

CASE REPORTS

**LATE-ONSET TEMPORAL LOBE EPILEPSY FOLLOWING
SUBARACHNOID HAEMORRHAGE: AN INTERPLAY
BETWEEN PRE-EXISTING CORTICAL DEVELOPMENT
ABNORMALITY AND TISSUE DAMAGE**

Case Report: Late-Onset Temporal Lobe Epilepsy Following Subarachnoid Haemorrhage: An Interplay Between Pre-existing Cortical Development Abnormality and Tissue Damage

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Abstract

Introduction

Epileptogenicity following brain insult is influenced by multiple factors, including lesion severity and the extent of brain damage. Interactions between pre-existing cortical abnormalities and acquired brain injuries may contribute significantly to the development of medically refractory epilepsy.

Case presentation

We report a 54-year-old female who developed drug-resistant epilepsy following subarachnoid haemorrhage (SAH) caused by a ruptured aneurysm. She underwent aneurysm clipping surgery, after which seizures began three months postoperatively. Magnetic resonance imaging revealed cerebral ischemia and hemosiderin deposits in the left temporal lobe, with suspected left hippocampal atrophy. Anti-seizure medications and vagus nerve stimulation failed to achieve seizure control. The patient subsequently underwent left temporal lobe resection and ventriculoperitoneal shunt placement for postoperative hydrocephalus. She has remained seizure-free to date.

Discussion and conclusion

Neuropathological examination revealed a previously undiagnosed focal cortical dysplasia (FCD) type 1a, indicating a pre-existing malformation of cortical development. The brain insult from SAH and associated ischemic changes likely acted as a second hit, precipitating late-onset epilepsy through the interaction of multiple underlying pathologies. This case highlights the importance of recognising dual pathology in patients with refractory epilepsy and demonstrates that surgical intervention can result in favourable seizure outcomes, even in complex, multifactorial cases.

Keywords: case report, epileptogenicity, parenchymal hemosiderosis, hippocampal atrophy, malformation of cortical development, multiple pathologies

Introduction

Parenchymal hemosiderosis is known to be a potential cause of focal seizures after an intracranial bleed, where the seizure causes may be due to interference of neurotransmitter activity or free radical formation.[1] Temporal lobe seizures can also occur due to damage to the hippocampus (hippocampal sclerosis), structural malformations on the cortex (such as corticosteroids and structural defects) and the presence of a low-grade tumor.[2] Clinicians sometimes believe that seizures are caused solely by previous brain injury, based on the image results when, in fact, there may have been already existing, undiagnosed lesions causing the seizures. Earlier studies have also shown that focal cortical dysplasia (FCD) is a significant contributor to seizures occurring after a brain injury.[3] This report describes the case of a patient diagnosed with an aneurysmal subarachnoid bleed and subsequently had surgery for refractory focal epilepsy and was found to have a previously undiagnosed FCD type 1a, supporting a multifactorial model of epileptogenesis.

Case Presentation

A 54-year-old right-handed female was assessed at the Comprehensive Epilepsy Center of Seirei Hamamatsu General Hospital, located in Hamamatsu, Japan, due to having medically refractory epilepsy resulting in frequent seizures during the week. Her medical history included having suffered a subarachnoid hemorrhage secondary to ruptured aneurysms of the left middle cerebral artery; she had undergone surgery to treat this condition via aneurysm clipping 11 months prior. She also experienced complications following the acute phase of SAH, including a hemorrhagic infarction within the left temporal lobe as a result of symptomatic arterial spasms after surgery.

Three months post-operatively, she began to experience focal aware and focal impaired awareness seizures. The nature of her seizures included an epigastric sensation

that started at the abdomen, occurred before aphasia and impaired awareness, and in some cases, progressed to focal-tonic seizures. An EEG showed interictal spikes on the left frontotemporal area corresponding to where she suffered the hemorrhagic infarction and complications. Levetiracetam, zonisamide, valproate and lamotrigine were not successful in controlling her seizures, thereby meeting the definition of medicine resistant epilepsy. Possible surgical interventions for her epilepsy were discussed, including the possibility of resection and vagus nerve stimulation (VNS). The fact that her seizures were characterized by focal awareness/epigastric aura and could be terminated with the aid of a magnet, led to her decision to undergo placement of a VNS implant at the age of 55 years and 3 months.

