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Review Article

Tailoring of neurosurgical practice during COVID-19 in a developing country: Insights gained and a way forward

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ABSTRACT

Background: The coronavirus disease-19 pandemic has aggravated the already neglected neurosurgical specialty in developing countries with a mounting shortage of specialists, long queues of operative patients, and a lack of adequate critical care units.

Methods: We have reviewed the innovative strategies adopted for maintaining an optimal surgical practice while ensuring team safety at the Aga Khan University Hospital, Karachi Pakistan.

Results: There is already a scarcity of resources in developing countries. The international guidelines had to be tailored to the context of the developing world. A multimodal strategy that focused on infection control, continuum of care, and the well-being of staff was adopted at Aga Khan University. Patients were screened and seen either in person or through telemedicine, depending on the severity of the disease. All educational activities for residents were shifted online, and this helped in preventing overcrowding.

Conclusion: Optimal surgical practice while ensuring team safety can be achieved through a multimodal strategy focusing on infection control, continuum of care, and the well-being of staff.

Keywords: Coronavirus disease-19, Developing world, Neurosurgical practice

INTRODUCTION

The coronavirus disease (COVID-19) was initially identified as a respiratory illness that was first discovered in December 2019, after the emergence of a cluster of pneumonia cases in the city of Wuhan, China.^[5] It is caused by severe acute respiratory syndrome coronavirus 2, a highly contagious virus with the potential to cause life-threatening impacts on patients. Due to its contagious nature, the World Health Organization declared it a public health emergency on January 30, 2020, and subsequently a pandemic on the March 11, 2020.^[12]

In Pakistan, its presentation was delayed, and the first case was diagnosed, on February 26, 2020.^[10] Hence, the government of Pakistan immediately announced a lockdown, along with the process of mass screening, testing, and quarantine following in the footsteps of other countries that were also caught off guard amidst this pandemic. The government of Pakistan also shut the borders to contain the disease from spreading further. Despite the radical measures taken, the disease

expanded exponentially in the country, causing thousands of mortalities. This peaked in the mid of June followed by a decrease in the cases by the start of August 2020. As the number of cases decreased, it led the government to re-think the stringent lockdown strategy to prevent economic crisis and a new policy of smart lockdown was implemented, in which lockdown was imposed in particular areas of the city where most of the cases were reported.^[13] This decision led to an unfortunate rise in COVID-19 cases with overcrowding of hospital emergencies, lack of isolation wards and intensive care units (ICUs), dwindling of hospital resources, lack of physicians, and nervous breakdown in working personnel. Thus, curtailing the disease had become a major nuisance in all hospitals throughout the country with major ramifications required in care plans throughout the country.

Throughout the pandemic, surgical practices worldwide underwent major practice modifications to avoid undue strain on already limited health-care resources by careful selection and deferral of elective cases. Neurosurgical specialty like other medical fields has faced numerous challenges, like shortage of doctors and medical staff because of quarantine due to disease or exposure, postponement of elective surgeries, and hindrance to academic activities in hospitals.^[1] The magnitude of the crises has been most severe, particularly in developing countries such as Pakistan, where the shortage of neurosurgeons is already increasing. The global ratio of neurosurgeons is one neurosurgeon/230,000 people whereas Pakistan has only 212 neurosurgeons serving 200 million people.^[7]

In this article, we have reviewed the strategies adopted in neurosurgical practice at the major tertiary care hospital “The Aga Khan University Hospital,” based in Karachi, which is a major cosmopolitan city in Pakistan, and highlighted the proactive steps taken by the hospital in maintaining an optimal surgical practice while ensuring health team safety. We believe that this proposition would be an important inclusion in the global surgical community recommendations for continuing surgical care during future pandemics.

A FRAMEWORK FOR ENSURING SAFETY

The safety of trainees and employees is the main consideration in any health-care system. The COVID-19 pandemic demanded an emergency revision of the residency program to accommodate shifting demands. As the national infection rate climbed significantly, a surgical departmental response plan was being considered among faculty in collaboration with the institution. The provision of personal protective equipment (PPE) to minimize COVID-19 exposure, and the continuation of surgical training were the major concerns. The directions that were taken to respond to this pandemic are outlined below.

