

Is a Brain Stroke Caused by the COVID-19 Seen Under Two Years of Age? A Case Report

Mohammad Vafae-Shahi

Iran University of Medical Sciences

Sedigheh Yousefzadegan

Iran University of Medical Sciences

Ramin Zare Mahmoudabadi

Iran University of Medical Sciences

Fatemeh Ahmadi

Iran University of Medical Sciences

Aina Riahi (✉ ainariahi@yahoo.com)

Iran University of Medical Sciences

Case report

Keywords: Covid 19, SARS CoV-2, Infant, Children, Stroke, MIS-C

Posted Date: May 17th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-509667/v1>

License:   This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Abstract

Introduction: Brain ischemic stroke in children especially in infancy is a rare condition. Stroke presents with a variety of symptoms and usually is an underestimated diagnosis in infants. The current pandemic of novel coronavirus disease type 2 (COVID-19), involves different organs in the human body, like the central nervous system. Researchers believe that there is a probable association between this retroviral infection and stroke but there were a few cases of strokes in the pediatrics field with positive RT-PCR for SARS-CoV-2.

Case presentation: Herein we introduce a 17-month-old girl with a hemiparesis and focal status epilepticus that was admitted to Firoozabadi hospital. The onset of symptoms was approximately 4 days before the admission with non-bloody, watery diarrhea, nausea, vomiting, and low-grade fever. The brain MRI with DWI sequence confirmed acute ischemic stroke (AIS). Because of her multisystemic involvement, the COVID-19 RT-PCR test was requested and the result was positive. So according to the positive PCR test and negative of other results along with fever and gastrointestinal involvement picture - which is a common form of COVID-19 infection in pediatric patients- her neurological symptoms could be explainable with COVID-19 infection. Based on our knowledge, this is the first case of acute ischemic stroke (AIS) due to SARS CoV-2 infection that was reported under two years of age in the world.

Conclusion: COVID-19 infection in pediatric patients has different presentations. In a significant number of these patients, the involvement of more than 2 body organs could be seen, known as "Multisystem Inflammatory Syndrome in Children (MIS-C) Associated with Coronavirus Disease 2019 (COVID-19). There are some reports of stroke due to COVID-19 infection and it's related to hypercoagulability state so far and we introduce one infant case of that. According to this new emerging coronavirus and probability of nervous system involvement with this virus, we recommended checking the COVID-19 RT-PCR test in nasopharynx and cerebrospinal fluid of all children presented with neurological symptoms, even in the post-COVID-19 era.

Introduction

Brain stroke in children especially in infancy is a rare condition. It has 2 main types; hemorrhagic and ischemic, which due to brain vessel rupture or occlusion, respectively (1). Strokes can lead to serious morbidity. Up to 25% of children will have recurrent episodes of strokes and up to 66% will have persistent neurological deficits or epilepsy (2, 3, 4). Stroke presents with a variety of symptoms and usually is an underestimated diagnosis in infants. The etiologies of stroke are classified into 4 main categories: heart disorders, blood disorders, infections, and vascular disorders (1, 2, 3, 4). The current pandemic of novel coronavirus disease type 2 (COVID-19), involves different organs in the human body, like the central nervous system. Researchers believe that there is a probable association between this retroviral infection and stroke but there were a few cases of strokes in the pediatrics field with positive RT-PCR for SARS-CoV-2 (5, 6, 7, 8).

Herein we introduce a 17-month-old girl with a focal neurological symptom and a positive RT-PCR test for covid-19 infection that was admitted to Firouzabadi hospital. The brain RT-PCR with DWI sequence confirmed acute ischemic stroke (AIS). Based on our knowledge, this is the first case of acute ischemic stroke (AIS) due to SARS CoV-2 infection that was reported under two years of age in the world.

Case

A 17-month-old infant was admitted because of abnormal jerky movements of the right upper limb in favor of seizure. The onset of symptoms was approximately 4 days before the admission with non-bloody, watery diarrhea, nausea, vomiting, and low-grade fever. On the 2nd day, she developed neurologic symptoms as frequent focal seizures that were taken more than 30 minutes and this condition got worse on the 3rd day and she had hemiparesis in the right side of her limbs, so the parents bring her to the emergency department. The patient was admitted while she had moderate dehydration and was ill but oriented.

