

Effect of the COVID-19 pandemic on acute stroke admissions at a Referral Stroke Center in Indonesia: A descriptive study

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ABSTRACT

Background. Multiple countries affected by the Coronavirus disease 2019 (COVID-19) pandemic have noticed a drop in the number of patients attending the emergency department with acute stroke. This study aimed to assess the numbers of acute stroke admission during the COVID-19 pandemic in a major hospital in Yogyakarta.

Methods. This is a retrospective study design of stroke admissions, data on the numbers of hospital admissions and mortality from the same period (March to December) in 2019 and 2020 were collected. The data were analyzed descriptively.

Results. We collected data from a total of 1928 patients admitted with acute stroke. From March to December, the mean rate of admission was 114.9 cases per month in 2019 (Pre-COVID era), which dropped to 77.9 cases per month in 2020 (COVID era), with an overall reduction of 32.2%. There was a decrease in the numbers of ischemic (-36%) and hemorrhagic (-18%) stroke admissions during the state of the COVID-19 era compared with 2019. Furthermore, we also observed a reduction in the mortality rate of ischemic (-43%) and hemorrhagic (-1%) stroke patients.

Conclusions. The COVID-19 pandemic had an impact on the care for stroke patients, resulting fell in acute stroke admissions and mortality rate.

Keywords: COVID-19, Stroke, Admissions rate

BACKGROUND

Initially reported as a local outbreak of viral pneumonia in Wuhan, China. Coronavirus disease 2019 (COVID-19) which is caused by SARS-CoV-2 has become a global health burden since it was declared as a pandemic in March, 2020. The first two cases for COVID-19 in Indonesia were reported on March 2, 2020 (1). Due to its rapid infection rate, the Indonesian government urged the application of social distancing, hygiene policies and district lockdown, which restricted movement among citizens to reduce SARS-CoV-2 transmission (2).

In spite of increasing rates of COVID-19 patients hospitalization worldwide, multiple countries affected by the pandemic have reported a substantial reduction in the number of non-COVID-19 patients

attending the hospital, including elective procedures or surgeries (3). Preliminary reports have shown reductions in admission rates for diseases that required time-sensitive treatments like acute myocardial infarction and stroke (3,4). Furthermore, the downward trend in hospital admissions may influence the affected hospitals to face burdens on financial and healthcare services.

In this study, we evaluated the impact of COVID-19 on acute stroke admissions at Bethesda Hospital, Yogyakarta, Indonesia.

METHODS

This was a retrospective observational study of all stroke patients admitted to the stroke unit of

Bethesda Hospital. The current study was conducted at the stroke unit of the Bethesda Hospital, Yogyakarta, Indonesia. Bethesda hospital is a referral hospital and dedicated center to provide comprehensive stroke care in the Yogyakarta region. The diagnosis of stroke was made by CT Scans or MRI imaging confirmed by an attending neurologist or radiologist. Patients aged 18 years or above who had confirmed diagnosis of stroke were included in this study.

All data were identified and collected from the stroke registry database. Admissions were classified as ischemic or hemorrhagic stroke (including intracerebral hemorrhage and subarachnoid hemorrhage). We collected the total number of strokes based on its classification and the total number of death during hospitalization.

We analyzed data from two distinct periods. First, we compared data from the same period (March 2019 to December 2019; pre-COVID-19 era) to the COVID period (March 2020 to December 2020; COVID era). Second, we performed a trend analysis which was compared to historical data in the same period of 2019 to assess potential seasonal variations. Percentage changes in monthly admissions and number of deaths were analyzed descriptively and presented as proportion. Data analysis was done by using SPSS version 21.

This study was approved by the Ethics Commission of the Bethesda Hospital by the number of No.25/KEPK-RSB/III/2021. The need for informed consent from patients was waived due to the retrospective nature of the study.

RESULTS

A total of 1928 stroke patients were admitted to the Bethesda Hospital's stroke unit during two different study periods. Among them, 263 patients (13.6%) died during hospitalization stay. The per-

centage of monthly distribution and mortality rate are presented in Table 1 and Table 2.

A common pattern is that there was a large drop between 2019 and 2020 when the number of confirmed COVID-19 cases began to surge in Indonesia. In comparison, from March to December 2019 (the pre-COVID period), a total of 1149 acute stroke cases were admitted to the stroke unit with a mean rate of admission of 114.9 cases per month, whereas from March to December 2020 (the COVID period) total admission was only 779 with a mean rate of admission of 77.9 cases per month. This implies an overall reduction of 32.2% in acute stroke admissions between those two periods. Figure 1 and 2 contains plots of monthly time series of the number of admissions of acute stroke cases by years comparison.

For each type of stroke, the number of admissions during the pre-COVID period in 2019 is higher than that during the COVID period in 2020, as revealed by Tables 1 & 2. Before and during the pandemic, the mean admission rate for ischemic stroke was 72.92 versus 46.25 and hemorrhagic stroke was 22.82 versus 18.67 cases per month. The total reductions in admissions for ischemic and hemorrhagic stroke were 36% and 18%, respectively.

