

Brain tumor neurosurgery in the COVID-19 era

Neurocirurgia de tumor cerebral na era COVID-19

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ABSTRACT

Introduction: COVID-19 is a current medical breakthrough. It has led to significant pressure on health systems worldwide, with care and structure being directed primarily to disease control. However, other pathologies did not cease to exist. In the specific case of brain tumors, we deal with a pathology with a high potential for life-threatening, even in benign cases. **Objective:** The objective of this study is to evaluate a sample of patients with brain tumors undergoing neurosurgical procedure during the pandemic period to determine the impact of COVID-19 pandemic on brain tumor surgery in a single Brazilian tertiary institution. **Methods:** We consecutively evaluated our patients prior and after COVID-19 pandemics during hospital stay. We included in analysis patients diagnosed and submitted to neurosurgical treatment of all primary and secondary brain neoplasms. Most cases are symptomatic brain metastases and gliomas. We excluded from analysis patients with asymptomatic or oligosymptomatic slow-growing and benign tumors (including meningiomas and schwannomas). **Results:** There was a decrease of 54% in total number of surgeries and 30% of brain tumor surgeries during COVID-19 pandemics. There was an increase of mortality rate between pre-COVID era and post-COVID era (4% versus 19%), however it was not statistically significant. **Discussion:** Neurooncological patients are facing a specially complex situation during COVID-19 pandemics. On one hand, they need to follow caution measures but on the other hand they need proper routine and emergency evaluation when necessary. They are more prone to complications in hospital or outward environments.

Keywords: COVID-19; public health; brain neoplasms; neuro-oncology.

RESUMO

Introdução: A COVID-19 é uma doença nova e levou a uma pressão significativa nos sistemas de saúde em todo o mundo, com atendimento e estrutura direcionados principalmente para o controle da doença. No entanto, outras patologias não deixaram de existir. No caso específico dos tumores cerebrais, tratamos de uma patologia com alto potencial de risco de vida, mesmo em casos benignos. **Objetivo:** O objetivo deste estudo é avaliar uma amostra de pacientes com tumores cerebrais submetidos a procedimento neurocirúrgico durante o período pandêmico para determinar o impacto da pandemia de COVID-19 na cirurgia de tumor cerebral em uma única instituição terciária brasileira. **Métodos:** Avaliamos consecutivamente nossos pacientes antes e depois da pandemia de COVID-19 durante a internação hospitalar. Incluímos na análise, pacientes diagnosticados e submetidos a tratamento neurocirúrgico de todas as neoplasias cerebrais primárias e secundárias. A maioria dos casos são metástases cerebrais sintomáticas e gliomas. Excluímos da análise pacientes com tumores benignos e de crescimento lento assintomáticos ou oligossintomáticos (incluindo meningiomas e schwannomas). **Resultados:** Houve uma redução de 54% no número total de cirurgias e 30% nas cirurgias de tumor cerebral durante a pandemia de COVID-19. Houve aumento da taxa de mortalidade entre a era pré-COVID e a era pós-COVID (4% versus 19%), porém sem significância estatística. **Discussão:** Os pacientes neuro-oncológicos estão enfrentando uma situação especialmente complexa durante a pandemia de COVID-19. Por um lado, eles precisam seguir medidas de cautela, mas por outro lado, eles precisam de rotina adequada e avaliação de emergência quando necessário. Por serem mais vulneráveis, os equilíbrios entre medidas de cautela para o vírus e o tratamento da doença de base são igualmente importantes.

Descritores: COVID-19; saúde pública; neoplasias encefálicas; neuro-oncologia.

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INTRODUCTION

In November 2019 a new pneumonia caught the attention of health services in the city of Wuhan, Hubei province in China. Subsequently, it was identified as a subtype of coronavirus, being called SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus 2)¹. The disease spread rapidly across all continents, being declared by the World Health Organization (WHO) as a pandemic in March 2020, showing itself to be highly infectious, with a high rate of complications²⁻⁵.