TEAM DYNAMICS

Our neurosurgery team is divided into tiers based on seniority and it is comprised of eight attending physicians, ten residents, and four interns. In general, two residents are assigned to each attending and the residents assist in the outpatient clinics and operating room (OR). Residents and interns are on call every 4th day. During the COVID-19 peak from April 2020, our hospital followed the paired-coverage model, and the trainees were divided into two non-overlapping teams.^[3] Each team was designated to perform duties for 2 weeks: that is, each team will cover for 2 weeks, and then have 2 weeks off while the second team covers. The switch between teams was virtual, avoiding unnecessary contact. With the implementation of this model, we were able to effectively cover our inpatient services, outpatient clinics, and OR. Most importantly it reduced transmission risk and we always had an “alternate pool” of residents that will substitute for those who show COVID-19 symptoms. The 2 weeks break provided adequate time to recuperate from any viral contamination if present.

OUT-PATIENT SERVICES REFORMATION

Outpatient clinics are conducted in our hospital in the morning, afternoon, and evening shifts, 6 days a week. Before the hospital visit, COVID-19 screening was done on the phone and all patients with exposure or symptoms were scheduled for online consultation. One attendant policy was implemented, and the clinic’s capacity was limited to four people (attending, nurse, patient, and attendant). A COVID-19 compliance team made sure that there is adequate social distancing and proper PPE use. Until the decline of COVID-19 cases, to diminish viral exposure to trainees, neurosurgery attendings were doing clinics without residents’ assistance.

WARD ROUNDS CONFIGURATION

Ward rounds are an integral part of collaborative learning for residents and interns. With COVID-19, to ensure maximum safety and limit viral exposure, but also without compromising patient care, only one resident and an intern were allowed to round with assigned attending and note orders with proper PPEs donned. Similarly, the team making a round in the emergency department was limited to a junior and a senior resident. Each general ward and special care bed had maintained a distance of at least 6 feet to avoid cross-infection.

TRIAGING OF ADMISSIONS

Operative cases were labeled as either elective (that can be deferred for at least 4 weeks) or semi-elective (that were

scheduled and operated on a priority basis) based on the disease severity [Table 1]. To ensure the patients are infection free a negative polymerase chain reaction (PCR) was required at the time of admission (ideally done 72 h before admission). If the patient tested positive, then surgery was postponed till complete recovery of symptoms and a negative PCR report. Whereas for emergency cases including both traumatic and non-traumatic injuries, COVID-19 PCR was sent after resuscitation, and the patient was moved to either a COVID-designated OR or COVID ICU. The patient's post-operative stay was decided based on his COVID-19 test results; positive patients were shifted to the designated COVID-19 unit/ICU. After a negative PCR result, patients were shifted to the general ward where proper standard operating procedures (SOPs) were followed as per hospital-based guidelines. Hence, by following the above-systematized plan neurosurgery, patients' census was kept to a minimum with a standard of care maintained.

ALLOCATION OF STAFFING

During the peak of the pandemic, there was an acute shortage of workforce serving COVID-19 patients with personnel burnout. There were intense discussions among faculties, particularly with infectious disease consultants, and the framework was created to deploy residents from every department of the hospital to COVID-19 designated areas (ICU, high dependency unit, and special care) as per their experience. Beforehand, adequate learning modules and videos were displayed regarding proper donning and doffing techniques, and basic airway management techniques.^[4]

Neurosurgical residents were also instructed regarding the basic care plan of COVID-19 patients with present guidelines. The scheduled rotation of residents from each department not just helped them in learning basic management skills but also offloaded the staffing shortage problem in the hospital.

OR PRACTICES

With the emergence of this pandemic, elective cases were postponed especially those, placing surgeons and staff at higher risk of disease contraction, particularly endonasal procedures.^[2] In cases of neurosurgical emergencies, surgeries were being performed in negative pressure ORs with all PPEs including gowns, face shields, and N95 masks or respirator masks. In emergency cases, only one surgeon and one assistant, either an instructor or senior resident, were allowed in the negative pressure OR. The usage of drills for craniotomy was minimized and only used with copious saline irrigation to avoid the aerosol formation and OR contamination with risks of disease spread to the surgical team and other health-care providers.^[6] Furthermore, the timings of surgery were kept to a minimum when possible. As per the American Association of Neurological Surgeons recommendation, after uncomplicated craniotomies, patients were aimed to shift to special care units or wards instead of ICUs, to avoid burdening limited ICU capacity, and patients were preferably discharged to homes on an earlier basis.^[8] Elective and semi-elective cases were performed in standard positive-pressure ORs with all of the above precautions executed [Table 1].

COWORKERS' WELL-BEING

As there were increasing numbers of cases and mortality reported in the medical fraternity throughout the country. The utmost attention was given to safeguarding the health of employees and particularly residents who while having long hours of stay on hospital premises were particularly at high risk of catching the disease.

