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Case Report

The Heart-Shaped Sign Infarct: A Rare Case of Bilateral Medial Medullary Infarction

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ABSTRACT

Introduction: Medullary infarction is a life-threatening condition with an incidence rate of 0.5-1.5% of all ischemic strokes. It seldom occurs bilaterally and might cause fatal respiratory complications. Here, we present a rare case of Bilateral Medial Medullary Infarct (BMMI) with unique Magnetic Resonance Imaging (MRI) findings and discuss its anatomical involvement.
Case Report: a 67-year-old man with poorly controlled hypertension and diabetes presented with acute visual impairment, dysphagia, dysarthria, and left hemiparesis one day before. On the third day post-stroke, the patient developed quadriparesis along with worsening bulbar symptoms. Brain MRI revealed a heart-shaped infarct in the medial medulla, confirming the rare diagnosis of BMMI. The patient was treated with an antiplatelet, and there were no further complications.
Discussion: Although rare, clinical findings of bulbar symptoms, quadriparesis, and respiratory involvement may aid early identification of BMMI. Brain MRI is recommended as it reveals the radiological hallmark of a heart-shaped infarct associated with the anteromedial and anterolateral branches of the vertebrobasilar artery that supply the medullary. MRI is useful in differentiating BMMI from other neurological disorders and determining the proper course of treatment.
Conclusion: BMMI early identification with a typical heart-shaped infarct is essential to prevent fatal respiratory failure. Risk factor management is crucial to prevent recurring infarcts.

Keywords: Bilateral medial medullary infarct (BMMI), Heart-shaped sign infarct

INTRODUCTION

Bilateral medial medullary infarction (BMMI) is a rare type of medial medullary infarction. The incidence rate of medial medullary infarction itself accounts for 0.5-1.5% of all ischemic strokes and rarely occurs bilaterally.[1] It is characterized by infarction of the brainstem structure, specifically the medulla oblongata, due to bilateral occlusion of the vertebral artery, anterior spinal artery, basilar artery, or its branches. Medial structures consist of the medial lemniscus, longitudinal fasciculus, pyramids, and hypoglossal nuclei are supplied by those arteries. Brain imaging plays a crucial role in diagnosis by showing radiological hallmarks of heart-shaped appearance in BMMI, though the occurrence is uncommon [2,3,4]

The heart-shaped appearance resembles the anatomical configuration of medullary arteries and it vascularization. In this study we reported a unique rare case of BMMI, highlighting the importance of advanced imaging with MRI for accurate diagnosis and demonstrating the challenges in treatment and possible complications.[3,4]

CASE REPORT

A 67-year-old man with a history of hypertension and type-2 diabetes came to the emergency department with complaints of blurred vision since the day before, accompanied by slurred speech and difficulty swallowing. His blood pressure was measured at 160/90 mmHg, with a heart rate of 77 beats per minute. The patient was found to be compos mentis with neurological deficits including right peripheral facial nerve palsy, right hypoglossal nerve palsy, and left hemiparesis.

On the third day of the stroke, the patient's deficits progressed to quadriplegia with a motor strength of 0000/0000 in the upper extremities and 0000/0000 in the lower extremities, accompanied by right ophthalmoplegia, dysarthria, and a decreased cough reflex. Brain MRI were performed due to suspicion of evolving ischemic stroke, and revealed an acute infarct at the level between pons and medullary. However, MRA failed to found any stenosis, aneurysm or vascular malformation in the vertebro-basilar artery. DSA was performed, revealing an obstruction in the inferior cerebellar artery at the level of pons and medulla oblongata. The patient then underwent a repeat MRI head WI, FLAIR, and T2-Weighted and showed a central bilateral medullary acute infarct with a heart-shaped infarct as shown in figure 1.

The patient was admitted to the Intensive care unit and was treated with aspirin and rosuvastatin, along with physiotherapy. Hypertension management included telmisartan, amlodipine, and clonidine, while insulin was administered for diabetes. However, on the eighth day of stroke onset, he developed a complication of pneumonia due to a decreased cough

reflex and was treated with intravenous antibiotics. The patient's general condition and hemodynamics then improved, and the patient was discharged and required homecare due to remaining neurological deficits.

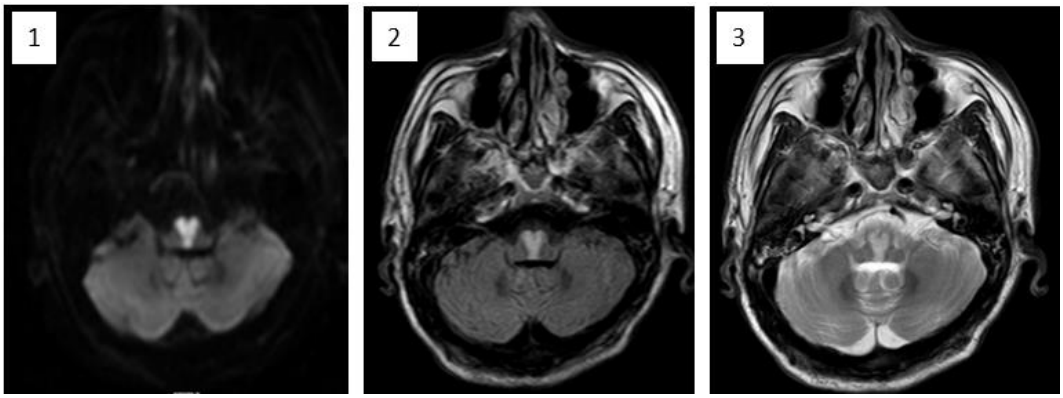

Figure 1. MRI head with bilateral medullary acute infarct in heart-shaped hyperintensity in the axial DWI (1), FLAIR section (2), and T2-Weighted (3).

