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IP Indian Journal of Neurosciences

Journal homepage: <https://www.ijonline.org/>

Original Research Article

Intracerebral hemorrhage during the pandemic- Learning from experience

Dileep Ramachandran¹, Praveen Panicker¹, Sunil D¹, Manju Surendran¹, Thomas Iype^{1,*}, Rammohan¹¹Dept. of Neurology, Government Medical College, Thiruvananthapuram, Kerala, India

ARTICLE INFO

Article history:

Received 23-11-2021

Accepted 10-12-2021

Available online 05-01-2022

Keywords:

COVID19 Pandemic

Workflow

Hospital Mortality

Functional Outcome

ABSTRACT

Background: Worldwide stroke care was affected by COVID 19 pandemic and the majority of the literature was on ischemic stroke. Intracerebral hemorrhage (ICH) accounts for about one-fourth of strokes worldwide and has got high mortality and morbidity. We aimed to study the effect of the Pandemic on ICH outcomes and flow metrics during the first wave compared to the pre-pandemic period and how that experience was made used in managing ICH during the second wave.

Materials and Methods: Ours was a single-center observational study, where consecutive patients with non-COVID spontaneous ICH aged more than 18 years who presented within 24 hours of last seen normal were included in the study. We selected the months of June, July, and August in 2021 as the second wave of the pandemic, the same months in 2020 as the first wave of the pandemic, and the same months in 2019 as the pre-pandemic period. We compared the 3-month functional outcomes, in hospital mortality and workflow metrics during the three time periods.

Results: We found poor three-month functional outcomes and higher hospital mortality during the first wave of the COVID 19 pandemic, which improved during the second wave. In-hospital time metrics measured by the door to CT time which was delayed during the first wave improved to a level better than the pre-pandemic period during the second wave. ICH volume was more during the first and second waves compared to the pre-pandemic period. Other observations of our study were younger age during the second wave and higher baseline systolic BP at admission during both pandemic waves.

Conclusion: Our study showed that functional outcomes and flow metrics in ICH care improved during the second wave of the pandemic through crucial re-organization of hospital stroke workflows. We are sharing this experience because we may have to do further rearrangements in future as the upcoming times are challenging due to new variants emerging.

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1. Introduction

During the first wave of the COVID pandemic, entire health care was focused more on the management of COVID 19 cases and prevention of spreading the COVID infection. There was a reduction in stroke admissions and delay in time metrics in stroke care worldwide.¹⁻³ Fear of contracting the infection from hospitals and strict lockdown measures,

including the stay-at-home campaign, contributed to this. Nevertheless, Indian data during the first wave showed no drop in stroke admissions, but there was a delay in stroke metrics.⁴ During the second pandemic wave, there was a further decline in Germany's number of ischemic stroke admissions.⁵

Much of the research reported in stroke care during the pandemic was on ischemic stroke and on improving acute ischemic stroke workflows. Intracerebral hemorrhage accounts for 26% of all strokes worldwide, with one

* Corresponding author.

E-mail address: drdileepramachandraneuro@gmail.com (T. Iype).

monthly case fatality rate of around 30% and survivors left with a disability.^{6,7} ‘Time is Brain’ applies to ICH too, but data regarding the ICH care during the pandemic is scarce. We are sharing our experience in the care of non-COVID intracerebral hemorrhage during the second wave of the pandemic, the first wave of the pandemic, and the pre-pandemic period.

