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COVID-19 and stroke: Experience in a Ghanaian healthcare system

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ABSTRACT

Background: The novel coronavirus disease 19 (COVID-19) causes multi-system disease including possibly heightened stroke risk. Data from high-income countries (HIC) suggest disruptions to care delivery with reduced stroke admissions and administration of acute stroke reperfusion therapies. We are unaware of any published data on the impact of the COVID-19 pandemic on stroke admissions and outcomes in sub-Saharan Africa.
Purpose: To compare rates of stroke admissions and case fatality between corresponding periods in 2020 and 2019, within a hospital system in Ghana, to assess the potential impact of the COVID-19 pandemic.
Methods: We compared monthly stroke admissions and mortality rates between January to June 2020 vs. January to June 2019 at the Komfo Anokye Teaching Hospital, a tertiary medical center in Ghana. Predictors of in-patient mortality were assessed using a multivariate logistic regression model.
Results: Stroke admissions were higher in January to June 2020 vs. January to June 2019 (431 vs. 401), an increase of +7.5% (95% CI: 5.1–10.5%). There was also a rise in recurrent stroke admissions in 2020 vs. 2019 (19.0% vs. 10.9%, $p = .0026$). Stroke case fatality trended higher in 2020 vs. 2019 (29.3% vs. 24.2%, $p = .095$) with an adjusted odds ratio of 1.22 (95% CI: 0.89–1.68).
Conclusion: While an influence of secular trends cannot be excluded, the COVID-19 outbreak coincided with a comparatively significant rise in initial and recurrent stroke admissions at this Ghanaian tertiary hospital. Continued surveillance at this hospital, as well as assessment of this issue at other sites in Africa is warranted.

1. Introduction

The novel Coronavirus disease 2019 (COVID-19) has to date infected close to 12 million people with nearly 550,000 deaths reported worldwide [1]. Although the SARS-CoV-2 virus initially gains entry into the human host via the respiratory tract causing a pulmonary infection, its multi-systemic effects include hypercoagulable and thrombotic complications [2–4]. Data emerging from China, France and the US suggest that COVID-19 could heighten the risk of ischemic stroke occurrence [5–8]. In addition, disruption to healthcare service delivery engendered by the pandemic has impacted stroke care in various regions of the globe with reported delays in presentation of stroke cases, declines in volumes of stroke admissions, thrombolytic therapy administration, mechanical thrombectomy and increased stroke mortality [8–12].

We are unaware of any published data on the impact of the COVID-19 pandemic on stroke admissions and outcomes in sub-Saharan Africa (SSA). The objective of this study was to compare stroke admission and case fatality rates during a period that coincided with the Covid-19 outbreak with a corresponding period during the preceding year, so could assess the potential impact of the novel Covid-19 pandemic on stroke occurrence and outcomes in SSA [13,14].

2. Methods

2.1. Study context

The first cases of COVID-19 were confirmed in Ghana in the first week of March 2020. The government then proceeded to lock down three major cities in two regions namely Accra (the capital city), Kumasi (the second largest city) and Tema (a commercial and ports city) due to rising number of cases in these cities starting from March 30,2020. Following this 2-week lockdown, out-patient clinics were temporarily halted with only emergency admissions allowed. In April 2020, the partial lockdown was lifted with resumption of out-patient services to date amidst rising numbers of COVID-19 infections. To date,

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there are 21,000 confirmed cases in Ghana with 130 deaths [1].

3. Study design and settings

The study was approved by the Committee on Human Research Publication and Ethics (CHRPE) of the School of Medical Sciences, Kwame Nkrumah University of Science and Technology. This is a retrospective study conducted at the Komfo Anokye Teaching Hospital, a tertiary medical center in the Ashanti region (state) in Ghana. The hospital has a stroke unit and neuroimaging facilities for providing care for acute stroke cases and serves as a referral center for a population of 4 million dwelling within the Ashanti region. Reperfusion therapies including intravenous thrombolysis and thrombectomy are not well established at our center.

A review of hospital admissions and discharges for stroke was conducted between January and June of 2020 compared with a similar half year period in 2019. Strokes were diagnosed clinically using the WHO definition as a sudden onset of focal neurological deficit lasting longer than 24 h or leading to death with no other cause than a vascular event. Computerized tomography was performed in nearly 80% of all stroke cases to confirm and ascertain stroke type. Data collected from hospital records included age, sex, date of admission, stroke type, new or recurrent strokes and vital status on discharge.

