

Stroke Risk, Phenotypes, and Death in COVID-19: Systematic Review and Newly Reported Cases

Supplementary Online File

Index

Table/figure	Content	Page
Table e-1.	Systematic search: PubMed	02
Table e-2.	Systematic search: medRxiv and bioRxiv	03
Table e-3.	Systematic search: Research Square	04
Figure e-1.	PRISMA flow chart showing the results of the systematic search for meta-analyses of proportion of COVID-19 patients with stroke	05
Figure e-2.	Funnel plots for meta-analyses of stroke incidence	06
Figure e-3.	PRISMA flow chart showing the results of the systematic search for case series and case reports	07
Table e-4.	Summary of 160 cases included in the study	08
Figure e-4.	Dendrogram, silhouette and C-Index plots for clusters of 158 strokes	14
Figure e-5.	Dendrogram, silhouette and C-Index plots for clusters of 124 ischemic strokes	15
Table e-5.	Cluster analysis for 158 COVID-19 patients with any stroke	16
Table e-6.	Cluster analysis for 124 COVID-19 patients with ischemic stroke	18
Table e-7.	Outcomes of three clusters for any stroke	20
Table e-8.	Unadjusted association between in-hospital mortality and variables more frequently found in stroke cluster #3	21
Table e-9.	Outcomes of two clusters for ischemic strokes	22
Table e-10.	Unadjusted association between in-hospital mortality and variables more frequently found in the ischemic stroke cluster #2	23
References		24

Table e1. Systematic search for stroke and COVID-19 in PubMed (May 23, 2020)

Search Term	Number of Titles
COVID AND stroke	139
coronavirus AND stroke	94
COVID AND cerebrovascular	59
coronavirus AND cerebrovascular	50
COVID AND subarachnoid	7
coronavirus AND subarachnoid	9
COVID AND cerebral venous	9
coronavirus AND cerebral venous	11
COVID AND neurol*	623
coronavirus AND neurol*	589
TOTAL	1,590

Table e2. Systematic search for stroke and COVID-19 in medRxiv and bioRxiv (May 23, 2020)

Search Term	Number of Titles
Full text or abstract or title "COVID stroke" (match whole all)	186
Full text or abstract or title "coronavirus stroke" (match whole all)	176
For full text or abstract or title "COVID cerebrovascular" (match whole all)	180
Full text or abstract or title "coronavirus cerebrovascular" (match whole all)	180
Full text or abstract or title "COVID subarachnoid" (match whole all)	10
Full text or abstract or title "coronavirus subarachnoid" (match whole all)	9
Full text or abstract or title "COVID cerebral venous" (match whole all)	16
Full text or abstract or title "coronavirus cerebral venous" (match whole all)	13
Full text or abstract or title "COVID neurological" (match whole all)	274
Full text or abstract or title "coronavirus neurological" (match whole all)	301
TOTAL	1,345

Table e3. Systematic search for stroke and COVID-19 in Research Square (May 23, 2020)

Search Term	Number of Titles
All COVID-19 preprints (https://www.researchsquare.com/coronavirus)	1,090
TOTAL	1,090

Figure e-1. PRISMA flow chart showing the results of the systematic search for meta-analyses of proportion of COVID-19 patients with stroke