2. Materials and Methods

We did a single-centre observational study with a prospective and retrospective component at Stroke Unit, Government Medical College, Thiruvananthapuram. The stroke unit in Government Medical College, Thiruvananthapuram, started functioning in 2012 and is currently catering care for acute stroke patients from the southern districts of Kerala and Tamil Nadu. During the Pandemic period, we provided care for COVID and non-COVID patients. We selected June, July, and August in 2020 to represent the first pandemic wave during which there was peaking of the COVID cases, the same months in 2021 represented the second pandemic, and the same months in 2019 the pre-pandemic period. The study was initiated after getting institutional human ethics committee approval. We included consecutive patients with non-COVID spontaneous intracerebral hemorrhage aged more than 18 years who presented within 24 hours of last seen normal. For the pre-pandemic period, data were collected retrospectively from medical case records; the ethical committee waived patient consent for the retrospective data. We prospectively collected data for the first and second pandemic waves. Basic demographic data (age, sex), risk factor profiles (hypertension, diabetes, dyslipidemia, drugs like antiplatelet and anticoagulant, chronic liver disease) were collected., Systolic Blood pressure(SBP), baseline NIHSS (National Institute of Health Stroke Scale), GCS (Glasgow Coma Scale), and onset-to-door time in minutes at admission were documented.⁸ We shifted all patients to CT; door to CT time in minutes, and volume of ICH in milliliter measured. The CT machine calculated the volume after manual tracing of margins of ICH in 2.5mm cuts. All patients received standard care in the Stroke ICU. We noted the need for decompression, extra ventricular drainage, duration of hospital stay, the Modified Rankin Scale (mRS) at discharge, and at three months.⁹

Our primary objective was to compare the functional outcome of ICH patients at 3 months during the second wave, first wave, and pre-pandemic period. The secondary objective was to compare the time metrics during the same periods.

Statistical analysis was done with IBM-SPSS v.27. Continuous variables were expressed in mean and standard deviation and analyzed using the student’s t-test. Alternatively, skewed data were expressed as a median and interquartile interval. Categorical variables were expressed

in proportions and analyzed by the Chi-square test. A p-value less than 0.05 was considered statistically significant.

3. Results

3.1. Demographic, risk factor profile and clinical characteristics

The demographic, risk factor profile, and baseline clinical characteristics of patients during the pre-pandemic, first, and second pandemic periods are summarised in Table 1. Compared with the first pandemic wave, the younger population developed intracerebral hemorrhage during the second wave. Gender and the risk factor profile were similar during the three periods. Baseline NIHSS and GCS were not different during the periods. Compared to the pre-pandemic period, systolic blood pressure(BP) was higher during the first wave, and the second wave was associated with higher values than the first wave.

3.2. Time metrics, investigation, and treatment

Table 2 compares the three periods’ time metrics, investigation, and treatment details. Onset-to-door time (OTD) was lesser during the second wave compared to the pre-pandemic period. Even though OTD time was lower numerically in the first wave than pre-pandemic, it did not reach statistical significance. Door to CT time was prolonged during the first wave but shortened in the second pandemic compared to the pre-pandemic period. The volume of intracerebral hemorrhage was more during the first and second waves when compared to the pre-pandemic period. No lobar bleeds were admitted during the pre-pandemic and second pandemic waves. During the first wave, there was a predominance of lobar bleed. There was no difference in ICH scores during the periods. Neutrophil lymphocyte ratio was higher during the two waves of the pandemic when compared with the pre-pandemic period.

3.3. Outcomes and etiology

Table 3 compares the outcomes, duration of hospital stay, and etiology during the three periods. In-hospital mortality was higher during the first wave than pre-pandemic and second waves. Even though hospital stay duration was less during the first wave, it was not statistically significant. The functional outcome at discharge was not different during the three time periods. Functional outcome at three months was poor during the first wave compared with the pre-pandemic period. Hypertension was the most common etiology during the periods.

4. Discussion

To best of our knowledge, this is the first study that compared ICH patients’ care in the two waves of the pandemic with the pre-pandemic period. We found poor