DISCUSSION

Bilateral medial medullary infarction (BMMI), accounts for fewer than 1% of all posterior infarctions.[3] BMMI is often found at the age of 45 to 60 years with a higher prevalence in men than women, reaching 81%. Previous studies have also shown the presence of primary risk factors for hypertension and diabetes mellitus in the formation of atherosclerosis in the posterior circulation causing BMMI cases.[1,3]

The anatomical structure of the medulla oblongata is divided into three parts, namely ventral, medial, and dorsal. Significant structures found in the medulla oblongata are pyramidal tracts, medial colliculus, and ipsilateral hypoglossal nerve.[5] It also plays an important role in autonomic functions, which are responsible for respiratory and cardiovascular control.[2] Figure 2 shows the schematic neuroanatomy of the medulla, where infarction in this area can result in the sudden onset of quadriplegia, sensory loss, horizontal gaze palsy, nystagmus, dysphagia, dysarthria, and autonomic problems.[6] These clinical symptoms, are called Bilateral medullary syndrome (BMS), characterized by simultaneous infarction in both medullary

pyramids.[1,2] In our case, the patient also developed right peripheral type facial nerve palsy. Based on the previous studies, this peripheral type of facial palsy may have resulted from facial intranuclear involvement of the caudal pons extended from a dorsolateral upper medullary lesion in the ascending pathway of corticobulbar fibers. In addition, some cases also show clinical progression starting with hemiplegia, which then becomes tetraplegia within 2 days. This is related to uneven blockage in both parts of the pyramidal tracts at the beginning of the onset of the deficit.[7,8]

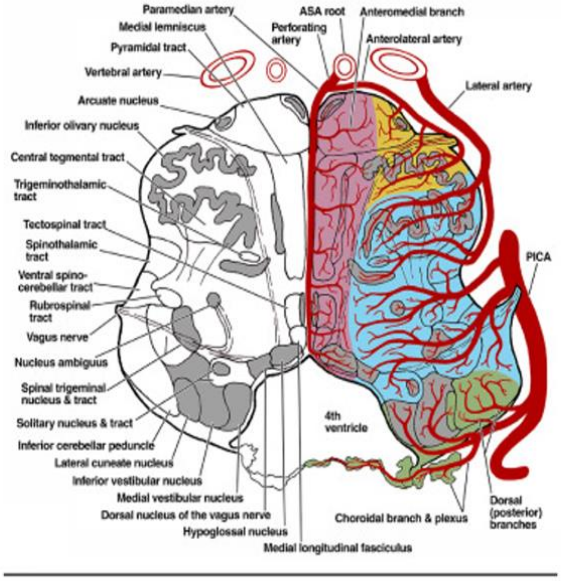

Figure 2. Diagrammatic representations of the vascular regions in upper medulla transverse sections with intramedullary arteries inserted. Regions are divided into Medial (pink), Anterolateral (yellow), Lateral (blue), and Dorsal (green).[6]

A rare discovery on this patient's MRI is the heart-shaped infarct (figure 1), which most likely depicts the anatomical arrangement of the arteries and blood flow distribution of the medulla. The vertebrobasilar artery is the source of the medulla oblongata vascularization, which is further subdivided into anteromedial, anterolateral, lateral, and posterior sections (figure 2).[1,6] On imaging, blockage in both the anteromedial and anterolateral regions creates this unique heart-shaped infarct, serving

as a radiological hallmark in diagnosing BMMI.[6,9]

Stroke progression in BMMI cases was found to be high with 45.4% incidence in a recent study group. Progression was most frequently found between the 2nd and 6th of stroke onset.[1] Early identification is necessary to prevent the involvement of autonomic dysfunction and further complications. Compared to CT scans, previous studies showed a higher incidence of heart-shaped medullary infarction using MRI during the early stages of infarction.[6,9,10]

Even though CT scans are useful in many settings, it is prone to misdiagnosis due to their low sensitivity in identifying acute ischemic changes, notably in the brainstem and medulla. Therefore, brain MRI, specifically DWI sequences, provides a critical advantage in super early stages of infarction.[1,10] Clinical presentation of sudden onset of bulbar symptoms, quadriparesis, and respiratory failure in BMMI could mimic other neurological problems such as Guillain-Barré syndrome, myasthenia gravis crisis, brainstem encephalitis, and another demyelinating disease. Because of these overlapping symptoms, diagnosis can be difficult, and imaging tests like MRI are typically required. Specific MRI abnormalities and acute onset provide substantial evidence for the BMMI diagnosis.[2,11]

BMMI has a poorer prognosis than any other posterior stroke with a higher mortality rate. In a systematic review study, patients with BMMI had 23.8% hospital mortality with a dependency rate of surviving patients of 61.9%. In stroke patients, pneumonia is a leading cause of death, due to disruption of the coughing and breathing centers. A poor prognosis and sepsis secondary to pneumonia may result from the greater incidence of pneumonia in individuals with dysphagia.[12]

Management of BMMI emphasizes acute management, complication prevention, rehabilitation therapy implementation, and long-term strategy formulation. Prognosis is significantly improved by early detection and acute management, including intravenous thrombolysis, in strokes that occur within 4.5 hours

Acute treatment was not carried out in this case, though, because the stroke occurred more than 4.5 hours. Some patients may achieve partial recovery with therapy, whilst others may encounter long-term incapacity or death.[13.14]

CONCLUSION

Bilateral medial medullary stroke is a rare type of posterior stroke that mimics GBS and neuromuscular disorders presenting with bulbar symptoms, quadriparesis, and respiratory failure. However, acute onset and specific MRI finding of heart-shaped hyperintensity become the key in differentiating BMMI from any other neurological disorder. The majority of patients with bilateral medial medullary stroke who survived remained dependent.

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