

Adaptation and Change in Practices in Neuro-Intervention during COVID-19 Pandemic: Experience from Department of Interventional Neurology at Referral Tertiary Care Hospital in Bangladesh

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Abstract

Background: Different adaptation and changes have been practiced during COVID-19 pandemic. **Objective:** In this paper we investigated the impact of the COVID-19 pandemic on service delivery in the department of interventional neurology and adaptation of the department to the changed environment. **Methodology:** This was a retrospective analysis of diagnostic digital subtraction angiography (DSA) procedures done from January 2018 to December 2020 and were analyzed to detect significant breaks in time trend. **Results:** A total of 358, 426 and 251 patients got admitted for DSA in consecutive three years from 2018 to 2020 respectively. There was a sudden drop in the number of DSA procedures from 30 to 50 patients per month in the pre-COVID era before March 2020 to less than 10 patients per month during the COVID period of March to June 2020. However, the situation gradually improved following the introduction of RT-PCR test for SARS CoV-2 in June 2020. A poisson regression showed a significant increase in monthly DSA procedures in the year 2019 compared to the year 2018, but a significant decrease in the pandemic year of 2020. **Conclusion:** By incorporating COVID-19 testing as a pre-requisite test before DSA procedures, the department of interventional neurology recovered from experiencing a significant drop in the number of performed DSA procedures in the initial periods of the pandemic to reaching a level observed in the pre-COVID era. [*Bangladesh Journal of Infectious Diseases*, April 2022;9(suppl_1):S3-S8]

Keywords: Digital Subtraction Angiography; Interventional Neurology; COVID-19

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Introduction

After the surge of COVID-19 pandemic in 2020, the whole world has observed an unprecedented public movement restriction and social distancing due to the lock down measures. The health care delivery system had been overburdened throughout the time. As the infection rate was increasing rapidly, hospitals from Italy, Spain, UK, France, Brazil and USA were treating an overwhelming number of COVID-19 cases far beyond their capacity¹. The exhaustion of health care delivery system is one of the prime reasons for initial high case fatality².

The acute requirement of personal protective equipment along with the increasing demand for intensive care unit beds, adjusting health care work force capacity to these demands, managing continuous oxygen supply and establishing more SARS CoV2 detection facilities pushed the health care managers to their limits. All these required adaptations demanded stretching of the health care budget. When COVID-19 was first reported in Bangladesh on March 8, 2020, there was only one laboratory with facilities to detect SARS CoV-2, which was increased to 113 test centers later on³. The Ministry of Health also responded promptly by rapidly increasing the COVID-19 treatment capacity by dedicating several public/ private hospitals and several field hospitals exclusively for management of COVID-19 patients.

In contrast, during the initial periods of the COVID pandemic, a decline in hospital admission for non-COVID illness due to fear of infections and government-enforced lockdowns and social-distancing measures had been reported in different parts of the world⁴. With this ever-growing challenge of dealing with COVID, hospitals were required to restructure their health care delivery system and accordingly reallocate resource for continuation of their services. The stroke unit in the National Institute of Neurosciences and Hospital (NINS&H) also observed more than fifty percent reduction in acute stroke admission from April to June 2020 in comparison to first three months of this year⁵.

The NINS&H is the highest center of referral for neurological illness in Bangladesh and the only center with a dedicated department of interventional neurology in Bangladesh. During this pandemic the NINS&H also had to adapt to the challenges of the situation. Through this study we wanted to assess the coping strategy of the department during this pandemic.

Methodology

This is a retrospective analysis of all the diagnostic digital subtraction angiography (DSA) performed at the department of interventional neurology, National Institute of Neurosciences & Hospital, Dhaka, Bangladesh over the last three years; starting from January, 2018 to December 2020. We compared the monthly procedure performance rate over the designated period of time. The hospital had not been declared as a Government designated COVID-19 hospital during the study period.

Department of Interventional Neurology: The department is equipped with two dedicated state-of-the-art neuro cath labs one of which is a biplane machine. The department has a dedicated team of nine neuro-interventionists. Around 350-500 diagnostic DSA and 100-150 therapeutic interventions are performed in this department each year⁶.

Assessment of COVID-19 Status before Any Procedure: Adaptation during the pandemic was done in different ways. From July 2020 results of RT-PCR for SARS CoV-2 from nasal swab were made a prerequisite for performing any DSA or therapeutic procedure; in addition to the basic routine tests done for general anesthetic fitness of the patients. For a clinically suspected case of COVID-19 with a negative RT-PCR report, an HRCT scan of the chest was done to confirm the diagnosis. Patients with positive RT-PCR reports were referred to the Government-designated COVID-19 hospitals for treatment.

