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Case Report

Early neurological deterioration with severe headache as the initial manifestation: A case report ☆,☆☆

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ABSTRACT

Severe headache as the initial clinical manifestation of early neurological deterioration (END) is uncommon. The emergence of severe headache should be promptly recognized as a potential indicator of large vessel stenosis. Here, we describe a male patient who initially presented with severe headache accompanied by transient left limb weakness, which subsequently progressed to persistent weakness. Imaging studies revealed severe stenosis at the origin of the right internal carotid artery, along with the presence of asymmetrically prominent cortical veins (APCV). Despite the administration of pregabalin orally and tramadol intramuscularly, his headache persisted. However, significant alleviation of his headache symptoms was observed following the improvement of cerebral perfusion.

Re-examination revealed the resolution of cortical vein dilation. This case underscores the importance of recognizing severe headache and APCV as potential indicators of large vessel stenosis and early neurological deterioration (END). Improving cerebral perfusion may serve as an effective means of alleviating headache symptoms in such cases.

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Introduction

In recent years, stroke has emerged as the second leading cause of mortality worldwide [1]. Among these cases, early

neurological deterioration (END) warrants particular attention due to its association with higher rates of disability and mortality. The precise epidemiology, predictive value, and therapeutic strategies for headache as a prodromal symptom of stroke remain incompletely understood. A study on prehos-

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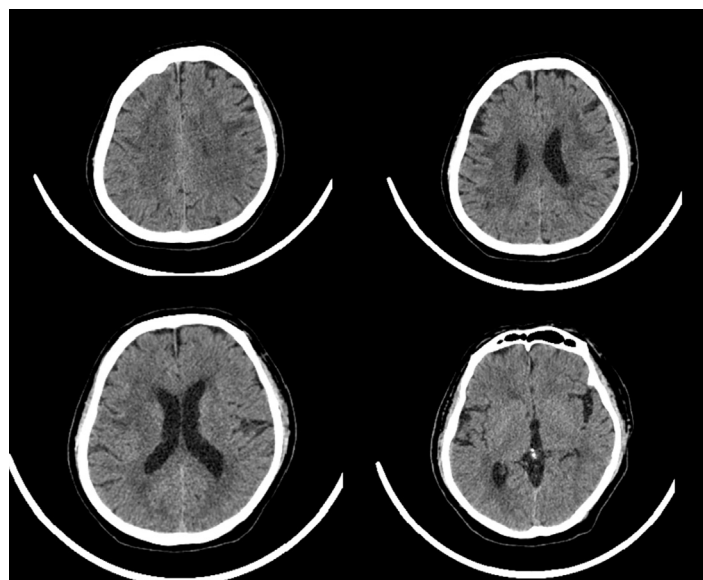


Fig. 1 – Computed tomography of the head before admission: Computed tomography examination revealed multiple small patchy hypodense areas in the brain.

pital stroke identification indicated that patients presenting with atypical complaints like dizziness and headache were more likely to be overlooked during consultation [2]. This article presents a case study of END characterized by severe headache as the primary presenting symptom, aiming to enhance early recognition of END and underscore its pivotal role in effective management.

Case report

A 65-year-old man with a history of stroke and diabetes presented with a severe headache for 7 days. He described the pain as swelling on the right side of his head with nausea, no vomiting. Additionally, he experienced transient left limb numbness and weakness for 10 minutes, occurring twice daily. A head computed tomography (CT) scan at the local hospital indicated the presence of minute ischemic lesions, and the patient was given oral aspirin and atorvastatin. However, the headache did not alleviate. On the eighth day, he presented to the emergency with severe headache accompanied by left limb weakness and numbness. CT examination revealed multiple small patchy hypodense areas in the brain (Fig. 1).

Upon arrival, his mental status and cognition remained intact. Neurologic exam showed mild left-sided facial and lingual paresis. The other cranial nerves were intact. Motor examination revealed a left limb muscle strength of 4/5. The left Babinski sign was positive, and the neck resistance was negative. Sensory examination revealed diminished sensation to light touch, pinprick, and temperature in his left upper limb. Upon admission, the patient's blood pressure was 122/71 mmHg. An electrocardiogram (ECG) and relevant blood tests conducted showed no significant abnormalities.

