Magna Neurologica Vol. 2, No. 2, July 2024

https://journal.uns.ac.id/magna-neurologica
DOI: 10.20961/magnaneurologica.v2i2.1140
e-ISSN 2985-3729 p-ISSN 2963-6027

MAGNA NEUROLOGICA

CASE REPORT **OPEN ACCESS**

CASE REPORT: COVID-19 AND ISCHEMIC STROKE IN A 16-YEARS-OLD PATIENT

Cynthia[1*], July Kumalawati[2]

***Correspondence:** cynthiazakharia@yahoo.com
[1]*Laboratory of Clinical Pathology and Blood Bank, Mahar Mardjono National Brain Center Hospital, Jakarta, Indonesia*
[2]*Department of Clinical Pathology, Cipto Mangunkusumo Hospital, Jakarta, Indonesia*

Article History:
Received: January 23, 2024
Accepted: March 1, 2024
Published: July 1, 2024

Cite this as:
Cynthia, Kumalawati J. Case Report: COVID-19 and Ischemic Stroke in A 16-Years-Old Patient. Magna Neurologica. 2(2) July 2024: 72-76. 10.20961/magnaneurologica.v2i2.1140

ABSTRACT

Background: Recent reports show an increasing trend of ischemic stroke at a young age. Diseases associated with ischemic stroke at a young age, namely hereditary hypercoagulable conditions.

Case: In this case a 16-year-old boy with clinical complaints of sudden weakness of the right hand and leg, numbness, loss of appetite, nausea and vomiting. Laboratory tests showed results of increased levels of hemoglobin, hematocrit, erythrocyte count, platelet count, leukocyte count and NLR. The neutrophil-to-lymphocyte ratio (NLR), calculated as a simple ratio between the neutrophil and lymphocyte counts measured in peripheral blood. CT scan examination showed acute infarction in the medial left temporal lobe and old infarction in the left frontal lobe (medial gyrus). Thoracic CT Scan examination showed the results of bilateral pneumonia suggestive of viral. The patient encountered COVID-19. The patient experienced cough and shortness of breath and showed abnormal ABG results, namely respiratory alkalosis, decreased oxygen saturation, fever, increased procalcitonin and increased cardiac markers.

Discussion: This case report prompts discussions on various aspects of ischemic stroke in young patients, including the role of COVID-19, hypercoagulable states, hematological abnormalities, and diagnostic challenges, with implications for patient management and future research directions.

Conclusion: SARS CoV-2 can affect the nervous system through several mechanisms that cause persistent infection, resulting in neurological diseases, including stroke. Young ischemic stroke is usually hypercoagulable and the most common cause is APS. In this patient, polycythemia was occured,that causes blood flow slows and oxygen supply to the brain is reduced. This can cause ischemic stroke.

Keywords: case report, COVID-19, ischemic stroke, youth

Introduction

Stroke is often considered a disease of old age, but it is estimated that 10% of stroke patients are <50 years old. Recent reports show an increasing trend of ischemic stroke at a young age compared with a decrease in stroke incidence and death.[1] Despite the ever increasing number of young stroke patients, the risk factors and causes of stroke remain unknown in about one-third of all patients.[2] In young people, the causes can be multiple: heart, vascular, or genetic disorders that require further, sometimes complex investigations.[3] The diagnosis of stroke in young age can be challenging to differentiate from stroke mimics and to identify the cause or underlying pathogenesis.[4]

Many factors can affect blood flow in the brain, including the condition of the pulse or arteries, arteries can be narrowed by the process of atherosclerosis or blocked by thrombus or embolus. Blood vessels can also be compressed by movement and calcification in the cervical spine, blood conditions can also affect

blood flow and oxygen supply. Increasingly thick blood, increased blood viscosity, increased hematocrit (eg in polycythemia) makes blood flow slower.[5]

Corona Virus Disease 2019 (COVID-19) is an infectious disease caused by Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). SARS-CoV-2 has several differences from MERS-CoV and SARS-CoV, including the speed of spread and severity of symptoms. The death rate for SARS (9.6%) is higher than COVID-19 (less than 5%). COVID-19 also has a wider and faster spread to several countries than SARS.[3] Populations who are elderly, have chronic diseases, and have low immune systems are more susceptible to this infection and its complications.[7]