The magnitude of the outbreak, and the need for advanced respiratory support, has led to significant pressure on health systems worldwide⁴, with care and structure being directed primarily to disease control. Most countries have adopted social isolation measures to decrease social interaction and thus break the infection spreading. Although considered necessary, social isolation has brought several subsequent outcomes, such as economic impact, temporary stopping of education and outpatient medical care⁶⁻¹⁷. The impact of such stopping in health care is yet to be determined.

In Brazil, first confirmed COVID-19 case was in 26th February 2020, while first death was registered in 12th March 2020. The country reached its plateau phase in May-June 2020 and is facing an even worse second wave of infection while marching towards the mark of over 500 thousand deaths¹⁸⁻¹⁹.

However, other pathologies did not cease to exist. Cases like oncological diseases and serious cardiovascular diseases continued to affect the system, bringing two important challenges for the entire community involved in health care, from managers to frontline professionals: treating these patients in a standard way, further pressing on a system of health already affected by Covid-19 and during

treatment (hospitalization, surgery, outpatient, cancer treatment), exposing these patients to the risk of contracting COVID, increasing their risk morbidity.

In the specific case of brain tumors, we deal with a pathology with a high potential for life-threatening, even in benign cases. Gliomas and brain metastases may demand surgical treatment as soon as possible to control intracranial hypertension and allow proper treatment and survival²⁰⁻³⁶. Other tumors, even histologically benign, may demand prompt surgical treatment due to large size and/or associated focal neurological deficits. In addition, most patients have other comorbidities, use chemotherapy / immunosuppressive treatment, and are at high risk of complications in an eventual infection. In other words, patients harboring malignant intracranial tumors cannot wait for the quarantine and are of high risk.

OBJECTIVE

The objective of this study is to evaluate a sample of patients with brain tumors undergoing neurosurgical procedure during the pandemic period to determine the impact of COVID-19 pandemic on brain tumor surgery in a single Brazilian tertiary institution.

METHODS

We consecutively evaluated our patients in the period of three months prior to COVID-19 in Brazil (from January 2020 to March 2020) and 3 months after beginning of social isolation measures proposed (from April 2020 to June 2020) in a Brazilian tertiary hospital (Hospital do Servidor Público Estadual "Francisco Morato de Oliveira" HSPE-FMO, de São Paulo). We also included a similar analysis of a period in 2019 to allow comparison to a baseline (April to

June 2019). Patients were users of the medical facility coming from emergency rooms or from Hospital wards. The project was approved by Ethics and Research Committee.

We included in analysis patients diagnosed and submitted to neurosurgical treatment of all primary and secondary brain neoplasms. Most cases are symptomatic brain metastases and gliomas. We excluded from analysis patients with asymptomatic or oligosymptomatic slow-growing and benign tumors (including meningiomas and schwannomas). During the pandemic quarantine, all non-malignant and slow-growing tumors which were asymptomatic or oligosymptomatic had their treatment postponed, unless if presenting with acute neurological deterioration.

Relevant medical data were analysed. All patients underwent clinical evaluation, obtaining medical history, comorbidities, physical examination, neuroimage and deaths. We did not focus on surgical strategies and outcomes. We performed a brief quantitative analysis of brain tumor neurosurgery before and after COVID-19. Additionally we used the data from a previous year (2019) as a baseline to allow comparison.

STATISTICS

In this study, numerical data are presented as mean \pm standard deviation or median with range when appropriate. Categorical data are presented as percentages. When comparing groups the level of significance will be considered when $p < 0.05$.

RESULTS

Sample characterization

In 2019, from April to June there were 153 neurosurgical procedures, being 24 of

brain tumors. In 2020, from January to March this number decreased to 111 neurosurgical procedures, being 30 of brain tumors; from April to June we had a decrease to 70 surgeries and 21 of brain tumors. (Table 1 and Figure 1).

April-June 2019

Among 24 operated patients there were 12 men and 12 women. Mean age was 67.5 ± 9 years old. There were 12 pituitary adenomas, 4 glioblastomas and 8 metastases. There was one hospitalar death in the group (Table 1 and Figure 1).