Her past medical history didn't show any illness or hospital admission previously. She is the 4th child of all 4 children in their family and didn't have any birth complications or insult. She didn't receive any special medication except acetaminophen. The family history was negative for neurological disorders. Vital signs at admission were as below: Blood Pressure: 88/55 mmHg, Pulse Rate: 140/ min, Respiratory Rate: 36/min, Oral Temperature: 37°C and her first blood glucose was 114 mg/dl. Cranial nerve examinations were normal. There was no visual problem, neck stiffness, seizure, or jerky movement, but she had right-side deviated posture while sited and muscle force of right side was decreased that reveals hemiparesis. The plantar reflexes were asymmetric and upward in the right side. Deep tendon reflexes were brisk in the right limbs.

Due to her gastrointestinal symptoms which were followed by focal seizures and right-side hemiparesis, viral encephalitis placed on the top of the differential diagnosis list. Brain CT scan without contrast showed hypodensity in the left temporoparietal region and lower corticomedullary differentiation of left hemisphere compare with right side (Fig. 1). The brain MRI with DWI sequence confirmed acute ischemic stroke (AIS) in left hemisphere (Fig. 1). On echocardiography, there wasn't any structural or functional abnormality. Lumbar puncture performed and viral panel (HSV, CMV, EBV, Influenza, Varicella, Enterovirus, HHV6, HHV7, HHV8) requested. Serum Ammonia, Lactate and Homocysteine and complete panel for amino acids level in blood were checked to see if there is any metabolic disorder that would explain the patient's seizure and stroke. A rheumatologic panel (ANA, dsDNA, C3, C4, CH50, Antiphospholipid Ab, Anticardiolipin Ab) was checked to rule out other causes of stroke. Screening investigations for inherited thrombophilia revealed normal results of protein S, C, Antithrombin III, HB electrophoresis, Factor V Leiden, PT and PTT (Table 1).

Because of her multisystemic involvement, the COVID-19 RT-PCT test was requested and the result was positive. So according to the positive PCR test and negative of other results along with fever and gastrointestinal involvement picture - which is a common form of COVID-19 infection in pediatric

patients- her neurological symptoms could be explainable with COVID-19 infection. Based on our knowledge, this is the first case of acute ischemic stroke (AIS) due to SARS CoV-2 infection that was reported under two years of age in the world. She underwent treatment with phenytoin, acyclovir, enoxaparin, and aspirin and was discharged from the hospital in a good condition.

Table 1
laboratory tests of a 17-month infant with stroke due to COVID-19 infection

Lab Test	Result	Lab Test	Result
CBC:	12930	CSF:	5
WBC	56%	WBC	5
Lymph (%)	12	RBC	39
Hb	733000	PRO (mg/dl)	178
PLT		LDH (unit/l)	77
		Glu (mg/dl)	119
		Blood Glu	
CRP(mg/l)	3	CSF Culture	Negative
ESR	2	Na (mmol/l)	137
CPK	140	K (mmol/l)	4.2
LDH (mg/dl)	1637 (+)	Albumin	
BUN	5	AST (u/l)	84
Cr	0.3	ALT (u/l)	21
D-Dimer (ng/ml)	800 (+)	ALKP	
Hb electrophoresis	Normal	PT	13
Anti-Phospholipid Ab:	1.4	PTT	26
IgM (RU/ml)	1.8		
IgG (RU/ml)			
Blood Culture	Negative	INR	1
Factor V Laden	142 (Normal)	Ca (mg/dl)	9.5
Mg (mg/dl)	2.5	P (mg/dl)	4.2
VBG:	7.50	COVID-19 RT-PCR TEST	+
PH	21		
PCO2	16.4	Amino acids Chromatography	Normal
HCO3	-4.6		
BE			
Ammonia (micg/dl)	96	Lactate (mg/dl)	31

Conclusion

COVID-19 infection in pediatric patients has different presentations. In a significant number of these patients, the involvement of more than 2 body organs could be seen, known as “Multisystem Inflammatory Syndrome in Children (MIS-C) Associated with Coronavirus Disease 2019 (COVID-19). One of the involved systems could be the neurologic system and theoretically, it could be any neurological sign with no other alternative plausible diagnoses (9). There are some reports of stroke due to COVID-19 infection and it's related to hypercoagulability state so far and we introduce one infant case of that. According to this new emerging coronavirus and probability of nervous system involvement with this virus, we recommended checking the COVID-19 RT-PCR test in nasopharynx and cerebrospinal fluid of all children and infants presented with neurological symptoms, even in the post-COVID-19 era.

