Association of Corona virus Disease (COVID 19) with Large Vessel Occlusion Strokes

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Abstract

Background & Objective : Coronavirus disease 2019 (COVID-19) may increase the risk of acute ischemic stroke similar to the increased risk of 3.2-fold to 7.8-fold seen within the first 3 days after other respiratory tract infections. The purpose of the study is to study the association of COVID 19 and stroke subtypes in patient presenting with acute neurologic symptoms. **Materials and Methods :** This study was designed as an Observational case control study from January 2021 to March 2022. Demographic data, COVID-19 status, stroke-related risk factors, and clinical and imaging findings pertaining to stroke were collected. Univariate and multivariate analyses were conducted to evaluate the association between COVID-19 and stroke subtypes., **Results :** In the COVID-19 group, the NIH stroke scale score was found as 9.2 and in the control group the score was found as 7.9. The diagnostic variables such as acute ischemic infract, large vessel occlusions, Middle cerebral artery segments M1 and M2, Anterior cerebral artery segments A1 and A2, and Posterior cerebral artery segments P1 and P2 were evaluated. Out of the 50 patients included in the study, 23 patients (46%) had acute ischemic infract, followed by large vessel occlusions with 10 patients (40%), Anterior cerebral artery segments A1 and A2 with 3 patients (6%) and both Middle cerebral artery segments M1 and M2 as well as Posterior cerebral artery segments P1 and P2 with 2 patients each (4% each).**Interpretation and Conclusions:** COVID-19 is associated with LVO strokes but not with SVO strokes. Patients with COVID-19 presenting with acute neurologic symptoms warrant a lower threshold for suspicion of large vessel stroke, and prompt workup for large vessel stroke is recommended.

Key words -Coronavirus disease 2019, LVO strokes and SVO strokes

Introduction

As a respiratory illness, Coronavirus disease 2019 (COVID-19) can be transmitted from person to person. It was discovered during an investigation into a COVID-19 outbreak in Wuhan, China, that the virus responsible for this disease is a novel coronavirus. East Asian and Middle Eastern disease outbreaks have been associated with Coronaviruses (CoVs) for the last two decades[1].

As early as 2002, SARS (severe acute respiratory syndrome) and MERS (middle east respiratory syndrome) emerged. In late 2019, a novel coronavirus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), causing Coronavirus disease 2019 (COVID-19), emerged, causing an ongoing pandemic in many countries.

The novel CoV (originally named 2019-nCoV), first identified in Wuhan City, Hubei Province, China, on 12 December 2019, is currently causing disease outbreaks throughout the world[2].

COVID-19, caused by SARS-CoV-2, was officially named by the World Health Organization (WHO) on 11 February 2020.

Wuhan's Huanan South China Seafood Market was found to be the primary cluster of patients. SARS, MERS, and, presently, COVID-19 are severe and potentially fatal diseases caused by the Coronaviridae (subfamily Coronavirinae) family.

SARS-CoV-2 belongs to the same lineage as the CoVs that cause SARS, but it is genetically distinct from them. There were six known CoVs that infected humans until 2020, including the human CoV 229E (HCoV-229E), the human CoV NL63, the human CoV OC43, the human CoV HKU1, the SARS-CoV, and the MERS-CoV. There have been outbreaks of SARS-CoV and MERSCoV with high mortality rates, but other illnesses associated with the upper respiratory tract remain mild[3].

Acute emergencies are experiencing unusually long delays before patients seek medical attention. Based on a review of neuroimaging databases from the RAPID software platform, the timeliness of acute stroke evaluations has decreased by 39%.

In a retrospective single-center study, the proportion of new large vessel occlusions doubled during this COVID period. In five young patients, COVID-19 was associated with large vessel occlusion.

There were 11 acute ischemic strokes among 221 Chinese patients hospitalized for COVID-19. Cerebrovascular disease was detected about 12 days after SARS-CoV-2 infection[4],[5].

Initial reports indicated that ACE-2 receptors were located in the heart, kidney, and testis, but they were later found to be present throughout blood vessels and in brain glial tissue as well. COVID-19 patients have been reported to suffer from deep vein

thrombosis, myocardial infarction, and pulmonary embolisms due to vascular thrombosis and hypercoagulability. In addition, there have been numerous case reports describing strokes caused by COVID-19[6].

During the COVID-19 pandemic, we observed an increase in acute ischemic strokes in patients presenting with acute neurologic symptoms[7]. As far as we know, no study has examined the association of COVID-19 with either large vessel strokes or small vessel strokes. We investigated the association between COVID-19 and stroke subtypes in patients with acute neurologic symptoms in this study.

Materials and Methods

Place of Study

Vinayaka Mission's Medical College and Hospitals, Karaikal, Puducherry, India - 609609

Study Design

Observational case control study

Source of Data

All patients referred to the department of Radio-Diagnosis. Patients of all age groups clinically suspected for acute neurological manifestation.