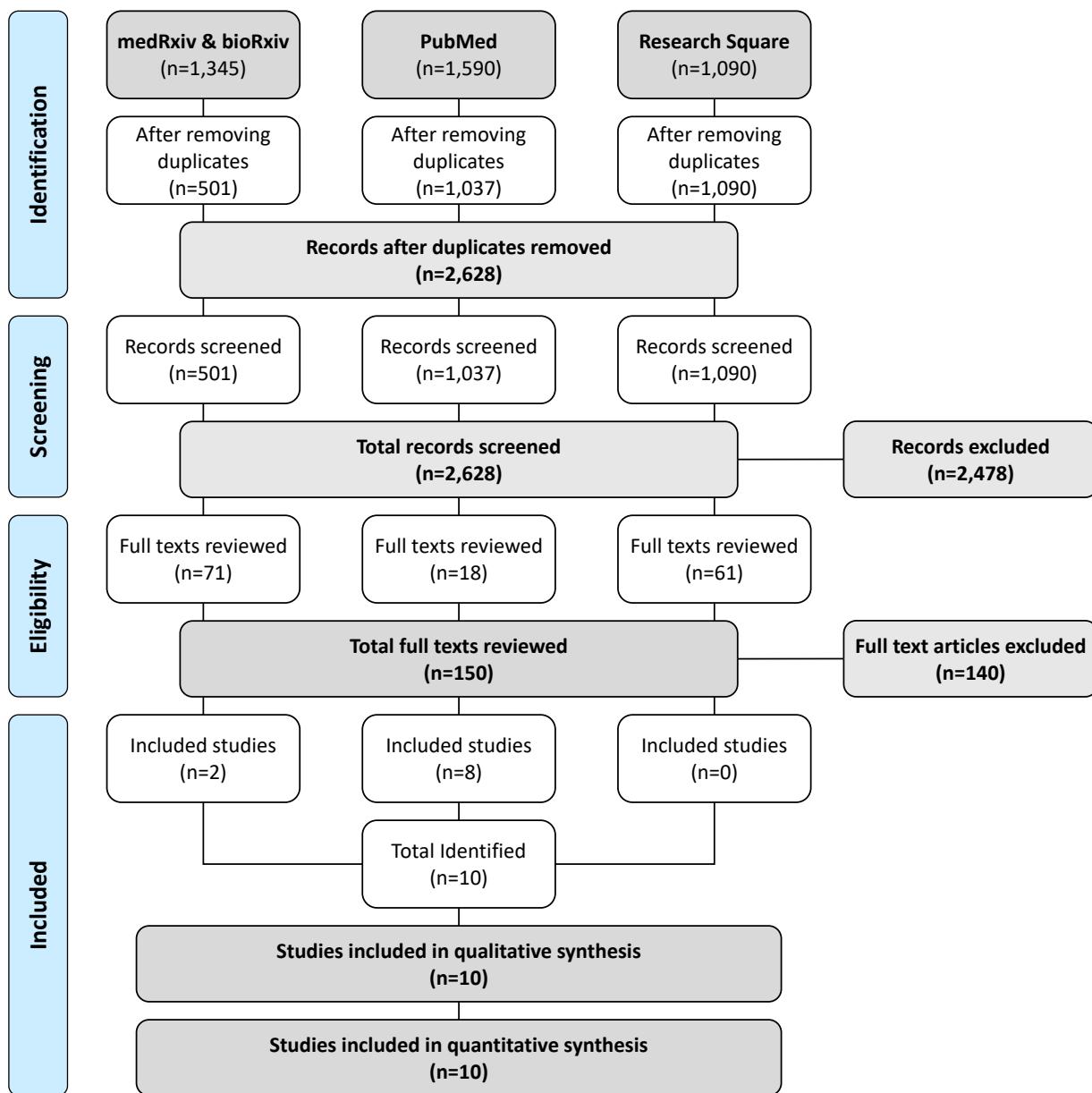
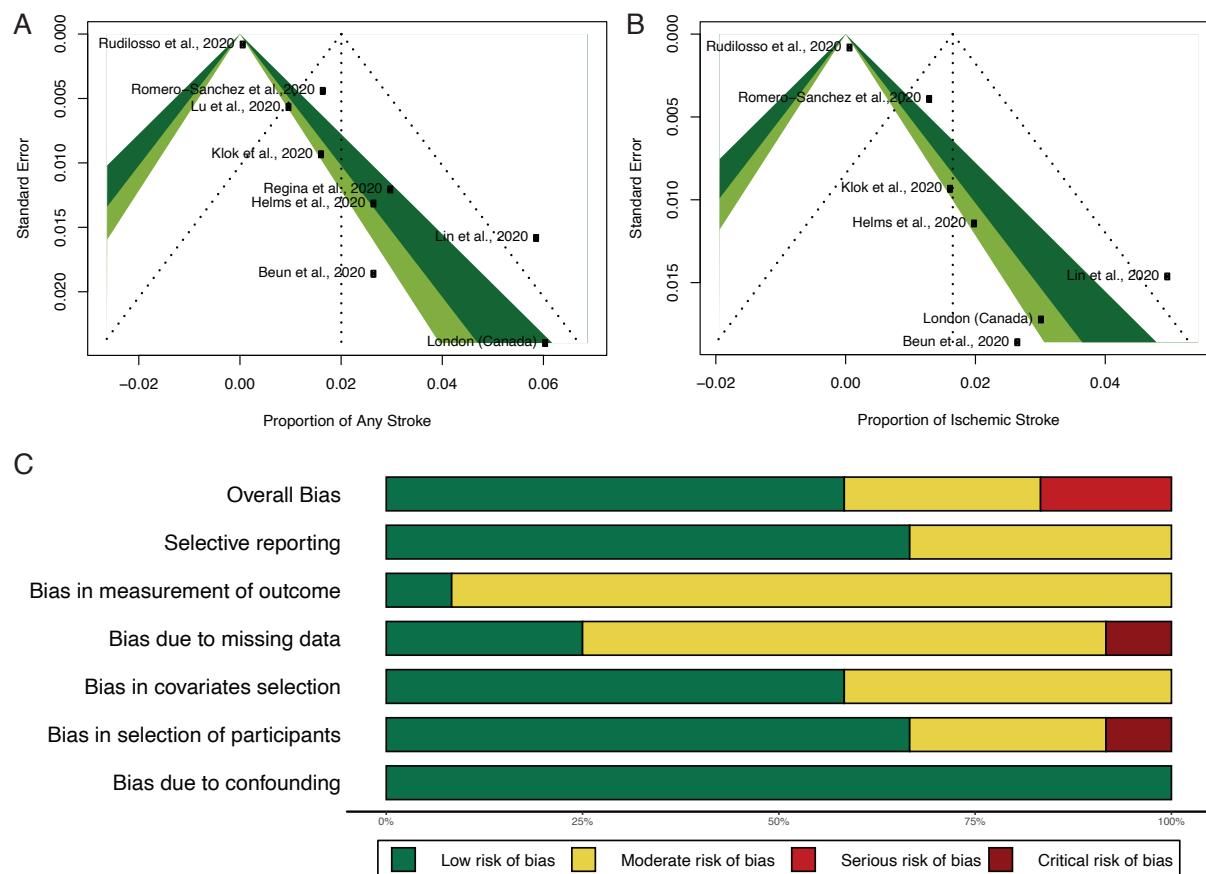
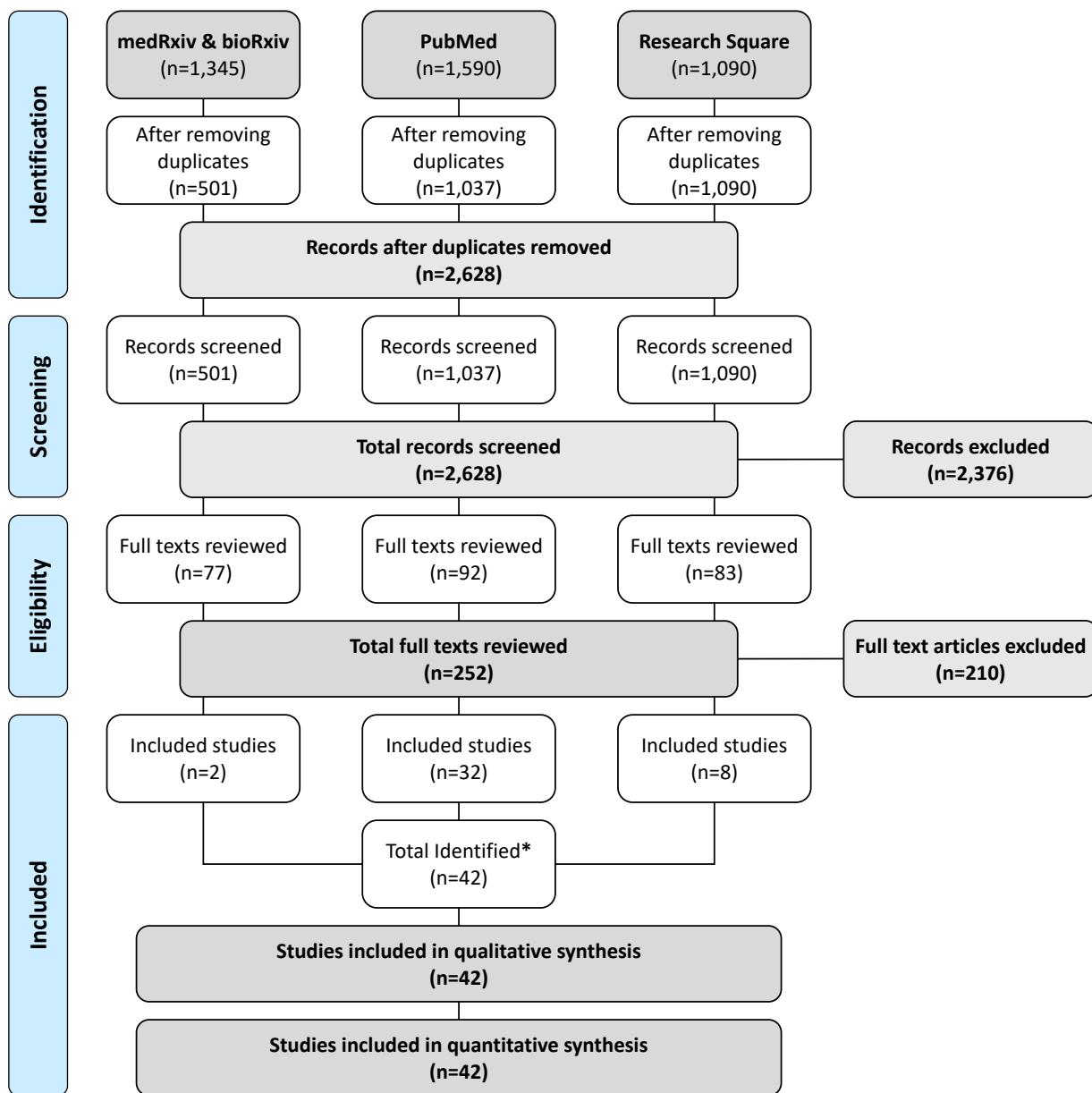