Ethical Issues: The study protocol was thoroughly reviewed and approved by the Ethical Review Committee (ERC), National Institute of Neurosciences and Hospital. All the data were anonymized and collected from the hospital records. As the data were not individualized and the study was done only from the recorded data base, the need for informed consents from patients was also waived by the ERC. The study did not violate any privacy and confidentiality of patients were strictly maintained.

Statistical Analysis: Monthly data on number of performed DSA procedures in three consecutive years, January 2018 to December 2020, were used for analysis. Data analysis was done by using Statistical Package for Social Sciences (SPSS) version 21.0 and R version 4.0.0. In addition to exploratory analysis with time series plots of DSA counts, Chow tests are performed to identify

significant structural break points. Furthermore, Poisson regression and Mann-Whitney U-tests are used to evaluate whether there were significant changes in monthly DSA rates during the COVID-19 period, and also following the intervention of adopting COVID test in the routine admission procedures.

Results

All the patients admitted in the department of interventional neurology undergo the diagnostic DSA procedures. The yearly number of admission from 2018 to 2020 at the department was 358, 426 and 251 respectively. Majority of the patients were aged 30 to 60 years (66.4%, 65.02% and 68.5%

respectively). Majority of the patients were male through all these years (Table 1).

Table 1: Distribution of Patients by Age and Sex

Characteristics	Year Wise Distribution		
	2018	2019	2020
Age Group			
• Less than 30 Years	43	58	29
• 30 to 60 Years	238	277	172
• More than 60 Years	87	91	50
Gender			
• Male	221	247	152
• Female	137	179	99

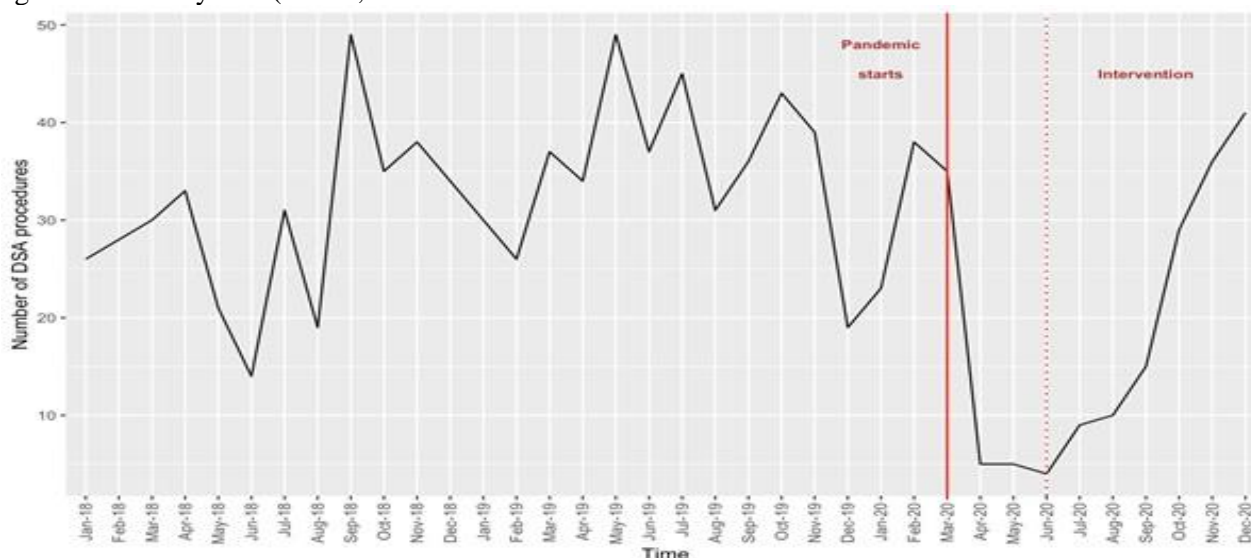


Figure I: Time series plot of monthly DSA procedures performed from 2018 to 2020

Figure I shows the plot of monthly time series of the number of patient's undergone DSA procedures at the department of interventional neurology, NINS&H. There was a shift in the level of the series after August 2018 and the mean of the series increased from 25 DSA per month prior that point to around 35 patients per month in the following months till March 2020 (marked by the solid vertical line in Fig 1), when the pandemic started. In April 2020 when COVID infections in Bangladesh began to surge, the DSA procedures abruptly fell to only 5 patients and remained this low in the next couple of months. However, after the initiation of routine implementation of COVID-19 test before performing DSA from June 2020 (marked by the dashed vertical line in Fig 1), the DSA rate rapidly increased over time and exceeded the pre-COVID average in November 2020 to reach

41 patients in December that year. Chow tests of structural changes confirmed March 2020 and June 2020 as two break points ($F=22.788$; $P\text{-value}<0.001$ and $F=3.92$; $P\text{-value}=0.03$, respectively), which led to alteration of the trend of the DSA series downward and upward, respectively.

