

Original Article

## Effects of the covid-19 pandemic on paediatric neurosurgery in turkey

### *Türkiye'de covid-19 pandemisinin pediatrik nöroşirürji üzerine etkileri*

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#### Abstract

**Aim:** The coronavirus disease 2019 (COVID-19) pandemic is a catastrophe that has affected millions worldwide and changed the past world order in all respects. In particular, health institutions have been greatly affected as procedural changes were required in all medical specialties, including neurosurgery. In this article, we describe the paediatric neurosurgery patient management practice in our clinic and changes in this procedure in Turkey during the COVID-19 pandemic.

**Material and Methods:** Patient movements from November 2020 to January 2021 and November 2021 to January 2022 in the paediatric neurosurgery department of our clinic were retrospectively evaluated. Further, we performed a literature review.

**Results:** From November 2020 to January 2021 and November 2021 to January 2022, 1888 and 2895 patients were examined at the outpatient clinic and 65 and 156 surgeries were performed, respectively. At the peak of the COVID-19 pandemic, the number outpatient visits decreased by 65.2% and that of surgeries decreased by 41.6%.

**Conclusion:** During the pandemic, the first step in surgical procedures is to distinguish between emergency and elective cases. In this regard, shunt dysfunction, acute hydrocephalus, meningomyelocele and tumours that cause clinical impairment are prioritized in paediatric neurosurgery. Although the health care system is under great pressure due to the COVID-19 pandemic, it remains committed to prioritising patients. In particular, paediatric patients are more vulnerable in all respects and require greater care, especially in such trying times.

**Keywords:** Children, health care system, SARS-CoV-2

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## Öz

**Amaç:** Koronavirüs hastalığı 2019 (COVID-19) pandemisi, dünya çapında milyonlarca insanı etkileyen ve geçmiş dünya düzenini her bakımdan değiştiren bir felakettir. Özellikle, nöroşirürji de dahil olmak üzere tüm tıbbi uzmanlık alanlarında prosedür değişiklikleri gerektiğinden sağlık kurumları büyük ölçüde etkilenmiştir. Bu yazıda kliniğimizde pediatrik nöroşirürji hasta yönetimi uygulamasını ve Türkiye'de COVID-19 pandemisi sırasında meydana gelen değişiklikleri anlatacağız.

**Gereç ve Yöntemler:** Kliniğimizin pediatrik nöroşirürji bölümünde Kasım 2020 - Ocak 2021 ve Kasım 2021 - Ocak 2022 tarihleri arasında hasta hareketleri retrospektif olarak değerlendirildi.

**Bulgular:** Kasım 2020 - Ocak 2021 ve Kasım 2021 - Ocak 2022 tarihleri arasında poliklinikte 1888 ve 2895 hasta incelendi ve sırasıyla 65 ve 156 ameliyat yapıldı. COVID-19 pandemisinin zirvesinde, ayakta tedavi ziyaretlerinin sayısı% 65.2, ameliyatların sayısı% 41.6 azaldı.

**Sonuç:** Pandemi sırasında cerrahi işlemlerde ilk adım acil ve elektif olgular arasında ayırım yapmaktır. Bu bağlamda pediatrik nöroşirürjide şant disfonksiyonu, akut hidrosefali, meningomyelose ve klinik bozukluğa neden olan tümörlere öncelik verilmektedir. Özellikle, pediatrik hastalar her bakımdan daha savunmasızdır ve özellikle bu tür zamanlarında daha fazla bakıma ihtiyaç duyarlar.

**Anahtar Kelimeler:** Pediatri, Sağlık sistemi, SARS-CoV-2

## Introduction

The coronavirus disease 2019 (COVID-19) pandemic is a global catastrophe that has disrupted the lives and livelihoods of people worldwide since December 2019. There have been more than one wave of this global crisis. The protocols implemented to control the spread of COVID-19 have seriously affected medical practices and caused disruptions in the health care system.

This situation has also affected the neurosurgical community and has led to changes in patient management. The pandemic has had a negative impact on all elective neurosurgical activities and also led to changes in the management of neurosurgical emergencies [1].

Although the clinical manifestations of COVID-19 are usually less severe particularly in paediatric patients than in adults, this study included a group of patients who are already vulnerable to infection because of the fact that these patients are young children and infants [2].

