

## Case Report

# Aneurysmal subarachnoid hemorrhage accompanied by changes in the patterns of chronic migraine: a case report

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## Abstract

Subarachnoid hemorrhage (SAH) has a high mortality rate, and cerebral aneurysm ruptures account for 80% of all cases. Although several previous case studies have reported a headache before aneurysmal SAH, no previous study has reported a case of SAH after a change in the existing migraine pattern without any other clinical signs. A 43-year-old male patient who had suffered chronic migraines for 10 years visited the emergency department due to migraine symptoms, which exacerbated 3 days before the visit. He was admitted for symptom management, and his condition improved after taking migraine-specific medication. However, his consciousness deteriorated, and he became drowsy 8 days from the onset of headache aggravation. Brain computed tomography angiography revealed SAH. A small ruptured aneurysm, which was not detected by brain magnetic resonance angiography performed a few days earlier, was found in the A1 segment of the right anterior cerebral artery. We performed emergency endovascular coil embolization in the right A1 without any other complications. After the procedure, his neurological symptoms no longer exacerbated during hospitalization. He showed only a mild headache after 2 weeks and was discharged. Aneurysmal SAH is one of the most devastating neurological diseases, but early detection and treatment of aneurysms before major rupture may facilitate a good prognosis. If the pattern of previously diagnosed chronic migraine changes suddenly, a minor leak before the major rupture of a cerebral aneurysm should be considered, even if a sentinel headache has not been suggested.

## Keywords

Aneurysmal rupture; Endovascular coil embolization; Migraine; Sentinel headache; Subarachnoid hemorrhage

## 1. Introduction

Subarachnoid hemorrhage (SAH) has a high mortality rate (approximately 30–50%), with cerebral aneurysmal ruptures

accounting for 80% of all cases [1]. A minor leak with a sentinel headache occurs in approximately one-third of patients before the major rupture of the cerebral aneurysm. If Guglielmi Detachable Coil (GDC) coiling or aneurysmal

clipping is performed at this stage, a relatively good prognosis can be expected. In general, a sentinel headache presents as a sudden severe headache. However, the symptoms are often less prominent than those of a major rupture, which can be mistaken for a headache due to other causes. Several previous studies have reported cases presenting with diverse headache patterns before the occurrence of aneurysmal SAH [2]. However, no previous study has reported a case of SAH after a change in the existing migraine pattern without any other clinical signs of SAH.

## 2. Case presentation

A 43-year-old male patient visited the emergency room due to a migraine. The patient had suffered intermittent migraines (approximately 5 points on the visual analog scale [VAS]) in the right temporal area for 10 years, and the symptom improved after acetaminophen administration. The patient reported that his migraine symptoms changed to a pulsatile pattern in the bilateral temporal area 3 days before the visit, and the severity worsened to 7 points on VAS. The patient visited the primary care clinic on the day his headache started, and his systolic blood pressure was measured as 170 mmHg. His headache was temporarily alleviated after normalizing blood pressure, but it recurred soon afterward, and the patient visited the emergency department of our hospital.

The patient did not have other underlying conditions, apart from the migraines, and regular medications. The headache lasted from 30 minutes to 2 hours on one occasion. Moreover, the headache fluctuated; it would be alleviated and exacerbated repeatedly. Visual aura accompanied the headache, but no other clinical symptoms or signs, such as nausea, vomiting, or deterioration of everyday life activities, were found. Neurologic examination was performed when he was admitted. Her mental status was alert and oriented. Cranial nerve examination was normal including visual function, facial motor and sensation, and hearing. Her motor and sensory function of upper and lower limbs were normal strength. Deep tendon reflex were all normal range. Her cerebellar function and gait were also normal state. There was no other neurological deficits, including signs of meningeal irritation. In the subsequent brain magnetic resonance (MR) image, an acute tiny infarction was found in the left basal ganglia, but there were no abnormal findings on cerebral MR angiography (Fig. 1A,B). His headache improved (1 point in VAS) after administering an analgesic, and he was discharged. However, his headache recurred 2 days later, and he revisited the hospital. There was a headache with the same pattern as before, but the daily life activities were impaired by the headache, and symptom control was necessary (7 points in VAS). The patient was administered with naproxen (1000 mg/day), nimodipine (60 mg/day), flunarizine (40 mg/day), and topiramate (2 mg/day). Sumatriptan (50 mg/day) was administered when the symptoms were not controlled by regular medication. An antiplatelet agent was administered to prevent additional cerebral infarction. The patient reported that his symptoms improved after medication.