Table 1: Demographic, risk factor profile and clinical characteristics

	Pre Pandemic (n=7)	First pandemic wave (n=13)	Second pandemic wave (n=9)	Pre Pandemic Vs First pandemic	Pre Pandemic Vs Second pandemic	First Pandemic Vs Second pandemic
Age Mean (SD)	56(18.6)	68(14.7)	48(12.2)	0.24	0.31	0.009
Sex- Male %(n)	71.4 (5)	61.5 (8)	88.9 (8)	0.65	0.37	0.15
Hypertension %(N)	71.4 (5)	92.3 (12)	100 (9)	0.21	0.08	0.39
Diabetes %(N)	28.6 (2)	23 (3)	0 (0)	0.78	0.086	0.12
Alcoholism %(N)	28.6 (2)	23 (3)	0 (0)	0.78	0.086	0.12
Previous Antiplatelet %(N)	28.6 (2)	15.3 (2)	11.1 (1)	0.48	0.09	0.77
NIHSS- Median (IQR)	12(7)	18(9)	16(3)	0.32	0.07	0.58
GCS Mean (SD)	12.7 (2.1)	10.5 (3.7)	13.0 (1.7)	0.17	0.77	0.08
SBP Mean (SD)	159 (28.5)	190 (16)	210 (15)	0.005	<0.01	0.007
DBP Mean (SD)	90 (10)	98 (15.9)	117 (8.6)	0.20	<0.01	0.06

n-Number, SD- Standard deviation, NIHSS- National Institute of Health Stroke Scale, IQR -Interquartile Range, GCS- Glasgow Coma scale, SBP -Systolic blood pressure, DBP- Diastolic blood pressure.

Table 2: Time metrics, investigation and treatment details

	Pre Pandemic (n=7)	First pandemic (n=13)	Second pandemic (n=9)	Pre Pandemic Vs First pandemic	Pre Pandemic Vs Second pandemic	First Pandemic Vs Second pandemic
OTD–Median (IQR)	200(40)	140(80)	115(45)	0.27	0.02	0.58
DTC Mean (SD)	25.3 (5.5)	53.1(16.7)	19.4 (3.0)	<0.001	0.017	<0.01
ICH volume in milliliter Mean (SD)	16.7 (5.3)	24.9(15.4)	23.2 (3.5)	0.19	0.01	0.75
Location of ICH Deep: Lobar	7:0	6:7	9:0	0.016	-	0.008
ICH score Mean (SD)	1.1(1.1)	1.9(1.7)	0.7 (0.7)	0.29	0.31	0.051
RBS in mg/dl Mean (SD)	140 (30.3)	151 (48.5)	133 (37.3)	0.58	0.67	0.37
Neutrophil Lymphocyte Ratio-Median (IQR)	2.38 (0.29)	4.44(4.5)	4.88(2)	0.02	0.018	0.27
Hematoma evacuation (n)	0	1	0	0.45	-	0.39
EVD (n)	0	1	1	0.45	0.36	0.78

n-Number, OTD -Onset to door time in minutes, DTC -Door to CT time in minutes, IQR -Interquartile Range, SD- Standard deviation, CT -computerized tomogram, ICH -intracerebral hemorrhage, RBS – Random blood sugar, EVD- Ext ventricular drainage

functional outcomes at three months and higher in-hospital mortality in patients with Non-COVID spontaneous intracerebral hemorrhage during the first wave of the COVID 19 pandemic. Poor outcomes during the first wave could be attributed to higher age, lower GCS, higher baseline ICH volume, and delay in hospital time metrics. Poorer outcomes in ICH during the first wave were reported from Korea and were due to treatment delays leading to hematoma expansion.¹⁰

The increase in the number of ICH cases in the first wave compared to the pre-pandemic period was intriguing because worldwide, there was a reduction in ICH cases during the first wave.^{1,11} Reduced access to health care

due to restrictions created by lockdown and fear of getting infected, hypertensive patients would have poor control of hypertension which may have contributed to the rise in ICH. ICH strokes would have caused more severe strokes (as evidenced by higher NIHSS) due to which patients were forced to attend hospitals which may be another reason for the increase in the number of ICH cases.

