Original research

Alarming downtrend in mechanical thrombectomy rates in African American patients during the COVID-19 pandemic-Insights from STAR

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ABSTRACT

Background The coronavirus disease (COVID-19) pandemic has affected stroke care globally. In this study, we aim to evaluate the impact of the current pandemic on racial disparities among stroke patients receiving mechanical thrombectomy (MT).

Methods We used the prospectively collected data in the Stroke Thrombectomy and Aneurysm Registry from 12 thrombectomy-capable stroke centers in the US and Europe. We included acute stroke patients who underwent MT between January 2017 and May 2020. We compared baseline features, vascular risk factors, location of occlusion, procedural metrics, complications, and discharge outcomes between patients presenting before (before February 2020) and those who presented during the pandemic (February to May 2020).

Results We identified 2083 stroke patients: of those 235 (11.3%) underwent MT during the COVID-19 pandemic. Compared with pre-pandemic, stroke patients who received MT during the pandemic had longer procedure duration (44 vs 38 min, P=0.006), longer length of hospitalization (6 vs 4 days, P<0.001), and higher in-hospital mortality (18.7% vs 11%, P<0.001). Importantly, there was a lower number of African American patients undergoing MT during the COVID-19 pandemic (609 (32.9%) vs 56 (23.8%); P=0.004).

Conclusion The COVID-19 pandemic has affected the care process for stroke patients receiving MT globally. There is a significant decline in the number of African American patients receiving MT, which mandates further investigation.

INTRODUCTION

The Coronavirus disease of 2019 (COVID-19) pandemic has affected all aspects of medical care for various conditions.[1] Several studies reported a potential relationship between COVID-19 infection and ischemic stroke secondary to large vessel occlusion (LVO).[2 3] Importantly, recent studies reported a significant decline in the number of patients presenting with acute stroke, raising concerns that stroke patients are avoiding hospitals for various reasons including fear of COVID-19 infection.[4 5] Evidence from recently published studies suggested that this decline disproportionately affects African American (AA) patients, widening the already existed racial disparity in stroke care.[6] In this study, we aimed to investigate the impact of the COVID-19 pandemic on the racial disparities related to MT.

METHODS

Patient population and collected variables

Prospectively collected data from 12 thrombectomy-capable stroke centers included in the Stroke Thrombectomy and Aneurysm Registry (STAR) collaboration was interrogated to identify stroke patients who received mechanical thrombectomy (MT) between January 2017 and May 2020. Eleven of the included centers are located in the United States and one in Germany. Patients who presented before February 2020 were considered pre-COVID-19 pandemic and patients who presented after February 2020 were considered during the COVID-19 pandemic. We compared baseline demographics, procedural metrics, and outcomes between patients undergoing MT before and during the pandemic. Approval from the Institutional Review Board at the Medical University of South Carolina was obtained, and no consent was needed per the institutional policy.

Statistical analysis

We used univariate analysis to report patient demographic and clinical characteristics using median and IQR for continuous variables and percentages for categorical variables. Characteristics of groups were compared using the Mann–Whitney *U* test, and chi-square as appropriate. To assess for the relationship between the rate of AA (or Black Europeans of African ancestry) patients receiving MT and COVID-19 pandemic controlling for the center of presentation, we used the Cochran Mantel Haenszel test. An alpha level of 0.05 was used as the level of statistical significance. The analysis was conducted using SPSS v25 (IBM Corporation, New York, NY).

RESULTS

Patients' characteristics

A total of 2083 stroke patients were included in this study, 1848 (88.7%) underwent MT before the

Table 1 Characteristics, procedural metrics, and outcomes of stroke patients receiving mechanical thrombectomy before and during the COVID-19 pandemic

	Thrombectomy patients during COVID-19 pandemic (n=235)	Thrombectomy patients before COVID-19 pandemic (n=1848)	P- value*
Age, median (IQR)	71 (59–79)	69 (58–79)	0.058
Females, n (%)	113 (48.1%)	901 (48.8%)	0.846
Racial/ethnic distribution:			**0.01**
White, n (%)	146 (62.1%)	1047 (56.7%)	
African American, n (%)	56 (23.8%)	609 (32.9%)	
Hispanic, n (%)	31 (13.2%)	188 (10.2%)	
Others, n (%)	2 (0.9%)	4 (0.2%)	
Admission NIHSS, median (IQR)	16 (10–21)	16 (10–21)	0.898
IV-tPA, n (%)	106 (45.1%)	831 (45%)	0.968
ASPECTS, median (IQR)†	9 (7–10)	9 (7–10)	0.225
Posterior circulation occlusion, n (%)	21 (8.9%)	195 (10.6%)	0.444
Symptom onset to groin in minutes, median (IQR)	343 (202–576)	288 (178–575)	0.065
Number of passes, median (IQR)	2 (1–3)	2 (1–3)	0.921
mTICI ≥2 b, n (%)	196 (83.4%)	1588 (85.9%)	0.228
Procedure duration in minutes, median (IQR)	44 (25–73)	38 (21–63)	**0.006**
Procedure complications, n (%)	20 (8.5%)	163 (8.8%)	0.874
sICH, n (%)	15 (6.4%)	108 (5.8%)	0.741
Length of hospitalization in days, median (IQR)	6 (3–10)	4 (2–5)	**<0.001**
DC mRS, median (IQR)	4 (2–5)	3 (2–4)	**0.015**
mRS 0–2 on discharge, n (%)	77 (32.8%)	637 (34.5%)	0.604
In-hospital mortality, n (%)	44 (18.7%)	203 (11%)	**<0.001**