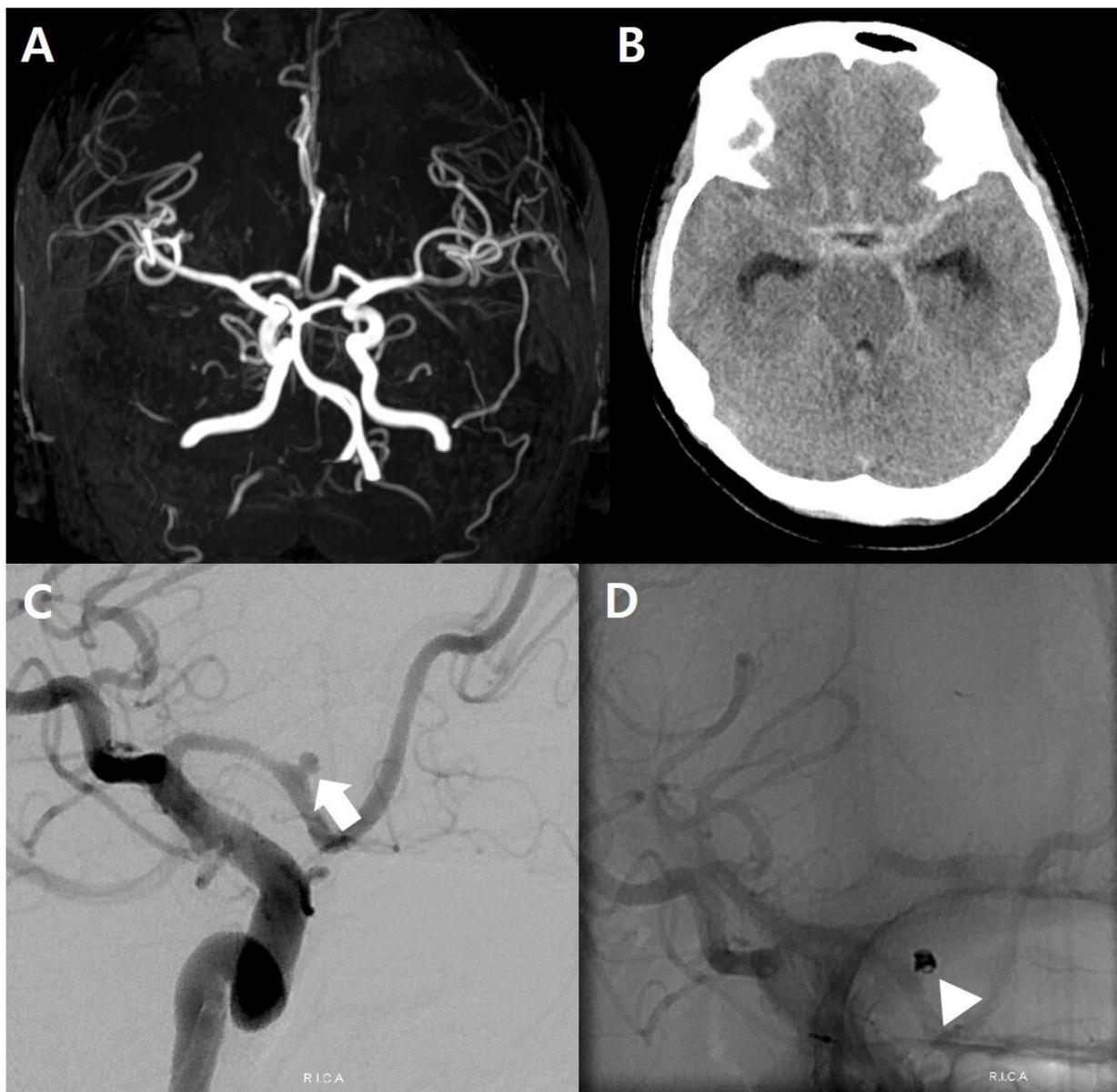
On the fourth day of hospitalization, however, at around 4:00 AM, the patient was sweating all over the body; his consciousness deteriorated, and he became drowsy. He also answered with another person's name when he was asked for his name, and his overall orientation deteriorated. Her Glasgow coma scale was 12 (E3V4M5). Other neurological abnormalities, such as hemiparesis and dysarthria, were not observed. Brain computed tomography angiography was conducted urgently, and SAH was confirmed. A small ruptured aneurysm, which was not detected by brain MR angiography, was found at the A1 segment of the right anterior cerebral artery. Emergency endovascular coil embolization was performed in the A1 segment without complications (Fig. 1C,D). Two weeks after the procedure, the patient only showed a mild headache, and his consciousness fully recovered.

## 3. Discussion

The patient had a subarachnoid hemorrhage due to an intracranial aneurysmal rupture a few days after the pattern of the previously diagnosed chronic migraine changed. It is well-known that a sentinel headache occurs before an aneurysmal SAH. However, no previous study has reported a case of SAH after a change in the existing migraine pattern without any other clinical signs of SAH.

