Keeping a cut above the coronavirus disease: surgical perspectives from a public health institution in Singapore during Covid-19

Coronavirus disease 2019 (COVID-19) was first reported as a pneumonia of unknown origin in Wuhan, China, in December 2019, and evolved rapidly over 3 months to become a pandemic causing widespread mortality. Singapore reported its first confirmed case of COVID-19 infection in January 2020. Shortly after, the Republic diagnosed over 800 cases and is at Disease Outbreak Response System Condition (DORSCON) Orange status. This translates to approximately 137 cases per million population, while that of Australia and Italy is approximately 156 and 1529 per million, respectively.

The DORSCON alert level is a colour-coded national framework, taking into consideration the global disease prevalence, its risk of human transmissibility and its impact on the public. A DORSCON Orange alert level indicates severe disease, with easy transmissibility between individuals, but is being contained within the country.

Recently, Singapore has witnessed a surge in the number of imported cases, leading to significant utilization of existing public healthcare resources. It has become an urgent need for public healthcare institutions to stay operational, despite the strain on manpower, medical consumables and elective operating theatre (OT) space. At the same time, education and training obligations to augment staff numbers cannot be postponed indefinitely, while clinical conditions arising from malignancy, pyogenic infections and other significant conditions continue to present for treatment.

This article details specific challenges faced by surgical units in a 1000-bed public healthcare institution in this ongoing COVID-19 pandemic, and describe operational measures undertaken to mitigate operational threats and maintain surgical operational effectiveness.

Collaboration for common solutions

Early in the pandemic, the authors established an ad hoc team comprising surgical heads of departments (from specialties of orthopaedics, otolaryngology, general surgery and urology). This Surgical Heads Operational Team (SHOT) met regularly to refine workflows, while taking into consideration the best available information on COVID-19.

This platform allowed mutual collaboration to avoid siloed approaches, and promoted common solutions to similar problems faced by all surgical units. It permitted for pooling and optimization of available resources of OT facilities, surgical equipment and medical manpower, which have not been consistently available during such times.

For example, where there is a need for restricting the number of elective OTs in DORSCON Orange, the SHOT team systematically assigned (limited) OT space in an equitable manner, having taken into consideration departments’ discrete requirements based on disease patterns and available surgical expertise.

It was also possible to expediently organize an OT specifically for diagnosed or suspected COVID-19 cases with specific personal protective equipment (PPE) instructions, and clearly demarcated areas for donning and doffing of PPE (Fig. 1a). This allowed for standardization of infection control protocols to be adopted across different surgical specialities easily.

Maintain sterility in communication channels

Clear communication channels ensure accurate and timely dissemination of information across departments in the volatile and dynamic environment of an evolving epidemic. This ensures that staff are kept up-to-date, avoids miscommunication or confusion from unverified information sources (especially in the era of social media) and helps build confidence and visibility in the hospital leadership.

For example, the travel history is paramount to aid the clinician in stratifying the risk of COVID-19 infection in a symptomatic patient. The geographical areas of elevated travel risk expanded rapidly to include many countries in a short 4-week period. It became necessary for frontline staff to be updated, so as to screen patients competently at each encounter.

In addition, these channels also serve as a feedback mechanism to hospital leadership, for example, on conflicting instructions or workflows which cannot be implemented.

Official emails allow for dissemination of lengthy figures and documents, while the secure messaging platform TigerConnect (Broadway Santa Monica, CA) is used for succinct messages meant for rapid broadcast, such as a change in PPE requirements in clinical areas.

Mitigation of infectious threats to staff

In addition to appropriate PPE, separating the department into smaller groups without cross-over can help mitigate the risk to staff in the event of exposure to a positive contact. There should also be restriction of inter-hospital transfers for providers. Each surgical department is rostered into two large teams, alternating outpatient...
(a) Designated coronavirus disease 2019 case operating theatre (OT). (b) An example of a departmental split-team roster. Separate ward rounds between teams during inpatient week as part of segregation. Virtual multidisciplinary meetings for clinical and education sessions (note the use of surgical face masks as personal protective equipment in all participants). (d) Surgical case tiering for elective OTs.

Fig. 1. (a) Donning PPE area. (ii) Doffing PPE area.

(b) Acute care team list (Before COVID-19)

| Team | Consultant       |
|------|------------------|
| A    | Consultant 1, 2  |
| B    | Consultant 3, 4, 5 |
| C    | Consultant 6, 7, 8 |
| D    | Consultant 9, 10, 11, 12 |
| E    | Consultant 13, 14 |

