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Case report

MIGRAINE WITH BRAINSTEM AURA – A CASE REPORT

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Abstract

Migraine with brainstem aura (MBA) is a rare subtype of migraine with aura, characterized by reversible neurological symptoms originating from the brainstem and accompanied by migraine headache. Because of its complex clinical presentation, MBA may mimic other serious neurological conditions, leading to diagnostic uncertainty. We present a case of a 47-year-old woman with recurrent episodes of diplopia, dysarthria, walking instability, and occipital headache and left-sided head pain, in whom extensive diagnostic evaluation excluded structural, vascular, and epileptic causes. The clinical features fulfilled the International Classification of Headache Disorders, 3rd edition (ICHD-3) criteria for migraine with brainstem aura. This case highlights the importance of careful clinical assessment, appropriate use of diagnostic tools, and awareness of MBA among clinicians to ensure timely diagnosis and management.

Keywords: migraine with brainstem aura, International Classification of Headache Disorders, brainstem dysfunction

Introduction

Migraine with brainstem aura has long been described; yet it remains poorly understood. It was initially described in 1961, when Bickerstaff reported for the first time a subtype of migraine associated with brainstem dysfunction and proposed the concept of basilar artery migraine[1]. Since then, impairment of consciousness in migraine has been considered a prominent aura symptom. Migraine with brainstem aura has been referred to by several different names, including basilar-type migraine, basilar migraine, basilar artery migraine, brainstem migraine, Bickerstaff's syndrome, and vertebrobasilar migraine. At present, the Headache Classification Committee of the International Headache Society (IHS) has renamed basilar artery migraine as migraine with brainstem aura (MBA)[2].

Migraine with brainstem aura is a rare migraine subtype[3] and accounts for approximately 1.5 % of all headaches and 6.6-10 % of migraine with aura[4]. It is an uncommon subtype of migraine with aura, primarily affecting children, adolescents, and younger adults. Aura features include vertigo, dysarthria, diplopia, tinnitus, ataxia, and disorders of consciousness (DOC)[2]. Exploding head syndrome (EHS)[5] or hiccups[6] may also occur in some patients. Notably, the complex symptoms and signs of DOC can complicate the differential diagnosis of the underlying primary disorder[7]. Therefore, greater attention is required to ensure early recognition, accurate diagnosis, and timely treatment.

The diagnosis of MBA is based on a thorough physical and neurological examination, fulfillment of the ICHD-3 diagnostic criteria, and the use of additional diagnostic tools such as brain magnetic resonance imaging (MRI), electroencephalography (EEG), and other appropriate modalities.

According to the ICHD-3 diagnostic criteria, aura in MBA should include at least two of the following fully reversible brainstem symptoms [2]:

a) dysarthria
b) vertigo
c) tinnitus
d) hypacusis
e) diplopia
f) ataxia not attributable to sensory deficit
g) decreased level of consciousness (GCS ≤13).

Motor or retinal symptoms must be absent.

Pathophysiology of MBA with DOC

The pathophysiology of MBA has not yet been fully elucidated. Three main hypotheses have been proposed: vasomotor dysfunction[8], neurogenic inflammation [9], and cortical spreading depression [10]. Abnormal cerebral cortical function can cause migraine aura symptoms [11]. Furthermore, abnormal neural activation within specific consciousness networks, including the prefrontal and posterior parietal cortices, may lead to alterations in consciousness.

In MBA with DOC, abnormal neurotransmitter secretion may result in dysfunction of the reticular activating system (RAS)[12]. Increased secretion of the inhibitory neurotransmitter γ-aminobutyric acid (GABA) in migraine patients[13] may contribute to RAS dysfunction and subsequent changes in the level of consciousness. The hypothalamus also plays a critical role in migraine. Resting regional cerebral blood flow decreases in the lateral hypothalamus immediately prior to a migraine attack[14]. Moreover, resting functional connectivity between the lateral hypothalamus and pain-processing pathways (including the midbrain periaqueductal gray, dorsal pons, rostral ventromedial medulla, and cingulate cortex) is reduced before migraine onset.

The etiology of MBA with DOC remains unclear; therefore, patients can only reduce attack frequency by avoiding known triggering factors. Most patients with MBA and DOC have a family history of migraine. Various gene mutations (including CACNA1A, ATP1A2, SCN1A, KCNK18, PRRT2, and CSNK1D) and rare functional gene network abnormalities have been associated with migraine[15]. However, no specific genetic susceptibility has been identified for MBA with DOC. The most common predisposing factors[4] include emotional stress, sleep disturbance, lack of sleep, weather changes, direct sunlight, cold exposure, hunger, dietary nitrites (e.g., processed meats), caffeine, alcohol consumption, hormonal fluctuations, excessive physical activity, and fatigue. Aura symptoms typically last between 5 minutes and 1 hour.