Inclusion Criteria

All patients referred to department of radiology with clinically suspected for acute neurological manifestation

Exclusion Criteria

- All patients having cardiac pacemakers, prosthetic heart valves, cochlear implants metallic implants, Patients having history of claustrophobia,
- All patients who do not consent to be a part of study.

Statistical Method Followed

- The results of the descriptive analysis will be presented in numbers, %ages and as a Mean+/- SD (Min-Max). Chi square /Fisher Exact test and Pearson's correlation will be used to find the association between clinical, radiological findings.
- Microsoft word and excel will be used to generate graphs and tables. Confidence interval with lower limit more than 50% is associated with statistical significance.

The Method of Study

The study will be conducted after obtaining Institutional Ethical committee clearance. Patients referred to Department of Radiodiagnosis will be evaluated.

Results

The gender distribution showed that 28 patients (56%) of the study population were males and the remaining 22 patients (44%) were females. The mean age comparison analysis between the two groups was given in table 6 and figure 4. The results showed that the mean age was 66.9 in the COVID-19 group and 69.23 in the control group. The diagnostic variables such as acute ischemic infract, large vessel occlusions, Middle cerebral artery segments M1 and M2, Anterior cerebral artery segments A1 and A2, and Posterior cerebral artery segments P1 and P2 were evaluated. Out of the 50 patients included in the study, 23 patients (46%) had acute ischemic infract, followed by large vessel occlusions with 10 patients (40%), Anterior cerebral artery segments A1 and A2 with 3 patients (6%) and both Middle cerebral artery segments M1 and M2 as well as Posterior cerebral artery segments P1 and P2 with 2 patients each (4% each).

Hypertension and Diabetes mellitus type 2 leads the chart with 30 patients (60%) each, followed by COVID-19 with 25 patients (50%). Small vesicle occlusions were found in 19 patients (76%), dyslipidemia and history of smoking were recorded in 11 patients (44%) each and coronary artery disease was found in 10 patients (40%). The large vessel occlusion analysis revealed that around 24% (6 patients) of the population in the COVID-19 group had large vessel occlusion and only 4 patients (16%) in the control group had the symptom.

In the small vessel occlusion analysis, 9 patients (36%) from the COVID-19 group were found to have the symptom whereas in the control group 10 patients (40%) had the symptom.

The distribution of Diabetes mellitus type 2 in the study groups was analyzed and given and showed that 19 patients (76%) from the COVID-19 group were suffering from diabetes mellitus type 2 and 11 patients (44%) from the control group were suffering from diabetes mellitus type 2. Distribution of hypertension in the study showed that diabetes mellitus, 19 patients (76%) form the COVID-19 group and 11 patients (44%) from the control group were suffering from hypertension.

In the case of coronary artery disease diagnosis in the study population, six patients form the COVID-19 group were found to have the disease condition and four patients from the control group also had coronary artery disease.

The congestive heart failure distribution in the study group was recorded and given in table 12 and figure 10. The results showed that only one patient from the COVID-19 group had suffered with congestive heart failure (4%). During the evaluation of atrial fibrillation among the study groups, it showed that only four patients (16%) from the COVID-19 group and one patient (4%) from the control group were suffering with atrial fibrillation.

It showed that for the COVID-19 group, the mean time to presentation was derived as 41.2. In the case of control group, the mean time to presentation was derived as 11.1. In the COVID-19 group, the NIH stroke scale score was found as 9.2 and in the control group the score was found as 7.9.

The results revealed that the mean D-dimer level was 8.2 in the COVID-19 group and 4.0 in the control group. The mean ESR of the COVID-19 group was recorded as 62.2, whereas in the control group the value was recorded as 37.8.

The value was higher in the COVID-19 group (88.3) when compared to the control group (48.7).

TABLE 1: Demographic Characteristics of Study Sample (*n* = 50)

Characteristic	Result
Age (y)	66.9 ± 14.9
Female	44% (22)
Male	56% (28)
Acute ischemic infarct	46% (23)
Large vessel occlusions[a]	40% (10)
Middle cerebral artery segments M1 and M2	4% (2)
Anterior cerebral artery segments A1 and A2	6% (3)
Posterior cerebral artery segments P1 and P2	4% (2)
Vertebral artery	--
Basilar artery	--
Internal carotid artery	--
Multifocal	--
Small vessel occlusions	(76)19
COVID-19[b]	(50%) 25
Hypertension	(60%) 30
Diabetes mellitus type 2	(60%) 30

Dyslipidemia	(44%)11
History of smoking	(44%)11
Coronary artery disease	(40%)10
Atrial fibrillation	--
Congestive heart failure	16% (4)
Body mass index	26 ±5.2
NIH Stroke Scale score	9 ±4.3
Time to presentation (h)	12 ±3.4
D-Dimer level (µg/mL)	5 ±2.7
Erythrocyte sedimentation rate (mm/h)	48 ±12.4
C-reactive protein level (mg/L)	74 ±22