A decline was seen in the mortality rate for acute ischemic stroke during the COVID period in the year 2020 (Table 1), with the total number of 69 in 2019 failing to 39 in 2020, the average number of acute ischemic stroke deaths were down slightly from 5.75 to 3.25 deaths per month. The total reduction in the mortality rate for ischemic stroke was 43%. Furthermore, there was a reduction in mortality rate of hemorrhagic stroke during the COVID period in year 2020 (Table 2), with the total number in 2019 of 78 to 88 in 2020, the average number of hemorrhagic stroke deaths were decreased slightly from 6.5 to 6.4 deaths per month with a total reduction in mortality rate for hemorrhagic stroke was 1%.



FIGURE 1. Monthly admission of patients with acute ischemic stroke at Bethesda Hospital, by years (2019 and 2020)



FIGURE 2. Monthly admission of patients with hemorrhagic stroke at Bethesda Hospital, by years (2019 and 2020)

DISCUSSION

This study assesses the impact of the COVID-19 pandemic on acute stroke patients' admission to our

hospital. This study's main findings are a reduction in the total number of stroke admissions during the COVID-19 pandemic, which differed from the year before the pandemic in 2019.

TABLE 1. Comparison of ischemic stroke patients admission and mortality rates between the same period of 2019 and 2020

	Admissions											Monthly Average
	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total	
2019	81	73	75	102	93	100	79	78	94	100	875	72.92
2020	69	60	46	43	58	60	44	52	54	69	555	46.25
Percent changes	-15%	-18%	-39%	-58%	-38%	-40%	-44%	-33%	-43%	-31%	-36%	
	Mortality											Monthly Average
	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total	
2019	7	7	8	8	6	7	7	7	1	11	69	5.75
2020	9	6	4	1	4	2	3	2	3	5	39	3.25
Percent changes	+22	-14%	-50%	-88%	-33%	-71%	-57%	-71%	+67%	-54%	-43%	

TABLE 2. Comparison of hemorrhagic stroke patients admission and mortality rates between the same period of 2019 and 2020

	Admissions											Monthly Average
	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total	
2019	25	17	16	32	42	26	29	29	27	31	274	22.82
2020	28	19	24	39	30	14	17	16	7	30	224	18.67
Percent changes	+11%	+11%	+33%	+18%	-29%	-46%	-12%	-45%	-74%	-3%	-18%	
	Mortality											Monthly Average
	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total	
2019	7	6	4	5	10	6	8	8	13	11	78	6.5
2020	8	7	10	16	10	6	8	3	4	5	77	6.4
Percent changes	+13%	+14%	+60%	+69%	0%	0%	0%	-63%	-69%	-64%	-1%	

Previous studies have linked COVID-19 with coagulopathy causing thrombosis in major blood vessels, including cerebral vessels (5,6). There are also several reports of stroke-related COVID-19 patients and an increase in the incidence of related strokes during the pandemic, especially in severe COVID-19 (6,7). With regards to these findings, the number of admissions of acute stroke patients was expected to show a rise during the pandemic. However, in contrast to this hypothesis, our study revealed a reduction of over 36% and 18% reduction in the rate of acute ischemic and hemorrhagic stroke admissions compared with the previous year, respectively.

Multiple studies also reported similar results of acute stroke admissions during the COVID-19 era. A multicentre study from Germany reported up to 46% reduction in acute stroke admissions in those centers (8). A study from the stroke unit in Bangladesh revealed an overall reduction of 46.3% in acute stroke admission per month in only six months period from January to June 2020 (9).

Additionally, similar trends were also observed in other diseases. Sto hr E et al. and Mafham et al. reported a significant reduction in hospitalization for all cardiovascular events in Germany and England, including perfusion procedures for emergency conditions such as acute coronary syndrome. This reduction rate occurs after the Government restricted movement and imposed social distancing measures (8,10).

It is assumed that while factors such as the fear of getting infected at hospitals and lock-down measures by the government might have resulted in lower interest in seeking medical care, followed by a consequent overall reduction in stroke admissions. Furthermore, Hoyer et al. hypothesized that social distancing and staying at home policy might have resulted in delayed disclosure of symptoms and late or no hospital admission (11). As there is no data from community stroke registry, patients who do not go to the hospital with an acute stroke, cannot receive reperfusion therapy or other appropriate treatments and are at increased risk of complications and mortality (10).

We also reported a reduction of over 43% and 1% in ischemic and hemorrhagic stroke mortality rate in our hospital during the COVID-19 era compared to the same period in 2019, respectively. Data from Italy and Bangladesh also showed a reduction in patients who received acute reperfusion treatment. Simultaneously, the mortality rate was unknown (9,12). It can be hypothesized that a lower number of stroke admissions allowed physicians to provide better medical care to the patients individual. Also, the limitation of clinic consultation and all non-clin-

ical tasks through the COVID-19 era in the hospital have freed up consultant time and increased consultant presence on the ward.

Preliminary reports showed a reduction in the number of stroke admissions with a delay in the presentation of acute strokes in the COVID-19 era. These findings might have resulted in delayed management of stroke, thus affecting the outcomes of this condition (13).

