Neurosurgical Dilemmas During the Emergence of Covid-19 in Sabah, Malaysia

Sabah, Malezya'da Covid-19'un Ortaya Çıkışı Sırasında Beyin Cerrahisi İkilemleri

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ABSTRACT

Neurosurgeons in Sabah were in a dilemma when Covid-19 became a pandemic and manpower was diverted into becoming front-liners at screening centers. Careful screening was introduced for cases requiring admission to the ward. We labelled our patients who are going for surgery into high and low risk categories. Level 3 PPE was used for high risk cases only. Emergency and semi emergency cases were continued with careful consideration. Elective cases were postponed based on the idea that we don't clog up the intensive care unit(ICU) beds and ventilators which might be needed for ill Covid-19 patients or avoidable usage of blood products which are in acute shortage during this pandemic. All outpatient clinic cases were screened by neurosurgeons and only those awaiting surgeries or those recently discharged home after major procedures were seen while others were managed via tele-medicine. Staff were divided to ensure that if someone becomes a positive contact, then it is easier to quarantine them. We believe that this is the first neurosurgery related article to the management of patient care during this pandemic in eastern Borneo and the approach we have taken can serve as a guide to most neurosurgeons during this unexpected time of Covid-19 pandemic.

Keywords: Coronavirus Disease, Covid-19, Neurosurgery, Pandemic, Risk stratification, Health care system.

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ÖZET

Sabah'taki beyin cerrahları, Covid-19 bir salgın haline geldiğinde ve insan gücü tarama merkezlerinde ön saflara yönlendirildiğinde bir ikilem içindeydi. Servise yatırılması gereken vakalar için dikkatli tarama başlatıldı. Ameliyat olacak hastalarımızı yüksek ve düşük risk kategorisine ayırdık. Seviye 3 kişisel koruyucu ekipman (KKE) yalnızca yüksek riskli vakalar için kullanıldı. Acil ve yarı acil vakalar dikkatle değerlendirilerek devam edildi. Covid-19 hastaları için gerekli olabilecek yoğun bakım (YBÜ) yatak ve ventilatörlerini tıkamadığımız veya bu pandemi sırasında akut eksikliği yaşanan kan ürünlerinin kullanılmaması gerektiği düşüncesiyle elektif vakalar ertelendi. Tüm poliklinik vakaları beyin cerrahları tarafından tarandı ve sadece ameliyat bekleyenler veya büyük prosedürlerden sonra eve yeni taburcu olanlar görüldü, diğerleri tele-tıp ile yönetildi. Personel, birisi pozitif bir temas haline gelirse, karantinaya almanın daha kolay olmasını sağlamak için bölündü. Bunun, Doğu Borneo'daki bu pandemi sırasında hasta bakımının yönetimine ilişkin beyin cerrahisi ile ilgili ilk makale olduğuna ve benimsediğimiz yaklaşımın, Covid-19 pandemisinin bu beklenmedik döneminde çoğu beyin cerrahı için bir rehber görevi görebileceğine inanıyoruz.

Anahtar Sözcükler: Coronavirus Hastalığı, Covid-19, Beyin Cerrahisi, Pandemi, Risk sınıflandırması, Sağlık sistemi

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INTRODUCTION

The whole world was awakened when World Health Organization(WHO) announced Covid- 19 as a pandemic on March 11, 2020. This meant more than just hot news to many around the world especially the health care workers as more than 100,000 cases around the world were reported initially with a steady rise in numbers gradually. The virus which was once thought to be only spread around Wuhan and neighboring areas; has now spread its wings globally claiming lives as each day passes by(1).

While many still debate the fact that the world should have been alarmed or international borders closed earlier; there is absolutely no point in arguing what could have been done. We have already lost several prominent neurosurgeons and we should rather focus on whatshould be done.

Geodemographic Setting

Once a wonderful bustling city with both tourists and scenic nature, now the state seems asleep with movement restriction order in place. Kota Kinabalu International Airport is the second busiest airport in Malaysia after Kuala Lumpur International Airport but it is now relatively quiet.

As everyone is affected, Neurosurgery didn't escape this pandemic. Usually we see patients whose life is at risk and we become heroes who are going to save their life. Now it's both patient and health care worker's life at risk due to this deadly virus. In Malaysia, it is for now a joint effort between many government sectors along with the public support in containing the spread of this virus. While the nation was told to adhere to operating policies via movement control order, vaccination drives and national recovery plans; essential services still continued in full force including the health care sector.