Abbreviations

acute ischemic stroke (AIS), reverse transcription polymerase chain reaction (RT-PCR), magnetic resonance imaging (MRI), diffusion weighted imaging (DWI), computed tomography scan (CT Scan)

Declarations

Ethics approval and consent to participate:

This case study was accredited by Ethical Committee of Iran University of Medical Sciences.

Consent to publish:

Written informed consent was obtained from the parents of the patient for publication of this Case Report and any accompanying images. A copy of the written consent is available for review by the Editor of this journal.

Availability of data and material:

The datasets used during the current case study are in the manuscript.

Competing interests:

The authors declare no conflict of interest in preparing this case presentation.

Funding:

This case presentation received no specific grant from any funding agency in the public, institutions or not-for-profit sectors.

Authors' contributions: VM and ZMR analyzed and interpreted the patient data regarding the neurologic disease. RA,YS and AH performed follow up the patient and were major contributors in writing the

manuscript. All authors read and approved the final manuscript.

Acknowledgements:

Not applicable.

References

1. Donna M. Ferriero, Heather J. Fullerton, Timothy J. Bernard, Lori Billinghamurst. Management of Stroke in Neonates and Children: A Scientific Statement From the American Heart Association/American Stroke Association. *Stroke* 2019;50:e51–e96
2. Lanthier S, Carmant L, David M, Larbrisseau A, de Veber G. Stroke in children: the coexistence of multiple risk factors predicts poor outcome. *Neurology*. 2000;54(2):371–378.
3. DeVeber GA, MacGregor D, Curtis R, Mayank S. Neurologic outcome in survivors of childhood arterial ischemic stroke and sinovenous thrombosis. *Journal of Child Neurology*. 2000;15(5):316–324.
4. DeVeber G. In pursuit of evidence-based treatments for paediatric stroke: the UK and Chest guidelines. *The Lancet Neurology*. 2005;4(7):432–436
5. Lam, K., Lee, J.H., Cheng, P. et al. Pediatric stroke associated with a sedentary lifestyle during the SARS-CoV-2 (COVID-19) pandemic: a case report on a 17-year-old. *Neurol Sci* (2021). 42, 21–23 <https://doi.org/10.1007/s10072-020-04857-w>
6. Seyed Mohammad Mousavi Mirzaee, Fabrício Guimarães Gonçalves, Mahyar Mohammadifard, Shirin Mojgan Tavakoli, Arastoo Vossough. Focal Cerebral Arteriopathy in a Pediatric Patient with COVID-19. *Radiology journal*, Vol. 297, No. 2. <https://doi.org/10.1148/radiol.2020202197>
7. Golnaz Gharehbaghi, Sedigheh Yousefzadegan, Asma Javid, Hamid Riazi-Esfahani, Ashraf Mousavi, et al. COVID-19 in Children and Neonates: A Comprehensive Review Article. *Iran J Pediatr*. 2021; 31(1):e108095.
8. Mahmoud Reza Ashrafi, Reza Azizimalamiri, Reza Shervin Badv, Ali Reza Tavasoli, Ali Nikkhah. Coronavirus, Its Neurologic Manifestations, and Complications. *Iran J Pediatr*. 2020; 30(2):e102569
9. CDC 24/7: saving lives, protecting people, Centers for disease control and prevention., <https://www.cdc.gov/mis-c/hcp/>