In general, there are 3 general symptoms that can indicate someone is infected with SARS-CoV-2, fever (body temperature above 38°C), dry cough, shortness of breath. Other symptoms that can appear are diarrhea, headaches, conjunctivitis, loss of the ability to taste or smell, rashes on the skin. These symptoms can get worse quickly and cause respiratory failure and death. According to the Centers for Disease Control and Prevention (CDC) symptoms of 2019-nCoV virus infection can appear from 2 days to 14 days after exposure to the virus.[8] SARS CoV-2 infection was reported by Mehta et al in 2020, Chen et al in 2020 caused a cytokine storm syndrome which is one of the causes of acute cerebrobasilar disease. In SARS CoV-2 infection, there is often an increase in D-dimer and a severe decrease in platelet count, which leads to acute cerebrovascular disorders, according to Wang et al., 2020.[9]

This paper reports the case of a young male patient with ischemic stroke and gastrointestinal symptoms. During the course of the disease, respiratory problems were found with positive SARS CoV-2 PCR results. SARS CoV-2 can affect the nervous system through several mechanisms that cause persistent infection resulting in neurological diseases, including cerebrovascular disorders or strokes. In patients found increased levels of Hb, hematocrit and the number of erythrocytes called polycythemia.

Case Report

On April 15 2020, the patient's blood material is 16 years old with clinical information of sudden weakness of the right hand and leg, numbness, loss of appetite, nausea and vomiting, complete hematological examination results, electrolytes, SGOT, SGPT, urea, creatinine, glucose as present increased levels of hemoglobin, hematocrit, erythrocyte count, platelet count, leukocyte count and NLR may be caused by dehydration DD/inflammation, infection, tissue injury (Table 1). History of asthma since childhood, experiencing shortness of breath to a bluish body, others denied, history of premature birth. The results of the physical examination GCS E3-4M6V5, blood pressure 115/71 mmHg, HR 70x/minute, regular, temperature 36.5, RR 18x/minute, BMI 25.95 (Obesity 1) in many individuals with obesity, changes in the hemostatic and fibrinolytic activity are observed that lead to hypercoagulability[10], general status within normal limits, neurological status paresis N VII dextra Central, negative dysphagia screening, CT Scan results while in the NBC hospital ER are acute infarction in the left medial temporal lobe and old infarction in the left frontal lobe (median gyrus) while chest X-ray images while in the NBC ER are no abnormalities in heart and lungs.

The diagnosis included recurrent ischemic stroke due to vasculitis, cardioembolic stroke, hyperkalemia, and low intake. By the second day, the patient developed subfebrile fever and cough. By the fourth day, the patient's GCS changed to E3-4M6V3-4. CT Angiography on April 20, 2020, revealed no abnormalities in the intracranial blood vessels, while Thoracic CT Scan on the same date indicated bilateral pneumonia consistent with a viral infection. On the 7th day of treatment the patient entered the isolation room with the condition of the patient sleeping a lot, difficult communication, tremors in the left hand, no fever but still coughing and motor disturbances right hemiparesis. On the 9th day of treatment, the patient's GCS changed to E3-4M5V2 with a motor impression of right spastic hemiparesis. On the 10th day of treatment, the patient had generalized seizures lasting 2-3 minutes, black NGT, GCS E2M5V2, motor impression of spastic duplex hemiparesis. On the 10th day of treatment at night, the patient had shortness of breath, decreased consciousness and had a fever, blackened NGT with a diagnosis of Recurrent Ischemic Stroke, Suspected viral meningitis et causa COVID-19, viral pneumonia et causa suspected COVID-19, sepsis, acute respiratory distress syndrome (ARDS), hypercoagulable state, stress ulcer, acute renal failure and cardiomyopathy. The COVID-19 virus can affect the digestive system via binding to ACE2 receptors and subsequent gut microbiome dysbiosis. Through a variety of molecular pathways and mechanisms, numerous drugs for the treatment of COVID-19 could interfere with GI function and lead to multiple clinical manifestations, which may further intensify the risk and severity of GI symptoms of COVID-19 infection, such as nausea, vomiting, gastroparesis, and gastric ulcers.[11] Respiratory damage in COVID-19 patient can cause hypoxia, myocardial supply-demand mismatch, followed by oxidative stress and damage to cardiomyocytes.[12]