As a neurosurgeon in Sabah Brain & Spine Center; a major tertiary government referral hospital in the state of Sabah in east Malaysia with the next nearest neurosurgical government hospital being around 330 kilometers away, this puts us in a major dilemma of how shouldwe handle our workload and daily practice. In Kota Kinabalu, the state's capital city; there are three functional government tertiary hospitals with adequate facilities. One hospital was converted into a Covid-19 only hospital while another was the active center for all neurosurgical related cases from the whole state except for maternal and pediatric related cases. The latter two groups of patients were referred to the third hospital which is Sabah Women & Children Hospital.

Many articles and guidelines were published later by the local authorities but were intended for general medical and health care workers. A more specific guideline or protocol was needed for the Sabah State Neurosurgical Services due to its geodemographic setting and thus we developed these specific guidelines which were adapted from known literatures at that time especially from similar pandemics such as during the time of airborne infection outbreak such as SARS, MERS-Cov or influenza. Most articles only spoke about elective surgeries but there were more to address to sustain the neurosurgical services in our center. Here, we discuss some of the issues faced by us and what measures were taken to overcome it. We developed local guidelines to facilitate us with the approval of the local state health board and authority. We believe this first neurosurgery related article from the east Borneo region with its unique geodemographic setting will guide others around the world who also face similar dilemma.

Patient Admission

As logical surgeons, we would assume every patient is positive for coronavirus disease until proven otherwise but yet again we will be unnecessarily wasting the usage of personal protective equipment (PPE) which would benefit the other front-liners at the screening centers instead. Careful consideration and adaptation was introduced on how we approached our cases which needed admission to the ward. The question was when someone should be an alert of Covid-19 suspected case. Table 1 shows the screening tool adapted by us in our center.

Table 1: Patient screening flow chart to determine level of risk for being a susceptible Covid-19 case.

CRITERIA	LOW RISK	HIGH RISK / SUSPICIOUS
Travel outside of the country or to red zone areas in the last 14 days and/or;	No	Yes
Close contact to Covid-19 positive patient and/or;	No	Yes
Fever with acute respiratory infection (shortness of breath, sore throat, influenza like illness or cough) or viral illness features (myalgia, headache) or loss of sense of smell or taste and/or diarrhea or vomiting and/or;	No	Yes
Rapid Test Kit (RTK) Covid-19 Antigen	Negative	Positive or Indeterminate (Proceed with Real-time Reverse Transcription Polymerase Chain Reaction [RT-PCR] test)
PPE usage	Level 2 Disposable fluid resistant gown, disposable gloves, surgical mask and goggles or face shield, surgical sterile gloves, disposable boot covers.	Level 3 Reinforced disposable fluid resistant gown, disposable fluid resistant hood or head cover, respirator, disposable full face visor, long cuff non- sterile disposable gloves, surgical sterile gloves, disposable boot covers.

A swab is taken for admission for all patients despite the risk level or for suspicious patients due to inaccuracies in the RTK-Ag results. Some cases will not be able to wait till the results are out, so we have to assume these cases as positive and proceed with standard PPE precaution. All patients with anticipation for surgery will require a RT-PCR test instead since we have had cases with negative RTK-Ag results but instead yielded positive for RT-PCR test. This also has caused us to cohort patients and apply standard use of PPE Level 2 for all cases admitted to the ward unless RT-PCR result is negative.

Emergency Surgeries

This Covid-19 pandemic is not going to stop a cerebral aneurysm from rupturing or a spine tumor from causing acute onset paraplegia. Actually these are emergencies and have to be treated but should I wonder if they are positive for Covid-19 or should I just disregard that fact.

As the first tier of screening was done at the time of admission, we labelled our patients who are going for surgery as high and low risk categories. Full PPE were used for high risk cases. In the state of Sabah, the tertiary medical centers are located in the capital city of Kota Kinabalu but there are also other hospitals with specialists but without neurosurgeons.

In anticipation of major patient transfer issues from district hospitals during the Covid-19 pandemic, we have placed our privileged senior medical officers with experience in handling basic lifesaving neurosurgical emergency procedures to be stationed at Hospital Tawau and Hospital Duchess of Kent in Sandakan both about more than 300 kilometers away. This enables the neurosurgical department to cover emergency services at the east coast region of the state without the need to transfer all patients over to Kota Kinabalu unnecessarily. This move enabled the health resources to be more focused on handling the Covid-19 crisis rather than thinking of patient transfer and logistics.

