
THE ORTHOPAEDIC FORUM

Spine Surgery and COVID-19 Challenges and Strategies from the Front Lines

Tamara Lee Ting Soh, MBBS, MRCS, Sean Wei Loong Ho, MBBS, FRCS, Wayne Ming Quan Yap, MBBS, FRCS, and Jacob Yoong-Leong Oh, MBBS, FRCS

Investigation performed at the Department of Orthopaedic Surgery, Tan Tock Seng Hospital, Singapore

The novel coronavirus first emerged in Wuhan, People's Republic of China, in December 2019. The subsequent unprecedented spread has since led to the global COVID-19 (the disease caused by the virus) pandemic, which was declared a public health emergency by the World Health Organization on January 30, 2020¹. As of April 1, 2020, a total of 754,948 cases have been reported globally, with 36,571 confirmed deaths².

Singapore was one of the first other countries to be affected, and up until February 19, 2020, had the highest number of COVID-19 cases apart from the People's Republic of China³. Despite being the earliest other country affected, the initial containment strategies in Singapore have been largely successful in achieving a relatively low case-fatality rate (0.3%) compared with that of Italy (7.7%)^{4,5}. Although we continue to adapt to the evolving situation, we believe that our experience in Singapore thus far may provide valuable insights into the challenges and strategies of orthopaedic and specifically spine surgery in the COVID-19 climate.

Response in Singapore: A Look from the Front Lines

Unique to our institution at Tan Tock Seng Hospital, we are at the epicenter of the COVID-19 outbreak in Singapore, being connected to the National Centre of Infectious Diseases (NCID), a specialist facility for the management of infectious diseases. The NCID comprises isolation and intensive-care wards, operating theaters, radiology and laboratory facilities,

as well as a screening center, which currently handles about 70% of the COVID-19 screening load in Singapore. Since the start of the COVID-19 outbreak in January, orthopaedic residents and attending surgeons have been deployed to the NCID screening center to assist in assessing suspected COVID-19 cases, under the purview of our emergency medicine and infectious diseases colleagues. As a spine service, we were no exception, with up to 25% of our orthopaedic department manpower being deployed to the NCID screening center at any point in time. Consequently, we had to frequently rotate from our regular "business as usual" responsibilities to our front-line duties at the NCID screening center, with no "cooling off" period in between. In order to do this safely, we needed to adhere strictly to, and more importantly, trust the personal protective equipment (PPE) protocols set by our institution to avoid cross-contamination and nosocomial infections of our patients and colleagues. At the start, the fact that we were working in an unfamiliar environment, out of the realms of the operating room and fraught with new threats, did provoke some anxiety and uncertainty; however, the strict PPE guidelines set by our institution and by the Ministry of Health, together with the widespread availability and, indeed, enforcement of PPE for health-care workers, gave us reassurance that we were well protected in this task of serving at the front lines. Additionally, clear clinical protocols and leadership at the NCID screening center by our emergency medicine colleagues helped to reduce the burden of clinical decision-making, as

Disclosure: The authors indicated that no external funding was received for any aspect of this work. The **Disclosure of Potential Conflicts of Interest** forms are provided with the online version of the article (<http://links.lww.com/JBJS/F854>).

each suspected case could be assessed and managed accordingly on the basis of clinical or epidemiological criteria. Although it may be novel for orthopaedic spine surgeons to be involved in the evaluation of COVID-19 suspect cases, we believe these are exceptional circumstances during which we can rise to the challenge and serve at the front lines, supporting our colleagues during times of need.

Evolving Strategies: From Surge to Sustainability

The response of Singapore to COVID-19 has been a graduated one, with our containment measures taken in proportion to community spread. At the start of the outbreak, when community spread was limited, we instituted selected safe-distancing measures while maintaining relative normalcy in day-to-day life. As of April 7, 2020, as the number of locally transmitted cases has increased, Singapore instituted a series of heightened measures, referred to collectively as a “circuit breaker,” in order to halt community spread⁶. Further safe-distancing measures were implemented, such as closures of schools and physical workplaces. This graduated, stepwise approach has avoided the need for an abrupt “lockdown” of work and public life. Similarly, in our spine service, we have taken the same stepwise approach in changing our practice according to the severity of the outbreak in order to conserve resources and ensure the safety of health-care workers.

