH. E-learning platforms for surgical education such as digital anatomical models, video recordings of surgical procedures and online quizzes for trainees [9] are being explored in our

surgical departments currently.

## 10. Communications

There was no segregation between information shared from higher hospital management to the doctors in the medical and surgical divisions. Sharing of real time information in a sensitive and timely manner was done via multiple Information Technology platforms catering to different age groups and usability of staff. Reach out was done via hospital email, WhatsApp messages, secured text messages (TigerConnect), Facebook@Work and Instagram posts and regular on-line townhall meetings. The hospital management ensured regular updates and transparency to alleviate fear and anxiety on the ground. Surgical heads from all disciplines worked together closely and remained united. Collective decisions were made and information disseminated and plans executed did not deviate from each surgical department.

## 11. Psychological impact on surgeons

A surgeon's role is to operate. This innate mindset has been ingrained in every medical student, young resident and full-fledged surgeon alike. However during these exceptional times, exceptional measures had to be drawn up. For resource prioritization, surgeons had to unfortunately stop or at least reduce doing what they have been trained and loved to do – operating. Being restricted in their craft and working in unfamiliar environments was very difficult for many surgeons, resulting in uneasiness, stress and frustration.

Fear was in the hearts of many young trainees with new families, young infants and elderly parents. They were afraid that by working at SC and operating on high risk patients, they would inevitably contract and carry the disease home to their vulnerable loved ones. There were even staff who were stigmatized and kicked out of their rental apartments by their landlords. TTSH made arrangements and provided allowances for doctors with high risk individuals at home to stay at lodging facilities during their stint at SC to minimize interaction with their families.

For surgeons and trainees, morale was initially at an all-time low. Leave was cancelled, scheduled exams and promotions were cancelled, training and education was cut, surgical caseloads were slashed, physical interaction with friends and colleagues even from the same department was discouraged, in-house ward calls for those remaining in the department were increased as more got rotated to SC. We were afraid of getting close to our own family, lived in constant fear of contracting the disease and we fundamentally found it stifling practicing as a surgeon.

Preempting this, the TTSH psychological medicine department published a psychological preparedness toolkit for frontline workers of COVID-19. This included information on how to mentally prepare oneself in the frontline, the emotional challenges one would feel, tips for recognizing burnout, resources for support groups, helplines to call and/or for direct consultation. At the national level, when fellow citizens saw those in the hospitals working tirelessly, everyone in the community chipped in to help. Words of encouragement, small tokens of appreciation, food discounts and deliveries for healthcare workers were rallied. All this made the frontline healthcare staff feel appreciated, proud and motivated to give it all in the fight.

## 12. Recommendations

Based on our surgical unit's experiences and available literature, we have come up with some key points to improve our practices to respond and prevent the pandemic from escalating further as a collective community of surgeons across the globe.

**Individual responsibility** – Every surgeons and trainee is responsible in the containment and mitigation of the spread of the

pandemic within their institution as well as the community [10,11].

**Leadership, Manpower and Workflow** – Surgeons need to be involved in hospital leadership committees which decide healthcare management policies so that the interest of the surgeons is also represented. Leadership by example, appropriate manpower segregations, timely workflow changes that reflect the sentiment and situation on the ground together with effective communication with all healthcare staff of all ranks within the hospital, ensures that morale remains high and anxiety is alleviated [12–14].

**Triaging of patients and prioritization of surgery** – Selection of appropriate elective surgical cases to be cancelled/postponed is vital in ensuring that limited resources are conserved and that the hospital is not overwhelmed in the event of a surge in COVID-19 cases [13–16].

**Operating amidst the pandemic** – In the event that surgery needs to continue, adequate use of PPE and sound workflows need to be implemented in OTs such that potential spread of the virus from patient to surgeon or patient to patient is prevented [10–12,17–19].

**Managing outpatient clinics** – Efforts need to be taken to minimize unnecessary contact between patients and providers [12,16,20]. Innovative strategies such as the use of telemedicine or tele-rehab may help in providing distant consults for patients requiring non-essential follow ups or allied health services [14,20].

**Continuing surgical education** – Innovative solutions including the use of E-learning and teleconferencing platforms need to be employed to circumvent distancing restrictions implemented for meetings and gathering so that education for residents is maintained [21].