Table 1. Laboratory Test Results

Complete hematology	Result	Unit	Reference Value
Hemoglobin	17.7	g/dL	13.0 - 16.0
Hematocrit	51	%	40 - 48
Erythrocyte	6.3	million/uL	4.5 - 5.5
MCV	81	fL	82 - 92
MCH	28	pg	27 - 31
MCHC	35	%	31 - 36
RDW-CV	13.9	%	12.2 - 14.6
Absolute Reticulocyte	9	10^4/uL	2.4 - 11.0
Relative Reticulocyte	1.4	%	0.5 - 2.0
Platelets	433	thousand/uL	150 - 400
Leukocytes	13.5	10^3/uL	5.0 - 10.0
Basophils	0	%	0 - 1
Eosinophils	2	%	1 - 3
Stem Neutrophils	1	%	2 - 6
Segment Neutrophils	77	%	50 - 70
Lymphocytes	13	%	20 - 40
Monocytes	7	%	2 - 8
Monocytes	0		
Blood Electrolytes			
Sodium (Na)	140	mmol/L	136 - 146
Potassium (K)	5.7	mmol/L	3.5 - 5.0
Chloride (Cl)	98	mmol/L	98 - 106
Clinical Chemistry			
SGOT (AST)	18	U/L	<=40
SGPT (ALT)	19	U/L	<= 41
Blood Urea	31.7	mg/dL	16.6 - 48.5
Blood Creatinine	1.02	mg/dL	0.67 - 1.17
eGFR	108.3		>90
Current Glucose	92	mg/dL	

Discussion

A 16-year-old male patient presents with sudden weakness and numbness in his right hand and leg, symptoms consistent with ischemic stroke. In young patients, ischemic stroke is typically caused by hypercoagulability (Table 2), which leads to abnormal blood clotting and subsequent blockage of blood flow to the brain.

Table 2. Causes of ischemic stroke in young adults

Category	Causes
Non-atherosclerotic Angiopathy	• Cervico-cephalic artery dissection • Cerebral amyloid angiopathy • Moyamoya disease • Fibromuscular dysplasia • Reversible cerebral vasoconstriction syndrome • Susac's syndrome • Migraine-induced stroke
Hematologic disorders	• Hypercoagulable state due to deficiencies of protein S, protein C, or antithrombin; factor V Leiden mutation, prothrombin gene G20210A mutation • Acquired hypercoagulable state (eg, cancer, pregnancy, use of hormonal contraception, exposure to hormonal treatments such as anabolic steroids and erythropoietin, nephrotic syndrome) • Antiphospholipid syndrome • Hyperhomocysteinemia • Sickle cell disease • Myleproliferative disorders (including Polycythemia vera)
Genetic disorders	• Fabric disease • CADASIL • WELD • Marfan's Syndrome • Neurofibromatosis • Sturge-Weber disease
Inflammation, Infection	• Vasculitis (primary angitis of the CNS, Sjögren syndrome, Wegener's granulomatosis) • Temporal disease • Takayasu disease • Behçet's syndrome • Neurosarcoidosis • Neurocysticercosis • HIV • Varicella zoster virus • Neurosyphilis • Tuberculous meningitis

Hypercoagulability describes the pathologic state of exaggerated coagulation or coagulation in the absence of bleeding.[13] Antiphospholipid syndrome (APS) is the most common acquired hypercoagulable condition found in ischemic stroke at a young age.[14,15] Antiphospholipid syndrome is an acquired autoimmune condition characterized by venous, arterial, and microvascular thrombosis. Diagnosis typically requires the presence of antiphospholipid (aPL) antibodies alongside thrombosis and/or recurrent miscarriage. The most common site of arterial thrombosis in APS is the cerebral vascular which can cause cerebral ischemia or transient stroke.

Antiphospholipid syndrome that occurs without any other autoimmune disease is called primary APS while secondary APS occurs due to other autoimmune diseases, the most common of which is systemic lupus erythematosus (SLE).[16-19]

Causes of temporary APS are usually due to inflammation, infection or drugs. Abnormalities of natural anticoagulants such as antithrombin, protein C and protein S are important risk factors for venous thrombosis, but their association with arterial thrombosis is unclear.[5] Therefore it is recommended to examine ACA IgM, ACA IgG, B2GP1 IgM, B2GP1 IgG, levels and activity of protein C, protein S, antithrombin to determine the cause of hypercoagulability.

