

Strategies to Offer Uninterrupted Neurosurgical Care at a Tertiary Center in Makka amid COVID-19 Pandemic

Abstract

Background: Globally, there is a shooting pandemic that affected many healthcare systems. Healthcare facilities had to set up logistics to avoid being drained while facing a catastrophic health problem. There are currently no available vaccines or perfect therapies and also no certified immunity against that disease. Therefore, it is probable that healthcare systems will face it for an exceptionally long period. That will have a grave effect on the strategy of daily practice of different specialties' services at healthcare centers. Impossible decisions in usual workdays are now forcibly adopted for the sake of patients, care providers, and health resources. **Methods:** We try in a simple way to share tertiary center expertise in managing neurosurgical cases amid a dreadful healthcare crisis. Healthcare workers' safety and patient safety were typical priorities for neurosurgical service at King Abdullah Medical City. We expose the lines of management, triaging cases, the methods of handling confirmed and suspected neurosurgical patients, and strategies for discharging and following up patients. We identified hospital admission and discharge records starting from March 2020 till July to track the neurosurgical case burden and the state of service offered and the rate of infection among healthcare workers who participated in surgeries. **Results:** At the peak time of the COVID-19 pandemic in Makka starting from March till July, we have admitted 250 neurosurgical patients. About 210 (84%) of them did surgeries according to the triaging protocol described in the article. About 155 (62%) of those who did surgeries were urgent and the rest were borderline or semi-urgent. About 10 (4%) were severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) positive and three of them died due to acute respiratory distress syndrome. Only two mortality cases were reported due to a neurological complication and not related to SARS-CoV-2 infection. The rest of the cases (98%) were discharged for follow-up without grave complications after they were offered the service. No neurosurgeons or anesthesia staff involved in offering the service were infected with SARS-CoV-2. Successful uninterrupted neurosurgical care was available for patients during that health crisis without any healthcare worker being infected. **Conclusion:** Following the suggested strategies, any center can provide the healthcare service amid any pandemic happening now or in the future without dismantling the normal health system, especially for life-saving cases in a critical specialty as neurosurgery.

Keywords: COVID-19, healthcare worker, neurosurgery, pandemic

Introduction

COVID-19 spread is evolving like a hurricane clashing medical care system in both low- and high-income countries. In December 2019, an outbreak of the respiratory disease occurred in China, and later, it disseminated to many countries.^[1] The most common presenting symptoms are fever (87.9%), dry cough (67.7%), and fatigue (38.1%).^[2] COVID-19 clinically progresses the same as severe acute respiratory syndrome and has an incubation period ranging from 1 to 14 days, which increases the rate of spread of infection.

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Governmental restrictions over travel, especially from high-risk countries like China and Italy, were imposed over the whole country. Lockdown, social distancing, and banning all social gatherings were the ways Saudi government used to minimize the spread which seemed to be inevitable, especially in Makka, the epicenter of the pandemic in the country.

There is a hard need to provide an update about different protocols that different hospitals used during the pandemic. Searching through the medical library, the total number of manuscripts published in that respect through the last 3 months was

How to cite this article: Azab MA. Strategies to offer uninterrupted neurosurgical care at a tertiary center in Makka amid COVID-19 pandemic. *Asian J Neurosurg* 2021;16:271-5.

Submitted: 30-Jun-2020 **Revised:** 14-Aug-2020
Accepted: 15-Feb-2021 **Published:** 28-May-2021

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Access this article online

Website: www.asianjns.org

DOI: 10.4103/ajns.AJNS_324_20

Quick Response Code:



4000, and for neurosurgery, it was only 0.4%.^[3] It was the early March when the first case of COVID-19 was reported at our center since then profound measures were sorted out to protect healthcare providers and patients and to continue the practice in the face of a difficult situation.