3.1. Statistical analysis

Means were compared using the Student's *t*-test and proportions using the Chi-squared test. Predictors of stroke fatality were assessed in a multivariate logistic regression model where covariates analyzed include year of admission (2020 vs 2019), sex, age/10 year rise, stroke type- ischemic, hemorrhagic or untyped, recurrent or first-ever stroke. In bivariate analysis, factors attaining a *p*-value of 0.10 were included in the multivariate models. Statistical significance was set a two-tailed p-value of < 0.05. Statistical analysis was conducted using GraphPad Prism version 7 and SPSS.

4. Results

Between January and June 2020, there were 431 stroke admissions which when compared with 401 admissions over a similar time period in 2019 represents an increase of +7.5% (95% CI: 5.1–10.5%). As shown in Fig. 1, the highest monthly percentage increase in stroke admissions of +20.3% was observed in March 2020 compared with March 2019. The lockdown period in April was accompanied by a smaller increase in stroke admissions of +1.4% after which increases of +4.5% and + 4.8% were observed in May and June. The mean age of strokes admitted in 2019 of 59.7 ± 15.4 years was not significantly different from 60.6 ± 14.8 years in 2020, $p = .61$. There were non-significant increases in proportion of males and untyped stroke admissions (shown in Table 1). The proportions of stroke admissions by stroke types are shown in Fig. 2. There was a significant increase in the proportion of recurrent stroke admissions over the period in 2020 19.0% versus 10.9%, $p = .0026$.

Stroke case fatality increased from 24.2% in 2019 to 29.3% in 2020, $p = .095$. Fig. 3 shows monthly case fatality with spike in case fatality in April 2020 at 36.6%. As shown in Table 2, being admitted for stroke in 2020 during the COVID-19 pandemic era was associated with an adjusted odds ratio of 1.22 (95% CI: 0.89–1.68), $p = .22$. The two independent factors associated with in-patient hospital mortality were male sex with aOR 1.48 (1.07–2.04) and hemorrhagic stroke with aOR of 2.23 (1.53–3.24) and untyped strokes aOR of 2.89 (1.94–4.31) relative to ischemic strokes.

5. Discussion

Our study shows an increase in the burden of stroke admissions by 7.5% in the first half of the year 2020 compared with a similar period in 2019. This is in tandem with the rising burden of stroke in sub-Saharan Africa. A previous 30-year analysis of stroke admissions between 1983 and 2013 at our medical center showed 260% rise in stroke admissions over the period [13]. However, the rise in stroke admissions observed the COVID-19 outbreak in Ghana is at variance with reported declines in Spain [10], Hong Kong [11], France, China [9] and the US[8]. These initial reports from Asia, Europe and North America where COIVD-19 has been most impactful show less activation of stroke emergency codes, delays in stroke cases reporting to hospital, and declines in rates of thrombolytic and thrombectomy therapies. However in sub-Saharan Africa, the COVID-19 is perhaps yet to exert a maximal toll on stroke service delivery. Certainly the metrics of acute stroke care delivery in sub-Saharan Africa where delays in presentation for acute care is rife is different from more advanced healthcare systems in high-income countries. Reperfusion therapies are universally not available or not accessible to many even in countries where such interventions are available.

The inception of COVID-19 outbreak in Ghana in March was heralded by a 20% spike in stroke admissions compared with admissions in March 2019. We have observed a decline in out-patient clinic attendance with few patients meeting clinic appointments and disruptions in non-emergent care since March 2020. This may explain the profound increase in proportion of recurrent stroke admissions during the COVID-19 outbreak. Indeed, the most striking alteration in clinical profile of stroke admissions observed was the near 2-fold increment in recurrent strokes admitted in 2020 compared with 2019. Unable to keep clinic appointments and perhaps non-compliant with primary and secondary cardiovascular preventative therapies, individuals at high cardiovascular risk may have an accentuated risk for major adverse cardiovascular events including stroke. The SARS-CoV-2 pandemic has wrecked untold havoc in the care of prevalent health conditions such as cancer, myocardial infarction and acute stroke in HICs [15–17]. A potential approach may be to accelerate the adoption of teleneurology [18–20] and mobile health interventions [21,22] for CVD risk reduction in our low-and-middle income settings in the wake of an anticipated rise in the COVID-19 cases with its associated health service delivery disruptions.