Case 1 (Emergency Surgery)

A 2 months old child was referred for bilateral subdural effusion from Hospital Duchess of Kent in Sandakan which is about 330 kilometers away. Initially the child presented with fever but later had persistent episodes of seizures necessitating a computed tomography(CT) scan of the brain (Figure 1). His head circumference was at the 97th centile and anterior fontanelle was tense. The child needs surgery but was from a red zone area and Covid-19 testing prior to transfer will delay the surgery. Decision was made to manage the child there via fontanelle tapping of cerebrospinal fluid(CSF) by our neurosurgical officer who is placed at that hospital. The child improved well and seizure was controlled while the CSF analysis showed infection which was treated with intravenous ceftriaxone.

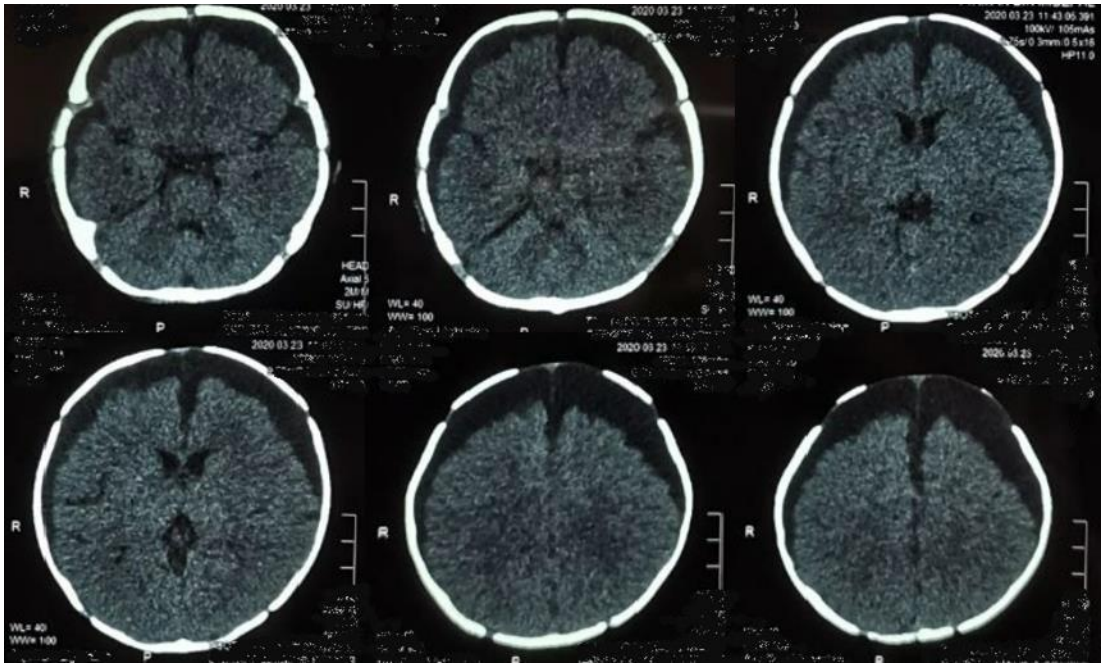

Figure 1: CT brain plain showing bilateral subdural effusion with hemispheric mass effect causing flattening of sulci and gyri without any other focal abnormality seen.

Semi Emergency and Elective Surgeries

Most of us think that semi emergency and elective surgeries are quite easily managed as cases can be postponed till this pandemic is over. The major concern in postponing elective surgeries are to ensure we don't clog up the ICU beds and ventilators which might be needed for ill Covid-19 patients and also avoid unnecessary usage of blood products which are in acute shortage due to reduced number of donors during this pandemic(2-4).

Ventilators were crucial for ill Covid-19 patients because findings such as diffuse alveolar damage and airway inflammation was found in an autopsy case(5). Reports also show that as for Covid-19 patients who are asymptomatic for the disease who undergo elective surgeries have very high mortality rate especially from extra pulmonary complications due to hyper-coagulable state. Thrombosis is rampant in these patients. So we concluded that it was the best not to operate in a positive patient who is asymptomatic if the surgery can be postponed. While some cases can wait, there are huge tumors with progressing neurological deficit or a metastatic lesion with massive perilesional edema causing mass effect.