While the VNS was able to decrease her seizures from weekly occurrences to monthly occurrences she ultimately decided on and had resective surgery in pursuit of seizure freedom. Prior surgery, she underwent a full evaluation which consisted of EEG video monitoring, MRI scans, FDG-PET scans. While the MRI scans indicated T2 intensity hyperintense lesions located in her frontal and temporal lobes and hemosiderin deposits spotted in her temporal lobe area and significant left-sided hippocampal atrophy, FDG-PET scan

revealed hypometabolism in both left frontal and left temporal lobes. (Figure 1) The EEG video monitoring captured many habitual seizures that originated in the left frontotemporal regions, which were clinically preceded by an epigastric sensation and aphasia. On the basis of these evaluations, she was suspected with mesial temporal lobe epilepsy originating from her dominant hemisphere and left anteromedial temporal lobectomy (also known as the Spencer procedure) was performed when she was 56 years old.

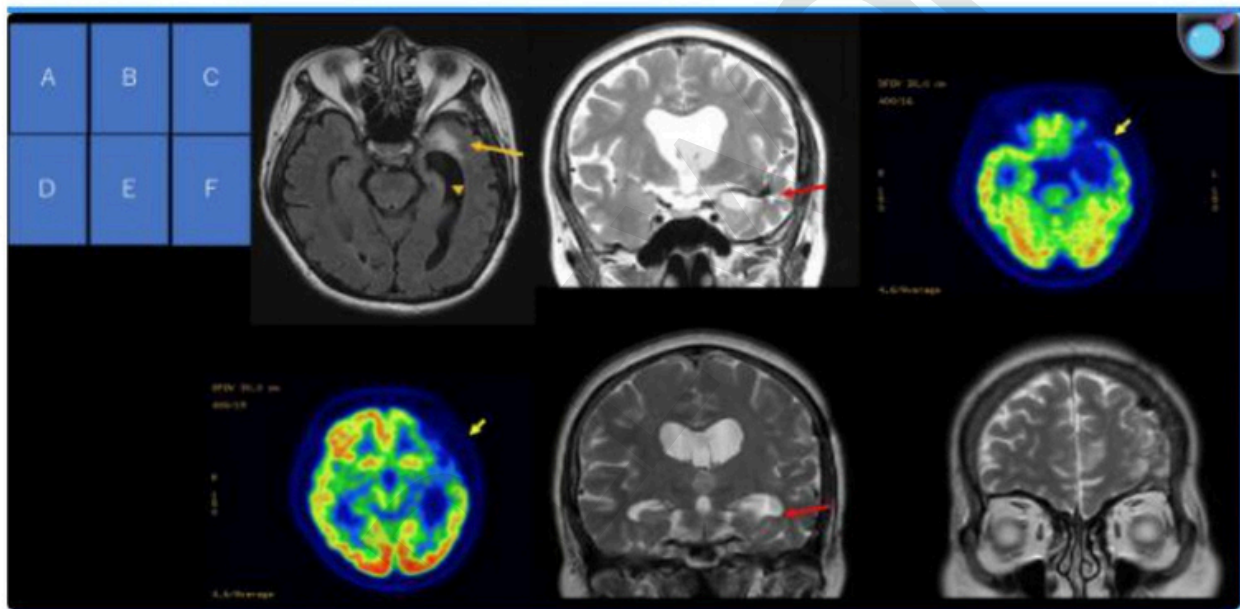


Figure 1: Pre-operative and post-operative neuroimaging. MRI FLAIR axial image (A) showing a hyperintense signal at the left temporal pole (arrow) and hippocampal atrophy (arrowhead). T2-weighted coronal image (B) showing a hypointense signal along the lower insula cortex and the roof of the inferior horn. Positron emission tomography (C,D) showing reduced glucose uptake in the left frontal and temporal lobes (arrow). T2-weighted coronal image (E) at the level of the hippocampal body showing hippocampal atrophy (arrow). T2-weighted coronal image at frontal region (F) showing a change in intensity.

After her surgery, she developed a subacute form of hydrocephalus, which was successfully resolved with the application of a VP shunt. She has remained completely

seizure-free for over 2 years with only levetiracetam monotherapy. The neuropathological analysis indicated that she had ectopic neurons within her temporal

lobe white matter along with satellite oligodendroglia which is consistent with focal cortical dysplasia type 1a.(Figure 2) Although she developed a radiological

finding of hippocampal atrophy, there was no indication of any neuronal loss or gliosis, and hippocampal sclerosis could not be proven through the examination.