Figure e-2. Funnel plots for random effect meta-analyses of all strokes and ischemic strokes

Panel A: funnel plot for proportion of COVID-19 patients with any stroke, including ischemic stroke, intracerebral hemorrhage, cerebral venous thrombosis, and subarachnoid hemorrhage. **Panel B:** funnel plot for proportion of COVID-19 patients with ischemic stroke. **Panel C:** ROBINS-I tool for the assessment of risk of bias showing an overall moderate-low risk.

The light-green area denotes studies with effect-sizes with a P value between 0.1 and 0.05. The dark-green area denotes studies with effect-sizes with a P value between 0.05 and 0.01. The outer white area (right side of the figure) denotes studies with effect-sizes with a P value <0.01.

Figure e-3. PRISMA flow chart showing the results of the systematic search for case series and case reports



* Five studies initially identified through Research Square were already published in a peer-reviewed journal by the time this manuscript was submitted. None of the 42 studies were included in the meta-analysis estimating the proportion of COVID-19 patients with stroke. One additional study by two co-authors of the present study is currently under review and is not included in this diagram. Another study including two patients reported in our cohort was accepted for publication after we closed the systematic search in May 29, 2020. The resulting total number of studies included in this systematic review is 44.

Table e-4. Summary of Cases included in the analysis

Author	Case #	Sex	Age Range	Stroke Type
Agarwal et al, 2020 ¹	1	M	70s	ICH
Al Saiegh et al, 2020 ²	1	M	30s	SAH
Al Saiegh et al, 2020 ²	2	F	60s	Ischemic
Al-olama et al, 2020 ³	1	M	30s	ICH
Avula et al, 2020 ⁴	1	M	70s	Ischemic
Avula et al, 2020 ⁴	2	F	80s	Ischemic
Avula et al, 2020 ⁴	3	F	80s	Ischemic
Avula et al, 2020 ⁴	4	F	80s	Ischemic
Bao et al, 2020 ⁵	1	M	30s	ICH
Barrios-Lopez et al, 2020 ⁶	1	M	50s	Ischemic
Barrios-Lopez et al, 2020 ⁶	2	M	60s	Ischemic
Barrios-Lopez et al, 2020 ⁶	4	F	80s	Ischemic
Berekashvili et al, 2020 ⁷	1	M	50s	Ischemic
Berekashvili et al, 2020 ⁷	2	F	70s	Ischemic
Berekashvili et al, 2020 ⁷	3	M	30s	Ischemic
Berekashvili et al, 2020 ⁷	4	M	40s	Ischemic
Berekashvili et al, 2020 ⁷	5	M	20s	Ischemic
Berekashvili et al, 2020 ⁷	6	F	70s	Ischemic
Berekashvili et al, 2020 ⁷	7	F	50s	Ischemic
Berekashvili et al, 2020 ⁷	8	F	70s	Ischemic
Berekashvili et al, 2020 ⁷	9	F	50s	Ischemic
Berekashvili et al, 2020 ⁷	10	F	60s	Ischemic
Beyrouti et al, 2020 ⁸	1	M	60s	Ischemic
Beyrouti et al, 2020 ⁸	2	F	50s	Ischemic
Beyrouti et al, 2020 ⁸	3	M	80s	Ischemic
Beyrouti et al, 2020 ⁸	4	M	60s	Ischemic
Beyrouti et al, 2020 ⁸	5	M	80s	Ischemic
Beyrouti et al, 2020 ⁸	6	M	70s	Ischemic
Cao et al, 2020 ⁹	2	M	50s	Ischemic
Carranza et al, 2020 ¹⁰	2	M	70s	Ischemic

Table e-4. Summary of Cases included in the analysis (continued)

Author	Case #	Sex	Age Range	Stroke Type
Carroll et al, 2020 ¹¹	1	M	60s	ICH
Carroll et al, 2020 ¹¹	2	M	70s	ICH
Co et al, 2020 ¹²	1	F	60s	Ischemic
Dahl-Cruz et al, 2020 ¹³	1	M	50s	CVT
Deliwala et al, 2020 ¹⁴	1	F	30s	Ischemic
Fara et al, 2020 ¹⁵	1	F	30s	Ischemic
Fara et al, 2020 ¹⁵	2	F	70s	Ischemic
Fu et al, 2020 ¹⁶	1	M	40s	Ischemic
Fu et al, 2020 ¹⁶	2	M	50s	Ischemic
Garaci et al, 2020 ¹⁷	1	F	40s	CVT
Goldberg et al, 2020 ¹⁸	1	M	60s	Ischemic
Gonzalez Pinto et al, 2020 ¹⁹	1	F	30s	Ischemic
Griffin et al, 2020 ²⁰	1	M	50s	Ischemic
Griffin et al, 2020 ²⁰	3	M	60s	Ischemic
Gunasekaran et al, 2020 ²¹	1	F	40s	Ischemic
Hemasian et al, 2020 ²²	1	M	60s	CVT
Hughes et al, 2020 ²³	1	M	50s	CVT
Jillella et al, 2020 ²⁴	1	F	50s	Ischemic
Jillella et al, 2020 ²⁴	2	M	60s	Ischemic
Jillella et al, 2020 ²⁴	3	M	70s	Ischemic
Jillella et al, 2020 ²⁴	4	F	50s	Ischemic
Jillella et al, 2020 ²⁴	5	M	60s	Ischemic
Jillella et al, 2020 ²⁴	6	M	60s	Ischemic
Jillella et al, 2020 ²⁴	7	M	60s	Ischemic
Jillella et al, 2020 ²⁴	8	F	60s	Ischemic
London, unpublished	1	M	50s	ICH
London, unpublished	2	F	40s	ICH
London, unpublished	3	M	60s	ICH
London, unpublished	4	F	70s	Ischemic

Table e-4. Summary of Cases included in the analysis (continued)