Table 3. Causes of polycythemia [20]

Category	Causes
Primary	• Polycythemia vera (polycythemia rubra vera) • Familial and congenital polycythaemia
Secondary EPO increase by compensatory mechanisms	• Being in a high place • Lung disease and hypoventilated alveoli • Cardiovascular disease, especially congenital abnormalities with cyanosis • Increased affinity of hemoglobin for oxygen (familia polycythemia) • Heavy smoker
Inappropriate EPO increase	• Kidney disease (hydronephrosis, vascular disorders, cysts and carcinomas) • Tumors such as uterine leomyoma, hypernephroma, hepatocellular carcinoma, cerebellar hemangioblastoma)
Relatively	• Stress, smoker • Dehydration: lack of water, vomiting • Plasma loss: burns and enteropathy

Complete hematology results showed an increase in hemoglobin levels, hematocrit, erythrocyte count, platelet count, leukocyte count and NLR possibly due to DD dehydration/inflammation, infection, tissue injury. Increased levels of hemoglobin, hematocrit, number of erythrocytes is called polycythemia. The causes of polycythemia are described (Table 3). To determine the cause of polycythemia in this patient, additional data is needed. One of the factors that can affect blood flow in the brain is the state of the blood which affects blood flow and oxygen supply. Increasingly thick blood, increased blood viscosity, increased hematocrit such as polycythemia can make blood flow slower.

From the results of a brain CT scan on April 15 2020, an acute infarction was found in the medial left temporal lobe dan old infarction in left frontal lobe (median gyrus). These results confirm the diagnosis of ischemic stroke, which is related to the sudden weakness of the right hand and leg accompanied by numbness. Based on the chronology on the medical resume, it is known that during the course of his diseases he encountered COVID-19. This patient had gastrointestinal disturbances such as nausea, vomiting and no appetite, then there were respiratory problems such as coughing and shortness of breath as evidenced by the abnormal ABG results on April 23 2020 showing respiratory alkalosis and on April 24 2020 a decrease in oxygen saturation was found, namely 75 .5%, the presence of fever with a temperature above 38^{o}C and an increase in procalcitonin 10 ng/mL indicates the presence of sepsis accompanied by heart problems with an increase in cardiac markers such as CKMB 91 U/L, Troponin T 114 ng/L and D-dimer 860 ng/mL then die.

The patient is a young man with ischemic stroke and gastrointestinal symptoms. During the course of his diseases, respiratory problems were found with positive SARS CoV-2 PCR results. In the presence of neurological symptoms such as headaches, decreased consciousness, paresthesias, and other pathological signs, a cerebrospinal fluid analysis should be performed. SARS CoV-2 can affect the nervous system through several mechanisms that cause persistent infection resulting in neurological diseases, including cerebrovascular disorders or strokes. Juvenile ischemic stroke is usually hypercoagulable and the most common cause is APS. In COVID-19, antiphospholipid syndrome (APS) can potentially occur, although it cannot be confirmed in this particular case. Patients have shown elevated levels of hemoglobin (Hb), hematocrit, and erythrocyte count, which indicate polycythemia. However, there is insufficient additional data available to ascertain the underlying cause of this polycythemia. In cases of polycythemia, the increased blood viscosity causes blood flow to slow down and reduces the oxygen supply to the brain. This significant reduction in oxygen and blood flow can ultimately result in an ischemic stroke.

Conclusion

SARS-CoV-2 can impact the nervous system through mechanisms that lead to persistent infection, potentially resulting in neurological conditions such as

cerebrovascular disorders or stroke. Young ischemic stroke is typically associated with hypercoagulability, with APS being the most common cause. The patient's elevated Hb, hematocrit, and erythrocyte levels indicate polycythemia, but further data is needed for diagnosis. Polycythemia may reduce brain blood flow and oxygen, potentially causing ischemic stroke.

Acknowledgment

The researchers express gratitude to the President Director, directors, staff, and neurology specialists at the National Brain Centre Hospital Prof. Dr. dr. Mahar Mardjono Jakarta for their support in this research. Special thanks to Prof. Dr. dr. Rahajuningsih Dharma Setiabudhy, D.Sc, Sp.PK(K), for her advice and guidance during the study.