All over the world, there was a common agreement to postpone elective neurosurgical procedures to limit the transmission of infection among healthcare workers.^[3] Although some surgeries can be postponed, others cannot be delayed for the fear of progression. Neurosurgery is a field of borderline cases that are hard to categorize as urgent or semi-urgent, for example, nonruptured aneurysm or a fully conscious patient presenting with a large tumor. We show how the pandemic changed practice in neurosurgery as the situation is getting more chaotic.

Workforce Management

On the administrative level, resource officials executed an order to prevent any leaves or unnecessary work vacations to exploit all available workforce. Strict regulations were applied to stop any gatherings and to apply social distancing with 2 m allowed between each person. Transmission of medical information or administrative rules was through electronic routes as e-mails, chatting, social media, and messaging groups that aided in tracking new events. That helped to abate the need for meetings that may expose healthcare workers to infection hazard. Documents and important questionnaires can be collected electronically to be available later for documentation. COVID-19 team was a vivid trial of collaboration among medical and surgical staff personnel. From each surgical specialty, two staff persons are assigned to help medical staff on regular rotating shifts. Their role is to help infection control staff to categorize and sort out cases for COVID-19 to unload the burden facing the medical staff. Adequate training sessions and online instruction brochures were offered to all surgical staff who will participate in the COVID-19 team. Surgical staff juniors and seniors needed to stand by medical colleagues on frontlines confronting COVID-19.

For daily neurosurgery care, the staffing sector was divided into two Groups A and B. Group A will follow neurosurgical cases for 2 weeks and Group B for the other 2 weeks to prevent transmission of infection among healthcare workers if someone gets infected. This deployment of staff helped much to relieve stress among us. Healthcare workers are the fuel that should be protected to provide continuous care during the pandemic.

Total Workload

Since the first case of COVID-19 was reported at our center, adjustments were made to admissions allocated for neurosurgery. The American College of Surgeons has declared to postpone or cancel elective surgeries by the middle of March 2020.^[4] Neurosurgeons are trained to

categorize patients and take sharp decisions to postpone or admit patients for surgery. Accommodating the normal capacity of work that we used to have at our center will not be feasible amid the pandemic. Therefore, a firm plan was sorted to postpone any elective cases. Sometimes, cases appear to be borderline and any delay in the intervention will lead to disease progression. It is the job of senior consultants to determine the degree of urgency and to admit patients or not. The emergency workload remained constant despite the reduction of the working staff by 50%. Emergency cases that were admitted included aneurysmal subarachnoid hemorrhage, large tumors causing disturbed conscious level, and tumors causing acute hydrocephalus. One of the most important reasons to decrease elective workload was the deployment of anesthesia staff to have roles in the crowded intensive care units that will be full of COVID-19 cases. Table 1 illustrates the numbers of admissions, surgeries done, and numbers of patients discharged amid the pandemic time from March to July 2020 at King Abdullah Medical Center.

Academic Life

Tertiary centers usually have a pivotal role in the academic life of residents and young neurosurgeons. Residents usually aspire to join teams at such centers to accelerate their learning curve specifically in subspecialties. Amid COVID-19 pandemic, decreased surgical cases numbers reduced learning chances for residents.

Scientific conferences were canceled as they are considered a form of social gatherings. Scientific discussions were limited to online groups. Residents were segregated into small groups to decrease the risk of infection. On the other hand, each resident and assistant was assigned to discuss a manuscript in neurosurgery to compensate for the defect in academic activity. Residents continued to participate in surgeries done on an emergency basis amid the pandemic to reimburse the lack of surgical practice.

Surgical Directives amid COVID-19 Era

Patients at our tertiary hospital were categorized into no-risk, suspected, and confirmed COVID-19 infected according to a triaging score of the Saudi Ministry of Health. That triaging will redirect the surgical plan

Table 1: Admitted patients from March to July 2020

| Patients | Numbers |
|-----------------------------------------------|----------|
| Total number of admitted patients | 250 |
| Patients with surgical management (%) | 210 (84) |
| Brain tumors | 115 (46) |
| Neurovascular | 80 (32) |
| Pituitary surgeries | 15 (6) |
| Urgent patients (%) | 155 (62) |
| Semi-urgent borderline patients (%) | 55 (22) |
| Discharged patients with no complications (%) | 245 (98) |

according to risk stratification in dealing with cases as suspected or confirmed as shown in Figure 1. The current pandemic directs our attention to the value of wise consumption of medical resources. It is important to make sure that healthcare workers function properly facing that turmoil.^[5] A vigilant effort had to be done to ensure extremely low risks of infection among healthcare workers. Each step starting by transferring the patient to the operating room until discharge was carefully organized to avoid infecting either the staff or the patient.