Author	Case #	Sex	Age Range	Stroke Type
London, unpublished	5	F	50s	Ischemic
Lushina et al, 2020 ²⁵	1	M	80s	Ischemic
Morassi et al, 2020 ²⁶	1	M	60s	Ischemic
Morassi et al, 2020 ²⁶	2	M	70s	Ischemic
Morassi et al, 2020 ²⁶	3	M	80s	Ischemic
Morassi et al, 2020 ²⁶	4	F	70s	Ischemic
Morassi et al, 2020 ²⁶	5	M	50s	ICH
Morassi et al, 2020 ²⁶	6	M	50s	ICH
Moshayedi et al, 2020 ²⁷	1	M	80s	Ischemic
Muhammad et al, 2020 ²⁸	1	F	60s	SAH
Karimi et al, 2020 ²⁹	1	M	80s	ICH
Karimi et al, 2020 ²⁹	2	F	60s	ICH
Karimi et al, 2020 ²⁹	3	F	60s	ICH
Karimi et al, 2020 ²⁹	4	M	80s	ICH
Karimi et al, 2020 ²⁹	5	M	70s	Ischemic
Karimi, unpublished	7	F	40s	ischemic
Karimi, unpublished	9	F	80s	ischemic
Karimi, unpublished	10	F	60s	Ischemic
Karimi, unpublished	11	M	60s	Ischemic
Karimi, unpublished	12	F	70s	ischemic
Karimi, unpublished	13	F	80s	Ischemic
Karimi, unpublished	14	M	50s	Ischemic
Karimi, unpublished	15	M	70s	Ischemic
Karimi, unpublished	16	F	70s	Ischemic
Karimi, unpublished	17	F	80s	Ischemic
Nepal et al, 2020 ³⁰	1	M	50s	Ischemic
Oxley et al, 2020 ³¹	1	F	30s	Ischemic
Oxley et al, 2020 ³¹	2	M	30s	Ischemic

Table e-4. Summary of Cases included in the analysis (continued)

Author	Case #	Sex	Age Range	Stroke Type
Oxley et al, 2020 ³¹	3	M	30s	Ischemic
Oxley et al, 2020 ³¹	4	M	40s	Ischemic
Oxley et al, 2020 ³¹	5	M	40s	Ischemic
Poillon et al, 2020 ³²	1	F	60s	CVT
Poillon et al, 2020 ³²	2	F	50s	CVT
Sharifi-Razavi et al, 2020 ³³	1	M	70s	ICH
Sharifi-Razavi et al, 2020 ³⁴	1	F	80s	Ischemic
Sharifi-Razavi et al, 2020 ³⁴	2	F	90s	ischemic
Sharifi-Razavi, unpublished	1	F	70s	ICH
Sharifi-Razavi, unpublished	2	M	60s	ICH
Sharifi-Razavi, unpublished	3	M	70s	ICH
Sharifi-Razavi, unpublished	4	F	60s	ICH
Sharifi-Razavi, unpublished	5	M	80s	ICH
Sharifi-Razavi, unpublished	6	M	90s	ICH
Sharifi-Razavi, unpublished	7	M	60s	ICH
Sharifi-Razavi, unpublished	8	F	80s	ICH
Sharifi-Razavi, unpublished	9	F	50s	Ischemic
Sharifi-Razavi, unpublished	10	M	80s	Ischemic
Sharifi-Razavi, unpublished	11	F	70s	Ischemic
Sharifi-Razavi, unpublished	12	F	60s	ischemic
Sharifi-Razavi, unpublished	13	M	60s	ischemic
Sharifi-Razavi, unpublished	14	M	50s	Ischemic
Sharifi-Razavi, unpublished	15	F	80s	Ischemic
Sharifi-Razavi, unpublished	16	F	70s	Ischemic
Sharifi-Razavi, unpublished	17	M	30s	CVT
Tunc et al, 2020 ³⁵	1	F	40s	Ischemic
Tunc et al, 2020 ³⁵	2	F	60s	Ischemic
Tunc et al, 2020 ³⁵	3	M	70s	Ischemic

Table e-4. Summary of Cases included in the analysis (continued)

Author	Case #	Sex	Age Range	Stroke Type
Tunc et al, 2020 ³⁵	4	M	70s	Ischemic
Valderrama et al, 2020 ³⁶	1	M	50s	Ischemic
Vela-Duarte/Linfante, unpublished	1	F	60s	Ischemic
Viguier et al, 2020 ³⁷	1	M	70s	Ischemic
Vu et al, 2020 ³⁸	3	M	30s	ICH
Yaghi et al, 2020 ³⁹	1	NA	50s	Ischemic
Yaghi et al, 2020 ³⁹	2	NA	60s	Ischemic
Yaghi et al, 2020 ³⁹	3	NA	70s	Ischemic
Yaghi et al, 2020 ³⁹	4	NA	70s	Ischemic
Yaghi et al, 2020 ³⁹	5	NA	70s	Ischemic
Yaghi et al, 2020 ³⁹	6	NA	50s	Ischemic
Yaghi et al, 2020 ³⁹	7	NA	40s	Ischemic
Yaghi et al, 2020 ³⁹	8	NA	40s	Ischemic
Yaghi et al, 2020 ³⁹	9	NA	60s	Ischemic
Yaghi et al, 2020 ³⁹	10	NA	50s	Ischemic
Yaghi et al, 2020 ³⁹	11	NA	60s	Ischemic
Yaghi et al, 2020 ³⁹	12	NA	70s	Ischemic
Yaghi et al, 2020 ³⁹	13	NA	60s	Ischemic
Yaghi et al, 2020 ³⁹	14	NA	40s	Ischemic
Yaghi et al, 2020 ³⁹	15	NA	40s	Ischemic
Yaghi et al, 2020 ³⁹	16	NA	70s	Ischemic
Yaghi et al, 2020 ³⁹	17	NA	40s	Ischemic
Yaghi et al, 2020 ³⁹	18	NA	60s	Ischemic
Yaghi et al, 2020 ³⁹	19	NA	70s	Ischemic
Yaghi et al, 2020 ³⁹	20	NA	60s	Ischemic
Yaghi et al, 2020 ³⁹	21	NA	60s	Ischemic
Yaghi et al, 2020 ³⁹	22	NA	60s	Ischemic
Yaghi et al, 2020 ³⁹	23	NA	40s	Ischemic
Yaghi et al, 2020 ³⁹	24	NA	70s	Ischemic
Yaghi et al, 2020 ³⁹	25	NA	50s	Ischemic

Table e-4. Summary of Cases included in the analysis (continued)

Author	Case #	Sex	Age Range	Stroke Type
Yaghi et al, 2020 ³⁹	26	NA	60s	Ischemic
Yaghi et al, 2020 ³⁹	27	NA	60s	Ischemic
Yaghi et al, 2020 ³⁹	28	NA	70s	Ischemic
Yaghi et al, 2020 ³⁹	29	NA	40s	Ischemic
Yaghi et al, 2020 ³⁹	30	NA	50s	Ischemic
Yaghi et al, 2020 ³⁹	31	NA	50s	Ischemic
Yaghi et al, 2020 ³⁹	32	NA	60s	Ischemic
Zayet et al, 2020 ⁴⁰	1	M	80s	Ischemic
Zayet et al, 2020 ⁴⁰	2	M	70s	Ischemic
Zhai et al, 2020 ⁴¹	1	M	70s	Ischemic
Zhang et al, 2020 ⁴²	1	M	60s	Ischemic
Zhang et al, 2020 ⁴²	2	F	60s	Ischemic
Zhang et al, 2020 ⁴²	3	M	70s	Ischemic
Zhou et al, 2020 ⁴³	1	F	70s	Ischemic
Zulfiqar et al, 2020 ⁴⁴	1	F	60s	SAH

ICH: intracerebral hemorrhage. **CVT:** cerebral venous thrombosis. **SAH:** subarachnoid hemorrhage. **F:** Female. **M:** Male.