The demographic characters evaluated in the study were given in table 1. The mean age of the study group was recorded as 66.9 ± 14.9. the males and females in the study group was 56% and 44%, respectively. Acute ischemic infract was observed in 46% of the study population whereas, large vessel occlusions were observed in 40% of the study group. The arterial segment evaluation such as Middle cerebral artery segments M1 and M2, Anterior cerebral artery segments A1 and A2, and Posterior cerebral artery segments P1 and P2 were observed in 2 patients, 3 patients and 2 patients, respectively. Small vessel occlusions were recorded in 76% of the patients. Hypertension and diabetes mellitus type 2 were recorded in 30 patients (60%). 44% of the patients had dyslipidemia and 44% of the patients had history of smoking. Covid 19 was recorded in 50% of the patients. Coronary artery disease was diagnosed in 40% of the study population and congestive heart failure was found in 16% of the patients. BMI of the study group was calculated as 26 ± 5.2. NIH stroke scale score for the study population was found as 9 ± 4.3. The D-dimer level was recorded as 5 ± 2.7 µg/mL in the study group. ESR was calculated as 48 ± 12.4 mm/h and C-reactive protein level was noted as 74 ± 22 mg/L.

TABLE 2: Univariate Comparisons of Stroke-Related Variables Between Patients with and Those Without Coronavirus Disease (COVID-19)

Characteristic	**With COVID-19 (*n* = 25)**	**Without COVID-19 (*n* = 25)**	***p***
Age (y)	66.9 ± 14.9	69.23 ± 11.9	0.472
Male sex	56% (14)	48% (12)	0.123
Large vessel occlusion	24 (6)	16% (4)	0.001[a]

Small vessel occlusion	36 (9)	40% (10)	0.517
Diabetes mellitus type 2	76 (19)	44% (11)	0.282
Hypertension	76 (19)	44% (11)	0.526
Coronary artery disease	24(6)	16% (4)	0.124
Congestive heart failure	4 (1)	0 (0)	0.052
Dyslipidemia	40 (10)	4% (1)	0.615
Atrial fibrillation	16 (4)	4% (1)	0.322
Smoking status	32 (8)	12% (3)	0.187
BMI	25.4 ± 4.3	27.2 ± 6.3	0.232
Time to presentation (h)	14.2 ± 5.2	11.1 ± 6.5	0.131
NIH Stroke Scale score	9.2 ± 7.2	7.9 ± 6.2	0.053
D-Dimer level (µg/mL)	8.2 ± 5.1	4.0 ± 5.3	0.313
Erythrocyte sedimentation rate (mm/h)	62.2 ± 11.3	37.8 ± 14.8	0.145
C-reactive protein level (mg/L)	88.3 ± 17.2	48.7 ± 36.3	0.235

Univariate Comparisons of Stroke-related Variables between Patients with COVID-19 and without COVID-19 was depicted in table 5. In the group of patients with COVID-19, the mean age was recorded as 66.9 ± 14.9, whereas in the control group, the mean age was found as 69.23 ± 11.9. No significant difference was found between the mean age of both the groups. Out of the 25 patients in each group, 14 patients (56%) were males in the COVID-19 group and 12 patients (48%) were males in the control group. No significant difference was observed in the sex distribution of both the groups. In the large vessel occlusion analysis, 6 patients were found to have the symptom in the COVID-19 group compared to the 4 patients having symptom in the control group. A significant difference was observed on the large vessel occlusion symptom evaluation between both the groups with the p-value of 0.001.

Discussion and conclusion

We conducted this retrospective study because of our anecdotal observation of an increased frequency of acute strokes in patients presenting with acute neurologic symptoms during the COVID-19 pandemic[8,9,10]. We included stroke code patients presenting during the COVID-19 pandemic who underwent emergency stroke workups. To our knowledge, this is the first study to show an association between

COVID-19 and large vessel strokes in south India.The diagnostic variables such as acute ischemic infract, large vessel occlusions, Middle cerebral artery segments M1 and M2, Anterior cerebral artery segments A1 and A2, and Posterior cerebral artery segments P1 and P2 were evaluated. Out of the 50 patients included in the study, 23 patients (46%) had acute ischemic infract, followed by large vessel occlusions with 10 patients (40%), Anterior cerebral artery segments A1 and A2 with 3 patients (6%) and both Middle cerebral artery segments M1 and M2 as well as Posterior cerebral artery segments P1 and P2 with 2 patients each (4% each).

Conclusion

COVID-19 is associated with LVO strokes but not with SVO strokes. Patients with COVID-19 presenting with acute neurologic symptoms warrant a lower threshold for suspicion of large vessel stroke, and prompt workup for large vessel stroke is recommended.

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