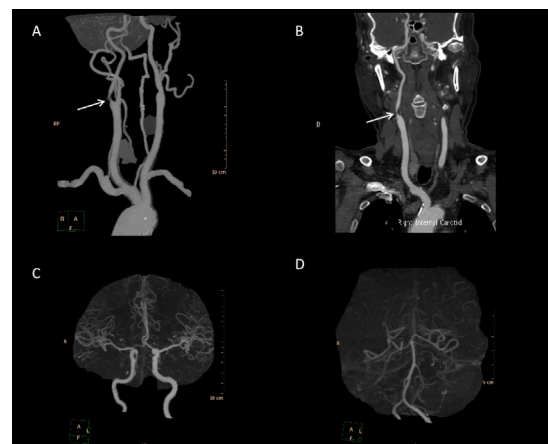


Fig. 2 – Computerized tomography angiography: The severe stenosis at the origin of the right internal carotid artery (white arrow) (A, B). No significant abnormalities were observed in the blood vessels of both the anterior and posterior cerebral circulations (C, D).

On hospital day 1, the patient experienced a recurrence of the headache, with a Visual Analog Scale (VAS) score of 9/10. Administration of pregabalin orally and tramadol hydrochloride intramuscularly did not provide relief from the headache. Additionally, the patient's left limb weakness worsened, accompanied by dysarthria and horizontal nystagmus. Muscle strength in both the left upper and lower limbs was assessed as 3/5. However, the etiology of headache remained elusive. On hospital day 2, an emergent cranio-cervical computed tomography angiography (CTA) revealed severe stenosis at the origin of the right internal carotid artery, with a stenosis rate of approximately 95% (Fig. 2). Diffusion-weighted imaging (DWI) demonstrated multiple scattered hyperintensities in the right

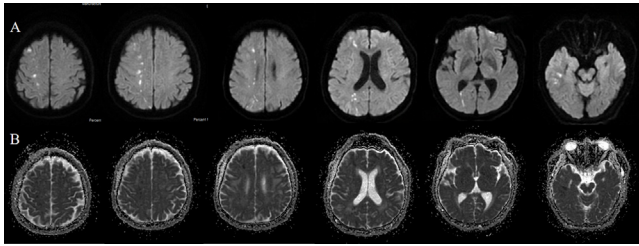


Fig. 3 – Magnetic resonance imaging after admission: Diffusion-weighted image showed multiple patchy and punctate high signals in the right frontal, temporal and parietal lobes, the right basal ganglia and the right corona radiata centrum semiovale (A) and low signal intensity on the apparent diffusion coefficient map (B).

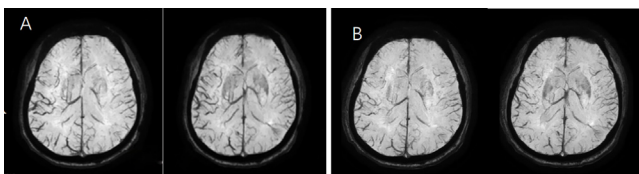


Fig. 4 – Susceptibility-weighted imaging: susceptibility-weighted imaging demonstrates that right vein was dilated compared with the left (A). Susceptibility-weighted imaging demonstrates the disappearance of cortical vein dilation (B).

hemisphere (Fig. 3). No hemorrhagic signal was found on susceptibility weighted imaging (SWI), unexpectedly, we found dilation of the right cortical vein in comparison to the left (Fig. 4A).

