Changes in the neurosurgical admissions during the COVID-19 pandemic – a comparison with 2019

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Abstract

Background: The coronavirus pandemic has strongly affected health-care systems around the world, testing their patients’ care capacities. Admission restrictions, patients’ fear of hospitalization or other uncomprehended constraints has affected admissions to neurosurgery department. Material and methods: The clinical data of admissions from March 1st to July 24th 2020, as well as data of the control group in relevant periods of time in 2019 was collected from the local hospital database and compared. Results: The total number of procedures performed between March and July 2020 is 1545, compared to the corresponding period of the previous year it was the number of 2062, indicating a decrease by about 25%. Both head and aneurysm procedures decreased over the entire analyzed period. The number of procedures classified as “other” was higher in each of the three stages. Between March 1st and April 30th (Phase 1) mainly younger male patients were admitted. Conclusions: We demonstrated the impact of the COVID-19 pandemic on the work organization of our Neurosurgery Department. We report that after the introduction of appropriate solutions, it is possible to provide care to neurosurgical patients while ensuring the safety of patients and Staff during the pandemic.

Keywords: coronavirus · spine surgery · neurosurgery · hospital admission · COVID-19

Citation

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## Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was first diagnosed in December 2019 in the city of Wuhan, Hubei Province in China. The disease caused by the virus, COVID-19, can lead to severe respiratory failure. Within a few months of the first reported case, SARS-CoV-2 spread throughout the world. It was designated by the World Health Organization (WHO) a pandemic on March 11, 2020. The non-specific symptoms of COVID-19 swabs before or during hospitalization caused by the virus, COVID-19, can lead to severe respiratory failure.

In this paper, we highlight the specific conditions and efficient management methods that a neurosurgery department took in Poland. We present the pattern of neurosurgical patient admissions to a single center during 2020, depending on the phase of adaptation to the COVID-19 pandemic. We hope that this information may lead to a more calm and predictable response during any future pandemics.

## Materials and Methods

We examined the admissions to the Neurosurgery Department at the University Clinical Center (UCC) of the Medical University of Gdańsk (a tertiary care, neurotrauma centre serving a population of 1 million). The study sample consisted of data about the number and types of procedures performed from March 1st to July 24th 2020. The control group consisted of procedures performed from March 1st to July 24th 2019. Simultaneously, we collected information about the changes in restrictions associated with patient care and hospital staff safety since the SARS-CoV-2 outbreak in Poland.

### Data acquisition

The clinical data of were collected from the hospital’s patient record system (CLININET, CompuGroup Medical, Lublin, Poland) using the IT tool MedStream Designer (MSD, Transition Technologies Co., Warsaw, Poland). Data related to patients undergoing COVID-19 swabs before or during hospitalization were obtained from the hospital’s COVID-19 database which has been functioning since the in-house laboratory began testing for SARS-CoV-2.

We divided the neurosurgical procedures into four groups: spinal procedures, head surgeries (brain tumors, hematomas, ventriculoperitoneal shunt insertion), aneurysm-securing procedures and other miscellaneous procedures.

### Phases of the pandemic

We divided the time from the study period into three stages based on the legal and organizational regulations implemented both at the national and hospital level. We attempted an overall quantitative and qualitative comparative analysis, considering both the type of procedures between and within the given stage of the pandemic.

Stage 1, which we will call “the Lockdown,” lasted from March 1st to April 30th when our hospital was in a state of high alert. During this time all planned admissions to the Neurosurgery Department were suspended and its function was limited to emergency admissions only. Throughout the hospital, numerous restrictions and strict guidelines were introduced for patient care, as well as to ensure the safety of all hospital employees. Furthermore, family visits, bedside teaching and internships for doctors were also suspended.

Stage 2, which we will call “Unlocking,” started on April 30th, when the planned procedures were gradually performed and the access to the operating room was increased. Numerous limitations and special guidelines were still in place, however they allowed somewhat flexibility and were adjusted to the patients’ planned treatment options.

Stage 3, which we will call “riding out the storm,” started on June 22nd, when all newly admitted patients underwent SARS-CoV-2 testing and then waited at home under self-quarantine for their results. This was the so-called, “kiss and fly” system.