Headache often occurs concurrently with or following recovery from DOC. The headache is frequently severe and throbbing, typically unilateral or bilateral, and most commonly localized to the occipital region. Approximately half of patients experience symptom resolution within a few hours, while others obtain relief through vomiting or sleep.

Diagnostic Tools

Routine blood tests and cerebrospinal fluid analysis in patients with MBA and DOC are usually normal[3]. Abnormal findings are typically reversible and may be detected using transcranial Doppler (TCD), magnetic resonance imaging (MRI), electroencephalography

(EEG), single-photon emission computed tomography (SPECT), and neurophysiological studies. TCD and MRI may demonstrate basilar artery spasm, abnormal occipital lobe signals, or brainstem capillary dilation during attacks[16]. EEG may show diffuse slow-wave activity during DOC episodes, most commonly originating from the occipital lobe, without epileptiform discharges. EEG findings usually normalize after recovery. SPECT may reveal hypoperfusion of the occipital cortex and cerebellar hemispheres. These abnormalities are reversible and correlate with aura symptoms and headache severity. Additionally, brainstem auditory evoked potentials may show prolonged III–IV wave latency in MBA patients, which normalizes after clinical recovery[17].

Several potential plasma biomarkers for migraine have been proposed, including:

- increased CD4+ effector memory helper T lymphocytes;
- elevated plasma CGRP levels[18];
- mRNA expression of prostacyclin receptors in peripheral blood lymphocytes[19];
- elevated serum cystatin C levels[20];
- increased apolipoprotein E levels[21];
- decreased serum S100B levels[22];
- increased interictal vasoactive intestinal peptide levels[23].

Among these, CGRP has emerged as a prominent therapeutic target. However, conflicting evidence suggests that serum CGRP concentration may not be a reliable biomarker for chronic migraine[24]. Currently, no biomarker has been validated specifically for MBA with DOC.

Treatment

Migraine prevention should combine pharmacological and non-pharmacological approaches, including avoidance of triggers, maintenance of a healthy lifestyle, adequate sleep, and weight control. Common dietary triggers include dairy products, wheat, chocolate, eggs, rye, tomatoes, and citrus fruits. Cognitive behavioral therapy may also reduce migraine frequency.

Pharmacological preventive therapies include β-blockers, calcium channel blockers[3], antiepileptic drugs, and tricyclic antidepressants. Recent studies have demonstrated reduced vitamin B12 and folic acid levels in migraine patients[25]; therefore, supplementation may play a preventive role. The calcitonin gene-related peptide (CGRP) pathway is now recognized as central to migraine pathophysiology, and CGRP monoclonal antibodies and receptor antagonists are increasingly used for both acute treatment and prevention.

Acute treatment of MBA focuses on symptom relief using nonsteroidal anti-inflammatory drugs (NSAIDs), antiemetics such as metoclopramide, and newer agents including gepants and ditans (e.g., lasmiditan). Traditional triptans have historically been avoided because of potential cerebrovascular risk, although this approach is evolving.

Case report

A 47-year-old woman was brought to the emergency department due to the acute onset of diplopia, speech difficulties, walking instability, occipital headache, and left-sided head pain, followed by nausea without vomiting. While at work (operating a cash register in a store), she developed blurred and double vision accompanied by dysarthria with preserved comprehension, generalized weakness, and a sensation of instability while walking. These symptoms lasted for a short period and resolved spontaneously. Subsequently, a headache developed, followed by nausea and an urge to vomit, although vomiting did not occur.

The patient denied any previous or current infectious symptoms and denied head trauma. At our emergency center, she was initially evaluated by the on-duty internist, who excluded acute internal medical pathology. Following neurological consultation, a non-contrast

brain CT scan and CT angiography of the cerebral vessels were performed, both with normal findings. Laboratory blood tests, including complete blood count, biochemical analyses (hepatogram, lipid profile, urea, creatinine, electrolyte status), and cardiospecific enzymes, were within normal limits. Basic coagulation tests and D-dimer levels were also normal.

The patient was examined by a neurosurgeon, and neurosurgical pathology was excluded. Additional anamnestic data revealed that identical symptoms - diplopia, speech difficulties, and occipital and left-sided headache with similar duration and characteristics - had first occurred six years earlier. At that time, ophthalmological examination, neurological examination, EEG monitoring, and brain MRI showed no pathological findings. Cardiological evaluation revealed an intra-atrial septal aneurysm on echocardiography, while Holter ECG monitoring and color Doppler duplex sonography (CDDS) of the carotid and vertebral arteries were normal. Antiplatelet therapy was recommended.