In order to evaluate potential changes in monthly admission in more details, we also plotted the month-on-month growth in admission/ DSA procedures from February 2018 to December 2020. While monthly changes in number of performed DSA procedures are almost random during the pre-COVID period, growths are consistently negative during the outbreak of the pandemic from April-June 2020 and all positive following the implementation of the routine COVID-19 testing as an intervention in June 2020.

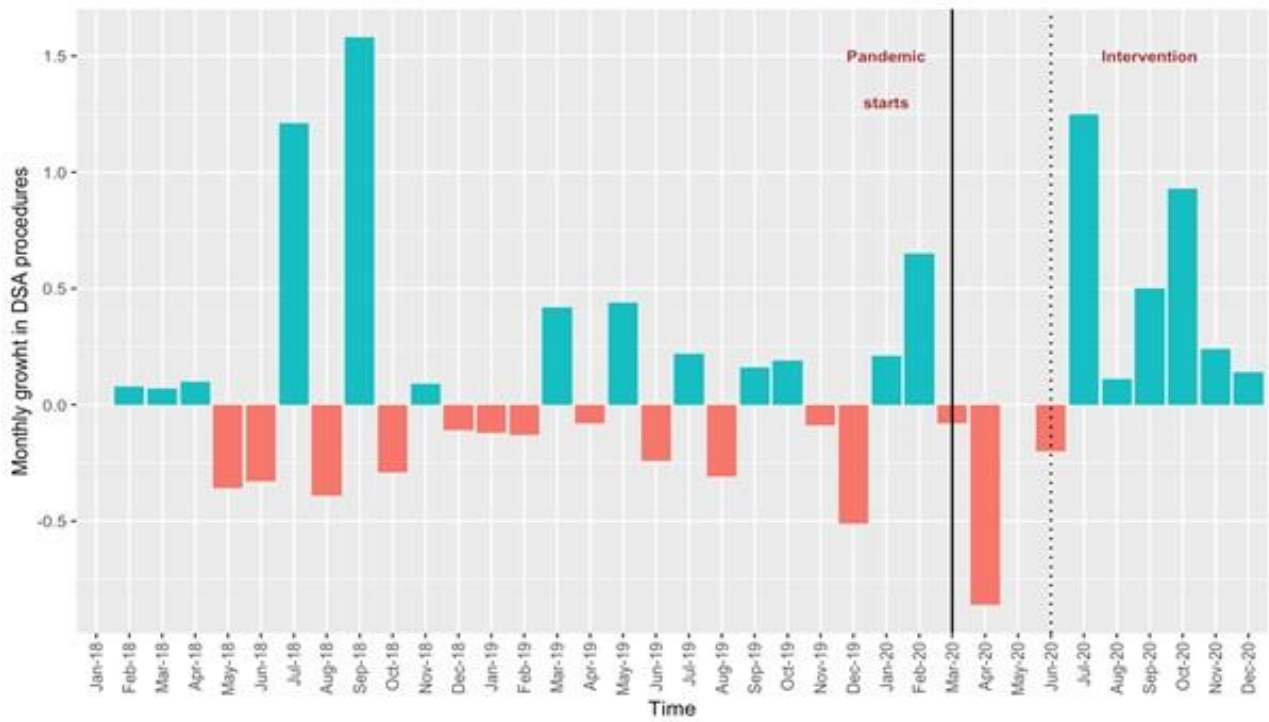


Figure II: Month-on-month change in DSA performed from 2018 to 2020

The results of a Poisson regression reported in Table 2 further confirms the impact of COVID outbreak on DSA procedures performed in NINS&H. By using year dummies as covariates we find that the mean DSA carried out in the year 2019 was significantly higher (p-value = 0.0153) compared to 2018, but significantly lower (p-value < 0.001) during the ongoing pandemic in the year 2020.

Table 2: Results of Poisson Regressions for Monthly, DSA Procedure

	Estimate	Standard error	P value
DSA			
Intercept	3.39563	0.05285	<0.001
Year 2019	0.17391	0.0717	0.0153
Year 2020	-0.35907	0.08242	<0.001

Next, we analyzed month-on-month changes in performed DSA procedures to understand the impact of the coping mechanism of adopting routine COVID test (the intervention) on subsequent services provided. In particular, we compared the post intervention period of July-December of 2020 to the same periods of the COVID-free years 2018 and 2019. Both the mean and median monthly changes in DSA counts are positive and the highest during the post intervention period in 2020. When the distributions of monthly

growth are compared across the three sample years using pair-wise non-parametric Mann-Whitney U tests, we found significant difference in the average monthly changes in DSA between the years 2019 and 2020 (Table 3).

