



The Consequences of the COVID-19 Pandemic on Pediatric Neurosurgery in the Middle East

Masoudi MS¹, Habibzadeh A^{2,3}, Movahedi F¹, Zafarshamspour S^{1,4}, Zangeneh S¹, Shahabinejad P¹ and Taheri R^{1*}

¹Department of Neurosurgery, Pediatric Neurosurgery Research Center, Shiraz University of Medical Sciences, Iran

²Student Research Committee, Fasa University of Medical Sciences, Iran

³USERN Office, Fasa University of Medical Sciences, Iran

⁴Department of Surgery, Rafsanjan University of Medical Sciences, Iran

Abstract

The SARS-CoV-2-caused COVID-19 pandemic has impacted the population, society, and behavioral patterns and preferences. Stay-at-home laws, social isolation, and self-quarantine were used to prevent viral spread and healthcare expenditures. Neurosurgical patients who need acute care may have suffered due to a lack of ICU beds, ventilators, and intensivists. The goals of this study were to examine how COVID-19 affects pediatric neurosurgical diseases and compare the daily incidence, patient demographics, injury patterns, and care strategies between the 2020 pandemic and the previous year.

Methods: We conducted a retrospective study of our institution's prospectively recorded registry with IRB approval. The study's major outcome variables were incidence and patient characteristics, including age, gender, admission context, and COVID-19 test status.

Results: The study included 456 neurosurgical pediatric patients. During the pandemic, our service admitted 456 fewer pediatric patients than before (604). Monthly admissions were much lower during the pandemic (30.4 ± 7.02 vs. 40.2 ± 4.1). Before the pandemic, the fewer patients admitted to our facility in a month were 31, but afterward, it was 20. Before the pandemic, we treated 47 pediatric patients; during the outbreak, 45. During the pandemic, hospitalizations from car accidents also dropped (20.3% vs. 34.4%).

Discussion and Conclusion: This study shows the compelling ethics of pediatric neurosurgeons in response to the COVID-19 pandemic in a low-income nation with few resources. This research examines individual and societal actions amid conflict, social alienation, and government shutdowns.

This promotes future implementations to improve treatment procedures and decrease damage. If referrals and loco-regional transfers decline significantly, pediatric neurosurgery tertiary-care facilities can be better placed to handle patients during times of severe resource allocation. A move toward outpatient care, needed by the epidemic, may reduce hospital admissions and associated costs.

Keywords: COVID-19; Pediatric neurosurgery; Pandemic

Introduction

The Coronavirus Disease 2019 (COVID-19) pandemic caused by SARS-CoV-2 has had a major impact on the population, society, and behavioral patterns. Stay-at-home regulations, social isolation, and self-quarantine were among the official and personal measures taken to limit viral spread and reduce healthcare costs [1]. Elective services were briefly halted to reduce virus exposure and the healthcare system's load. However, the influence of non-elective treatment, such as that caused by trauma, on incidence and epidemiology has yet to be thoroughly explored [2,3]. Along with the sharp fall in outpatient appointments over this time, a large reduction in access to the emergency room for minor and serious diseases has also been noted. Patients might have avoided seeking treatment even if they had severe symptoms out of fear of spreading the illness. As an alternative, individuals may have had trouble receiving medical care due to the immense commitment required to manage the newly arising condition and restrictions on people's movement [3]. As the majority of resources,

OPEN ACCESS

*Correspondence:

Reza Taheri, Department of Neurosurgery, Pediatric Neurosurgery Research Center, Shiraz University of Medical Sciences, Shiraz, Iran, E-mail: reza.neuro@gmail.com

Received Date: 24 Feb 2023

Accepted Date: 27 Feb 2023

Published Date: 16 Mar 2023

Citation:

Masoudi MS, Habibzadeh A, Movahedi F, Zafarshamspour S, Zangeneh S, Shahabinejad P, et al. The Consequences of the COVID-19 Pandemic on Pediatric Neurosurgery in the Middle East. *J Neurol Neurosurg Spine*. 2023; 6(1): 1024.