During the six-year interval prior to the current admission, the patient experienced occasional headaches, predominantly localized to the left side of the head and neck region, sometimes accompanied by nausea. Some of these episodes were preceded by short-lasting, self-limiting episodes of diplopia, speech difficulties, and walking instability. These headaches typically occurred after intense psychological stress or insufficient sleep.

Regarding comorbidities, the patient reported varicose veins of the lower extremities and denied other health conditions. Family history was negative for neurological diseases and other diseases of neurological interest. Throughout the hospitalization, both somatic and neurological examinations remained normal. The headache persisted for two days and did not recur during the hospital stay.

To further clarify the etiology of the clinical presentation, additional investigations were performed, including initial and follow-up CT scans and CT angiography of the cerebral vessels, all with normal findings. Brain MRI using standard pulse sequences and planes, as well as non-contrast MR angiography of the cerebral arteries, showed no abnormalities. CDDS of the carotid and vertebral arteries was normal. Transthoracic echocardiography demonstrated a thin, aneurysmally altered intraatrial septum without evidence of shunting, and contrast (bubble) echocardiography was negative.

Vascular Doppler ultrasound of the lower extremities revealed severe bilateral reflux at the saphenofemoral junctions. The small saphenous vein was aneurysmally dilated, compressible, and demonstrated severe reflux at the saphenopopliteal junction, with varicosely altered venous segments distal to the popliteal junction.

A cardiology consultation recommended continuation of antiplatelet therapy, the use of class I compression stockings, transesophageal echocardiography (TEE), and an elective consultation with a vascular surgeon for surgical management of the varicose veins. After discharge, TEE revealed a small, hemodynamically insignificant patent foramen ovale.

The patient has been followed for three months after hospitalization and remains on continuous antiplatelet therapy, with symptomatic analgesic treatment prescribed as needed for headache. During follow-up, she reported no recurrence of symptoms or other neurological complaints.

Conclusion

Migraine with brainstem aura is a rare and complex subtype of migraine with aura, most commonly affecting children, adolescents, and younger adults. It is characterized by migraine headache accompanied by reversible neurological symptoms attributed to brainstem dysfunction. Because MBA may mimic other serious neurological disorders, awareness of its clinical features and diagnostic criteria is essential[26]. The third edition of the International Classification of Headache Disorders (ICHD-3) officially replaced the terms “basilar artery migraine” and “basilar-type migraine” with “migraine with brainstem aura”[2]. Accurate

diagnosis requires careful history-taking, exclusion of alternative diagnoses, and recognition of characteristic brainstem aura features.

Conflict of interest statement. None declared.

References

1. Bickerstaff E. Basilar artery migraine. *Lancet* 1961; 277(7167): 15-17. https://doi.org/10.1016/S0140-6736(61)92184-5.
2. Headache Classification Committee of the International Headache Society (IHS) The International Classification of Headache Disorders, 3rd edition. *Cephalalgia* 2018; 38(1): 1-211. doi: 10.1177/0333102417738202.
3. Chirchiglia D, Chirchiglia P, Marotta R. A singular association of migraine with brainstem aura and Alice in Wonderland syndrome. *Childs Nerv Syst* 2019; 35(8): 1435-1437. doi: 10.1007/s00381-019-04170-8.
4. Ying G, Fan W, Li N, Wang J, Li W, Tan G, *et al*. Clinical characteristics of basilar-type migraine in the neurological clinic of a university hospital. *Pain Med* 2014; 15(7): 1230-1235. doi: 10.1111/pme.12402.
5. Rossi F, Gonzalez E, Rossi E, Tsakadze N. Exploding head syndrome as aura of migraine with brainstem aura: a case report. *J Orofac Pain Headache* 2018; 32(2): e34-e36. doi: 10.11607/ofph.1950.
6. Chaudhry P, Friedman D. Hiccups as a migraine aura. *Cephalalgia* 2015; 35(9): 831-834. doi: 10.1177/0333102414560633.
7. Kondziella D, Bender A, Diserens K, van Erp W, Estraneo A, Formisano R, *et al*. European academy of neurology guideline on the diagnosis of coma and other disorders of consciousness. *Eur J Neurol* 2020; 27(5): 741–756. doi: 10.1111/ene.14151.
8. Shevel E. The extracranial vascular theory of migraine–a great story confirmed by the facts. *Headache* 2011; 51(3): 409-417. doi: 10.1111/j.1526-4610.2011.01844.x
9. Cavestro C, Ferrero M, Mandrino S, Di Tavi M, Rota E. Novelty in Inflammation and Immunomodulation in Migraine. *Curr Pharm Des* 2019; 25(27): 2919-2936. doi: 10.2174/1381612825666190709204107.
10. Cui Y, Kataoka Y, Watanabe Y. Role of cortical spreading depression in the pathophysiology of migraine. *Neurosci Bull* 2014; 30(5): 812-822. doi: 10.1007/s12264-014-1471-y
11. Demarquay G, Ducros A, Montavont A, Mauguiere F. Migraine with brainstem aura: why not a cortical origin? *Cephalalgia*. 2018; 38(10): 1687-1695. doi: 10.1177/0333102417738251.
12. Marsala S, Gioulis M. Basilar migraine mistaken for encephalitis. *Neurolog Sci* 2012; 33(1): 213-214. doi: 10.1007/s10072-011-0658-5.
13. Aguila MR, Rebbeck T, Leaver AM, Lagopoulos J, Brennan PC, Hübscher M, *et al*. The association between clinical characteristics of migraine and brain GABA levels: an Exploratory Study. *J Pain* 2016; 17(10): 1058-1067. doi: 10.1016/j.jpain.2016.06.008.
14. Meylakh N, Marciszewski K, Di Pietro F, Macefield V, Macey P, Henderson L. Altered regional cerebral blood flow and hypothalamic connectivity immediately prior to a migraine headache. *Cephalalgia* 2020; 40(5): 448-460. doi: 10.1177/0333102420911623.
15. Rasmussen AH, Kogelman LJA, Kristensen DM, Chalmer MA, Olesen J, Hansen TF. Functional gene networks reveal distinct mechanisms segregating in migraine families. *Brain* 2020; 143(10): 2945-2956. doi: 10.1093/brain/awaa242.
16. Beukers R, Roos Y. Pontine capillary telangiectasia as visualized on MR imaging causing a clinical picture resembling basilar-type migraine: a case report. *J Neurol* 2009; 256(10): 1775-1777. doi: 10.1007/s00415-009-5204-5.