Table 3: Summary Statistics for Monthly Changes in Number of DSA Procedures during July to December of 2018 to 2020 and Tests for Pair-Wise Difference in Distributions

Year	Mean±SD	Test for difference in means	P value
2018	0.35±0.835	2018 vs 2019	0.409
2019	-0.06±0.302	2019 vs 2020	0.033
2020	0.53±0.467	2020 vs 2018	0.155

Discussion

This study investigates possible impact of COVID-19 outbreak and subsequent adaptation of new medical procedures on service delivery in one of the largest stroke-specialized referral hospitals in Bangladesh. In particular, changes in number of performed DSA procedures done at the department of interventional neurology, NINS&H during 2018 to 2020 were assessed. In our study we clearly observed a sharp decrease in DSA procedures during April 2020 to June 2020 from the level in the pre-COVID times. In the pre-COVID periods

before elective admission of cases routine pre-anesthetic check-up was done in every patient. Patients were admitted in the intervention department only if the pre-anesthetic routine tests were normal. There was fear of getting infected with COVID-19 among both the physicians and the patients. To overcome this, the department of interventional neurology in the hospital made the RT-PCR test from nasal swab for SARS CoV-2 a routine practice for pre-anesthetic check-up. Use of face masks by the patients was also ensured. The Chinese Federation of Interventional and Therapeutic Neuroradiology (CFITN) and the International Society for Neurovascular Disease (ISNVD) also suggested that in addition to use of proper personal protective equipment, COVID-19 testing should be done in all patients before any diagnostic or therapeutic intervention is done [6]. Gandhe RU et al also reported similar practice in neuroanesthesia at Kokilaben Dhirubhai Ambani Hospital and Medical Research Institute, India. They also ensured preoperative RT-PCR result for neuroanesthetic procedures⁷.

As the COVID-19 pandemic hit the world there was a sudden drop of admission of patients at NINS&H which was evident from an analysis of weekly acute stroke admissions in a 100-bed stroke unit of the hospital⁵. Studies conducted in different parts of the world also reported the impact of COVID-19 on hospital admission^{1,4-9}. Similar negative impacts on hospital services were also reported. For example, Jong J et al reported that interventional radiology procedures dropped around 31.0% during the pandemic¹⁰.

Several researchers suggested that social distancing measures, confinement at home with delayed disclosure of symptoms, the fear of getting COVID infections at hospitals, and late or no hospital admission following a wait-and-watch strategy along with forced lock-down measures might have resulted in reduction in acute admissions^{4,8}. The Public Health England reported a significant decrease in Accident and Emergency (A&E) visit from 2.11 million in April 2019 to less than a million in the same month of 2020¹⁰.

Following the introduction of routine COVID-19 test in June 2021, the monthly rate of admission and DSA procedures performed in the hospital, which closely matched admission of stroke patients, rose consistently and reached the pre-COVID level by November 2020. While there could be other factors contributing to this rise, we believe that the small intervention played a major role in regaining confidence in both the patients and the physicians

for providing and seeking services, respectively. Statistical tests in our empirical analysis confirmed the intervention point in the time series of DSA procedures as a significant break point and subsequent increase in the number of such services significant when compared to pre-COVID era.

We had some limitations in this study. First, of all, this is a single-center experience. But unfortunately, this is the only center with a full-fledged interventional neurology department in Bangladesh. Second, data were collected monthly. Weekly data could have shed more detailed insight into the impact of the intervention.

Conclusion

Pandemics like COVID-19 can make huge negative impacts on health service delivery. However, small interventions can turn situations around. Just the routine inclusion of RT-PCR test for SARS CoV2 saw a significant rise in monthly DSA procedures since the change of practice was made at the end of June 2020 after the initial fall from March 2020 to June 2020. A possible reason is that this intervention brought confidence among both the patients and physicians. Such adaptations and changes in practice will make our physicians and patients prepare for future outbreaks.

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Data Sharing: We have no commercial affiliation and we adhere to all PLOS ONE policies on sharing data and materials.

Author contribution: ATMHH was involved in planning the study, setting the methodology, consultation and data collection and write up for this study. MM, MSI and MSRS were involved in data analysis, data interpretation and partly writing the manuscript. The rest were involved in consultation and data collection. All the authors have read and approved the final version of the manuscript.

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