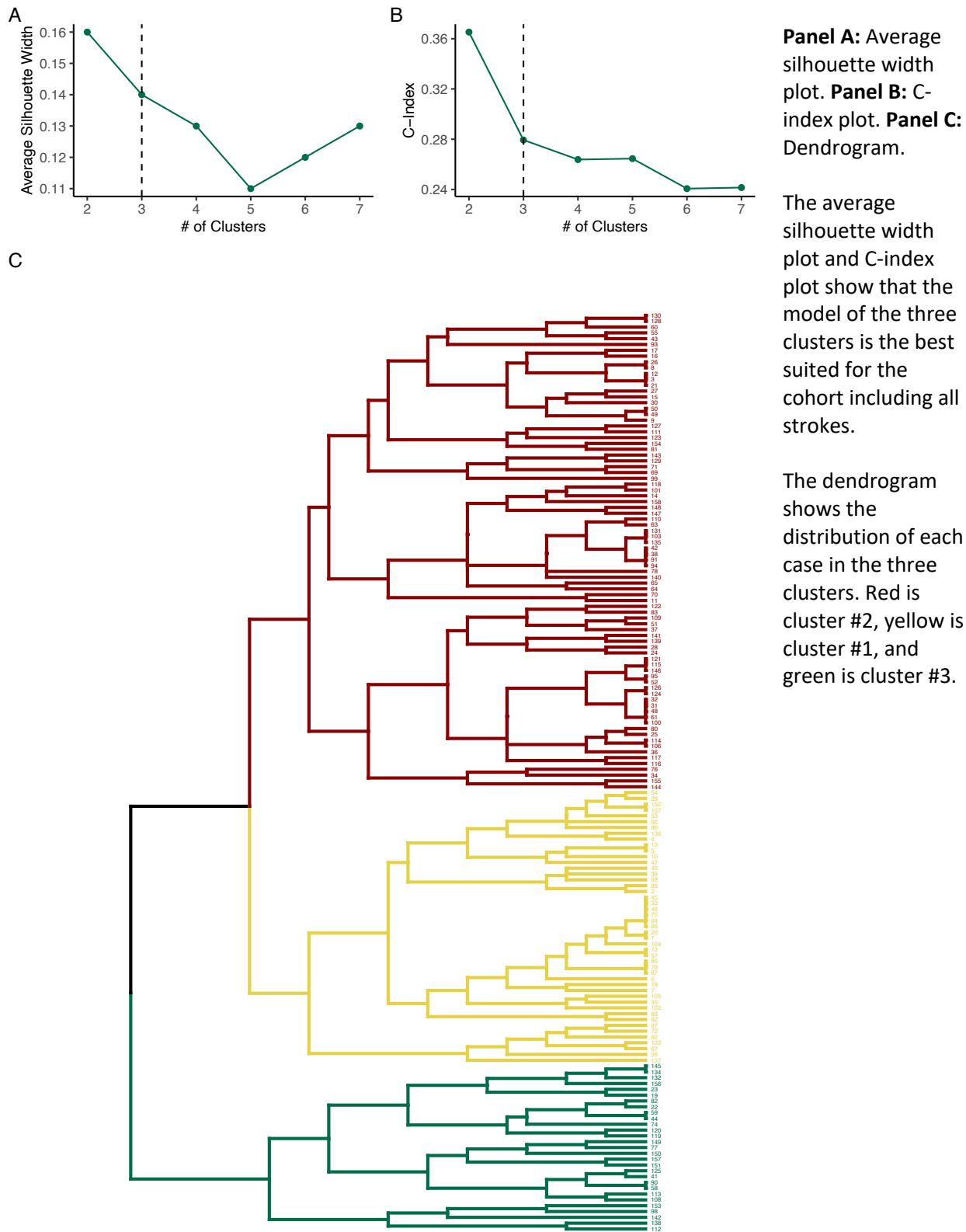
Figure e-4. Dendrogram, silhouette and C-Index plots for clusters of 158 strokes

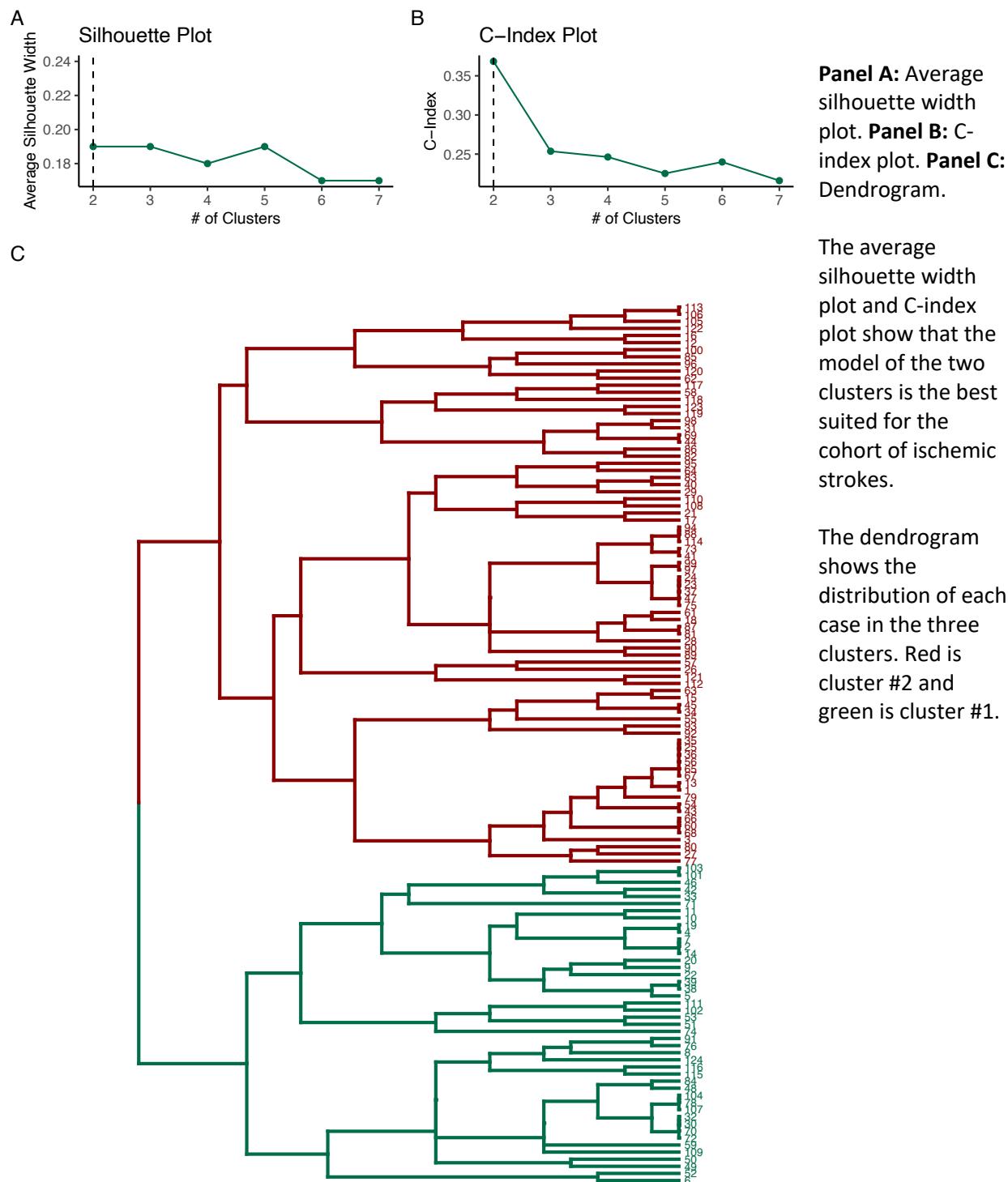
Figure e-5. Dendrogram, silhouette and C-Index plots for clusters of 124 ischemic strokes