Monthly stroke mortality was highest at 36% in April 2020 where the partial lock down may have potentially led to delays in presentation, admission of severe stroke cases and reduced neuroimaging rates for stroke type adjudication coupled attenuation of healthcare provider staff strengths due to sick leaves from COVID-19 exposure may have compromised the quality of service delivery. These might have contributed to an increased probability of in-patient case fatality from stroke by 22% (95% CI: −11 to 68%) in 2020. Available data from our hospital shows that between 1983 and 2013, stroke mortality rates averaged 40.1% [13]. However, between 2015 and 2019, with the establishment of a stroke unit and the provision of dedicated in-patient and out-patient services for stroke has resulted in a decline in stroke mortality to about 20% (see Fig. 3). However, the ensuing COVID-19 pandemic has eroded some of these gains by increasing case fatality. Although there are enhanced on-going public health education activities around prevention of COVID-19 transmission, the general public should be sensitized to report early to hospitals with emergent conditions such as strokes.

There are some limitations to our study. The analysis presented herein were derived from hospital admissions and discharge records which does not routinely capture risk factors and post-stroke complications in systematic fashion due to absence of electronic health records. Future studies should assess whether there are differences in stroke severity in the COVID-19 era. Also, the prevalence of COVID-19 co-infection among stroke admissions is unknown currently in Ghana. This is because there is no guidance yet on testing stroke patients on arrival at hospital for acute care. Such testing may be necessary to help optimize care such as prompt administration of anticoagulant therapy

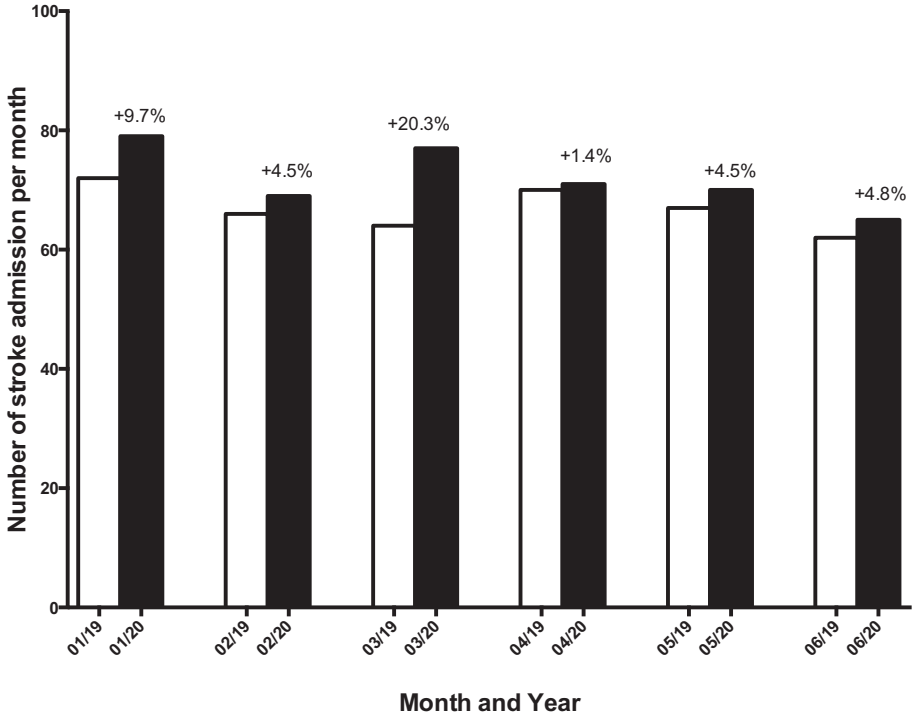

Fig. 1. Trends in stroke admission between January and June 2019 and 2020 in Kumasi, Ghana.

Table 1
Comparison of stroke admissions between January and June of 2019 versus 2020 in Kumasi, Ghana.

	January to June 2019	January to June 2020	P-value
Number of admissions	401	431	
Sex			0.28
Females, n (%)	187 (46.6)	185 (42.9)	
Males, n (%)	214 (53.4)	246 (57.1)	
Age, mean ± SD	59.7 ± 15.4	60.6 ± 14.8	0.41
Age categories			0.61
< 30	5 (1.3)	3 (0.7)	
30–49	108 (27.1)	104 (24.4)	
50–69	176 (44.2)	190 (44.6)	
70 +	109 (27.4)	129 (30.3)	
Stroke types			0.24
Ischemic	216 (53.9)	213 (49.5)	
Hemorrhagic	111 (27.7)	118 (27.4)	
Untyped	74 (18.5)	99 (23.0)	
Stroke			**0.0026**
New	303 (89.1)	289 (81.0)	
Recurrence	37 (10.9)	68 (19.0)	
Outcomes, n (%)			0.095
Died	96 (24.2)	125 (29.3)	
Discharged alive	301 (75.8)	301 (70.7)	

and enhanced precautionary and protective measures of vital health-care providers workforce to minimize bi-directional infection transmission. It will also be desirable to assess the impact of COVID-19 on adherence to primary and secondary preventative medications to help guide educational messages to the general population.