Clinical Impact on the Spine Service

In the first 6 weeks of the outbreak, our elective lists were reduced by 50%. We cancelled all spinal-deformity or revision cases and prioritized minimally invasive and endoscopic cases, which generally required a shorter length of stay and had lower surgical blood loss. Postoperatively, we actively expedited all discharge or transfer to rehabilitation facilities in order to free up hospital beds. In the outpatient setting, all non-urgent spine appointments, such as referrals for osteoporotic compression fractures, or acute back pain without neurology, were rescheduled to later dates. We offered patients with intractable radicular symptoms the option of nerve-root injections as they could be done under local anesthesia as surgical day cases; however, as a tertiary hospital and major trauma center, we continued to receive and operate on emergency spinal trauma or tumor cases. Because we had cut down on elective work as an institution, we were able to emergently operate on these cases as clinically indicated, with adequate anesthesia, nursing, and perioperative support, which highlights the need for resource conservation during times of crisis so that patients who urgently need care can continue to receive that care to the highest standard.

With the implementation of the “circuit breaker,” we have further changed our practice in line with the Ministry of Health guidelines to defer all nonessential medical procedures. As a result, we have cut our regular operating and outpatient caseload, otherwise termed as “business-as-usual” duties, from 50% to 30% of the norm and now limit our caseload to time-sensitive cases that require a surgical procedure to prevent neurological deterioration. Although our elec-

tive arthroplasty and sports surgery patients may be rescheduled to 6 months later or beyond, spine surgery is unique relative to other elective orthopaedic work in that there are emergency as well as urgent cases, which are also classified as “essential services” based on Ministry of Health criteria. Apart from spinal trauma, tumor, and other spinal emergencies, there are certain instances in which a prolonged delay in surgical treatment may lead to an irreversible deterioration of function, which can negatively impact both the work status and quality of life of the patient. In the setting of cervical myelopathy or new-onset neurological deficits from lumbar spinal stenosis, a 6-month postponement of surgical treatment could result in poorer neurological recovery and functional outcomes. Our underlying principle in reducing and prioritizing but not completely cancelling all surgical cases is to maintain sustainability in the long run as we try to balance our continued efforts against COVID-19 with our duty of care to our spine patients.

COVID-19 Precautions in Spine Surgery

As community spread of COVID-19 increases, we need to be well prepared and well protected in the event that emergency spine procedures need to be performed on patients with COVID-19. Young patients may display mild symptoms—and as such, may be infected but undiagnosed—and present with spinal trauma requiring an emergency surgical procedure. In our institution, we have formulated a protocol for patients with suspected COVID-19 who require a surgical procedure, based on the risk assessment regarding COVID-19 and the urgency of surgical treatment. This protocol works in tandem with specialized engineering features in our operating rooms and staff PPE measures to ensure the safety of health-care workers. Patients with confirmed or suspected COVID-19 and those with pneumonia and unknown COVID-19 status will be operated on in a designated operating room to avoid contamination of the main operating room and of other patients. This purpose-built operating room is equipped with a negative-pressure system as well as high-efficiency particulate filters. All health-care workers should be equipped with a cap, gown, N95 respirator mask, and goggles, and anesthetists may choose to use powered air-purifying respirators for aerosol-generating procedures such as airway intubation. Surgical procedures should be performed expeditiously, and only selected equipment should be brought into the operating room in order to reduce the number of items that require cleaning after the procedure. The presence of health-care personnel should be kept to a minimum to minimize exposure. Electrocautery, which has been shown to generate aerosols, should be kept to a minimum, with liberal use of suction to remove smoke and aerosols⁷.