Table e-5. Cluster analysis for 158 COVID-19 patients with any stroke

	All patients (n=158) ^a	Clusters			P value
		Cluster #1 (n=47)	Cluster #2 (n=82)	Cluster #3 (n=29)	
Demographics					
Age < 50 years old	29 (18.4)	10 (21.3)	16 (19.5)	3 (10.3)	
Age 50 – 70 years old	72 (45.6)	29 (61.7)	34 (41.5)	9 (31.0)	0.006
Age > 70 years old	57 (36.1)	8 (17.0)	32 (39.0)	17 (58.6)	
Female sex, n (%) ^b	55 (43.3)	11 (28.2)	34 (50.0)	10 (50.0)	0.07
Risk Factors					
No risk factors or comorbidities, n (%) c	26 (16.5)	19 (40.4)	7 (8.5)	0 (0.0)	<0.001
Hypertension, n (%)	99 (62.7)	11 (23.4)	66 (80.5)	22 (75.9)	<0.001
Diabetes mellitus, n (%)	64 (40.5)	7 (14.9)	34 (41.5)	23 (79.3)	<0.001
Dyslipidemia, n (%)	43 (27.2)	3 (6.4)	22 (26.8)	18 (62.1)	<0.001
Smoking, n (%)	11 (7.0)	3 (6.4)	8 (9.8)	0 (0.0)	0.204
Comorbidities					
Previous stroke/TIA, n (%)	17 (10.8)	0 (0.0)	9 (11.0)	8 (27.6)	0.001
Atrial fibrillation, n (%)	23 (14.6)	2 (4.3)	9 (11.0)	12 (41.4)	<0.001
Coronary artery disease, n (%)	27 (17.1)	2 (4.3)	14 (17.1)	11 (37.9)	0.001
Chronic kidney disease, n (%)	5 (3.2)	0 (0.0)	5 (6.1)	0 (0.0)	0.09
Obesity, n (%)	11 (7.0)	2 (4.3)	5 (6.1)	4 (13.8)	0.26
Cancer, n (%)	7 (4.4)	5 (10.6)	0 (0.0)	2 (6.9)	0.014

Types of stroke					
Ischemic, n (%)	124 (78.5)	18 (38.3)	82 (100.0)	24 (82.8)	<0.001
Intracerebral hemorrhage, n (%)	24 (15.2)	19 (40.4)	0 (0.0)	5 (17.2)	<0.001
Cerebral venous thrombosis, n (%)	7 (4.4)	7 (14.9)	0 (0.0)	0 (0.0)	<0.001
Subarachnoid hemorrhage, n (%)	3 (1.9)	3 (6.4)	0 (0.0)	0 (0.0)	0.027
Clinical features of COVID-19					
Severe/critical COVID-19, n (%)	91 (57.6)	28 (59.6)	35 (42.7)	28 (96.6)	<0.001
No COVID-19 symptoms before stroke, n (%)	49 (31.0)	10 (21.3)	31 (37.8)	8 (27.6)	0.14
Median time to stroke, d	8.0 [5.0, 15.0]	11.5 [7.0, 16.3]	7.0 [4.0, 15.0]	5.0 [3.0, 13.0]	0.33

^a The model dropped two of 160 cases, which was not included in this analysis. ^b Sex was not included as a variable for developing the cluster analysis because data were not available for all patients. ^cThe variable “No risk factors or comorbidities” was not used for developing the cluster analysis to avoid collinearity.

Table e-6. Cluster analysis for 124 COVID-19 patients with ischemic stroke

	All patients (n=124) ^a	Clusters		P value
		Cluster #1 (n=45)	Cluster #2 (n=79)	
Demographics				
Age < 50 years old	22 (17.7)	13 (28.9)	9 (11.4)	
Age 50 – 70 years old	55 (44.4)	19 (42.2)	36 (45.6)	0.038
Age > 70 years old	47 (37.9)	13 (28.9)	34 (43.0)	
Female sex, n (%) ^b	44 (47.3)	22 (55.0)	22 (41.5)	0.28
Risk Factors				
No risk factors or comorbidities, n (%) c	16 (12.9)	6 (13.3)	10 (12.7)	1.00
Hypertension, n (%)	84 (67.7)	32 (71.1)	52 (65.8)	0.69
Diabetes mellitus, n (%)	55 (44.4)	19 (42.2)	36 (45.6)	0.86
Dyslipidemia, n (%)	40 (32.3)	14 (31.1)	26 (32.9)	0.99
Smoking, n (%)	8 (6.5)	3 (6.7)	5 (6.3)	1.00
Comorbidities				
Previous stroke/TIA, n (%)	14 (11.3)	8 (17.8)	6 (7.6)	0.15
Atrial fibrillation, n (%)	22 (17.7)	3 (6.7)	19 (24.1)	0.028
Coronary artery disease, n (%)	22 (17.7)	3 (6.7)	19 (24.1)	0.028
Chronic kidney disease, n (%)	5 (4.0)	5 (11.1)	0 (0.0)	0.011
Obesity, n (%)	9 (7.3)	3 (6.7)	6 (7.6)	1.00
Cancer, n (%)	4 (3.2)	0 (0.0)	4 (5.1)	0.31

Clinical features of COVID-19

Severe/critical COVID-19, n (%)	76 (61.3)	3 (6.7)	73 (92.4)	<0.001
No COVID-19 symptoms before stroke, n (%)	37 (29.8)	18 (40.0)	19 (24.1)	0.10
Median time to stroke, d	8.0 [5.0, 15.0]	6.0 [2.0, 9.8]	9.0 [5.0, 15.5]	0.11

^aThe model dropped two of 160 cases, which was not included in this analysis. ^bSex was not included as a variable for developing the cluster analysis because data were not available for all patients. ^cThe variable “No risk factors or comorbidities” was not used for developing the cluster analysis to avoid collinearity.