SAH is a phenomenon in which arterial blood accumulates in the subarachnoid space; cerebral aneurysmal rupture is the most common cause of SAH. Although SAH accounts for a small proportion of stroke cases, it has a high personal and social burden because of the high probability of poor outcomes [3]. Headache is the most common symptom of SAH [4]. Generally, a severe headache that one has not experienced previously occurs suddenly and reaches its maximum intensity within a short time. Although the headache pattern is mainly explosive, neck or back pain or unilateral ocular pain may be experienced [2]. Moreover, some patients with SAH may experience a marked improvement in the symptoms within 48 hours after the hemorrhage. Therefore, it may be misdiagnosed as another type of headache [5].

SAH is often preceded by a sentinel headache before the major rupture of the cerebral aneurysm. A sentinel headache, which is relatively common, is caused by partial rupture (minor leak) of the aneurysm. Several studies have reported that approximately 40% of SAH patients have a minor leak [6]. A sentinel headache has no obvious signs as a headache caused by a major rupture, and it may be misdiagnosed as a result of other causes [2]. Patients may also have sudden changes in the chronic migraine pattern previously diagnosed without other neurological deficits before SAH. After medical treatment, his headache significantly improved, but SAH due to major aneurysmal rupture occurred 8 days later. It is difficult to confirm the minor leak because cerebrospinal fluid (CSF) analysis was not conducted before the aneurysm rupture. Considering the clinical and temporal relevance, it was presumed that minor leaks occurred in the aneurysm, and rupture occurred a few days later. In particular, the patient did not show any other symptoms suggestive of SAH



**FIG. 1. Peri-operative brain imaging of the patient.** (A) An unremarkable finding on brain magnetic resonance angiography performed on the third day after acute exacerbation of chronic migraine. (B) Subarachnoid hemorrhage was diagnosed on brain computed tomography performed on day 8 after acute exacerbation of chronic migraine. (C) A small intracranial aneurysm detected in the A1 portion of the right anterior cerebral artery by transfemoral cerebral angiography (arrow). (D) Endovascular coil embolization was successfully performed (arrowhead).

(e.g., nuchal rigidity, nausea, or vomiting). The patient showed typical symptoms suggesting migraine (e.g., pulsating, blurred vision, approximately 2 hours of duration, and exacerbated by everyday life). Therefore, we could not suspect a minor leak.

Migraine itself is known to be a risk factor for cerebral aneurysm rupture. In a study of 456 patients with cerebral aneurysms, migraine was a risk factor for cerebral aneurysm rupture [7]. In a meta-analysis of 11,264 patients, migraine was also identified as a risk factor for hemorrhagic stroke [8]. Although the potential for migraine to weaken the vessel wall has been highlighted, the underlying mechanism has not yet been established. The patient, in this case, had no known smoking history, hypertension, and family history of cerebral aneurysm, which are known risk factors of cerebral

aneurysm rupture. Brain 3D TOF-MRA was taken when the patient visited the hospital due to the worsened headache, but it did not reveal an aneurysm on the right A1. Findings that could suggest aneurysm were not clear even in the TOF source image. It is believed that the aneurysm was not diagnosed because it was very small, but aneurysmal rupture occurred because the aneurysm grew later. Considering that the maximum diameter of the aneurysm was only 3 mm at the time of rupture, which was small, it was believed that it was too small to discover before.

Considering that the size of the aneurysm was less than 6 mm and it ruptured despite its relatively small size, chronic migraine alone may have been a risk factor for cerebral aneurysm rupture.

## 4. Conclusions

SAH is a devastating disease, but its prognosis may be good if it is found before the major rupture of the aneurysm and treated early. Thus, if the pattern of a previously diagnosed chronic migraine changes suddenly, a minor leak before the cerebral aneurysm rupture should be considered, even if a sentinel headache is not indicated. In the absence of evidence of an aneurysm on non-invasive cerebral angiography, as in this case, additional tests, such as CSF analysis, may be helpful.

## Abbreviations

CSF, cerebrospinal fluid; MR, magnetic resonance; GDC, Guglielmi detachable coil; SAH, subarachnoid hemorrhage; VAS, visual analog scale.

## Author contributions

CHL and HGK participated in the design of this research. CHL, SJW, BNL, and BSS collected and analyzed the raw clinical data. BNL, BSS, and HGK carried out computational studies and wrote the manuscript. All authors have read and approved the final manuscript.

## Ethics approval and consent to participate

Written informed consent was obtained from our patient for publication of this case report and any accompanying images. Our patient was able to converse with others at the moment we obtained the informed consent. A copy of the written consent is available for review by the editor of this journal.

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## Conflict of interest

The authors declare no conflict of interest.

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