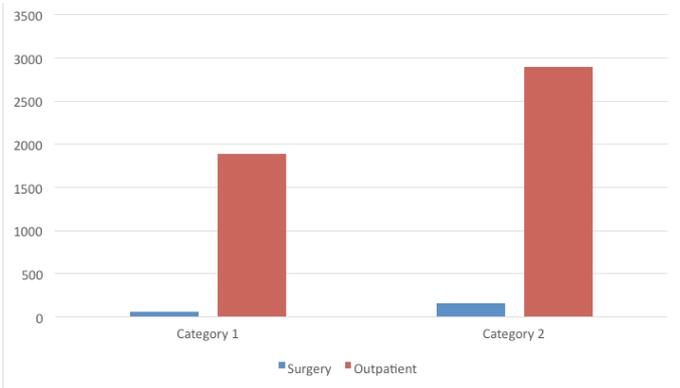
This article aimed to present the changes in paediatric patient management caused by the pandemic in the field of neurosurgery.

## Material and Methods

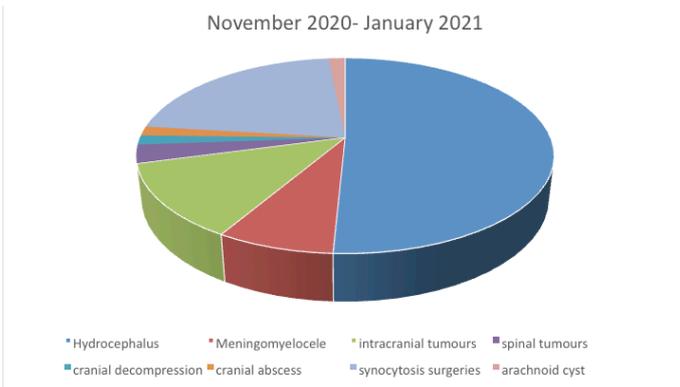
To evaluate the paediatric neurosurgical activities conducted in our clinic during the pandemic period, patient movements were retrospectively evaluated, and the literature was reviewed. The number of surgical procedures performed and patients examined at our outpatient clinic from November 2020 to January 2021, when the pandemic peaked in Turkey, and November 2021 to January 2022 were evaluated. Data were collected in Microsoft Excel (Microsoft Corporation, Redmond, Washington, USA) and analysed using the SPSS version 22.0 (IBM Corporation, Armonk, New York, USA). PubMed, UlakBİM and Web of Science databases were searched using the terms 'pandemic, paediatric neurosurgery, COVID-19, Turkey, healthy system'.

## Results

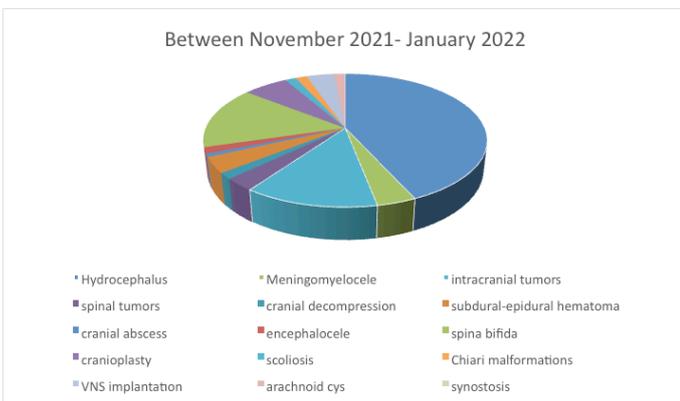
From November 2020 to January 2021, 1888 patients were examined at the outpatient clinic and 65 surgeries were performed, whereas from November 2021 to January 2022, 2895 patients were examined at the outpatient clinic and 156 surgeries were performed (Figure 1). Of the 65 surgeries performed from November 2020 to January 2021, 33 were emergency hydrocephalus surgeries (50.7%) and 5 were meningomyelose surgeries (7.9%). In addition, 8 intracranial and 2 spinal tumour surgeries as well as 1 cranial decompression and 1 cranial abscess surgery were performed as emergency surgeries. Elective surgeries included 1 arachnoid cyst surgery and 14 synocytosis surgeries (Figure 2). For the synocytosis surgeries performed during this period, time-based semi-elective craniostosis surgeries were performed to prevent open surgery considering patient age and to prevent vault reconstruction. From November 2021 to January 2022, of the 156 (36.5 %) surgeries performed, 57 were emergency hydrocephalus surgeries and 5 were meningomyelose surgeries (3.2%) (Figure 3). Additionally, emergency surgeries included 17 intracranial tumour, 4 spinal tumour, 2 cranial decompression, 5 subdural-epidural hematoma and 2 encephalocele surgeries as well as 1 cranial abscess surgery. With regard to elective surgeries, 8 cranioplasty; 5 vagus nerve stimulator implantation and 2 scoliosis, 2 Chiari malformation, 2 arachnoid cyst, 20 spina bifida and 21 synostosis surgeries were performed (Figure 3). The rate of performing other surgeries increased (from 41.5% to 69.2%) after the pandemic peaked. It has been observed that during the period when the pandemic was the most common, there was a 65.2% decrease in the number of outpatient visits and a 41.6% decrease in the number of surgeries performed.