17. Ganji S, Hellman S, Stagg S, Furlow J. Episodic coma due to acute basilar artery migraine: correlation of EEG and brainstem auditory evoked potential patterns. *Clin EEG* 1993; 24(1): 44-48. doi: 10.1177/155005949302400110.
18. Pavelek Z, Souček O, Krejsek J, Sobíšek L, Klímová B, Masopust J, *et al*. The role of the immune system and the biomarker CD3 + CD4 + CD45RA-CD62L- in the pathophysiology of migraine. *Sci Rep* 2020; 10(1): 12277. doi: 10.1038/s41598-020-69285-4.
19. Kheirollahi M, Kazemi M, Amini G, Khorvash F, Ahangari F, Kolahdouz M, *et al*. Expression of prostaglandin I2 (prostacyclin) receptor in blood of migraine patients: a potential biomarker. *Adv Biomed Res* 2015; 4(1): 121. doi: 10.4103/2277-9175.158030.
20. Akda GT, Uca AU. Cystatin C as a potential biomarker to evaluate migraine. *Arq Neuropsiquiatr* 2020; 78(6): 337-341. doi: 10.1590/0004-282X20200005.
21. Yuasa N, Nagata E, Fujii N, Ito M, Tsukamoto H, Takizawa S. Serum apolipoprotein E may be a novel biomarker of migraine. *PLoS One* 2018; 13(1): e0190620. doi: 10.1371/journal.pone.0190620.
22. Celikbilek A, Sabah S, Tanik N, Ak H, Atalay T, Yilmaz N. Is serum S100B protein an useful biomarker in migraine? *Neurol Sci* 2014; 35(8): 1197-1201. doi: 10.1007/s10072-014-1679-7.
23. Cernuda-Morollon E, Martinez-Camblor P, Alvarez R, Larrosa D, Ramon C, Pascual J. Increased VIP levels in peripheral blood outside migraine attacks as a potential biomarker of cranial parasympathetic activation in chronic migraine. *Cephalalgia* 2015; 35(4): 310-316. doi: 10.1177/0333102414535111.
24. Lee MJ, Lee SY, Cho S, Kang ES, Chung CS. Feasibility of serum CGRP measurement as a biomarker of chronic migraine: a critical reappraisal. *J Headache Pain* 2018; 19(1): 53. doi: 10.1186/s10194-018-0883-x.
25. Aydin H, Bucak IH, Geyik M. Vitamin B12 and folic acid levels in pediatric migraine patients. Acta Neurol Belg. 2021;121(6): 1741-1744. doi: 10.1007/s13760-020-01491-3.
26. Deleva Stoshevska T, Nikoloska S, Veljanovski D, Nikoloski M, Stoshevski B. Migraine and patent foramen ovale - case report. *Acad Med J* 2023; 3(2): 189-195. https://www.doi.org/10.53582/AMJ2332189ds.