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Coronavirus Disease 2019 (COVID-19) Response Measures—A Singapore Neurosurgical Academic Medical Center Experience in Emerging from the Worldwide Pandemic

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CORONAVIRUS AND THE WORLD

It is almost 7 months since the novel coronavirus disease 2019 (COVID-19) began spreading from Wuhan province in China¹ and 6 months after Singapore's first imported case of COVID-19,² 4 months from which the virus was declared a pandemic by the World Health Organization³ and 3 months since implementing the segregated team model in response.⁴ During this period, major strides have been made to better understand the virus, including its neurologic manifestations and impact on neurosurgery,^{5,6} its treatment,⁷ and vaccination.⁸ Singapore has also lifted her "circuit breaker" (lockdown) restrictions, in phases, starting from June 1, 2020.⁹ This is a follow-up article reflecting on the impact of COVID-19 on neurosurgical service provision, our response, and our results thus far.

NATIONAL UNIVERSITY HOSPITAL NEUROSURGERY, HER RESPONSE, AND RESULTS

We have responded to the loosening of restrictions and settling into the new routine with the re-establishment of our educational forums in addition to elective and outpatient services. Regular journal clubs, residents' tutorials, and multidisciplinary meetings, albeit via teleconferencing, have resumed. The bevy of international conferences now delivered to our doorstep via videoconferences are included into our mandatory educational curriculum. Combined teaching for the nation's 2 neurosurgical training programs has also become the norm.

The past 3 months have tightened up various implemented processes. These include the functioning and efficiency of our COVID-19 suspect emergency operating theater (EOT)—a theater fully equipped with advanced surgical and microsurgical capabilities, in a negatively pressurized room, with a separate entrance and route from the emergency department. The original standard personal protective equipment has also been upgraded to include powered air-purifying respirator. This improves the comfort and maneuverability of the surgeon, which in turn improves surgical efficiency.

Our teleconferencing procedures have also been streamlined with the addition of professional video-conferencing hardware and software that allows interface between the Internet and conferencing application with our intranet, electronic documentation, and neuroimaging software to enable a seamless experience from the comfort of the office or even home.

THE NEW-NEW NORMAL

As we look forward to the resumption of clinical work performed in the familiar consultant-led team-based model (the segregation

model is slated to end in August 2020 should the trajectory of COVID-19 cases in Singapore remain under control), we reflect on how our segregation model performed.

Under this model, each team manages either inpatient or outpatient duties and alternates on a weekly basis. As the inpatient responsibilities are generally much heavier, while managing outpatient duties, enforced rest is mandated on non-clinic days and weekends. In the last 3 months, we managed to maintain a busy inpatient and outpatient service while preserving an adequate work rest cycle for the service (**Table 1**).

During this period, we performed 16 surgeries on patients with suspected and confirmed COVID-19 in the COVID-19 EOT, including clipping of complex aneurysms, clot evacuations, and decompressive craniectomies for COVID-19-related malignant infarcts. We have also managed more than 30 suspected and confirmed patients with COVID-19 in the wards. To minimize community and cross-institution transmission, our patients undergo COVID-19 testing before discharge to subacute or rehabilitation facilities.

Concerning the conduct of emergency surgeries, the assumption that every emergency patient is a potential patient with COVID-19 was held, even if they did not fulfill the criteria for being operated in the COVID-19 EOT. Hence, in addition to the usual surgical aims, we aimed to limit exposure and

Table 1. National University Hospital Neurosurgery Team Segregation Plan

	Team A	Team B
Consultant	C1	C4
	C2	C5
	C3	
Registrar grade (PGY 4–6)	SR1	SR3
	SR2	SR4
Medical officer (PGY 2–3)	F1	RP1
	R1	R3
	R2	R4
House officer (PGY 1)		R5
	HO1	HO3
	HO2	HO4

C, consultant; PGY, postgraduate year; SR, senior resident; F, fellow; RP, resident physician; R, resident; HO, house officer.

Table 2. Average Monthly Clinical Load in 2019 and During COVID-19 Pandemic

	Average/Month in 2019	Average/Month in During COVID
Outpatient clinic visits		
Total patients	578	229
First visit consultations	106	37
Follow-up consultations	472	192
Inpatient admissions		
Total admissions	105	104
Emergency admissions	77	87
Surgeries		
Total procedures	91	88
Emergency procedures	39	52
Elective procedures	52	36

COVID-19, coronavirus disease 2019.

contact time. This has translated to an increased consultant involvement and rise in use of hemostatic agents such as FLOSEAL.

The rescheduling of elective neurosurgical cases is now allowed. We have also resumed the provision of elective endoscopic

transsphenoidal surgery. This high risk¹⁰ is mitigated by ensuring a negative COVID-19 swab before proceeding.

We are also ramping up the outpatient services by increasing the scheduling of first visit consultations and being more liberal with follow-up visits (Table 2). With all these, the workload is expected to rise back up to previous levels. To further cope with the rising demand, new directions such as telemedicine is considered for a select group of neurosurgical patients.

We are fortunate with our measures; thus far, there has been no cases of suspected COVID-19 infection among the faculty and residents thus far.

CONCLUSIONS

As we reflect on team-segregation model provision of clinical services, we were fortunate to have had no COVID-19-related incidents or near-misses and ensured that all clinical medical staff remained COVID-19 free. The provision of neurosurgical services was smooth, and we managed to further refine our operative, educational, and administrative processes while ensuring sufficient rest for clinical staff. As we take the first steps toward a cautious reopening, we remain wary and vigilant of the possibility of a second and third wave and conserve capacity and flexibility to return to previous segregation model if required, which has proven to be successful thus far.

As we grapple with the new normal, it is becoming more evident that change is the only constant. We need to continuously evolve and adapt to keep up, acclimatize, and overcome both predictable and unforeseen challenges and obstacles that will inevitably come our way.

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