(b) Acute care split-team roster (During COVID-19)

| Team | Consultant       |
|------|------------------|
| A    | Team A1, 1 Consultant 1, 2 |
| B    | Team B1, 3 Consultant 3, 4, 5 |
| C    | Team C1, 6 Consultant 6, 7, 8 |
| D    | Team D1, 9 Consultant 9, 10, 11, 12 |
| E    | Team E1, 13 Consultant 13, 14 |

| Inpatient care† | Outpatient care |
|-----------------|-----------------|
| Feb Week 2      | Team A1, B1, C1, D1 & E1 | Team A2, B2, C2, D2 & E2 |
| Feb Week 3      | Team A2, B2, C2, D2 & E2 | Team A1, B1, C1, D1 & E1 |
| Feb Week 4      | Team A1, B1, C1, D1 & E1 | Team A2, B2, C2, D2 & E2 |
| March Week 1    | Team A2, B2, C2, D2 & E2 | Team A1, B1, C1, D1 & E1 |
| March Week 2    | Team A1, B1, C1, D1 & E1 | Team A2, B2, C2, D2 & E2 |
and inpatient locations on a weekly basis without cross-over (Fig. 1b). Within each large team, further sub-divisions are made based on functional needs. Briefly, the inpatient team provides care for elective and emergency surgical cases, while the outpatient team focuses on ambulatory clinical services.

Harnessing teleconferencing technology allows for regular online meet-ups between teams for clinical updates (augments point 2). In addition, multidisciplinary team consults can still also take place, for example, oncology and radiology multidisciplinary meetings. This mechanism is augmented by the use of electronic medical records allowing easy access to clinical information (Fig. 1c).

The restriction of staff movement also impacts postgraduate education and competency training. Teleconferencing technology allows for interactive sessions across different logon sites, which can cater to audience numbers typical of a bedside teaching session, while maintaining social responsibility of physical separation. Hence, despite physical separation, the departments of the SHOT group are still able to conduct weekly mortality and morbidity rounds, journal clubs, post-residency teaching and regular professional teaching rounds.

### Build surge capacity to continue elective care

Systematic preparation for a reduction in elective surgical workload requires the surgical team to identify and re-schedule surgical cases accurately and rapidly. This may be achieved by creating a tiering system for surgical cases (Fig. 1d). For example, tier 1 (most urgent) elective cases comprise those undergoing surgery for malignancy or serious medical conditions. In the event of a reduction in available elective OT slots, surgical cases may be deferred with relative ease, minimal administrative burden and without an overt compromise to patient care. The tiering system can also guide the time period for deferment of elective surgical cases, and help the

| Tier 1 cases | General Surgery | Orthopaedics | Otolaryngology | Urology |
|--------------|-----------------|--------------|----------------|--------|
| All cancer surgeries | Long bone fractures with complications | Cancers | Cancers |
| | Spine cases with nerve compression | Facial trauma | Obstructive uropathy by BPH or stones |

| Tier 2 cases | Symptomatic gallstone disease | Symptomatic hernias | Benign tumours | Diagnostic procedures for suspected cancers |
|--------------|-----------------|-----------------|---------------|---------------------------------------------|
| Symptomatic hernias | Uncomplicated long bone fractures | Hand and microsurgical cases | FESS Mastoidectomy | Uncomplicated urinary stone or BPH disease |

| Tier 3 cases | Uncomplicated hernias | Piles surgery | Tonsillectomy, Septoplasty, Inferior turbinateoplasty, Myringoplasty, Sleep apnea surgery | Vasectomy |
|--------------|-----------------|--------------|---------------------------------|--------|
| Primary knee and hip arthroplasty for degenerative joint disease | | | Uncomplicated scrotal and penile conditions |
management of elective surgical caseloads, thus preventing routine case cancellations.

While the SHOT team have had prior experience in the severe acute respiratory syndrome epidemic of 2003, the current COVID-19 infection presents different operational challenges arising from its unique disease characteristics. Nevertheless, we are motivated to embrace this task and are confident to see through the rain and high waters together.

References

1. Wu Z, McGoogan JM. 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 2020; 323:1239–42.

2. Coronavirus disease (COVID-2019) situation reports. [Cited 23 Mar 2020.] Available from URL: www.WHO.Int

3. Coronavirus disease (COVID-2019) situation reports. [Cited 23 Mar 2020.] Available from URL: https://www.moh.gov.sg/covid-19

4. Wong JEL, Leo YS, Tan CC. COVID-19 in Singapore—current experience: critical global issues that require attention and action. JAMA 2020; 323:1243–44.

5. Young BE, Ong SWX, Kalimuddin S et al. Epidemiologic features and clinical course of patients infected with SARS-CoV-2 in Singapore. JAMA 2020. https://www.jama.elsevier.com/article/420787.

Aven Shan Hua Ng,* BSc (Hons) Min Hoe Chew,† MBBS, MRCS, M Med (Surg), FRCS Tze Choong Charn,‡ MBBS, MRCS, GDFM, MMed, DOHNS, FEBEORL Merng Koon Wong,§ MBBS, FRCS, FAMS Wai Keong Wong,† MBBS, FRCS, FAMS Lui Shiong Lee,¶ MBBS, MRCS *Operating Theatre Management Unit, Division of Surgery, Sengkang General Hospital, Singapore, †Department of General Surgery, Sengkang General Hospital, Singapore, ‡Department of Otolaryngology, Sengkang General Hospital, Singapore, §Department of Orthopaedics, Sengkang General Hospital, Singapore and ¶Department of Urology, Sengkang General Hospital, Singapore doi: 10.1111/ans.15904