*Calculated using chi-square test for categorical variables and Mann–Whitney *U* test for the continuous variables.
†Only for patients with anterior circulation occlusion.
ASPECTS, Alberta Stroke Program Early CT score; COVID-19, coronavirus disease of 2019; IQR, interquartile range; IV-tPA, intravenous tissue plasminogen activator; LKN, last known normal; mRS, modified Rankin Scale; mTICI, modified Thrombolysis in Cerebral Infarction; NIHSS, National Institute of Health Stroke Scale; sICH, symptomatic intracerebral hematoma.

COVID-19 pandemic and 235 (11.3%) during the COVID-19 pandemic. The median age was 69 (IQR 58–79) years, admission National Institute of Health Stroke Scale (NIHSS) 16 (10-21), and Alberta Stroke Program Eartly CT Score (ASPECTS) 9 (IQR 7–10). Online supplemental table I summarizes baseline features and clinical outcomes. The racial/ethnic distribution of the included patients was as follows: 1197 (57.8%) white, 665 (31.9%) AA, 215 (10.3%) Hispanic, and six (0.3%) others.

Before vs. during the COVID-19 pandemic

Table 1 summarizes the comparison between stroke patients who underwent MT before vs during the COVID-19 pandemic. Five (2.1%) of the MT patients during the pandemic were positive for COVID-19 polymerase chain reaction (PCR) in nasopharyngeal swap. Significant differences in patients undergoing MT during the COVID-19 pandemic include: longer procedure duration (44 vs 38 min, P=0.006), longer length of hospitalization (6 vs 4, P<0.001), lower discharge mRS (4 vs 3, P=0.015), and higher in-hospital mortality (18.7% vs 11%, P<0.001), compared with patients who underwent MT before the pandemic. While the difference between the symptom onset to groin time was not significant in the overall population (P=0.065) and in non-AA patients (P=0.278), AA patients had longer onset to groin time during the COVID-19 pandemic (362 vs 275 min, P=0.047). In addition, the percentage of AA patients who underwent MT in the included centers decreased from 609/1848 (32.9%) before the COVID-19 pandemic to 56/235 (23.8%) during the COVID-19 pandemic (P=0.004). No interaction was noted between the percentage of AA patients receiving thrombectomy and the centers that performed the thrombectomy before and after the COVID-19 pandemic (P=0.192). No other statistically significant differences were noted in other races/ethnicities. Figure 1 shows the trend in the rate of AA patients receiving mechanical thrombectomy during the study period. Online supplemental tables II and III show the comparison between AA and non-AA thrombectomy patients before and during the COVID-19 pandemic.

DISCUSSION

In this multicenter, international study, we evaluated the procedural metrics and outcomes of MT patients presenting during the COVID-19 pandemic compared with patients presenting during the