Table e-7. Outcomes of three clusters for any stroke

	All patients (n=158) ^a	Clusters			P value
		Cluster #1 (n=47)	Cluster #2 (n=82)	Cluster #3 (n=29)	
Outcomes					
Deceased, n (%)	54 (34.2)	11 (23.4)	26 (31.7)	17 (58.6)	
Home/Rehabilitation, n (%)	68 (43.0)	17 (36.2)	42 (51.2)	9 (31.0)	<0.001
Still hospitalized, n (%)	36 (22.8)	19 (40.4)	14 (17.1)	3 (10.3)	

Table e-8. Unadjusted association between in-hospital mortality and variables more frequently found in stroke cluster #3

Variable	Alive (n=105)	Deceased (n=55)	uOR (95%CI)	P value
Age > 70 years old	32 (30.5)	25 (45.5)	1.90 (0.97-3.73)	0.06
No risk factors or comorbidities	18 (17.3)	8 (14.5)	0.82 (0.33-2.03)	0.67
Hypertension	62 (59.6)	38 (69.1)	1.55 (0.77-3.10)	0.21
Diabetes mellitus	39 (37.5)	26 (47.3)	1.52 (0.78-2.93)	0.22
Dyslipidemia	26 (25.0)	18 (32.7)	1.48 (0.72-3.02)	0.29
Previous stroke/TIA	10 (9.6)	8 (14.5)	1.62 (0.60-4.37)	0.34
Atrial fibrillation	13 (12.5)	11 (20.0)	1.77 (0.73-4.26)	0.20
Coronary artery disease	15 (14.4)	13 (23.6)	1.86 (0.81-4.25)	0.14
Cancer	5 (4.8)	3 (5.5)	1.15 (0.27-5.02)	0.85
Ischemic stroke	81 (77.1)	45 (81.8)	1.33 (0.59-3.04)	0.49
Intracranial hemorrhage	14 (13.3)	10 (18.2)	1.44 (0.60-3.51)	0.42
Severe/critical COVID-19	46 (43.8)	46 (83.6)	6.56 (2.91-14.76)	<0.001

uOR: unadjusted OR

Table e-9. Outcomes of two clusters for ischemic stroke

	All patients (n=124) ^a	Clusters		P value
		Cluster #1 (n=45)	Cluster #2 (n=79)	
Outcomes				
Deceased, n (%)	44 (35.5)	6 (13.3)	38 (48.1)	
Home/Rehabilitation, n (%)	55 (44.4)	31 (68.9)	24 (30.4)	<0.001
Still hospitalized, n (%)	25 (20.2)	8 (17.8)	17 (21.5)	

Table e-10. Unadjusted association between in-hospital mortality and variables more frequently found in the ischemic stroke cluster #2

Variable	Alive (n=81)	Deceased (n=45)	uOR (95%CI)	P value
Age > 70 years old	26 (32.1)	21 (46.7)	1.85 (0.88-3.91)	0.11
Atrial fibrillation	13 (16.2)	10 (22.2)	1.50 (0.60-3.75)	0.39
Coronary artery disease	3 (3.8)	3 (6.7)	1.86 (0.36-9.61)	0.46
Chronic kidney disease	12 (15.0)	11 (24.4)	1.86 (0.75-4.65)	0.18
Severe/critical COVID-19	37 (45.7)	40 (88.9)	9.51 (3.41-26.58)	<0.001

uOR: unadjusted OR

References

1. Agarwal N, Martini R, Pedrotti G, Sala SWD. Unusual lesion in the splenium of the corpus callosum and coronavirus infectious disease-19. 2020
2. Al Saiegh F, Ghosh R, Leibold A, Avery MB, Schmidt RF, Theofanis T, et al. Status of sars-cov-2 in cerebrospinal fluid of patients with covid-19 and stroke. *J Neurol Neurosurg Psychiatry*. 2020
3. Al-olama M, Rashid A, Garozzo D. Covid-19-associated meningoencephalitis complicated with intracranial hemorrhage: A case report. *Acta Neurochirurgica*. 2020
4. Avula A, Nalleballe K, Narula N, Sapozhnikov S, Dandu V, Toom S, et al. Covid-19 presenting as stroke. *Brain Behav Immun*. 2020
5. Bao Y, Lin SY, Cheng ZH, Xia J, Sun YP, Zhao Q, et al. Clinical features of covid-19 in a young man with massive cerebral hemorrhage—case report. *SN Comprehensive Clinical Medicine*. 2020
6. Barrios-López JM, Rego-García I, Muñoz Martínez C, Romero-Fábrega JC, Rivero Rodríguez M, Ruiz Giménez JA, et al. Ischaemic stroke and sars-cov-2 infection: A causal or incidental association? *Neurologia*. 2020
7. Berekashvili k, Dmytriw AA, Vulkanov V, Agarwal S, Khaneja A, Turkel-Parella D, et al. Etiologic subtypes of ischemic stroke in sars-cov-2 virus patients. *medRxiv*. 2020:2020.2005.2003.20077206
8. Beyrouti R, Adams ME, Benjamin L, Cohen H, Farmer SF, Goh YY, et al. Characteristics of ischaemic stroke associated with covid-19. *Journal of Neurology, Neurosurgery & Psychiatry*. 2020:jnnp-2020-323586
9. Cao S, Li Y, Yue H, Li C, Xia M, Liu F, et al. Insight from a noticeable difference between two families infected with covid-19, 14 april 2020. *PREPRINT (Version 1) available at Research Square* <https://doi.org/10.21203/rs.3.rs-22850/v1>. 2020
10. Carranza M, Salazar D, Troya J, Alcazar R, Peña C, Muñoz N. Aortic thrombus in patients with severe covid-19. Review of three cases. *PREPRINT (Version 1) available at Research Square* <https://doi.org/10.21203/rs.3.rs-28657/v1>. 2020
11. Carroll E, Lewis A. Catastrophic intracranial hemorrhage in two critically ill patients with covid-19. *Neurocrit Care*. 2020:1-5
12. Co COC, Yu JRT, Laxamana LC, David-Ona DIA. Intravenous thrombolysis for stroke in a covid-19 positive filipino patient, a case report. *J Clin Neurosci*. 2020
13. Dahl-Cruz F, Guevara-Dalrymple N, López-Hernández N. [cerebral venous thrombosis and sars-cov-2 infection]. *Rev Neurol*. 2020;70:391-392
14. Deliwala S, Abdulhamid S, Abusalihi MF, Al-Qasmi MM, Bachuwa G. Encephalopathy as the sentinel sign of a cortical stroke in a patient infected with coronavirus disease-19 (covid-19). *Cureus*. 2020;12:e8121
15. Fara MG, Stein LK, Skliut M, Morgello S, Fifi JT, Dhamoon MS. Macrothrombosis and stroke in patients with mild covid-19 infection. *J Thromb Haemost*. 2020
16. Fu B, Chen Y, P L. The 2019 novel coronavirus disease with secondary ischemic stroke: Two cases report. *PREPRINT (Version 1) available at Research Square* <https://doi.org/10.21203/rs.3.rs-20943/v2>. 2020
17. Garaci F, Di Giuliano F, Picchi E, Da Ros V, Floris R. Venous cerebral thrombosis in covid-19 patient. *J Neurol Sci*. 2020;414:116871
18. Goldberg MF, Goldberg MF, Cerejo R, Tayal AH. Cerebrovascular disease in covid-19. *AJNR Am J Neuroradiol*. 2020
19. Gonzalez-Pinto T, Luna-Rodriguez A, Moreno-Estebanez A, Agirre-Beitia G, Rodriguez-Antiguedad A, Ruiz-Lopez M. Emergency room neurology in times of covid-19: Malignant ischemic stroke and sars-cov2 infection. *Eur J Neurol*. 2020
20. Griffin DO, Jensen A, Khan M, Chin J, Chin K, Parnell R, et al. Arterial thromboembolic complications in covid-19 in low risk patients despite prophylaxis. *Br J Haematol*. 2020