Onset-to-door time was less during the first and second wave when compared to the pre-pandemic period, which is contrary to the literature where onset-to-door time was prolonged during the first wave.¹⁰ This rapid shifting to our hospital might be contributed by lesser traffic during the lockdown and patients directly coming to our center,

Table 3: Outcomes and etiology

	Pre Pandemic (n=7)	First pandemic (n=13)	Second pandemic (n=9)	Pre Pandemic Vs First pandemic	Pre Pandemic Vs Second pandemic	First Pandemic Vs Second pandemic
Duration of hospital stay, Median (IQR)	12(8)	7(11)	12(3)	0.38	0.42	0.06
In hospital mortality %	0	53.8	11.1	0.016	0.36	0.04
mRS on discharge, Median (IQR)	4(1.5)	6(3)	4(1)	0.13	0.17	0.49
mRS at 3 months, Median (IQR)	3(1)	6(4)	3(1)	0.003	0.36	0.31
Hypertension as etiology of Bleed -% (n)	85.7 (6)	84.6 (11)	100 (9)	0.94	0.24	0.49

n-Number, IQR -Interquartile Range, mRS- Modified Rankin scale

as many of the second-line hospitals were converted into COVID treatment centers.

We also found that in-hospital time metrics measured by the door to CT time improved to a level better than the pre-pandemic period during the second wave. Door to CT time was prolonged during the first wave due to a delay in availability in getting the CT scanner free for imaging and the red channel creation for COVID patients. This experience in the first wave helped us convince the hospital administration to designate a CT scanner near emergency for acute stroke imaging, which helped us reduce the door to CT time by 33 minutes. This reduction in DTC time could have contributed to the better functional outcome of patients during the second wave.

ICH volume and higher baseline systolic BP at admission were higher during the first and second pandemics than the pre-pandemic period. The number of ICH during the second wave was more than the pre-pandemic period but less than the first wave. During the first wave, there was a predominance of lobar bleed, which raised the possibility of causes other than hypertension, like cerebral amyloid angiopathy, aneurysms, AV malformations, and coagulopathy.¹² Out of the seven lobar ICH, 3 patients had etiology other than hypertension (one had AV Malformation, one had coagulopathy, and the other with RCVS). During the second wave, hypertension was the etiology in all the patients and there were no lobar bleeds. ICH during the second wave occurred at a younger age. This may be a reflection of the increase in the prevalence of young hypertension in India.^{13–15} ICH in COVID patients also occurred more in the younger age group.¹⁶

Higher baseline systolic BP at admission during both pandemic waves pointed towards the poor BP control during the periods. Even during the second wave, when the lockdown restrictions were milder, BP management probably continued to be poor. Neutrophil lymphocyte ratio

a marker of systemic inflammation, was higher during the two waves of the pandemic when compared with the pre-pandemic period. Elevated Neutrophil lymphocyte ratio is considered a marker of poor prognosis in hemorrhagic strokes.^{17,18} The major limitation of our study is the small number of patients.

5. Conclusion

Learning from experience is very crucial in the reorganization of hospital stroke workflows because the upcoming times are challenging due to new variants emerging. As of November 9th, 2021, Omicron (SARS-CoV-2 variant: B.1.1.529.) has been reported from South Africa, and WHO has classified it as SARS-CoV-2 Variant of Concern on November 26th, 2021.¹⁹ More focus on workflow rearrangements and campaigns to increase public awareness are crucial to maintain the standards of stroke care.

6. Acknowledgments

We thank all the Staff of the Stroke unit of our hospital. The study was conceptualized by Dr.Dileep Ramachandran. Drafting was done by Dr.Dileep Ramachandran and Dr.Thomas Iype. Analysis was done by Dr.Dileep Ramachandran with help of Dr.Praveen Panicker, Dr.Manju Surendran, Dr.Ram Mohan and Dr.Sunil.D. All authors reviewed and approved the final article.

7. Abbreviations

ICH- Intracerebral haemorrhage, NCCT -Non-contrast CT

8. Conflict of Interest

The author declares no potential conflicts of interest with respect to research, authorship, and/or publication of this

article.

9. Source of Funding

None.

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Author biography

Dileep Ramachandran, Associate Professor

Praveen Panicker, Assistant Professor

Sunil D, Assistant Professor

Manju Surendran, Senior Resident

Thomas Iype, Professor and HOD

Rammohan, Associate Professor

Cite this article: Ramachandran D, Panicker P, Sunil D, Surendran M, Iype T, Rammohan. Intracerebral hemorrhage during the pandemic-Learning from experience. *IP Indian J Neurosci* 2021;7(4):301-305.