Patient transfer

Patient transfer is a very critical step that may spread infection unwittingly. The transfer should be done as quickly as possible to limit exposure time at hospital corridors. Special elevators are devoted to the transfer of patients categorized as suspected or confirmed COVID-19 infection. Transfer occurs through predefined corridors away from main hospital ways. Nursing staff and workers involved in transfer should wear all protective personal equipment as shown in Figure 2. The transfer process should be quick and under a complete organization. Personnel involved in transfer should be well trained and highly equipped. Precautions should be followed even after completing the patient transfer. All the elevators used to transfer the patient should be sanitized afterward. Cleaning team members are working continuously to ensure sanitization of lifts, corridors, and floors and are trained to protect themselves. Un-intubated patients should wear the disposable surgical mask, face shield, disposable gloves, and shoes cover while being transferred. Containers for disposable protective equipment are designed along hospital pathways to get rid of these materials whenever needed.

Operating area design

There was a recommendation at the department of neurosurgery to limit the number of persons in the operating

room as much as possible. A designed operating room is specified for surgeries that will involve COVID-19 patients whether suspected or confirmed. Operating rooms usually have positive pressure air circulation. High air flow cycles would be effective in halting viral transmission.^[5] In the COVID-19 area, all staff should wear all personal protective equipment as a mandatory precaution. Meticulous on-call staff is available at any time for urgent cases, and they are well trained to deal. Hand washing sanitizers and personal protective equipment are continuously replenished at COVID-19 operating area. Doors at the COVID-19 area in the operating room should be closed all the time. All instruments for surgery should be available on a case to case basis before beginning to avoid hustle and bustle at the COVID-19 operating area. Nondisposable equipment should be avoided as much as possible.

Anesthesia precautions

Surgical and anesthesia consenting is done through phone calls and also witnessed by a member of the patient relations office at King Abdullah Medical City (KAMC). All surgical procedures are explained to the patient family through phone calls, and they are allowed to take time to think and call back without being physically present. This will abate social contact completely.

The respiratory aerosol is an important source of COVID-19 infection. Intubation is a very hazardous procedure if one is not fully protected against COVID-19 transmission. Powered air-purifying respirator is available for medical staff doing laryngoscopy and intubation.^[6] At the end of procedures, all staff involved should remove all personal protective equipment in case of heavy involvement by cough and secretions. A ventilator specific for COVID-19 is assigned for those cases only to limit the risk of spread from confirmed to suspected patients.

Central catheterization or chest tube should be done bedside in the intensive care unit before transferring patients to minimize