January-March 2020

Among 30 operated patients there were 12 men and 18 women. Mean age was 56.7 ± 11 years old. No patient in this group presented COVID-19 during hospital stay. There were 3 pituitary adenomas, 17 gliomas, 5 metastases, 4 meningiomas and 1 lymphoma. There were 2 deaths in the group (6.6% of patients). No patients in this group had COVID-19 infection. (Table 1 and Figure 1).

April-June 2020

Among 21 operated patients there were 9 men and 12 women. Mean age was 64.6 ± 5.5 years old. There were 10 cases of gliomas, 3 meningiomas, 4 metastases, 2 vestibular schwannomas, 1 lymphoma and 1 hemangioblastoma. There were 4 deaths in the group (19% of patients) (Table 1 and Figure 1). Among deaths, 3 patients presented with COVID-19 infection, being 1 metastasis, 1 vestibular schwannoma and 1 glioblastoma.

Comparison

Comparing the three above periods, there was a decrease of 54% in total number of surgeries. The number of brain tumor surgeries has decreased 12.5% when comparing Apr-Jun 2019 period with Apr-Jun 2020 and also decreased 30% when comparing Jan-Mar period to Apr-Jun. Histology of operated tumors

had no significant change, being composed mainly by gliomas, metastasis or other tumors with neurological deterioration. However, during the ascendant phase of pandemic there were no transsphenoidal surgeries to treat pituitary adenomas. There was an increase of mortality rate between pre-COVID era and post-COVID era (4% versus 19%), however it was not statistically significant.

Table 1 - Surgical data of patients operated due to brain tumors in three periods: April to June 2019, January to March 2020 and April to June 2020.

	Apr-Jun 2019	Jan-Mar 2020	Apr-Jun 2020
Total number of neurosurgeries	153	111	70
Total number of brain tumor surgeries	24	30	21
Brain metastases	8	5	4
Malignant gliomas	4	17	10
Pituitary adenomas	12	3	0
Others	0	5	7
Deaths (mortality in %)	1 (4%)	2 (6.6%)	4 (19%)

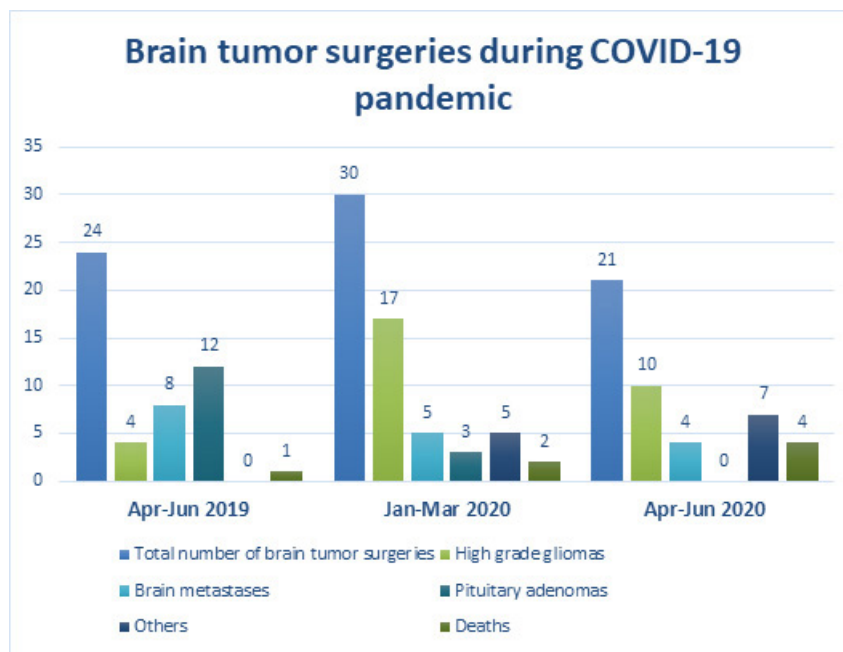


Figure 1 - The Figure displays a stability of number of brain tumors but a higher mortality in brain tumor surgery during COVID 19 pandemics.

