BRAINSTEM STROKE IN CHILDREN PRESENTING WITH NON-CEREBELLAR ATAXIA AND DYSARTHRIA : A CASE REPORT

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ABSTRACT

A rare case of chronic mesencephalic infarction in a 14-year-old boy with vertebral artery hypoplasia, hypertension, and nutritional deficiencies highlights the multifactorial risk factors contributing to pediatric posterior circulation stroke.

Keywords: mesencephalon infarction; Vertebral Artery Hypoplasia (VAH); posterior circulation ischemia; hypomagnesemia.

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INTRODUCTION

Stroke remains one of the leading causes of mortality and disability worldwide, including in Indonesia. Stroke in children can result from different causes, such as congenital vascular abnormality, coagulation disorders, infection, or head trauma. However, in this patient, none of these classical causes were identified. Moreover, infarctions in the mesencephalon are rare, accounting for approximately 9% of all the brainstem infarction (Baran et al., 2018).

Stroke among children and adolescent in 0-19 years is an underestimated public health issue. According to *Global Burden of Disease* study, the age-standardized rates of incidence, prevalence, and years lived with disability for pediatric stroke have significantly increased since 1990-2019, particularly in low-and middle-income countries (LMICs), such as in Southeast Asia and especially in Indonesia. That studies shown that pediatric stroke is a major health concern in developing countries like Indonesia (Sun et al., 2024).

Although pediatric stroke is relatively rare compared to adults, it often results in significant long-term neurological and developmental impairments. However, in Indonesia, research and published data focusing on brainstem infarction in children remain very limited. Therefore, studies and case report like this are essential to increase clinical understanding, support early recognition, and improve management strategies for pediatric stroke cases.

CASE

A 14-years old boy presented to the Emergency Department of Dr. Moewardi Hospital with metabolic abnormalities including hypomagnesemia (0.40 mmol/L), low ionized calcium (1.10 mmol/L), and a low INR/International Normalized Ratio (0.980 second). Other laboratory results were within normal limits.

He admitted to the Emergency Department of Dr. Moewardi Hospital with slurred speech and unsteady gait that began three days before admission. His parents noticed that he had difficulty pronouncing certain letters like "r", a softer voice, and slower responses. One day before admission, he started walking unsteadily without diziiness or headache. Although that main complaints ahead, he remained fully conscious and communicative. There was no similiar symptoms, history of head trauma, seizures, or fever. The baby was carried full term and the birth was uncomplicated, but he was born with a birth weight of 2,7 kilograms, which is at the lower limit of the

normal range. The developmental milestones were mildly delayed because he walked and spoke at 2 years of age and once repeated first grade but now attends school regulary.

On the general examination, he was alert and hemodynamically stable (BP 140/80 mmHg). Physical examinations were normal, but the oral mucosa revealed the presence of three small aphthous ulcers. Neurological examination revealed positive Romberg test that indacate impaired balance. Deep tendon reflexes and pathological reflexes were normal. While, the cranial nerve assessment showed mild dysfunction of cranial nerves VIII (vestibulocochlear nerve) and nerves XII (hypoglossal nerve).

The relevant findings on Brain MRI include lacunar infarction in the mesenchepalon and less area of pons along with mega cisterna magna, chronic pansinusitis, and hypoplasia of vertebralis artery sinistra. **Figure 1** shows the brain MSCT Non Contrast was showed acute phase of lacunar infarct in mesencephalon. It means cytotoxic oedema increasing water content and leads to decreased tissue attenuation, which appears as a hypodens imaging. **Figure 2** shows the Brain MRI FLAIR in the patient was showed hyperintense lesions indicating chronic infarction in the mesencephalon areas. It means the macrophages have clearance the damaged brain cells.

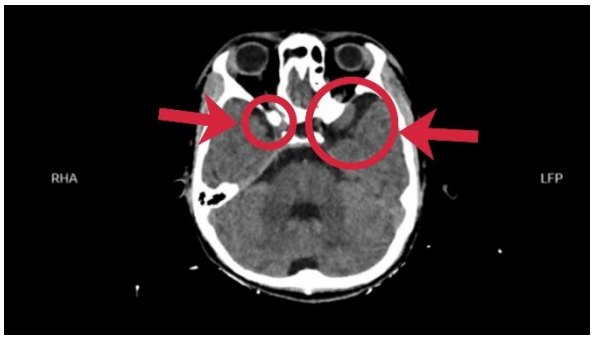

Figure 1. RHA indicates the right side of the patient's head (left side of the image). LFP indicates to the left side of the patient's head (right side of the image) in axial Non contrast MSCT.