### Supplementary figure 1. Pandemic milestones in Poland – timeline. Abbreviations: UCC: University Clinical Centre. → [https://ejtcm.gumed.edu.pl/files/62](https://ejtcm.gumed.edu.pl/files/62)

### Supplementary table 1. General rules for admissions during a pandemic by stage. → [https://ejtcm.gumed.edu.pl/files/65](https://ejtcm.gumed.edu.pl/files/65)

### Comparative analysis

The overall number of procedures performed between March 1st and July 24th 2020 (both as a whole and in the individual stages of the pandemic) were compared with procedures performed in the corresponding time period in 2019. We took into account the type of procedure, the patients’ age and sex.
Statistical methods

Continuous variables were described by mean and standard deviation (SD) and were tested for normal distribution using the Shapiro-Wilk test. The differences between groups were identified respectively by means of a t-test, Mann-Whitney U test, chi square or two-tailed Fisher test using Statistica v. 12.0 (StatSoft, Inc., Tulsa, USA). We considered p values < 0.05 as statistically significant.

Results

Total procedures: 2019 versus 2020

The total amount of procedures performed during the study period decreased by 25% (from 2062 to 1545) compared to the time time period in 2019 (Table 1).

Both aneurysms and head procedures decreased throughout all three analyzed phases of the pandemic. Not only was there a smaller total number of aneurysms, but also they were a smaller portion of the procedures performed in 2020. We observed the highest decrease in spinal procedures during Phase 1. This was due to hospital-related restrictions, however during Phase 3 this number started to increase. Parallel to this drop, we observed that the number of “other” procedures grew steadily.

Supplementary figure 2. Waterfall-plot depicting admission changes in pandemic phases. Explaining how the number of each type of performed procedures changed from 2019 to 2020. The gray rectangle shows the deficit between these years. → https://ejtcm.gumed.edu.pl/files/63

Age and sex of admitted patients

More younger patients were admitted during Phase 1 (March 1st – April 30th 2020) compared to the corresponding time the year before (P = 0.05). Since April 30, 2020, there were no differences in patient age compared to the same months in 2019. Significantly more males than females were admitted in Phase 1 of the pandemic (P = 0.03). On the contrary, since the beginning of Phase 3, we observed a greater proportion of female patients (P = 0.01). Details are presented in Table 2.

Supplementary figure 3. Age structure presentation between 2019 and 2020; The corresponding timeframes (1-4; 2-5; 3-6) were compared statistically. → https://ejtcm.gumed.edu.pl/files/64

Table 1. The number of performed neurosurgical procedures - a comparison between March 1st to July 24th in 2019 and 2020

|        | total | spine | head | aneurysms | other |
|--------|-------|-------|------|-----------|-------|
|        | 1st STAGE | 2nd STAGE | 3rd STAGE | 1st STAGE | 2nd STAGE | 3rd STAGE | 1st STAGE | 2nd STAGE | 3rd STAGE | 1st STAGE | 2nd STAGE | 3rd STAGE |
| 2019   | 2062   | 850    | 739   | 473       | 601    | 545    | 343    | 192       | 147     | 95      | 37      | 24      | 16      | 20      | 23      | 19      |
| 2020   | 1545   | 375    | 657   | 513       | 207    | 495    | 380    | 132       | 125     | 59      | 13      | 5       | 12      | 24      | 32      | 62      |
|        | p = 0.0000 | 4.9519 | 5.8045 | p = 0.0000 | 6.8350 | 0.0021 | 4.6997 | 0.0115 | 2.3438 | 0.0045 | 0.9188 | 0.0000 |
Stage 1, The Lockdown

We observed a significant decrease in the number of spine, head and aneurysm procedures during Phase 1. For the other procedures, a slight increase was observed.

Stage 2, Unlocking

During Phase 2, there was almost a complete equalization in the number of spine and head procedures. However, there was a dramatic decrease in aneurysm procedures compared to the same time period in 2019. During this phase, we observed a further increase in other procedures compared to the previous year.