In conclusion, the COVID-19 outbreak coincided with a comparatively significant rise in initial and recurrent stroke admissions at this Ghanaian tertiary hospital. Continued surveillance at this hospital, as well as assessment of this issue at other sites in sub-Saharan Africa is warranted.

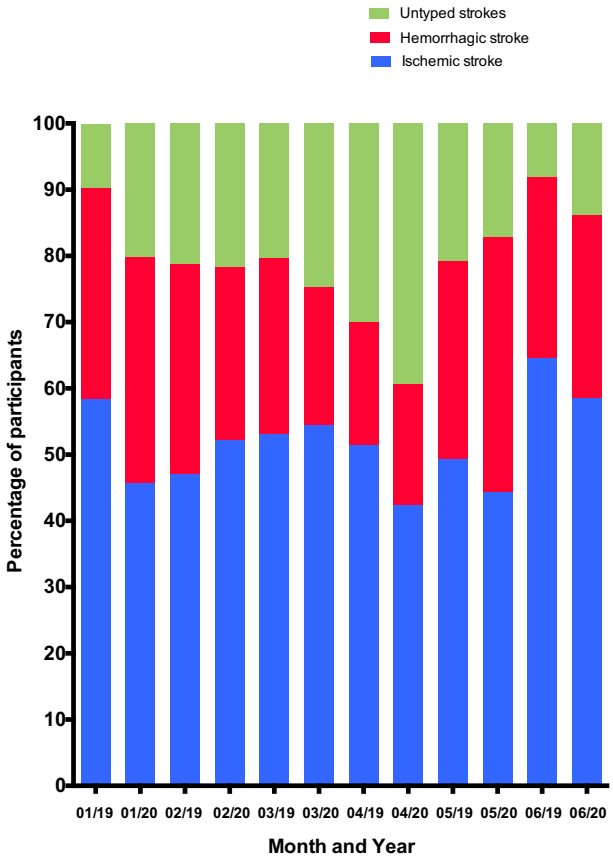

Fig. 2. Monthly trends in admissions by stroke types between January and June 2019 and 2020 in Kumasi, Ghana.

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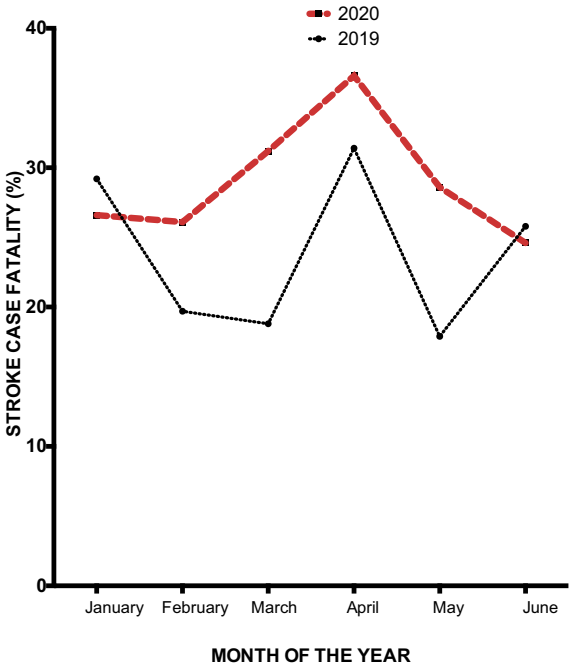

Fig. 3. Monthly trends in stroke mortality between January and June 2019 and 2020 in Kumasi, Ghana.

Table 2
Factors associated with stroke mortality.

Factor	Unadjusted odds ratio (95% CI)	P-value	Adjusted odds ratio (95% CI)	P-value
Year				
2020	1.30 (0.95–1.78)	0.095	1.22 (0.89–1.68)	0.22
2019	1.00		1.00	
Sex				
Male	1.48 (1.08–2.04)	0.014	1.48 (1.07–2.04)	0.018
Female	1.00		1.00	
Age				
Each 10-year rise	1.05 (0.95–1.17)	0.31	–	–
Stroke type				
Hemorrhagic stroke	2.33 (1.61–3.37)	0.0000	2.23 (1.53–3.24)	0.0000
Untyped stroke	2.95 (1.99–4.37)	0.0000	2.89 (1.94–4.31)	0.0000
Ischemic stroke	1.00		1.00	
Number of strokes				
Recurrent stroke	1.13 (0.70–1.83)	0.61	–	–
First-time stroke	1.00			

Declaration of Competing Interest

None to declare by all authors.

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