**Psychological impact** – Measures should be in place to alleviate the fear, anxiety and stress that surgeons face during these uncertain times. Recognition, protection and support for healthcare staff and their families will allow everyone to upkeep their morale and concentrate fully on the fight against COVID-19 [12,22,23].

**Collaborative effort** – Surgeons from different disciplines should work together with a common goal and motivation. Surgeons should also be flexible to work hand in hand with physicians, to augment and support their efforts in the fight against the pandemic.

### 13. Conclusion

From young to old, from surgical trainee to specialist, every doctor in every surgical discipline answered to the call of duty during this unprecedented pandemic. Regardless of their training, everyone was willing to step out of their comfort zone and were willing to adapt for the greater cause of the nation. We worked together and cared for each other like family. As surgeons, we are not disadvantaged in a medical pandemic. Instead, due to our ability to cut elective work at short notice, we were able to be the first responder to the crisis and were privileged to work side-by-side with our medical colleagues. Every surgeon is first a doctor. Sometimes, we have to put our desire to operate aside. We should not differentiate ourselves as surgeon and physician, but instead, work together as one united health care front battling the common enemy together – COVID-19.

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### Author contributions

All authors contributed equally in the literature review, manuscript writing and review and approved the version submitted for publication. Kumaran Rasappan (KR) is the corresponding author of this study and as such, take responsibility for the integrity of the data in the study and the accuracy of the content provided. KR had full access to all the data in the study and had the final responsibility for the decision to submit for publication.

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Kumaran Rasappan (KR) is the corresponding author of this study and as such, take responsibility for the integrity of the data in the study and the accuracy of the content provided. KR had full access to all the data in the study and had the final responsibility for the decision to submit for publication.

### CRediT authorship contribution statement

**Kumaran Rasappan:** Conceptualization, Data curation, Writing - original draft, Resources, Supervision. **Jacob Yoong Leong Oh:** Conceptualization, Writing - review & editing, Supervision. **Benjamin Tze Keong Ding:** Conceptualization, Data curation, Resources. **Muhd Farhan Mohd Fadhil:** Data curation, Resources. **Keng Thiam Lee:** Data curation, Resources, Writing - review & editing, Supervision.

### Declaration of competing interest

The authors report no financial and personal conflicts of interest in this work.

### References

- [1] Novel Coronavirus (2019-nCoV) situation reports, [Internet]. Available from: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports> Accessed 12 April 2020.
- [2] M.H. Chew, F.H. Koh, K.H. Ng, A call to arms: a perspective of safe general surgery in Singapore during the COVID-19 pandemic, *Singap. Med. J.* 1 (2020 Apr 3) 10.
- [3] Z. Wu, J.M. McGoogan, Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: summary of a report of 72 314 cases from the Chinese Center for Disease Control and Prevention, *JAMA* 323 (13) (2020 Apr 7) 1239–1242.
- [4] J. Bedford, D. Enria, J. Giesecke, D.L. Heymann, C. Ihekweazu, G. Kobinger, et al., COVID-19: towards controlling of a pandemic, *Lancet* 395 (10229) (2020 Mar 28) 1015–1018.
- [5] F. Zhou, T. Yu, R. Du, G. Fan, Y. Liu, Z. Liu, et al., Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study, *Lancet* 395 (10229) (2020 Mar 28) 1054–1062.
- [6] J.H. Kim, T. Wu, J.B. Powell, R.J. Roberge, Physiologic and fit factor profiles of N95 and P100 filtering facepiece respirators for use in hot, humid environments, *Am. J. Infect. Contr.* 44 (2) (2016 Feb 1) 194–198.
- [7] R.J. Roberge, A. Coca, W.J. Williams, J.B. Powell, A.J. Palmiero, Physiological impact of the N95 filtering facepiece respirator on healthcare workers, *Respir. Care* 55 (5) (2010 May 1) 569–577.
- [8] M.A. Van Egmond, M. van der Schaaf, T. Vredevelde, M.M.R. Vollenbroek-Hutten, M.I. van Berge Henegouwen, J.H.G. Klinkenbijn, et al., Effectiveness of physiotherapy with telerehabilitation in surgical patients: a systematic review and meta-analysis, *Physiotherapy* 104 (3) (2018 Sep 1) 277–298.
- [9] H. Maertens, A. Madani, T. Landry, F. Vermassen, I. Van Herzele, R. Aggarwal, Systematic review of e-learning for surgical training, *Br. J. Surg.* 103 (11) (2016 Oct) 1428–1437.
- [10] W.H. Gan, J.W. Lim, K.O. David, Preventing intra-hospital infection and transmission of COVID-19 in healthcare workers, *Saf. Health Work* (2020 Mar 24), <https://doi.org/10.1016/j.shaw.2020.03.001> [Epub ahead of print].
- [11] D. Yeo, C. Yeo, S. Kaushal, G. Tan, COVID-19 and the general surgical