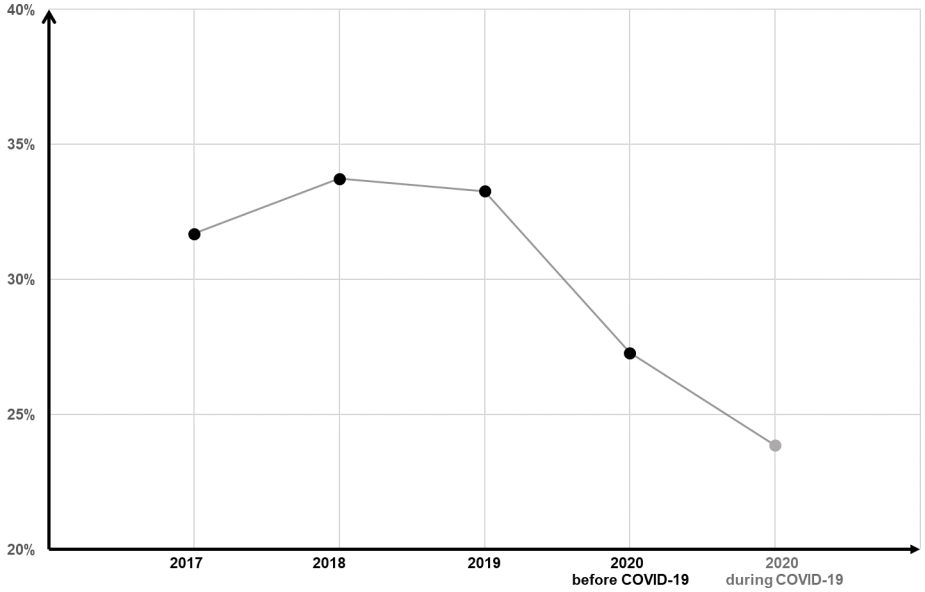

Figure 1 The trend in the rate of African American patients receiving mechanical thrombectomy during the study period.

3 prior years. We have found that patients who presented during the pandemic required a longer procedure time and had a higher rate of mortality. While only 2.1% of these patients were positive for COVID-19 PCR, these findings likely reflect the effect of COVID-19 precautions and the changes in healthcare workflow protocols.

Additional significant findings from our analyses included a reduction in the number of AA patients undergoing MT, which is highly alarming because racial disparities in cerebrovascular diseases care already exist. AA patients have higher vascular risk factors, and experience higher stroke-related in-hospital mortality.[7] Also, studies have shown that AA/Hispanic patients are more likely to have received aneurysm treatment following a subarachnoid hemorrhage rather than getting treatment in the early stages for unruptured aneurysm.[8]

The reduction in the number of AA patients receiving MT during the COVID-19 pandemic threatens to widen the gap in racial disparities given that most patients with emergent LVO would suffer from significant long-term disability if they do not receive treatment.[9–11] A recent study evaluating racial disparities among patients evaluated over a large telestroke network reported a significant drop among AA patients with acute ischemic stroke.[6] The overall drop in the number of AA patients presenting with acute stroke is a likely reason that there is a drop in the number of AA patients receiving MT. It remains unclear the reasons behind this drop. However, studies have shown that AA patients have a higher incidence of COVID-19 infection and increased mortality[12 13] which could be the reason why AA patients are reluctant to seek medical attention over concerns for safety due to fear of acquiring COVID-19.

Interestingly, there was an increase in the symptom onset to groin time in AA, but not non-AA patients which may also reflect the abundance of caution from presenting to hospitals during the early COVID-19 pandemic. A similar delay in care in all stroke patients during the COVID-19 pandemic was reported recently by Schirmer et al.[14] One of the proposed causes for this delay is the changes in stroke triage protocols during the pandemic.[15]

Our study has a few limitations. First, our study is limited by its observational nature. Also, our study does not provide information related to the relationship between COVID-19 infection and emergent LVO. However, our study provides multicentric, early observations stroke centers in different regions.

CONCLUSION

Stroke patients receiving MT during the COVID-19 pandemic had a longer procedure duration and a higher mortality rate compared with patients presenting before the pandemic. Also, there is a decline in the number of AA patients receiving MT during the pandemic, which demonstrates the need for more work in the public health domain to educate patients with the importance of prompt medical evaluation for all those suffering from stroke symptoms.

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Supplementary Appendix

Table of Contents:

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Supplementary Tables:

Table I: Characteristics, procedural metrics, and outcomes of all stroke patients undergoing mechanical thrombectomy during the study period (January 2017 to May 2020).

	All mechanical thrombectomy patients during study period (n=2083)
Age, median (IQR)	69 (58-79)
Females, n (%)	1014 (48.7%)
Admission NIHSS, median (IQR)	16 (10-21)
IV-tPA, n (%)	937 (45%)
ASPECTS, median (IQR)[§]	9 (7-10)
Posterior circulation occlusion, n (%)	216 (10.4%)
Symptom-onset to groin in minutes, median (IQR)	292 (180-575)
Number of passes, median (IQR)	2 (1-3)
mTICI≥2b, n (%)	1784 (85.6%)
Procedure duration in minutes, median (IQR)	38 (21-64)
Procedure complications, n (%)	183 (8.8%)
sICH, n (%)	123 (5.9%)
Length of stay in days, median (IQR)	4 (2-6)
DC mRS, median (IQR)	3 (2-5)
Functional independence on discharge (mRS 0-2), n (%)	714 (34.3%)
In-hospital mortality, n (%)	247 (11.9%)

[§]Only for patients with anterior circulation occlusion

[†]Calculated using chi-square test (or Fisher exact test for cells<5) for categorical variables and Mann-Whitney U test for the continuous variables.