**Figure 1.** A graphic representation of the number of patients admitted to the outpatient clinic and operated on in the pediatric neurosurgical clinic between November 2020- January 2021 and November 2021- January 2022.



**Figure 2.** Between November 2020- January 2021, 33 of the 65 surgeries performed consisted of emergency hydrocephalus surgeries (50.7%) and 5 of meningomyelocele surgeries (7.9%)



**Figure 3.** Between November 2021- January 2022, 57 of the 156 surgeries performed consisted of emergency hydrocephalus surgeries and 5 of meningomyelocele surgeries.

## Discussion

In December 2019, a new zoonotic coronavirus (SARS-CoV-2) was identified in Wuhan (China) and found to cause COVID-19, which quickly turned into a pandemic [3]. The

COVID-19 pandemic has made it necessary for the health care systems worldwide to fit the new world order. Algorithms were developed in this direction, and patient and hospital management formats had to be changed. This affected the health care system's ability to handle a health emergency correctly. To increase resources such as hospital beds and medical staff, procedures that were considered elective or non-urgent were postponed or cancelled. Based on the COVID-19 pandemic data that were obtained first in China and then worldwide, children under the age of 10 years were found to have significantly lower susceptibility to SARS-CoV-2 infection compared with adults [4].

Elective and outpatient procedures in the paediatric neurosurgery department as well as in other departments have been severely affected by the COVID-19 pandemic. The decrease in the number of surgeries performed during the pandemic is attributed to the changes in surgical procedures, increased preparation time and lack of personnel. To limit the use of consumables and avoid waste of time, basic team members were advised to work as much as possible. In many hospitals, the number of operating rooms that are potentially in use has been limited. Many centres followed the procedures described in the guide developed by the American College of Surgeons Clinic for paediatric neurosurgery surgical triage decision-making [5]. This led to the establishment of an algorithm, supplies, personal protective equipment, intensive care beds, blood product reserves for surgery, anaesthesia procedures and operating room personnel for potential patients who are COVID-19-positive to minimise exposure. Moreover, under the pandemic conditions and management scheme, in some centres, the concept of 'emergency' was defined as a case that could not be postponed for 14 days, whereas in other centres, it was defined as a case that could not be postponed for  $\geq 30$  days [6]. In our own clinic, we have managed to treat cases that cannot be postponed for 14 days as emergency cases.

In many centres, patients are managed on the basis of the following three-level system: (1) basic/emergency: immediate interventions, without death or disability (e.g. trauma, hernia, acute hydrocephalus, etc.); (2) time-sensitive basic/emergency: newly diagnosed or progressive tumour, shunt dysfunction, myelomeningocele repair, baclofen withdrawal, spinal cord compression, etc. and (3) cases for which safe re-elective cases can be planned after  $\geq 30$  days (e.g. craniofacial surgery, Chiari decompression, baclofen pump placement, rizotomi, etc.) [7].

Several policies have been put forward regarding the need to test all patients for COVID-19 before surgery [7]. These recommendations

were followed, and nasopharyngeal swab testing was performed for each patient; however, emergency surgeries were performed without waiting for the test results. In many centres, especially to limit neuroradiological studies to only those deemed urgent and necessary, joint decisions were made again in our own hospital. We paid attention to this issue, and the number of imaging procedures performed was reduced to a minimum.

Preoperative examinations for patients with COVID-19 who were scheduled to undergo elective surgeries were delayed. This led to the requirement for surgery time extension. Furthermore, in some patients, such as those with impaired respiratory tract or lung function, the need for intermittent or prolonged ventilation assistance led to an even further extension of this process. Ventriculoperitoneal shunt placements and supra-infra tentorial tumour surgeries were the most common surgeries performed. There was a significant decrease in subspecialty elective surgeries such as tethered cord, scoliosis and craniostylosis surgeries.

Hu et al. recommended that all postoperative patients be treated as suspected COVID-19 cases and quarantined for at least 2 weeks [8]. However, due to the fact that the number of beds is not enough and the length of the hospital stay increases the risk of infection, especially in the paediatric patient group, and due to the anxiety of families, we have not been able to implement it in our own clinic. However, we have tried to implement the necessary measures by limiting the number of visitors whenever possible.