Copyright © 2023 Taheri R. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

such as ICU beds, ventilators, and intensivists, were devoted to the care of COVID patients, neurosurgical patients who needed acute care may have suffered. However, there are also significant disparities between the industrialized and developing worlds (such as Iran); Iran has a very large and dense population, few resources, and a health infrastructure that is already under strain. There have recently been a few papers from the developing world discussing how neurosurgeons view the pandemic and how neurosurgery practice has changed as a result, but none from the Middle East [4,5].

Our academic Level I Pediatric Neurosurgery Center admits more than 700 children a year for various neurosurgical conditions. It serves as a referral center for more than 20 hospitals in the region. This study looked at how the COVID-19 pandemic affected the incidence and features of pediatric neurosurgical disorders. The researchers predicted that the outbreak would have little impact on the number of emergent neurosurgery cases or the epidemiology. The objectives were to compare the daily incidence, patient demographics, injury patterns, and care strategies between the 2020 pandemic and the same period from the prior year.

Methods

After receiving consent from the Institutional Review Board of Shiraz University of Medical Sciences, the investigators conducted a retrospective study of our institution's prospectively recorded registry. Time was a preliminary modifier, which we used to initiate the enrollment of our subjects into the research group. The day on which the pandemic was announced in our country was March 14th, 2020. The key outcome variables of the study were the incidence and characteristics of patients admitted, which were categorized as age, gender, setting of admission (emergent/urgent vs. elective), and status of the COVID-19 test. The type of care given also served as an input (no intervention, procedure performed in the operating room within 24 h of admission, the procedure performed in the operating room after 24 h of consultation but within the same hospitalization, or operative intervention to be postponed). Total numbers and daily admissions were used to calculate incidence rates. Death rates, transfers, departures against medical recommendations, and refusals to receive treatment were all documented. Our research was

scheduled to conclude in May 2021, when it was anticipated that the epidemic would be declared over. The cohort was subjected to the generation of a variety of statistics. To determine whether or not the data followed a normal distribution, the Shapiro-Wilk test was carried out. The independent sample t-test was used to assess the degree of difference in daily admission volume across the primary research groups. The Pearson Chi-square and Fisher's Exact tests as well as the Mann-Whitney U test were conducted to assess whether or not there was a significant difference in the outcome variables. Using the Chi-square and Fisher's Exact tests, we were able to calculate the Relative Risk (RR) along with 95% confidence intervals. The level of significance was determined by applying a two-sided critical value of p less than 0.05. All statistical analyses were conducted by SPSS Statistics Software, Version 27.0 (Armonk, NY, USA).

Results

The research included a total of 456 pediatric patients who needed neurosurgical treatment. When compared to the time before the pandemic, the number of pediatric patients admitted to our service during the pandemic (n=456) was significantly lower than the number of pediatric patients admitted during the pre-pandemic era (n=604). There was also a substantial difference in the monthly incidence of admissions (30.4 ± 7.02 for the pandemic and 40.2 ± 4.1 for the pre-pandemic). Before the pandemic, the lowest number of patients admitted to our unit in a single month was 31, but after the epidemic, that number dropped to 20 individuals. The differences in the number of patients admitted to hospitals throughout the study period as compared to the same period before the epidemic are depicted in (Figure 1).

Patients treated before the pandemic had a median age of 5 years old (range: 2 months to 16 years), whereas patients seen during the epidemic had a median age of 6 years old (range: 3 months to 15 years). Males made up 60% of the population during the pandemic, while they made up 65% of the patients before the epidemic. Between the two time periods, there was no discernible variation in the gender breakdown of the population. During the pandemic, the percentage of patients transferred in from other hospitals and clinics was lower than it had been in the previous year (60.0% vs. 73.2%). During the

