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TOPIC REVIEW

Inpatient and outpatient case prioritization for patients with neuro-oncologic disease amid the COVID-19 pandemic: general guidance for neuro-oncology practitioners from the AANS/CNS Tumor Section and Society for Neuro-Oncology

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Abstract
The Coronavirus pandemic has created unprecedented strain on medical resources at health care institutions around the world. At many institutions, this has resulted in efforts to prioritize cases with an attempt to balance the acuity of medical needs with available resources. Here, we provide a framework for institutions and governments to help adjudicate treatment allocations to patients with neuro-oncologic disease.

Keywords Neuro-oncology · Neurosurgery · COVID19 · Coronavirus · SARS-CoV-2 · Glioblastoma · Glioma · Meningioma · Brain metastasis · Meningioma · Acoustic neuroma · Skull base · Endoscopic endonasal

Introduction

The Coronavirus (SARS-CoV-2) pandemic, first identified in Wuhan China in December 2019, has fast spread throughout the globe with nearly 200 countries affected [1]. The relatively easy spread of this virus combined with the higher morbidity and mortality of symptomatic infection as compared to influenza have resulted in overwhelmed hospital systems in China, Italy, and the United States, to name just a few [2, 3]. As a result, elective medical care has been necessarily de-prioritized to meet the demands of this public health crisis. In the face of this unprecedented situation, a rational framework to adjudicate patient prioritization in the context of severely constrained resources is urgently needed [4]. There have been some guidelines recently promulgated by the American College of Surgeons based on surgical acuity that are generally sound [5]. Similarly, a recent article by Burke et al. articulated an approach towards case prioritization for neurosurgical cases specifically [6]. In addition, Centers for Medicare and Medicaid (CMS) guidelines list neurosurgery and most cancers as Tier 3a cases and as such recommend that these cases not be postponed if possible given their high acuity [7]. Neuro-oncology cases are unique in that the brain or spine tumors which may not be urgent now will become urgent in due course. For malignant Central Nervous System (CNS) tumors, this time course will likely occur in the near future when the Coronavirus pandemic may still be ongoing. Here, we present a framework to assist in determining case priorities in patients with neuro-oncologic disease. We divide the framework between Resource-Constrained (Some hospital resources available for non-COVID disease) and No Resource settings(All hospital resources directed towards COVID patients).

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Resource-constrained

Outpatient access

In many centers affected by the pandemic, outpatient access has been significantly curtailed. To the extent possible, patients and health providers should be given access to their providers through telemedicine appointments. Given the importance of imaging in neuro-oncology patients for diagnosis and surveillance, it is critical that outpatient radiology remain accessible for patients and providers. Radiology and radiation oncology centers should establish protocols to limit patients in waiting areas and provide masks for patients. Finally, for those patients requiring infusions, patients should be appropriately separated with masks given. Ill patients should, of course, remain home and home health care including infusions at home should be considered. For ill patients that are COVID+, discussions between patient and provider should occur to discuss whether their treatment (surgery, chemotherapy, or radiation) can be reasonably postponed until recovery. If it cannot, appropriate evaluation and treatment of these patients should occur in isolated settings with staff provided the appropriate Personal Protective Equipment (PPE).

Process for determining access to physical hospital infrastructure

Departments and health care Institutions should create panels to help fairly adjudicate health care resources. These panels should be blinded to providers to ensure fairness. It is imperative that Health Care Providers with expertise in neuro-oncologic decision making (Neurosurgeons, Radiation Oncologists, Medical Neuro-Oncologists) be part of the process. Hospital administration should provide transparent reporting on available resources locally and regionally based on available real-time information.

For procedures, the bare minimum of staff and Graduate Medical Education (GME) trainees (if any) should be permitted into the operating room both to minimize staff exposures and to conserve PPE. Patients should receive COVID testing prior to their procedures so that discussions about relative risks to patients and providers can be thoughtfully discussed. For example, a patient who tests positive for COVID-19, even if asymptomatic, should delay their procedure until their infection clears given risks to care providers and other hospitalized patients. Procedures in COVID-19 positive patients should be done only for true emergencies. We recommend that to the extent possible, preoperative testing or labwork be performed on the day of surgery for outpatients to minimize patient exposure to hospital settings. Patients with significant cytopenias from their cancers or their therapies should be evaluated in detail to determine whether a surgical intervention is advisable, given their potential poor ability to recover from a hospital acquired COVID-infection.