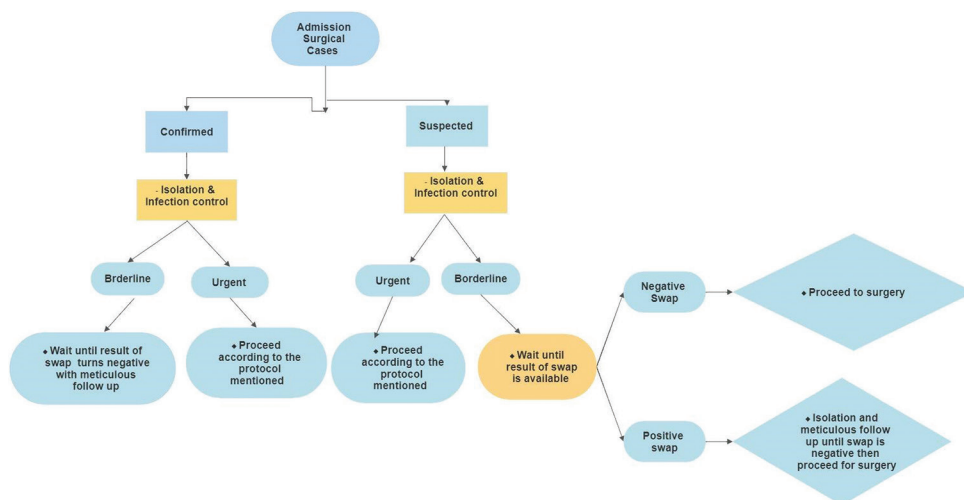


Figure 1: Neurosurgery department strategy according to patient COVID-19 category



Figure 2: A staff nurse and a neurosurgeon dressed in the protective dress before preparing for surgery on a patient with intraventricular aneurysmal hemorrhage

time spent in the COVID-19 operating area. Anesthesia assistants should prepare everything while the patient is transferred to limit the time of contact with each patient.

Intraoperative precautions

The operating room door should be labeled and closed all the time to halt any inadvertent entry. The surgical team should anticipate the instrument kit that will be needed in advance before starting. Persons in the operating room should not leave under any condition until they finish the whole procedure. Only a senior surgeon and assistant should do the surgery to limit the number of persons there. All surgeons have to wear Powered air purifying respirator PAPR during surgery even while they are using the microscope. Although it causes some headaches, all surgeons have to wear it all the time. Specimens from surgery should be handled carefully as they may be a source of contamination. It is unknown if there may be a viral load of COVID-19 in body fluids and brain tissues.^[3] After the surgery is over, all areas at risk of contamination should be disinfected. Surgeons are trained on how to take off their powered air-purifying respirators after they finish the surgery.

Postoperative Management

The strategy we followed is to discharge the patient as soon as possible to minimize the risk for any patient to stay more at the hospital and get an infection. No visitors are allowed at all. Communication with patient family should pursue through the phone to decrease the social visits at the hospital. Outpatient appointments are scheduled according to patient condition through phone calls to determine patients who need service and to limit outpatient visits. Medications will be sent home through a delivery service. Each patient is instructed to visit the emergency casualty only if there is an urgent problem.

Conclusion

Lessons from dealing with the pandemic are precious for

young neurosurgeons to make use of, if they encounter any future pandemics. Continuing clinical services at that time is considered a big challenge. Our strategy to manage resources helped us to provide a kind of nonstop neurosurgical care for most patients, meanwhile protecting healthcare workers. Every institution can try to stick to our guidelines that may aid to reduce the number of infections among healthcare workers substantiated by the zero number of infections among our staff members.

Ethics approval and consent to participate

This study is a review article that did not involve any human participation or animal involvement or clinical trial or any biological tissues. All procedures performed in studies involving human participants were by following the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. For this study, formal consent is not required as it did not involve any clinical trial. The permission for the photograph in Figure 2 has been obtained from staff worker to include the photo in the manuscript as per agreement and consent.

Consent for publication

I, Mohammed Atef Azab, declare that this manuscript is original, has not been published before, and is not currently being considered for publication elsewhere. We confirm that the manuscript has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed. I further confirm that the order of authors listed in the manuscript has been approved by all of us. I understand that the Corresponding Author is the sole contact for the Editorial process. He is responsible for communicating with the other authors about progress, submissions of revisions, and final approval of proofs.

Acknowledgment

The author thanks Essam Monir and Ahmed Adel for their extensive assistance in reviewing the manuscript and for significant help in preparing this manuscript for submission. I thank also Dr. Abdulraheem Al-Omari, a diligent resident at the Department of Neurosurgery at KAMC for addressing meticulous care for patients amid the pandemic. Great appreciation for Dr Sultan Al-Saiari who is the Head of the Department of Neurosurgery at KAMC for his dedicated leadership.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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