- department—measures to reduce spread of SARS-COV-2 among surgeons, *Ann. Surg.* (2020 Apr 13), <https://doi.org/10.1097/SLA.0000000000003957> [Epub ahead of print].
- [12] S. Ahmed, T.W. Glenn, Y.L. Chong, Surgical response to COVID-19 pandemic: a Singapore perspective, *J. Am. Coll. Surg.* (2020 Apr 9), <https://doi.org/10.1016/j.jamcollsurg.2020.04.003> pii: S1072-7515(20)30308-2, [Epub ahead of print].
- [13] E.M. Lancaster, J.A. Sosa, A. Sammann, L. Pierce, W. Shen, M. Conte, E. Wick, Rapid response of an academic surgical department to the COVID-19 pandemic: implications for patients, surgeons, and the community, *J. Am. Coll. Surg.* (2020 Apr 9), <https://doi.org/10.1016/j.jamcollsurg.2020.04.007> pii: S1072-7515(20)30312-4, [Epub ahead of print].
- [14] A.R. Vaccaro, C.L. Getz, B.E. Cohen, B.J. Cole, C.J. Donnelly III, Practice management during the COVID-19 pandemic, *J. Am. Acad. Orthop. Surg.* (2020 Apr 13), <https://doi.org/10.5435/JAAOS-D-20-00379> [Epub ahead of print].
- [15] P.F. Stahel, *How to Risk-Stratify Elective Surgery during the COVID-19 Pandemic?* Springer, 2020.
- [16] C. Collaborative, Global guidance for surgical care during the COVID-19 pandemic, *Br. J. Surg.* (2020), <https://doi.org/10.1002/bjs.11646> [Epub ahead of print].
- [17] T.M. Cook, Personal protective equipment during the COVID-19 pandemic—a narrative review, *Anaesthesia* (2020 Apr 4), <https://doi.org/10.1111/anae.15071> [Epub ahead of print].
- [18] M.E. Brindle, A. Gawande, Managing COVID-19 in surgical systems, *Ann. Surg.* (2020 Mar 20), <https://doi.org/10.1097/SLA.0000000000003923> [Epub ahead of print].
- [19] F. Coccolini, G. Perrone, M. Chiarugi, F. Di Marzo, L. Ansaloni, I. Scandroglio, P. Marini, M. Zago, P. De Paolis, F. Forfori, F. Agresta, Surgery in COVID-19 patients: operational directives, *World J. Emerg. Surg.* 15 (2020 Dec) 1–7.
- [20] A. Spinelli, G. Pellino, COVID-19 pandemic: perspectives on an unfolding crisis, *Br. J. Surg.* (2020 Mar 19) 10.
- [21] R.C. Chick, G.T. Clifton, K.M. Peace, B.W. Propper, D.F. Hale, A.A. Alseidi, T.J. Vreeland, Using technology to maintain the education of residents during the COVID-19 pandemic, *J. Surg. Educ.* (2020 Apr 3), <https://doi.org/10.1016/j.jsurg.2020.03.018> pii: S1931-7204(20)30084-2, [Epub ahead of print].
- [22] T. Shanafelt, J. Ripp, M. Trockel, Understanding and addressing sources of anxiety among health care professionals during the COVID-19 pandemic, *JAMA* (2020 Apr 7), <https://doi.org/10.1001/jama.2020.5893> [Epub ahead of print].
- [23] J.G. Adams, R.M. Walls, Supporting the health care workforce during the COVID-19 global epidemic, *JAMA* (2020 Mar 12), <https://doi.org/10.1001/jama.2020.3972> [Epub ahead of print].