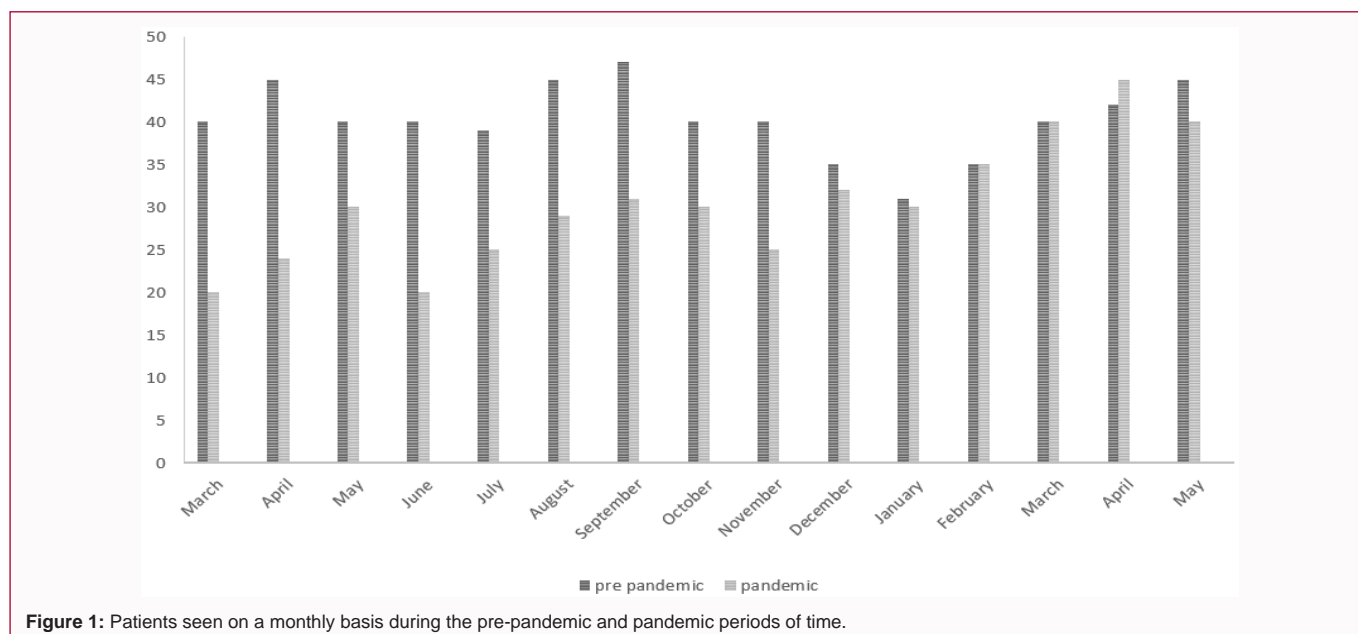


Figure 1: Patients seen on a monthly basis during the pre-pandemic and pandemic periods of time.

Table 1: Comparison of demographic features between the pandemic cohort and the pre-pandemic cohort.

| Feature | Pandemic cohort | Pre-pandemic cohort |
|--|------------------------------|------------------------------|
| Total subjects | 456 | 604 |
| Monthly admissions | 30.4 ± 7.02 | 40.2 ± 4.1 |
| Minimum number of admissions (per month) | 20 | 31 |
| Maximum number of admissions (per month) | 45 | 47 |
| Mean age | 6 yrs. (3 months to 15 yrs.) | 5 yrs. (2 months to 16 yrs.) |
| Male/Female ratio | 60%/40% | 65%/35% |
| Transferred in patients (%) | 60% | 73.2% |
| Admissions via an EMS alert | 1.2 | 1.0 |
| Subjects required a neurosurgical intervention | 248 (54%) | 416 (68%) |
| Postponed operations | 12% | 7% |
| Positive SARS-CoV-2 test (during the admission period) | 30 (6%) | - |
| Chest CT positive subjects | 97 (21%) | - |

pandemic, the likelihood of an admission presenting as an Emergency Medical Services (EMS) alert was 1.2 times higher than it had been before the epidemic. When we talk about traumatic brain injuries, we should mention that the most prevalent mechanism of injury that caused head trauma during the pandemic was a vehicle rollover (32%), followed by falls (23.6%). The overturning of vehicles was the most prevalent cause of death in the pre-pandemic group (34.3%), followed by falling down stairs (29.4%). During the pandemic, the percentage of hospital admissions attributable to motor vehicle collisions fell from 34.4% to 20.3%. During the pandemic and before the pandemic, patients were also found to be pedestrians hit by a vehicle. During the pandemic, 248 people (54%) required a neurosurgery operation. In the time before the pandemic, this number was 416; to put it another way, 68% of patients who were hospitalized in the time before the pandemic required a neurosurgical procedure. There was a notable rise in the number of patients who were allowed to return home and were scheduled to have surgery as outpatients, despite needing medical attention (12% vs. 7%). The demographic and selected endpoint changes between the pre-pandemic and pandemic groups are compared and summarized in Table 1. Thirty patients out of 456 individuals hospitalized during the pandemic had a positive SARS-CoV-2 test during their hospitalization in pediatric neurosurgery. Additionally, there were 97 subjects with a suspicious chest computed tomography scan in favor of COVID-19 involvement (21%).