An android application software was designed by our institution, named Sehat (Urdu translation of "health") check. Sehat, check app. comprised of five questions on any rise in temperature ($\geq 100.4^{\circ}\text{F}$), new-onset sore throat, cough, body aches, and exposure to any COVID-19-positive patient within the last 24 h without wearing proper PPEs. Each employee had to answer these questions before reporting to the hospital. If the answer was affirmative to any of the questions, a representative from employee health reached out to the individual and guided him on the appropriate steps. In case of COVID-19 infection, employee health center monitored quarantined employees and residents by teleclinic. Contact tracing was done and employees with a high exposure risk were tested and quarantined. Residents

Table 1: Elective and semi-elective procedures.

| Elective cases (can be postponed 4 weeks or more in some cases) | Semi-elective cases (need priority for scheduling on the elective list) |
|---|---|
| Spinal degenerative disease with chronic pain | Brain tumors with neurological deficit |
| Brain tumors without neurological deficit | Brain tumors with hydrocephalus |
| Normal-pressure hydrocephalus | Malignant brain tumors |
| Spinal tumors with pain only | Spinal tumors with neurological deficit |
| Infratentorial tumors without hydrocephalus | Spinal degenerative disease with neurological deficit |
| Non-neonatal myelomeningocele | Neonatal or leaking myelomeningocele |
| Tethered cord | Hydrocephalus other than normal pressure hydrocephalus |
| Entrapment neuropathies | Pituitary tumors with visual deficits |
| Microvascular decompression | Elective aneurysm surgery |
| Deep brain stimulation | Surgery for cerebrospinal fluid leaks |
| - | Spinal infections |

were also provided extra call rooms to stay in during duties and to avoid overcrowding in single rooms.

FROM SURGICAL DIDACTICS TO E-LEARNING

Meetings and educational sessions are great resources for trainees to interact and learn. During the pandemic, all educational activities were put on hold, and the learning of trainees was under serious challenge. With the continuously evolving situation, all educational activities were shifted online, and this helped us prevent overcrowding and limit exposure to disease. In our hospital, tumor board meetings, journal club meetings, surgical grand rounds, and neuroscience case discussions as well as neuroradiology sessions were regularly conducted on weekly basis on the Zoom meeting app. Furthermore, morbidity and mortality meetings discussing our operative cases were held online. The neurosurgical chief resident had daily 1½ h interactive sessions on important neurosurgical concepts through case scenarios with trainees on the Zoom app. Our hospital strived to provide residents with an adequate learning atmosphere without compromising their health while discharging duties.

NEUROSURGICAL CONTINUUM OF CARE DURING COVID-19

These were very unprecedented times with worldwide challenges that led to major health-care reformations. To succeed, our neurosurgical department had made persistent efforts in remodeling the residency program and opting for optimum ways to provide patients with the best level of multidisciplinary care and prevent COVID-19 cross-infection among frontline healthcare workers and above all the patients. Above were the multimodal measures enacted by our institute in consonance with the developing guidelines to reduce patients' complications and mortalities while maintaining the safety of healthcare staff.

LESSONS LEARNT AND FUTURE PROSPECTS

Although mass vaccination has significantly curbed the severity and spread of COVID-19, the pandemic continues to be a looming threat with the intermittent resurgence of new cases, like over 4.6 million new cases were recorded for the week of June 27–July 3, 2022, with approximately 8100 fatalities reported.^[11] The number of new weekly deaths in South-East Asia has surged by 16%, and presently the Omicron variant accounts for 92% of cases reported recently in June 2022.^[11]

Some of the extraordinary innovations that were achieved during the pandemic were the advancement of virtual learning which has promoted remote learning and being more accessible. It is likely that in the future most academic

programs will continue to adopt the virtual format. The measures that we have adopted like the introduction of teleclinic services, outpatient service modifications, the introduction of the Sehat check application to monitor employee well-being, and redistribution of trainees from different disciplines to COVID units during the initial wave of COVID proved helpful not only in terms of extending the workforce in COVID units but also for the augmentation of a trainee learning experience.

CONCLUSION

The reaction of healthcare institutions and medical practitioners to the COVID-19 epidemic necessitated major modifications in the health-care system.^[9] The surgical practice in the developing world was severely impacted, and the above measures that were adopted by our hospital might serve as a framework for other health-care setups to follow in the future pandemic responses. We anticipate that in the future surgeons will be equipped with better skills and understanding of the challenges to confront such pandemics.

Declaration of patient consent

Patient's consent not required as there are no patients in this study.

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Conflicts of interest

There are no conflicts of interest.

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