Case 2 (Semi Emergency Surgery)

An elderly gentleman presented with gradual onset of speech deficits followed by acute right sided hemiparesis to Hospital Tawau which is about 540 kilometers away from our main neurosurgical center in Kota Kinabalu. His CT scan (Figure 2) showed a huge left frontal convexity meningioma with mass effect necessitating surgery but in view of this crisis and shortage of supply of blood products, we decided to admit the patient and initiate anti edema therapy with dexamethasone. He was closely monitored by our neurosurgical officer placed there. Decision was also made that if he deteriorates further, decompressive craniectomy will be performed as a life-saving procedure prior to arrangement for transfer to Kota Kinabalu. He tremendously improved to near normal condition with some minor speech deficit. While his condition improved, we managed to ensure supply of blood products and the availability of intensive care unit(ICU) bed and ventilator back up after which surgery was performed 2 weeks later.

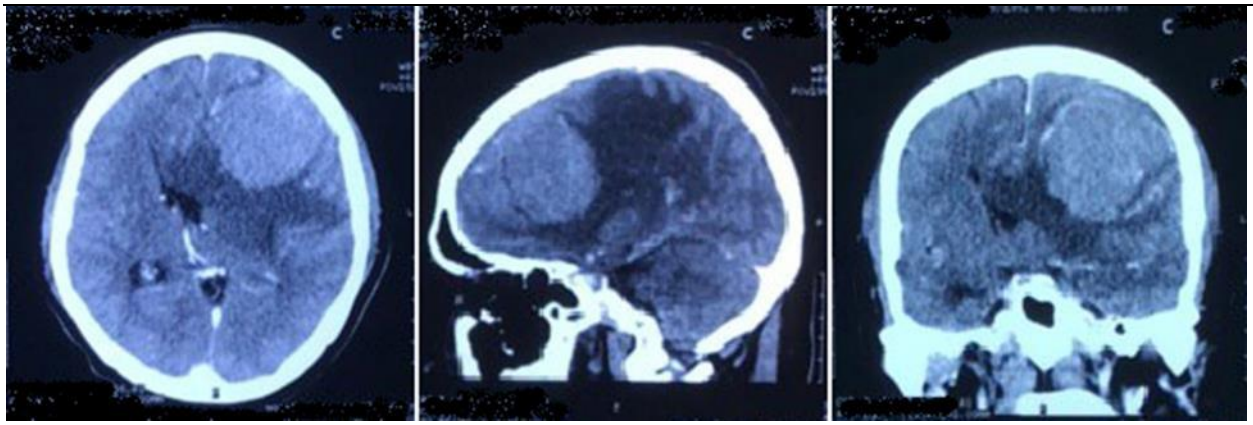

Figure 2: Contrast enhanced CT brain showing large extra-axial dura based lesion with perilesional edema causing mass effect. Lesion most likely represent a meningioma.

Case 3 (Elective Surgery)

A 20-year-old girl presented with recurrent episodes of generalized tonic clinic seizures with the frequency of one to two attacks per week but did not seek medical treatment due to the fact that she was away for studies. Her parents noticed her seizure when she returned home during this pandemic and was brought to the hospital.

CT scan (Figure 3) showed a hypo-dense lesion at the temporal lobe without any mass effect most likely being a low grade glioma. She was admitted and treated with oral levetiracetam. She became seizure free and an outpatient magnetic resonance image(MRI) appointment date and outpatient clinic appointment was given to her during discharge. She was also advised to watch out for warning signs and to seek early medical treatment if needed while awaiting her next appointment to plan further regarding elective surgery.