Discussion

In an effort to put a stop to the COVID-19 pandemic, visible alterations have been made to components of daily life at the individual, regional, and national levels. The aim of this study was to investigate the ways in which the pandemic and the accompanying changes had an influence on the patterns of patients seeking treatment for pediatric neurosurgery concerns. In particular, the purpose of this inquiry was to assess the differences between the pandemic in 2020 and the year before. This is in terms of the prevalence of pediatric neurosurgical concerns, the characteristics of patients and their diseases, and the patterns of treatment. According to the findings of our study, the absolute number as well as the monthly volume of admissions dropped by a large amount during the pandemic. The number of patients brought in by EMS following traumatic brain injuries did not significantly decrease. This demonstrates the tragic weight that our country bears due to the fact that road traffic accidents claim the lives of several victims in the pediatric age range.

In fact, a retrospective analysis of the pandemic cohort demonstrated the unfortunate reality that traumatic brain injury continues to follow a consistent pattern statistically, notwithstanding the occurrence of a massive pandemic event like COVID-19. This finding, on the other hand, may signify a rise in the number of pedestrians in the community. Or, it might signify an increase in hazardous driving behaviors as a response to the decreased amount of traffic in the area. These findings are consistent with previous investigations that have been completed to this point [6].

The fact that children under the age of 18 living in southern Iran are not at risk of experiencing domestic violence is a remarkable achievement in and of itself. This gives rise to a significant concern in the mind of a neurosurgeon, and that question is as follows: Is it necessary to rethink the systems of monitoring for the pediatric domestic violence issue in south Iran, or is this silent area indeed a clean field as it looks to be?

When compared to the cohort that traces back to the pandemic, the number of patients who needed some sort of neurosurgical intervention over the course of their treatment decreased by 14%. This exemplifies the outstanding ethics of our pediatric neurosurgeons in response to the campaign to combat the COVID-19 pandemic in a low-income country with the obvious consequences of resource scarcity. The data discussed in this paper delves deep into individual and societal actions during times of conflict, social distancing attempts, and government-directed shutdowns.

A very small number of patients who tested positive for SARS-CoV-2 were discovered while being treated in hospitals. However, when chest Computed Tomography (CT) scans were taken into account, the previously indicated minority increased. This lends credence to the hypothesis that pediatric patients had a lower risk of infection during the Pandemic's early phases. This is due to the low prevalence of the disease among children. This is consistent with the findings of previously published research [7-9].

The pandemic was responsible for a number of shifts in management concepts and practices that were system-based. These shifts were perhaps even more substantial than the changes that occurred in the epidemiological burden of pediatric neurosurgery patients. When compared to the cohort that existed before the pandemic, there was a significant decrease in the number of patients transferred from their respective hospitals. This conclusion most likely

corresponds to the distribution of resources during the pandemic for testing patients, arranging for professional transportation, and making beds in hospitals available. In addition, in order to make up for the lack of resources, a revised strategy was implemented, which involved postponing the treatment of elective patients. This brought about a shift in the paradigm. This tendency may reflect reductions in the number of patients admitted to hospitals. This fact should be kept in mind for impending outbreaks, particularly in a low-income nation that is subject to multiple sanctions as a result of numerous political difficulties that, in reality, would damage the total wealth and resources of the nation's comprehensive healthcare system.

During the pandemic, the percentage of admissions that were considered to be operative dropped by 114%. However, operative patients were more likely to be discharged as outpatients than they were before the epidemic. Patients in this situation were sent home with conservative treatment recommendations and short-interval follow-ups in order to schedule surgery. During these exceptional circumstances, this was most likely conducted in an attempt to limit the number of hospital admissions and the pressure put on healthcare providers. This strategy may also have the unintended consequence of reducing the costs associated with an unwanted elective type of hospitalization. This approach looks less feasible in the hands of a pediatric neurosurgeon, though, due to the unusual nature of pediatric neurosurgical difficulties. These difficulties are less likely to occur in an elective context than in craniosynostosis. If the outcomes of outpatient management are comparable to those of inpatient care, then this may be a beneficial impact that the epidemic has brought about. However, this appears more like a declaration on paper than a truth that actually occurs in real life.