Figures

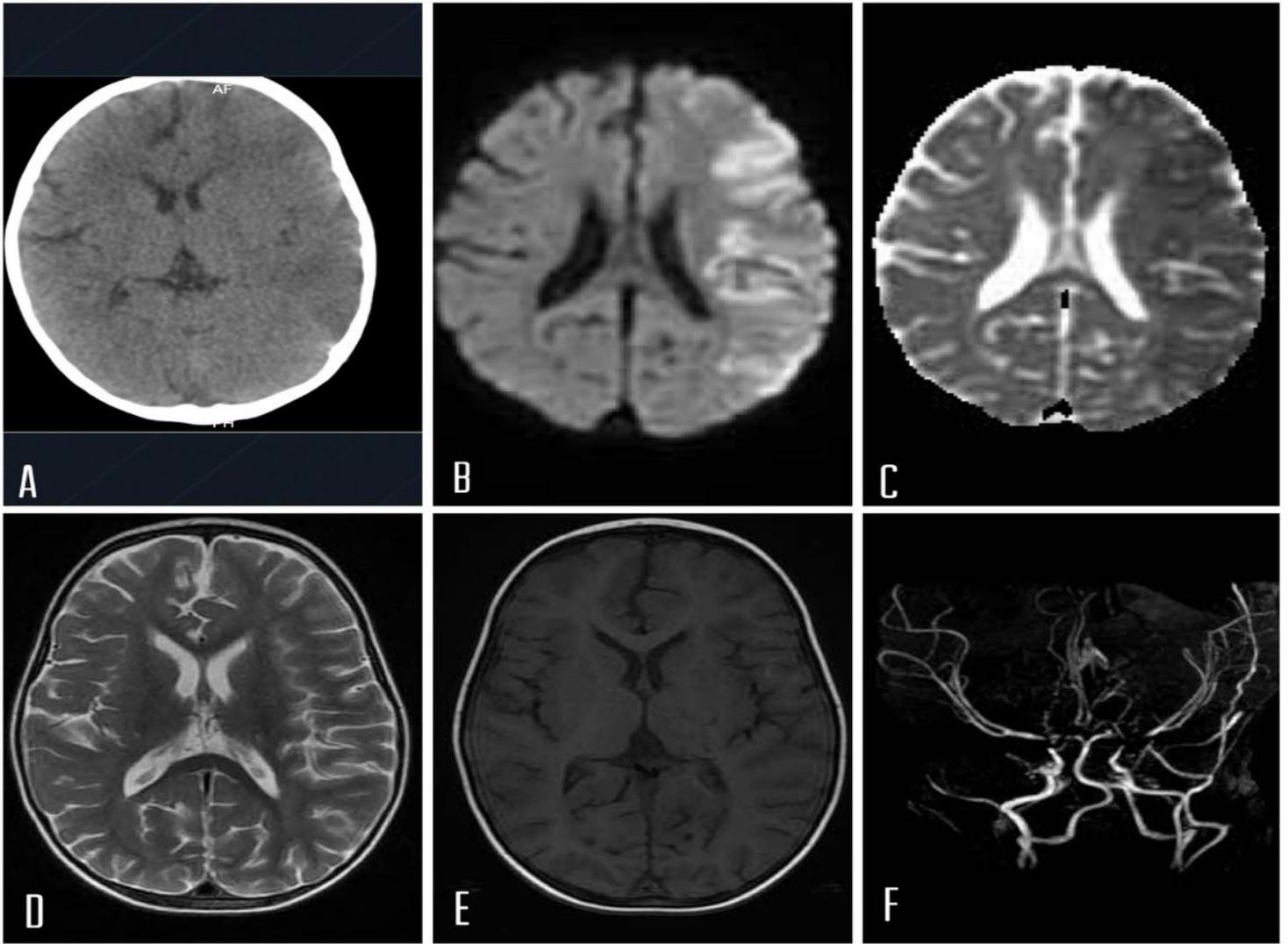


Figure 1

CT scan shows wedge shape hypodensity in left temporoparietal region and lower corticomedullary differentiation of left hemisphere (A), DWI sequence of MRI reveals high signal intensity in left MCA territory (B), ADC map sequence of MRI reveals restriction in the involved area (C), T2 and T1 sequences of MRI show normal results (D and E), Brain MRA reveals normal result (F).