Abbreviations: ASPECTS: Alberta Stroke Program Early CT score, COVID: coronavirus disease of 2019, IQR: interquartile range, IV-tPA: intravenous tissue plasminogen activator, LKN: last known normal, mRS: modified Rankin scale, mTICI: modified Thrombolysis in Cerebral Infarction, NIHSS: National Institute of Health stroke scale, sICH: symptomatic intracerebral hematoma.

Table II: Characteristics, procedural metrics, and outcomes of patients receiving mechanical thrombectomy before COVID-19 pandemic.

	African American patients (n=609)	Non-African American patients (n=1239)	P-value†
Age, median (IQR)	63 (54-74)	71 (61-81)	**<0.001**
Females, n (%)	305 (50.1%)	596 (48.1%)	0.424
Admission NIHSS, median (IQR)	16 (10-20)	16 (10-21)	0.821
IV-tPA, n (%)	285 (46.8%)	546 (44.1%)	0.267
ASPECTS, median (IQR)§	9 (7-10)	9 (7-10)	0.14
Posterior circulation occlusion, n (%)	72 (11.8%)	123 (9.9%)	0.213
Symptom-onset to groin in minutes, median (IQR)	275 (175-557)	292 (178-589)	0.222
Number of passes, median (IQR)	1 (1-3)	2 (1-3)	**0.049**
mTICI≥2b, n (%)	520 (85.4%)	1068 (86.2%)	0.637
Procedure duration in minutes, median (IQR)	39 (23-64)	37 (20-63)	0.09
Procedure complications, n (%)	56 (6.2%)	107 (8.6%)	0.69
sICH, n (%)	34 (5.6%)	74 (6%)	0.737
Length of stay in days, median (IQR)	3 (2-5)	4 (2-6)	**0.001**
DC mRS, median (IQR)	3 (2-4)	4 (2-5)	**0.015**
Functional independence on discharge (mRS 0-2), n (%)	226 (37.1%)	401 (32.4%)	**0.043**
In-hospital mortality, n (%)	45 (7.4%)	158 (12.8%)	**<0.001**

§Only for patients with anterior circulation occlusion

†Calculated using chi-square test for categorical variables and Mann-Whitney U test for the continuous variables.

Abbreviations: ASPECTS: Alberta Stroke Program Early CT score, COVID: coronavirus disease of 2019, IQR: interquartile range, IV-tPA: intravenous tissue plasminogen

activator, LKN: last known normal, mRS: modified Rankin scale, mTICI: modified Thrombolysis in Cerebral Infarction, NIHSS: National Institute of Health stroke scale, sICH: symptomatic intracerebral hematoma

Table III: Characteristics, procedural metrics, and outcomes of patients receiving mechanical thrombectomy during COVID-19 pandemic.

	African American patients (n=56)	Non-African American patients (n=179)	P-value†
Age, median (IQR)	67 (57-74)	73 (62-80)	**0.011**
Females, n (%)	24 (48.2%)	86 (48%)	0.982
Admission NIHSS, median (IQR)	17 (10-23)	15 (10-20)	0.293
IV-tPA, n (%)	25 (44.6%)	81 (45.3%)	0.936
ASPECTS, median (IQR)§	9 (6-10)	9 (7-10)	0.84
Posterior circulation occlusion, n (%)	3 (5.4%)	18 (10.1%)	0.282
Symptom-onset to groin in minutes, median (IQR)	362 (205-495)	336 (201-597)	0.636
Number of passes, median (IQR)	1 (1-3)	2 (1-3)	**0.033**
mTICI≥2b, n (%)	47 (83.9%)	149 (8.32%)	0.904
Procedure duration in minutes, median (IQR)	36 (23-64)	47 (26-76)	**0.019**
Procedure complications, n (%)	6 (10.7%)	14 (7.8%)	0.498
sICH, n (%)	4 (7.1%)	11 (6.1%)	0.79
Length of stay in days, median (IQR)	6 (4-12)	5 (3-9)	0.114
DC mRS, median (IQR)	4 (2-4)	4 (2-5)	0.884
Functional independence on discharge (mRS 0-2), n (%)	24 (42.9%)	61 (34.1%)	0.233
In-hospital mortality, n (%)	8 (14.3%)	36 (20.1%)	0.329

§Only for patients with anterior circulation occlusion

†Calculated using chi-square test (or Fisher exact test for cells<5) for categorical variables and Mann-Whitney U test for the continuous variables.

Abbreviations: ASPECTS: Alberta Stroke Program Early CT score, COVID: coronavirus disease of 2019, IQR: interquartile range, IV-tPA: intravenous tissue plasminogen

activator, LKN: last known normal, mRS: modified Rankin scale, mTICI: modified Thrombolysis in Cerebral Infarction, NIHSS: National Institute of Health stroke scale, sICH: symptomatic intracerebral hematoma.