In terms of operating room dynamics, minimal OR staff should be present during intubation and extubation. Frozen section diagnoses should only be utilized when the information will change intraoperative management to help minimize staff exposure to the hospital setting. Tissue banking procedures should be either temporarily suspended or modified such that the minimal necessary staff are required to complete tissue procurement activities. Intraoperative neuromonitoring should be utilized only if absolutely necessary, again to minimize staff exposure.

Postoperative otherwise uncomplicated craniotomies should consider non-ICU settings for convalescence so these resources (ICU beds and ventilators) can be more appropriately deployed [8]. All efforts should be made for patients to go home rather than subacute nursing facilities or rehabilitation centers given the likely increased COVID risk in these health care settings. Considerable attention should be paid to reducing length of stay for hospitalized neuro-oncology patients to help reduce in-hospital patient exposure and reduce strain on health care institutions.

Pathology-specific considerations

Neuro-oncology represents a field with a broad range of pathology, ranging from relatively benign lesions to malignancies. While is tempting to focus on malignancies, where delay in care may result in abbreviated survival, neuro-oncologic illness also can irreversible neurologic deficits if not treated expeditiously even with benign tumors. Hereafter we describe some conditions where we believe timely access to care is appropriate even in the challenging setting we currently face.

High grade gliomas

For patients with newly diagnosed or recurrent high grade gliomas, urgent surgery should be performed with 1–2 weeks of diagnosis followed by adjuvant chemotherapy and radiation therapies per established standards. In cases where hypofractionated radiotherapy could be used to limit patient exposure in the hospital, this should be considered.

Low grade gliomas

For non-enhancing lesions that likely represent lower grade gliomas, these should be watched closely until clinical resources are more widely available. While it is understood that many of these lesions may behave more aggressively

based on molecular phenotype, under the current pandemic situation, close outpatient monitoring will stratify those patients who need more urgent intervention based on relevant imaging changes versus those whose treatment can be postponed until the direness of the situation improves.

Brain metastases

For patients with brain metastases, surgery should be offered only to those patients with large lesions causing symptoms related to mass effect and vasogenic edema and whose survival is expected to be greater than 3 months. For "grey zone" patients who might be treated with surgery and radiosurgery versus radiosurgery alone, we encourage providers to lean towards radiosurgery alone until hospital access improves, recognizing that in a subset of patients salvage therapy may be required. For patients who do not require surgery, radiation therapy in the form of either radiosurgery or whole brain radiation therapy should be offered at the discretion of the treating providers. Radiation therapy departments should establish protocols to minimize patient flow and provide masks to patients for use during clinical care. For patients where targeted or immunologic therapies are available as either a primary or neoadjuvant strategy, this should be considered [i.e. lung cancer(EGFR+), (ALK+), (RET+), (high PDL1); breast (her2+); melanoma(PDL1 and BRAF/MEK inhibitors); Renal cell(pazopanib, sunitinib), etc.] This is by no means an exhaustive list, but meant to provide examples of where systemic agents may be both efficacious and less resource intensive than surgery or radiation therapy.

Spine metastases

For patients with spinal metastases, conventional radiotherapy or radiosurgery should be offered where appropriate to prevent local growth and neurologic symptoms. Triaging based on symptoms amongst this population will of course be necessary. For patients with progressive deformity, neurologic deficits, and significant epidural spinal disease, surgery or emergent/urgent radiotherapy (i.e., spinal lymphoma) should be offered where appropriate [9]. For patients where targeted therapies or immunologic therapies are available as either a primary or neoadjuvant strategy, this should be considered.

Other lesions

While it is impractical to describe the appropriate management of all the lesions encountered in neuro-oncologic practice, we believe we have discussed the most common lesions encountered, especially complex given their multidisciplinary nature. In general, patients with progressive neurologic symptoms from brain and spine tumors should be managed expeditiously to prevent irreversible neurologic deficits even if the tumor is considered benign disease. For example, pituitary tumors or skull base lesions with rapidly worsening vision should receive treatment (more chronic vision loss cases can and will likely need to be delayed). Similarly, acoustic neuromas, meningiomas, etc. with hydrocephalus or other symptoms of brainstem compression should be managed expeditiously. Tumors associated with slow but progressive symptoms should be evaluated on a case by case basis. These decisions can adjudicated fairly by departments and resource allocation panels based on available hospital resources and patient needs across the hospital system. Finally, as previously mentioned, radiation therapy or systemic therapy should be considered as an alternative to surgery if possible during this crisis.