Stage 3, Riding out the Storm

We observed an increase in spine procedures during Phase 3 as compared with the same time period in 2019. There was a decrease in the number of head and aneurysm procedures at that phase in 2020. An increase in, “other” procedures was observed.

Discussion

Despite the several changes to clinical practice due to the COVID-19 pandemic, we found that the total amount of performed procedures decreased only by 25%. Our comparison to the same time period in 2019 aimed to demonstrate to what extent neurosurgery practice during the pandemic differed from the usual.

Applied restrictions – a detailed historical account

“The Lockdown”

In March of 2020 the UCC in Gdańsk implemented a detailed action plan. First, patient visits were suspended at all departments along with internships. On March 12th, the UCC was put on high alert in connection with the SARS-CoV-2 pandemic. Most scheduled admissions were suspended, with the exception of patients with oncological, transplantation, chemotherapy, ophthalmology,
pregnancy and puerperium, pediatric-related needs or who were enrolled in special drug programs. SARS-CoV-2 risk was assessed via obligatory telephone epidemiological interview and body temperature measurement along with paper questionnaire upon arrival at the Scheduled Admission Center and Day Wards. Heads of Departments and other organizational units of UCK were obliged to ensure daily body temperature measurements of all employees at the start of each shift or working day. The activities of specialist clinics had to be carried out with the use of ICT systems [1]. Detailed patient management regimens were introduced at the emergency department. Stable patients had standard PCR tests for SARS-CoV-2, whereas Rapid-PCR was performed in urgent cases. If the patient’s clinical condition could not afford any delays for the result of SARS-CoV-2 test, the operating procedure was performed using personal protective equipment, as if the patient had tested positive. During the complete “Lockdown” the number of performed procedures decreased dramatically, mainly due to the complete suspension of planned admissions. From March 12th, the department was limited to emergency admissions and on-call interventions. The number of spine and aneurysms procedures has decreased significantly, while the number of head interventions increased. This was probably due coding the admissions in the patient record system as emergencies and with the lack of planned spine surgeries. Moreover, there was a marked increase in “other” procedures. COVID-19 testing procedures were categorized under, “other” category. Therefore, this increase may have been related to the need for a SARS-CoV-2 swab before each admission. Notably, some of the testing-swabs were performed at the Emergency Department and therefore are not included in the presented data.

“Riding out the storm”

The “kiss and fly” system enabled complete unlocking of the Neurosurgery Department. The average waiting time for the SARS-CoV-2 result with a standard swab was about 3 to 5 hours depending on the laboratory workload, while the Rapid-PCR, in urgent situations, took about 1 hour. The above-mentioned solutions allowed not only to match, but also exceeded the number of procedures performed during typical clinical practice. Both spine and aneurysm procedures represented a fraction of treatments comparable to the pre-pandemic norm, while the fraction of head procedures decreased drastically. This is most likely due to a re-increase in elective procedures which, overall, reduces the percentage of urgent cases such as hematomas. As for the number of other procedures, it is still higher than typically. We assert that the obligation to test each patient for COVID-19 increases the number of this particular fraction.

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Discussion with the main findings

Older people have a worse prognosis and during the pandemic their hospitalization increased the threat to their health. The risk of serious comorbidities increases with age, as well as the severity of COVID-19. Older patients were not only less willingly hospitalized, but also were motivated by fear and may have decided to visit their doctor less often.

The male predominance in the admission profile could possibly result from hospital restrictions solely to emergency cases in the initial phase of the lock-up. Due to neurotrauma status of the hospital these were patients after head or back injuries.

It is worth noting that by the time this paper was written, none of the patients admitted to the neurosurgery department had a positive result for SARS-CoV-2. In the hospital’s pre-hospitalization screening, it was possible to capture 5 patients with a positive result (out of the total number of 11548 performed tests). According to the worldometer.com, at this time Poland was found at the 9th place worldwide in the ranking of the most infected cases per million people. Due to this, they were transferred to an infectious disease hospital or placed under home quarantine. However, for safety reasons, each patient admitted to the hospital was regarded as an asymptomatic infected patient as per previous recommendations [2].
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