21. Gunasekaran K, Amoah K, Rajasurya V, Buscher MG. Stroke in a young covid -19 patient. *Qjm.* 2020
22. Hemasian H, Ansari B. First case of covid-19 presented with cerebral venous thrombosis: A rare and dreaded case. *Rev Neurol (Paris).* 2020;176:521-523
23. Hughes C, Nichols T, Pike M, Subbe C, Elghenai S. Cerebral venous sinus thrombosis as a presentation of covid-19. *Eur J Case Rep Intern Med.* 2020;7:001691
24. Jillella DV, Janocko NJ, Nahab F, Benameur K, Greene JG, Wright WL, et al. Ischemic stroke in covid-19: An urgent need for early identification and management. *medRxiv.* 2020:2020.2005.2025.20111047
25. Lushina N, Kuo JS, Shaikh HA. Pulmonary, cerebral, and renal thromboembolic disease associated with covid-19 infection. *Radiology.* 2020:201623
26. Morassi M, Bagatto D, Cobelli M, D'Agostini S, Gigli GL, Bnà C, et al. Stroke in patients with sars-cov-2 infection: Case series. *J Neurol.* 2020:1-8
27. Moshayedi P, Ryan TE, Mejia LLP, Nour M, Liebeskind DS. Triage of acute ischemic stroke in confirmed covid-19: Large vessel occlusion associated with coronavirus infection. *Front Neurol.* 2020;11:353
28. Muhammad S, Petridis A, Cornelius JF, Hänggi D. Letter to editor: Severe brain haemorrhage and concomitant covid-19 infection: A neurovascular complication of covid-19. *Brain Behav Immun.* 2020
29. Karimi N, Sedaghat Z, Baziboroun M, Sharifi-Razavi A. Covid-19 accompanied with intracerebral hemorrhage: A case series. *Under Review.* 2020
30. Nepal P, Batchala PP, Songmen S, Parashar K, Sapire J. An unresponsive covid-19 patient. *Emerg Radiol.* 2020
31. Oxley TJ, Mocco J, Majidi S, Kellner CP, Shoerah H, Singh IP, et al. Large-vessel stroke as a presenting feature of covid-19 in the young. *New England Journal of Medicine.* 2020:e60
32. Poillon G, Obadia M, Perrin M, Savatovsky J, Lecler A. Cerebral venous thrombosis associated with covid-19 infection: Causality or coincidence? *J Neuroradiol.* 2020
33. Sharifi-Razavi A, Karimi N, Rouhani N. Covid-19 and intracerebral haemorrhage: Causative or coincidental? *New Microbes New Infect.* 2020;35:100669
34. Sharifi-Razavi A, Karimi N, Zarvani A, Cheraghmakani H, Baghbanian S. Ischemic stroke associated with novel coronavirus 2019: A report of three cases. *International Journal of Neuroscience.* 2020;In press
35. Tunç A, Ünlübaş Y, Alemdar M, Akyüz E. Coexistence of covid-19 and acute ischemic stroke report of four cases. *J Clin Neurosci.* 2020
36. Valderrama EV, Humbert K, Lord A, Frontera J, Yaghi S. Severe acute respiratory syndrome coronavirus 2 infection and ischemic stroke. *Stroke.* 2020:STROKEAHA120030153
37. Viguer A, Delamarre L, Duplantier J, Olivot JM, Bonneville F. Acute ischemic stroke complicating common carotid artery thrombosis during a severe covid-19 infection. *J Neuroradiol.* 2020
38. Vu D, Ruggiero M, Choi WS, Masri D, Flyer M, Shyknevsy I, et al. Three unsuspected ct diagnoses of covid-19. *Emerg Radiol.* 2020;27:229-232
39. Yaghi S, Ishida K, Torres J, Mac Grory B, Raz E, Humbert K, et al. Sars2-cov-2 and stroke in a new york healthcare system. *Stroke.* 2020:Strokeaha120030335
40. Zayet S, Klopfenstein T, Kovács R, Stancescu S, Hagenkötter B. Acute cerebral stroke with multiple infarctions and covid-19, france, 2020. *Emerg Infect Dis.* 2020;26
41. Zhai P, Ding Y, Li Y. The impact of covid-19 on ischemic stroke: A case report. *PREPRINT (Version 1) available at Research Square* <https://doi.org/10.21203/rs.3.rs-20393/v1>. 2020

42. Zhang Y, Xiao M, Zhang S, Xia P, Cao W, Jiang W, et al. Coagulopathy and antiphospholipid antibodies in patients with covid-19. *New England Journal of Medicine*. 2020;382:e38
43. Zhou B, She J, Wang Y, Ma X. A case of coronavirus disease 2019 with concomitant acute cerebral infarction and deep vein thrombosis. *Front Neurol*. 2020;11:296
44. Zulfiqar AA, Lorenzo-Villalba N, Hassler P, Andrès E. Immune thrombocytopenic purpura in a patient with covid-19. *N Engl J Med*. 2020;382:e43