References

1. Smaljlovic D. Strokes in young adults: epidemiology and prevention. Vascular Health and Risk Management; 2015. 11:157-64. DOI: 10.2147/VHRM.S53203
2. Van Alebeek ME, Arntz RM, Ekker MS, et al. Risk factors and mechanisms of stroke in young adults: The FUTURE study. J Cereb Blood Flow Metab; 2018. 38(9):1631-1641. DOI: 10.1177/0271678X17707138
3. Mihai D, Cristina Plesa F, Docu Axelerad A, Munteanu A, Claudia Ghinescu M, Adella Sirbu C. Ischemic Stroke in Young Adults: Practical Diagnosis Guide. Ischemic Stroke. IntechOpen; 2021. DOI: 10.5772/intechopen.92671
4. George MG. Risk Factors for Ischemic Stroke in Younger Adults: A Focused Update. Stroke; 2020. 51(3):729-735. DOI: 10.1161/STROKEAHA.119.024156
5. Gyawali P, Lillicrap TP, Tomari S, Bivard A, et al. Whole blood viscosity is associated with baseline cerebral perfusion in acute ischemic stroke. Neurol Sci; 2022 Apr. 43(4):2375-2381. DOI: 10.1007/s10072-021-05666-5555
6. Kannan S, Ali PSS, Sheeza A, Hemalatha K, Covid-19 (Novel Coronavirus 2019)–recent trends. European review for medical and pharmacological science; 2020. 24:2006-2011. DOI: 10.26355/eurrev_202002_20378
7. Guan W.T., Ni Z., Hu Y., et al. Clinical characteristics of Coronavirus Disease 2019 in China. New England Journal of Medicine; 2020 Feb. 382(18):1708-1720. DOI: 10.1056/NEJMoa2002032.
8. Ministry of Health Republic of Indonesia. Update percepatan penanganan COVID-19 di Indonesia. 2020.
9. Wu Y., Xu X., Chen Z., Duan J., et al. Nervous system involvement after infection with COVID-19 and other coronaviruses. Brain, Behavior, and Immunity; 2020. 87:18-22. DOI: 10.1016/j.bbi.2020.03.031
10. De Laat-Kremers R, Di Castelnuovo A, et al. Increased BMI and Blood Lipids Are Associated With a Hypercoagulable State in the Moli-sani Cohort. Front Cardiovasc Med; 2022. 9:897733. DOI: 10.3389/fcvm.2022.897733
11. Chen F, Dai Z, Huang C, Chen H, Wang X, Li X. Gastrointestinal Disease and COVID-19: A Review of Current Evidence. Dig Dis; 2022.40(4):506-514. DOI: 10.1159/000519412
12. Bemtgen X, Krüger K, Supady A, et al. First Successful Treatment of Coronavirus Disease 2019 Induced Refractory Cardiogenic Plus Vasoplegic Shock by Combination of Percutaneous Ventricular Assist Device and Extracorporeal Membrane Oxygenation: A Case Report. ASAIO J; 2020. 66(6):607-609. DOI: 10.1097/MAT.0000000000001180
13. Senst B, Tadi P, Basit H, et al. Hypercoagulability. StatPearls Publishing; 2024 Jan. Retrieved on Jan 19, 2023. Available from: https://www.ncbi.nlm.nih.gov/books
14. Caplan LR, Liebeskind DS. Pathology, anatomy, and pathophysiology of stroke. In: Caplan's Stroke: A Clinical Approach. 5th ed. Cambridge: Cambridge University Press; 2016. 19-50. DOI: 10.1017/CBO9781316095805.003
15. Sarecka-Hujar B, Kopyta I. Antiphospholipid syndrome and its role in pediatric cerebrovascular diseases: A literature review. World J Clin Cases; 2020. 8(10):1806-1817. DOI: 10.12998/wjcc.v8.i10.1806
16. Mallhi RS, Kushwaha N, Chatterjee T, Philip J. Antiphospholipid syndrome: A diagnostic challenge. Med J Armed Forces India; 2016. 72(Suppl 1):S31-S36. DOI: 10.1016/j.mjafi.2016.05.007
17. Sayar Z, Moll R, Isenberg D, Cohen H. Thrombotic antiphospholipid syndrome: A practical guide to diagnosis and management. Thromb Res; 2021. 198:213-221. DOI: 10.1016/j.thromres.2020.12.024
18. Tumian NR, Hunt BJ. Clinical management of thrombotic antiphospholipid syndrome. J Clin Med; 2022 Jan. 11(3):735. DOI: 10.3390/jcm11030735
19. Adiyanti SS. Diagnosis laboratorium pada antiphospholipid syndrome (APS). Departemen Patologi Klinik Fakultas Kedokteran Universitas Indonesia Rumah Sakit Umum Pusat Nasional Ciptomangunkusumo; 2015.
20. Wirawan R. Polisitemia dan Diagnosis Polisitemia. Pendidikan Berkesinambungan Patologi Klinik; 2015.