It's interesting to note that during the pandemic, 94% of patients didn't know their COVID status when they came in for admission to our service. Even if the number of tests, the speed at which they were performed, and their availability rose as the months marched on. However, there was still a considerable cohort that was never examined. A suspicious chest CT was added to the list of diagnostic criteria, which resulted in a positive rate of 21% for COVID-19 status. In many cases, pediatric neurosurgery difficulties take precedence over awaiting test results. As a result, healthcare practitioners are forced to expose themselves to an expanded danger of possible exposure and physical damage in a pandemic era. Nevertheless, it is of the utmost importance that hospitals and other healthcare institutions make the health and safety of their staff members their number one concern. Similar to other studies, our study had some limitations, and there are a few caveats that need to be mentioned. Despite the fact that our facility is known for its status as a referral center for pediatric neurosurgical illnesses.

Although our facility treats patients from a wide variety of provinces, the outcomes we achieve are tailored to the area in which we are located. It is recommended that multi-center studies be carried out in order to further understand the relationships that were discussed in this article.

Conclusion

The neurosurgical community in underdeveloped nations cannot shield itself from the effects of the COVID epidemic. It must quickly adjust to the changing environment in which healthcare is being provided. This serves the purpose of promoting future implementations to improve treatment techniques and reduce the risk of damage. Pediatric neurosurgery tertiary-care facilities can be better equipped to handle patients even during times of severe resource allocation if there is a significant drop in the number of referrals and locoregional transfers. It is possible that a shift toward outpatient care, which has been necessitated by the ongoing epidemic, has the potential to lower the rates of hospital admissions and the expenses that are connected with them.

Acknowledgment

This study was conducted at the Neurosurgical ward of Shiraz, Iran. Thanks to neurosurgery residents of Emtiaz Hospital.

References

1. Raneri F, Rustemi O, Zambon G, Moro GD, Magrini S, Ceccaroni Y, et al. Neurosurgery in times of a pandemic: A survey of neurosurgical services during the COVID-19 outbreak in the Veneto region in Italy. *Neurosurg Focus*. 2020;49(6):E9.
2. Ballesterio MFM, Furlanetti L, de Oliveira RS. Pediatric neurosurgery during the COVID-19 pandemic: Update and recommendations from the Brazilian Society of Pediatric Neurosurgery. *Neurosurg Focus*. 2020;49(6):E2.
3. Deora H, Mishra S, Tripathi M, Garg K, Tandon V, Borkar S, et al. Adapting neurosurgery practice during the COVID-19 pandemic in the Indian Subcontinent. *World Neurosurg*. 2020;142:e396-406.
4. Rahman MM, Azam MG, Bohorquez-Rivero J, Ballestas EG, Agrawal A, Salazar LRM, et al. Letter to the Editor: "Telehealth and telemedicine in the COVID-19 era: A world of opportunities for the neurosurgeon". *World Neurosurg*. 2020;142:541-2.
5. Rivero BJ, Ballestas GE, Salazar LRM. Letter to the Editor: "The neurosurgeon and medical professionalism during the COVID-19 pandemic". *World Neurosurg*. 2020;142:559-60.
6. Saponaro G, Gasparini G, Pelo S, Todaro M, Soverina D, Barbera G, et al. Influence of SARS-CoV-2 lockdown on the incidence of facial trauma in a tertiary care hospital in Rome, Italy. *Minerva Dent Oral Sci*. 2022;71(2):96-100.
7. Nikolopoulou GB, Maltezou HC. COVID-19 in children: Where do we stand? *Arch Med Res*. 2022;53(1):1-8.
8. Martins MM, Barbosa PA, da Cunha AJLA. Update on SARS-CoV-2 infection in children. *Paediatr Int Child Health*. 2021;41(1):56-64.
9. Rudan I, Adeloye D, Katikireddi SV, Murray J, Simpson C, Shah SA, et al. The COVID-19 pandemic in children and young people during 2020-2021: Learning about clinical presentation, patterns of spread, viral load, diagnosis and treatment. *J Glob Health*. 2021;11:01010.