Khazaei et al. showed that some trauma cases are asymptomatic according to the findings of lung computed tomography, which is widely used to screen for trauma severity. In addition, they suggested that COVID-19 may be undetected in such patients due to post-traumatic fever [9]. The trauma patients we operated on were evaluated urgently for COVID-19; those with positive results were operated on with appropriate precautions. Similarly, patients with tumours requiring urgent surgery were regarded as suspected COVID-19 cases and appropriate precautions were taken both before and during surgery. Nasopharyngeal swab tests were also performed for emergency cases before starting the surgery; however, the surgeries were started before receiving the results. The test results were effective for postoperative patient management of emergency cases.

Despite the lack of clear guidelines for the provision of care to children with cancer, paediatric anticancer treatments should not be discontinued or delayed. Conversely, in order to avoid situations that increase the risk of infection for immunocompromised children with cancer, active strategies

and hygienic training programmes should be guaranteed and implemented with priority [10]. Boulad et al. revealed that paediatric patients with cancer require hospitalisation for severe symptoms of only 5% of infected patients due to SARS-CoV-2 [11]. In addition, malignant paediatric brain tumours are characterised by rapid growth, which requires prompt diagnosis and appropriate treatment. Therefore, a treatment delay or change can compromise their effectiveness and reduce the patients' survival rates. Flores et al. reported that delayed diagnosis of brain tumours correlates with a worse prognosis [12]. Considering these, operations were performed quickly without any conditions for children with a tumour that has started a herniation that causes clinical deterioration. For children with a glioma that is clinically better, the surgeries have not been postponed in the same way. As a postoperative treatment for glioma or a non-surgical option, chemoradiotherapy has been proposed, which requires patients to regularly visit medical institutes. However, these regular hospital visits further increase the exposure risk to COVID-19. To solve this dilemma, Mohile et al. proposed an adjuvant treatment protocol for at-risk patients with glioma due to treatment protocols that require frequent hospital visits. According to this protocol, they recommended not to use temozolomide with shorter radiation therapy for patients with newly diagnosed wild-type glioma. As for patients with low-grade astrocytoma and oligodendroglioma, postponing the treatment was recommended in asymptomatic patients [13].

Patel et al. said that the transsphenoidal approach strongly suggests that the transnasal approach should be avoided as much as possible because there is a significant amount of exposure to aerosols in the surgeries used [14].

Jean et al. evaluated the case number changes in the neurosurgical clinic during COVID-19. They said that roughly half of the participants reported a >50% reduction in total surgery volume in the survey study [15]. Accordingly at our clinical data, there has been a 27.7% decrease in the number of paediatric elective cases other than emergency surgeries.

In summary, as a paediatric neurosurgery clinic during the pandemic, the method which was followed was to first distinguish between emergency and elective cases. In this context, shunt dysfunction, acute hydrocephalus, meningomyelocele and tumours that caused clinical deterioration were our priority operations. Then, taking into account the patient's clinical conditions, a nasopharyngeal swab for SARS-CoV-2 was performed for each patient before surgery. If the swab was negative, the patient was admitted to the neurosurgical ward, considering it negative. If there is

any positivity, if it is an elective case, it is postponed until the negativity is achieved. However, if the emergency intervention was necessary, surgery and postoperative care were carried out in pandemic services with the necessary precautions taken. Again, urgent cases that needed surgery without waiting for swab results were considered positive, and surgery was started. Then, management was shaped according to the test result.

## Conclusion

The COVID-19 pandemic has caused considerable changes in the national and local health care systems, economies and patient care worldwide. The pandemic has affected all neurosurgical subspecialties as well as negatively affected paediatric neurosurgery, leading to measurable reductions in case load, inpatient consultations and outpatient visits.

Doctors all over the world are exhausted in this process, and we have fought very well and are still continuing to do so. Although the management of the paediatric patient group is more specific in the neurosurgical clinic, it also required a different management process to be implemented during the pandemic. For children, it is important that surgeries are not postponed as much as possible and performed while taking the necessary precautions.

## Declaration of conflict of interest

The authors received no financial support for the research and/or authorship of this article. There is no conflict of interest

## Ethics approval

This study was approved by the local ethics committee of Health Sciences University Dr. Suat Seren Chest Diseases and Chest Surgery Training and Research Hospital (approval number: 49109414- 604.02).

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