A study by Padmanabhan in England reports an increase in stroke severity during the COVID-19 pandemic¹⁴. Moreover, a direct comparison between mortality rates before and after the COVID-19 era in 2020 is likely to be confounded by differences in the underlying risk of admitted patients and by the duration of hospital stay. However, the risk for disability and death might be higher due to delayed or even avoided hospital presentation due to fear of COVID-19 contagion.

Fewer hospital admission rates may have been due to national policy to avoid going outside of the house, including hospital, wherever possible, or because of patients refusing transfer to hospital because of fear of contracting COVID-19, especially in the early months of the pandemic. Hospitals around the country have also promoted consultation and through telephone or telemedicine. The reasons for patients failing to attend emergency departments with acute stroke and other emergency conditions should be addressed promptly to avoid unnecessary deaths and disability, particularly during subsequent recurrences of COVID-19 in Indonesia.

This study has some limitations. First, this is a retrospective study based on medical records. Therefore, we could not assess other risk factors such as age, stroke severity or hospitalization stay due to the data limitation. This would make the investigation of reasons behind the change in stroke admissions rate not possible. Therefore, further analyses with continuous data and prospective study design are suggested to ensure a better data comparison to consider any possible effects on admissions.

CONCLUSION

This study found that there was a reduction in acute stroke admissions during the COVID-19 pandemic. The reduction rate was more prominent in ischemic stroke admissions than hemorrhagic stroke. Furthermore, the mortality rate was also affected during this period. Our study's findings provide new evidence and might have implications for increasing public and government awareness to avoid unnecessary losses and prevent jeopardizing outcomes in acute stroke management.

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REFERENCES

1. Indonesia's latest official COVID-19 figures. The Jakarta Post. Published May 5, 2020. Accessed May 5, 2020. <https://www.thejakartapost.com/news/2020/03/23/indonesias-latestcovid-19-figures.html>
2. Media Informasi Resmi Terkini Penyakit Infeksi Emerging. Dokumen Resmi Kesiapsiagaan Menghadapi Novel Coronavirus (COVID-19) Revisi ke-4. Published March 29, 2020. Accessed May 5, 2020. <https://covid19.kemkes.go.id/situasi-infeksi-emerging/info-corona-virus/dokumen-resmi-kesiap-siagaan-menghadapi-novel-coronavirus-covid-19-revisi-ke-4/#.XrFyMtNKgOp>
3. Nalleballe K, Siddamreddy S, Kovvuru S et al. Risk of coronavirus disease 2019 (COVID-19) from hospital admission during the pandemic. 2021 Oct;42(10):1285-1286.
4. Kwok CS, Gale CP, Kinnaird T et al. Impact of COVID-19 on percutaneous coronary intervention for ST-elevation myocardial infarction. *Heart*. 2020 Dec;106(23):1805-1811.
5. Oxley TJ, Mocco J, Majidi S et al. Large-vessel stroke as a presenting feature of COVID-19 in the young. *N Engl J Med*. 2020; 382(20): e60.
6. Pinzon R, Wijaya VO, Paramitha D. Middle cerebral artery territory infarction in a COVID-19 patient: a case report. *Med J Indones* [Internet]. 2020Nov.14 [cited 2021Mar.7];1(1)
7. Pinzon RT, Wijaya VO, Buana RB et al. Neurologic Characteristics in Coronavirus Disease 2019 (COVID-19): A Systematic Review and Meta-Analysis. *Front Neurol*. 2020; 11:565.
8. Stöhr E, Aksoy A, Campbell M et al. Hospital admissions during COVID-19 lock-down in Germany: Differences in discretionary and unavoidable cardiovascular events. *PLoS One*. 2020; 15 (11): e0242653.
9. Hasan ATMH, Das SC, Islam MS et al. Impact of COVID-19 on hospital admission of acute stroke patients in Bangladesh. *PLoS ONE*. 2021. 16(1): e0240385.
10. Mafham MM, Spata E, Goldacre R et al. COVID-19 pandemic and admission rates for and management of acute coronary syndromes in England. *Lancet*. 2020 Aug 8;396(10248):381-389.
11. Hoyer C, Ebert A, Huttner HB et al. Acute stroke in times of the COVID-19 pandemic: a multicenter study. *Stroke*. 2020; 51:2224–2227.
12. Candelaresi P, Manzo V, Servillo G, et al. The Impact of Covid-19 Lockdown on Stroke Admissions and Treatments in Campania. *J Stroke Cerebrovasc Dis*. 2021; 30(1):105448.
13. Schirmer CM, Ringer AJ, Arthur AS et al. Delayed presentation of acute ischemic strokes during the COVID-19 crisis. *J Neurointervent Surg*. 2020; 12:639–642.
14. Padmanabhan N, Natarajan I, Gunston R et al. Impact of COVID-19 on stroke admissions, treatments, and outcomes at a comprehensive stroke centre in the United Kingdom. *Neural Sci*. 2021; 42(1): 15–20.