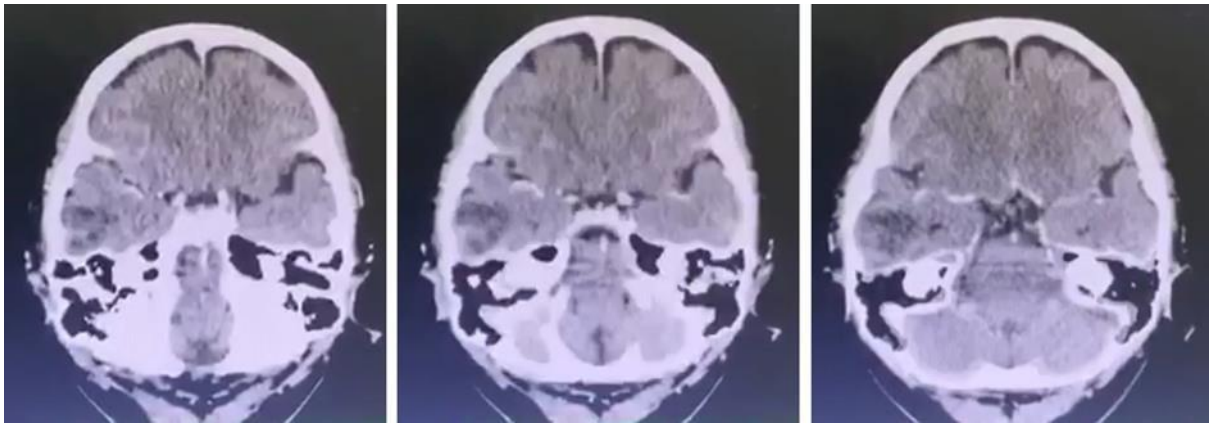

Figure 3: Contrast enhanced CT scan showing a mixed density lesion at the right temporal region without surrounding mass effect likely representing a low grade glioma.

DISCUSSION

As much as we screen or stratify patients into groups, it's best to assume that everyone is positive and be cautious with universal hygiene and protective gears as the majority of positive patients are asymptomatic. It is of utmost importance to ensure the health care workers (HCW) are always safe. Here we discuss few important aspects that we should focus in daily work(6). Adaptation guidelines for neurosurgical specific workflow for the entire state of Sabah was developed locally with the approval by the Sabah State Health Department prior to release of other national guidelines.

Universal Precaution

Our neurosurgical practice has now changed. Despite knowing what is the best to do; now our patient's management has changed to suit this pandemic without harming their health and at the same time to ensure HCW are safe. All symptomatic patients are considered positive until unless a series of 2 repeated swabs for Covid-19 till the fifth day are negative. A complete cessation of all neurosurgical related aerosol generating procedures is practiced unless unavoidable and the usage of medical grade respirators are compulsory. Endoscopic procedures are abandoned and reverted back to traditional open craniotomy methods. If a case is Covid-19 positive; surgical procedure should aim at a lifesaving minimal intervention to reduce a neurosurgeon's operative exposure time. A follow up completion of procedure can be performed once treatment is completed for the deadly Covid-19.

All elective surgeries are postponed till the pandemic is over mainly not to occupy intensive care unit (ICU) beds and avoid usage of perioperative blood products which are scarce. Asymptomatic or negative patients have shown an increase in becoming positive or developing complications such as widespread thrombosis after surgery if they become Covid-19 positive. At the same time, no acute or lifesaving bed-side intervention is allowed without proper donning of personal protective equipment (PPE) if the case is under investigation or Covid-19 positive. End of life care and expectations are to be discussed and properly documented in positive Covid-19 cases with respect to resuscitation in special cases with poor prognosis(7).

Staff Restructuring & Work Place Modification

The department is separated into teams to manage various sections of the hospital without contact between each other. This is to ensure that the neurosurgical service is continued by the other team even if someone becomes a contact or positive of Covid-19. The nurses are divided into 4 teams and the teams works alternately to avoid contact. The medical officers and nurses in the department were given block system in which only the similar person rotates in certain cubicles or ward and doesn't examine patients from different cubicles or wards. This is to ensure that no service interruption or ward “lock-down” will be required if someone becomes a contact to patient who is positive for Covid-19. It is easier to quarantine them till swab results are obtained. This also prevents the suspected medical officer from cross-contaminating the whole department.

As for social distancing, work stations in ward and clinics were strictly designated tomaintain at least a distance of 1 meter between each other and to take turns to use common places such as the pantry. A common adaptation of "being paranoid" of positive Covid-19 among colleagues were practiced so that the infection spread chain is broken. All our colleagues are treated as a possible source of disease spread and advised to be cautious with constant use of masks, face shield and distancing of at least 1 meter except in operating theatres which is unavoidable. Most HCW's positive contacts are via poor adherence to the standard operating protocols. As Kota Kinabalu is unique with 3 tertiary government hospitals, inter hospital movement is strictly prohibited among doctors and support staff. We also minimize personnel at operating theatres for high risk cases. This reduces risk of HCW contamination and also helps reduce PPE usage.