The patient underwent volume expansion with colloidal fluid to enhance cerebral perfusion, and his headache gradually improved. Extensive laboratory investigations, encompassing complete blood count, electrolyte levels, coagulation studies, as well as assessments of hepatic, renal, and thyroid functions, were all within normal limits. On hospital day 5, he reported no further headache symptoms. The left limb weakness improved, with the left upper limb muscle strength graded as 3/5 and the left lower limb muscle strength at 4/5. One week after treatment, the right cortical vein sign on SWI had disappeared (Fig. 4B). Upon discharge, the patient was asymptomatic for headache, with the left upper limb muscle strength assessed as grade 3/5 and the left lower limb muscle strength evaluated as grade 4/5.

He underwent a right carotid endarterectomy at our hospital one month later (Fig. 5). At follow-up 12 months after treatment initiation, he could walk and function independently, but had mild left limb weakness.

Discussion

END with severe headache as the initial manifestation is uncommon. The presence of a severe headache should prompt suspicion of the possibility of large artery stenosis. A study

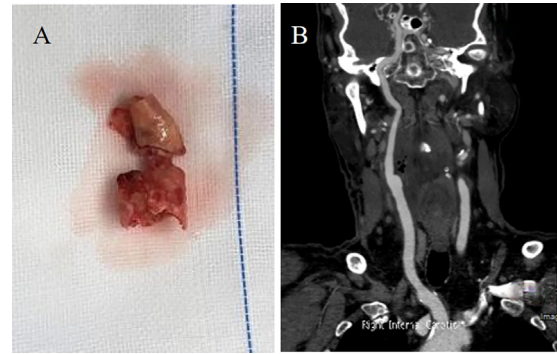


Fig. 5 – Arterial plaque and postoperative computerized tomography angiography: Plaque stripped during surgery (A). The postoperative computerized tomography angiography revealed a significant alleviation of the severe stenosis in the right internal carotid artery (B).

examined 160 patients with ischemic stroke revealed that headache was the initial manifestation in 17% of cases, while an incidence of large artery occlusive disease was observed in 26% [3]. The occurrence of severe headache may suggest the presence of cerebral vascular stenosis or occlusion as the sole clinical manifestation. Leira et al. [4] suggest that headaches could be indicative of more pronounced neuroinflammation or END.

Most scholars refer to vessels that appear significantly more dilated than the contralateral side along the cortical venous pathway in SWI as the asymmetrically prominent cortical veins (APCV). The degree of SWI vein development is primarily determined by the deoxyhemoglobin content in venous blood. The formation of APCV may be attributed to an increase in venous volume resulting from the relaxation of small vessels caused by ischemia [5]. Another mechanism involves the uncoupling between oxygen supply and demand in hypo-perfused tissues, leading to a relative increase in deoxyhemoglobin and a decrease of oxyhemoglobin in the tissue capillaries and the draining veins [6]. Xia et al. [7] observed a decrease in oxygen saturation at the APCV ranging from 16% to 44% relative to the veins of the contralateral hemisphere, resulting in enhanced venous development on SWI. In a retrospective study, they suggested that APCV could serve as a predictive indicator for stenosis or occlusion of ipsilateral vessels [8]. Verma et al. [9] propose that the presence of APCV is indicative of inadequate collateral circulation. However, in instances where significant intracranial artery stenosis is present yet APCV is absent, this may be attributed to effective compensation by robust collateral circulation.

A study has demonstrated that the APCV is a robust neuroimaging marker for END in acute stroke patients with ipsilateral severe intracranial arterial stenosis or occlusion [10]. The presence of APCV in this patient may suggest inadequate collateral circulation. Notably, APCV was significantly improved after the treatment of improving cerebral perfusion.

Conclusion

In conclusion, when patients present with unexplained severe headache or APCV, it is crucial to consider the possibility of large artery stenosis and to remain vigilant for potential cases of END. It is advisable to monitor cerebral function and maintain a stable level of cerebral perfusion as a rational approach to preventing END and alleviating headache symptoms.

Author's contribution

MT and YY contributed to data acquisition, writing, and editing. HC contributed to writing and editing. MD edited this paper. All authors provided substantial contributions to the conception of this work, critically revised the work, and gave final approval of the work.

Patient consent

We sincerely thank the patient for participating in this study. The patient provided consent for the writing and publication of the manuscript.

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