Final Considerations

We recognize that the COVID-19 pandemic is evolving to be a marathon and less of a short-lived sprint. Similar to our measures in the practice of spine surgery, our other workplace activities need constant review and adaptation in order to be

sustainable. For example, although all continuing medical education and residency teaching sessions were stopped at the beginning of the outbreak, we have transitioned toward gradually restarting these talks and sessions through videoconferencing platforms. One advantage of videoconferencing is that it can be conducted in an informal setting, with residents and attending surgeons being able to log in from home. As our department segregates and practices safe social distancing, these videoconferencing sessions may help us to connect with one another, foster camaraderie, and bring some sense of normalcy in this time of chaos.

Often, in an evolving situation like the COVID-19 pandemic, lack of information can give rise to uncertainty and anxiety, especially for the younger trainees among us who may not have ready access to the chain of information from senior management yet are being tasked to work at the front lines of the pandemic. Through our conversations with residents, it appears that the 2 main recurring considerations are those of (1) safety at work, especially among those with young families at home, and (2) ramifications on training and progression. During times of crisis, it is important to manage the fears and anxieties of our colleagues as early as possible by providing assurances that there is good evidence on the efficacy of our PPE protocols, as well as reassuring trainees that training requirements may be temporarily modified or, indeed, suspended so as not to penalize those who have had to sacrifice their training for other responsibilities during this time.

Conclusions

The dawn of a new global pandemic brings about new challenges for us all. As an orthopaedic community, we need to rise up to the challenges ahead, adapt, and innovate our practice in order to best serve the patients who need us now more than ever. Additionally, may we not forget to look out for one another and bear burdens for one another during this unprecedented time, as this too shall pass. ■

Tamara Lee Ting Soh, MBBS, MRCS¹
Sean Wei Loong Ho, MBBS, FRCS¹
Wayne Ming Quan Yap, MBBS, FRCS¹
Jacob Yoong-Leong Oh, MBBS, FRCS¹

¹Department of Orthopaedic Surgery, Tan Tock Seng Hospital, Singapore

Email address for T.L.T. Soh: tamarasoh@gmail.com

ORCID iD for T. Lee Ting Soh: [0000-0002-4247-6109](https://orcid.org/0000-0002-4247-6109)

ORCID iD for S.W. Loong Ho: [0000-0003-3839-5207](https://orcid.org/0000-0003-3839-5207)

ORCID iD for W.M. Quan Yap: [0000-0002-9165-2658](https://orcid.org/0000-0002-9165-2658)

ORCID iD for J. Yoong-Leong Oh: [0000-0002-2832-8433](https://orcid.org/0000-0002-2832-8433)

References

- World Health Organization. Statement on the second meeting of the International Health Regulations (2005) Emergency Committee regarding the outbreak of novel coronavirus (2019-nCoV). 2020 Jan 30. Accessed 2020 Mar 23. [https://www.who.int/news-room/detail/30-01-2020-statement-on-the-second-meeting-of-the-international-health-regulations-\(2005\)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-\(2019-ncov\)](https://www.who.int/news-room/detail/30-01-2020-statement-on-the-second-meeting-of-the-international-health-regulations-(2005)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-(2019-ncov))
- World Health Organization. Coronavirus disease (COVID-19) pandemic. 2020. Accessed 2020 Apr 1. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019>
- World Health Organization. Coronavirus disease (COVID-2019) situation reports. 2020. Accessed 2020 Mar 23. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports>
- Lazzerini M, Putoto G. COVID-19 in Italy: momentous decisions and many uncertainties. *Lancet Glob Health*. 2020 Mar 18:S2214-109X(20)30110-8. Epub 2020 Mar 18.
- Rajgor DD, Lee MH, Archuleta S, Bagdasarian N, Quek SC. The many estimates of the COVID-19 case fatality rate. *Lancet Infect Dis*. 2020 Mar 27:S1473-3099(20)30244-9. Epub 2020 Mar 27.
- Ministry of Health. Singapore. Circuit breaker to minimise further spread of COVID-19. 2020 Apr 3. Accessed 2020 Apr 6. <https://www.moh.gov.sg/news-highlights/details/circuit-breaker-to-minimise-further-spread-of-covid-19>
- Zheng MH, Boni L, Fingerhut A. Minimally invasive surgery and the novel coronavirus outbreak: lessons learned in China and Italy. *Ann Surg*. 2020 Mar 26. Epub 2020 Mar 26.