DISCUSSION

COVID-19 pandemic is a complex situation demanding changes in individual and collective management of health system. In Brazil, first confirmed COVID-19 case was in 26th February 2020, while first death was registered in 12th March.

Nowadays the country is reaching the mark of 500 thousand deaths and is facing a second wave of infection while vaccine is implemented¹⁸⁻¹⁹. At the beginning of curve ascending phase, most states and cities adopted World Health Organization (WHO) recommendations, including social distancing and stopping of unessential services¹⁻²⁰. The only services kept working were

those related to transport, logistic, health care, pharmaceuticals and food supply. Major social and health system reaction included social distance to decrease infection rate and thus avoid supramaximal hospital overload¹⁻²⁰.

In healthcare institutions there was an immediate impact, ceasing elective surgeries and outpatient evaluations. Full hospital capacity was driven to receive COVID-19 patients. Although contingency plans tried to maintain main health assistance, adopted pandemic measures led to a large amount of patients hesitating and delaying to attend to hospital even in urgent situations. In Brazil, some institutions may have faced a decrease of up to 70% in their patient flow, including high risk patients such as cardiovascular and oncologic ones (unpublished data). The impact of current pandemic state on the occurrence of brain tumor surgery and health care support search is yet to be fully understood. In this study, we evaluated a consecutive sample of subjects in order to determine the impact of COVID-19 pandemic on brain tumor surgery.

Malignant brain neoplasms are life-threatening conditions which may course with acute and subacute symptoms such as headache, vomiting, focal neurological deficits and impaired consciousness¹⁰⁻¹⁵. Gliomas and brain metastases may demand surgical treatment as soon as possible to control intracranial hypertension and allow proper treatment and survival¹⁰⁻¹⁵. Additionally, these patients are especially fragile, immunosuppressed and prone for surgical/clinical complications, especially concerning to the risk of COVID-19 infection 25-36.

Several institutions reacted to COVID-19 performing special patient and treatment flows²³⁻³⁶. Modern health care systems had to change from a "patient-centered" care to a "community-centered" care perspective

²⁷. Main points in most cases is to separate positive and negative patients according to pre-hospitalization polymerase chain reaction (PCR) results, focusing on massive testing. Then, other cautions were adopted in wards and surgical centers. There were new protocols for anesthesiology²⁶ and surgery, even in cases of endoscopic transnasal approach^{26,32}. In some centers, surgery was postponed or substituted by radiosurgery when possible²⁴. All these measures attenuated the impact of COVID-19 and improved results after being implemented. However, implications and impact of COVID-19 has still remained relevant^{27,33}.

One of the points that should be highlighted is the marked reduction in the number of surgeries for pituitary tumors, performed via transphenoidal. The number of procedures dropped from 12 (April-June 2019) to no procedure between April-June 2020. Papers in Italy and China during the peak of the pandemic showed the increased risk of contagion in aerosol-generating procedures. Following these data, there has been strong recommendations to avoid the transphenoidal approach, due to the high risk of transmission^{26,32}.

Our institution is a tertiary university hospital with approximately one thousand beds, being approximately 100 intensive care units (ICU) while the other are nursery units. It is the reference health institution for over 2 million people throughout São Paulo State, receiving patients from many cities. In this study, we evaluated consecutive samples of patients submitted to brain tumor surgery before and after COVID-19 pandemic.

There was a decrease in total number of surgeries and in number of brain surgeries. Most patients operated in our service come from the emergency service, which was kept working even during pandemics. Besides, it

seems that symptomatic patients due to large tumors or eloquent area locations continued to search for medical help despite pandemics. On the other hand, no elective surgeries of brain tumors were performed during this time. Additionally, there was an increase of mortality rate between pre-COVID era and post-COVID era (4% versus 19%), however it was not statistically significant.

COVID-19 infection impacted negatively in mortality of brain tumor patients. This was previously reported by other authors²⁵⁻³⁶.

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