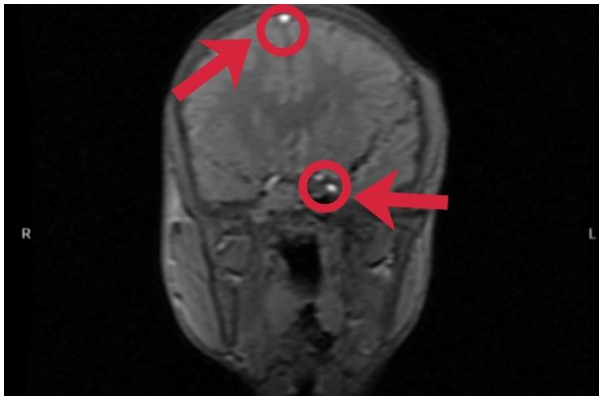

Figure 2. R indicates the right side of the patient's head (left side of the image). L indicates to the left side of the patient's head (right side of the image) in the brain MRI FLAIR.

He was diagnosed with chronic infarction of the mesencephalon (ICD-10 : 163.9), accompanied by primary hypertension, mild malnutrition, and grade I stomatitis. After three days of hospitalization, his condition improved, he was discharge with a favorable prognosis.

DISCUSSION

This is a unique case because brainstem stroke in children is very rare. The common case of strokes in children happen because of embolic causes, infections or inflammation, or metabolism problems. But in this patient, the stroke happened mainly because of a brainstem lesion, especially in the midbrain (mesencephalon) and a small part of the pons. It is hypothesized that anatomical variations of the vertebral artery in this patient, such as vertebral artery hypoplasia (VAH) may act as a predisposing factor for ischemia in the posterior circulation (Vilimas et al., 2022). Posterior circulation of the brain originates from the subclavian arteries, which give rise to vertebral arteries. The vertebral arteries merge to form the basilar artery which gives off branches supplying mesencephalon, pons, and others. Functionally, the brainstem serves as a key centre for balance, coordinated movement, speech, hearing, eye movement, and swallowing. As damage to this region can lead to deficits in these functions. Brainstem

infarction commonly results in ataxia and dysarthria, along with paralysis, diplopia, and dysphagia (Anand et al., 2023)

The presence of dysarthria was evident where the parents reported that the patient had slurred speech for three days, difficulty pronouncing the letter 'r', and reduced voice volume, although he was still able to communicate. Neurological examination confirmed involvement of cranial nerve XII (hypoglossal nerve), showing dysarthria without tongue deviation, supporting impaired articulation due to brainstem dysfunction. Ataxia was indicated by the patient's unsteady gait that demonstrating inability to maintain upright posture while standing or walking, without complaints of dizziness or motor weakness. This presentation is characteristic of gait ataxia, suggesting a cerebellar or brainstem origin. Neurological testing further corroborated this finding, with cranial nerve VIII (vestibulocochlear nerve) examination showing impaired balance and a positive Romberg test, confirming deficits in coordination and equilibrium.

Laboratory evaluation revealed a slightly decreased INR (0,98 per second). INR or International Normalized Ratio is a laboratory measurement of blood clotting that calculated from the patient's prothrombin time relative to an international standard. In this patient, a slightly decreased INR indicating a state of hypercoagulability predisposing to microthrombus formation in small vessels (Bal et al., 2024). Lacunar infarcts in the mesencephalon and pons suggest occlusion of small perforating arteries, resulting in ischemic stroke and resulting the worsened dysarthria and ataxia in the patient.

In this patient, the other risk factors likely contributed to the development of a chronic brainstem infarct affecting the mesencephalon and a small portion of the pons. Hypertension in this patient represents a secondary risk factor that may exacerbate vascular vulnerability. Chronically elevated blood pressure contributes to endothelial dysfunction and accelerates atherosclerotic changes in cerebral vessels, including those supplying the brainstem. In the presence of vertebral artery hypoplasia (VAH), hypertensive stress can further compromise perfusion, increasing the likelihood of ischemic events. Studies show that smalls vessel disease and underlying atherosclerotic process included hypertension are determinate of the cause and risk factors associated with the development of stroke (Baran et al., 2018).

Nutritional deficiencies in the patient particularly low levels of magnesium and calcium, also physical examination finds underweight categories can impair neuronal and vascular function, exacerbate neuromuscular symptoms, and hinder recovery after an ischemic insult. Magnesium and calcium are essential for neuronal excitability, muscle contraction, and vascular tone; deficiencies may worsen motor coordination and balance deficits post-stroke. Another studies show the low levels of magnesium role as the risk factor of ischemic stroke. Meanwhile, the low levels of calcium doesn't effect the risk factor of ischemic stroke (Larsson et al., 2019).

CONCLUSION

Vertebral artery hypoplasia (VAH) is a major causes, including pediatric cases, to posterior circulation ischemia. Early detection of VAH is important to identify individuals at risk and to implement timely preventive measures. In this patient, a combination of systemic risk factors, such as hypertension, hypomagnesemia, poor nutritional status, and a state of relative hypercoagulability (slightly low INR) likely contributed to the formation of microthrombi, leading to lacunar infarcts in the mesencephalon and pons. Strategic involvement of motor and cerebellar pathways explains the observed neurological deficits, including dysarthria and ataxia. This case underscores the importance of evaluating both vascular anatomical variations and systemic risk factors to prevent posterior circulation stroke.

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