Outpatient Clinic Appointments

All our cases were screened by neurosurgeons and labelled as "to come" or "to call". The "to come" labelled patients are those awaiting surgeries or those recently discharged home after major procedures. Patients were given appointment time slots as to only one patient is allowed in the clinic waiting area during each time and they were spaced out with social distancing too. Doctors wore basic PPE while attending to these patients during clinic session with utmost care given to hygiene and preventive measures to avoid disease spread. Number of patients were limited to a maximum of 10 cases each day. As for the "to call" patients, they were basically patients on long term follow up or on medications but stable. Neurosurgical history and patient update were obtained via telemedicine and a new date for appointment given to everyone. Patients who are on medication such as anti-epileptics were told to provide residential address and medications were sent via post to ease convenience and reduce travelling during this pandemic. If any new complaints were picked up during phone interview sessions; they were told to come for appointment as per the new given time slot.

Case Specific Modifications in High Risk or Positive Covid-19 Cases

Vascular surgery

Ideally surgery is to be avoided for all unruptured arteriovenous malformation (AVM) patients presenting with minor symptoms which are able to be controlled by medication such as seizure or headache. Interventional procedure of coiling is to be of choice for aneurysm ruptures instead of traditional clipping during this pandemic but in Sabah this service lacks in immediate availability and clipping is still the choice especially for anterior circulation aneurysms. Interventional procedure of embolization is also advised for AVM instead of excision. Decompressive craniectomy without fascia-duraplasty is acceptable for malignant middle cerebral artery infarcts and craniotomy or craniectomy with simple clot decompression to relieve mass effect and correct shift is adequate in large hypertensive hemorrhages. These measures are taken to reduce a neurosurgeon's exposure time in operation theatres.

Neuro-oncology

Patients who present with space occupying lesions (SOL) causing major mass effects due to vasogenic edema and without the presence of intracranial herniation signs; the usage of anti- edema therapy to relieve mass effect is acceptable while awaiting PCR swab results for definitive surgery. In contrary, SOL patients with the presence of intracranial herniation signs who does not respond to anti edema therapy will require a simple decompressive craniectomy with or without lesion debulking or even a biopsy in the same seating. Patients with posterior fossa lesions causing hydrocephalus without brain stem compression signs, will just require an emergency CSF diversion procedure which is adequate while awaiting RT-PCR swab result for the definitive surgery.

Neuro-spine

All patients with back pain of neuropathic or nociceptive in character as their main presenting complaint without neurological deficits are managed with analgesics or gabapentinoids. Degenerative spine disease patients without neurological deficit are managed with life-style modification and physiotherapy but those with acute onset neurological deficits are considered an emergency and managed via emergency surgery. In fractures or mal-alignments; surgery is avoided if a conservative non-surgical management with collar or vest is one of the acceptable choices.

Neuro-trauma

All brain trauma patients are managed according to Brain Trauma Foundation's (BTF) guidelines and emergency surgery is performed if indicated. Single burr hole drainage for chronic subdural hematoma (SDH) patients while mini craniotomy for acute on chronic or mixed density SDH is adequate as a life-saving procedure.

Other Neurosurgical Procedures

Cranioplasty can be performed if a patient is symptomatic for sunken flap syndrome but for autologous expiring bone flaps; ideally it should be discussed with the patient or family to be discarded and to proceed with artificial flaps such as acrylic or titanium mesh once this pandemic is over. Cranioplasty for patients who are not ambulatory or in a vegetative state should be avoided till the pandemic is under control. The usage of external ventricular drain (EVD) is avoided for temporary cerebrospinal fluid (CSF) diversion due to risk of displacement or multiple re-siting surgeries. Alternatively, a ventriculosubgaleal or a ventriculoperitoneal shunt can be performed for temporary CSF diversion.

CONCLUSION

In this time of crisis, a more deliberate approach should be taken in managing neurosurgical patients. Most of our patients deteriorate fast but at the same time it's important to identify stable patients. A neurosurgeon must be actively involved in preventing unnecessary patient transfers and focusing on life saving measures which are of utmost importance. We believe that the approach we have taken can serve as a guide to most neurosurgeons who are also in a similar dilemma during this unexpected time of Covid-19 pandemic.

Conflict of interest

No conflict of interest was declared by the authors.

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