Clinical trials

Many clinical trials have suspended accrual given the current pandemic which is appropriate. It is crucial that health institutions and industry work diligently to serve current trial patients to avoid lapses in care. Institutions should explore the feasibility of telemedicine for trial related follow up visits. To the extent that any trials are opened, prioritization should be given to late stage trials assessing efficacy rather than trials assessing safety.

Patient support

Visitors to inpatients with neuro-oncologic disease should be minimized and/or even prohibited until epidemiologic data indicate it is safe to lift this burdensome restriction. It is important that providers educate patients on the ramifications of the COVID19 pandemic. They must also reassure them that they will be monitored as closely as possible and that their treatments will be delivered as soon as is practicable.

Government interventions

We believe that governments should let individual health systems manage their prioritization schema without rigid guidelines. However, we do believe that governments should establish civil immunity for health care providers who must make tough treatment allocation decisions in this extraordinary current pandemic crisis [10].

Governments should also increase production and availability of personal protective equipment (PPE) production, especially for health care workers so they remain safe and effective for their patients. In certain neuro-oncologic procedures like endoscopic endonasal procedures for skull base lesions, there is a risk of viral aerosolization with subsequent

infection of surgeons and operating room staff [11]. These patients should be tested for COVID-19 infection, even if asymptomatic. For patients who are or who may be infected, aerosol generating procedures should only be performed with powered, air purifying respiratory (PARP) equipment.

Neuro-oncologic patients who cannot self-isolate from their medical appointments (in facilities affected by the pandemic), should be provided masks to the extent practicable. That said, procurement strategies for PPE are outside the scope of this article. A governmental response coordinated at all levels (federal, state, and local) with dynamic allocation based on need would be preferred in contrast to current efforts in the United States.

No resource setting

In the event of all hospital resources being functionally devoted to treatment of COVID patients, neuro-oncologic treatments (surgery, radiosurgery, chemotherapy, or radiation therapy) should be focused on truly emergent situations. These indications might include impending demise relative to mass effect in the brain, impending paraplegia from mass effect in the spine, hematomas and infections.

Discussion

The COVID-19 pandemic has forced an unpleasant conversation with regards to judicious use of health care resources. The current crisis has forced hospital systems to carefully review and at times postpone medical care so that COVID-19 cases can be triaged and managed and so PPE and other infrastructure (e.g. ventilators, ICU beds) can be saved for COVID-19 patients. The inevitable consequence of this will be a backlog of semi-urgent cases across all of medicine and in neuro-oncology. The best way to manage this disruption is to thoughtfully consider when and how neuro-oncology care (both interventional and outpatient) must be delivered, while simultaneously considering both risks to patients/staff and burden on health care systems. We recognize the burden this pandemic has placed on our neuro-oncology patients and their families and hope this framework provides a rational approach to prioritize patient care.

We recognize the ethical burden placed on providers which others have discussed at length [4].

In this current crisis, neuro-oncology providers will have to be especially cognizant of the risks to patients and providers if aggressive in-hospital treatments are pursued. Moreover, these recommendations for treatment will have to be contextualized to current health system capabilities (i.e., ICU and ventilator availability). Finally, societal utilitarian concerns may have to be considered with perhaps younger patients or patients with better prognoses favored for intensive resources relative to older patients. There are no easy ways to manage these clinical scenarios and there is certainly no universally applicable algorithm, but depending on the severity of the pandemic at individual hospitals, these considerations may well be necessary.

Conclusion

We recognize the extraordinary implications of this case prioritization framework. Given the high acuity of many neuro-oncologic patients, the challenges to providers in selecting appropriate cases for treatment in this pandemic crisis are substantial. That said, we hope this document provides a framework that can guide clinicians in neuro-oncology practice as they adjudicate which patients to concentrate limited healthcare resources. We further recognize that our patients exist in a vast ecosystem of medical need. That said, we feel it is our duty in the neuro-oncologic community to advocate for our patients forcefully but responsibly as good citizens in the healthcare workforce.

Compliance with ethical standards

Conflict of interest The authors have no relevant conflicts of interest.

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