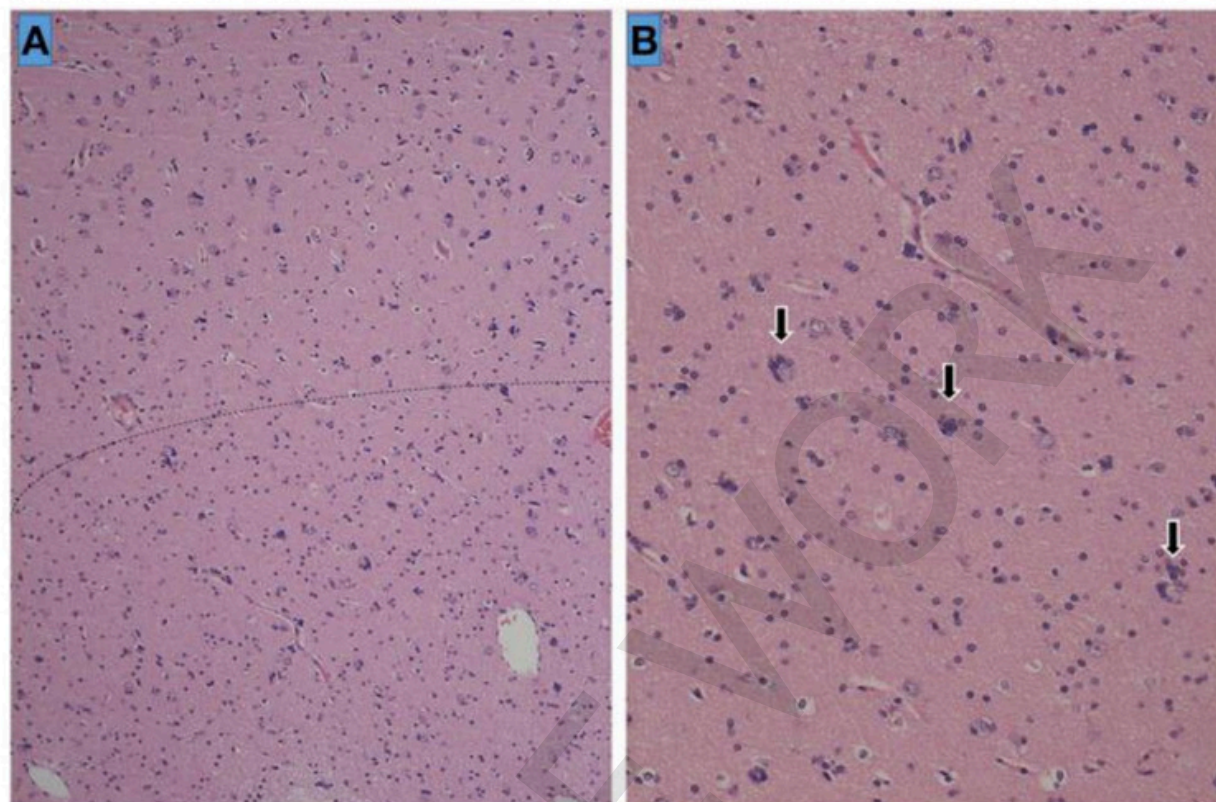


Figure 2: Histopathology of the left temporal lobe. The cortical-white matter border is ill-defined and indicated as a dotted line (A). Sporadic ectopic neurons accompanied by glial cell proliferation (satellite oligodendrocytes equivalent to oligodendrocytes) surrounding the neurons (arrows) are seen at high magnification ($\times 200$) (B).

Discussion

The patient's late-onset epilepsy was originally thought to be caused by a previous subarachnoid hemorrhage and ischemic infarction of the left temporal and frontal lobes; there was also evidence of vasospasm causing hemorrhagic transformation. Later, after having developed drug-resistant seizures and responding only partially to vagus nerve stimulation, a full pre-surgical evaluation of the patient was undertaken. MRI showed

evidence of hippocampal atrophy, so a resection of the presumed mesial temporal seizure generator was ruled out. Instead, on pathologic examination, the small area that was excised showed evidence of FCD type 1a in the temporal lobe. This previously unknown focal cortical dysplastic lesion may provide an explanation for the patient's seizures, since not all patients with vascular injuries develop recurrent seizures and chronic epilepsy.

Some people experience recurrent seizures after they suffer from some type of injury, like a stroke, a traumatic brain injury or a brain tumor.[4,5] Clinicians often use the term post-stroke epilepsy, post-traumatic epilepsy or tumor-related epilepsy as a way to provide guidance for clinical decisions and to estimate prognosis. However, it is important to consider other known or unknown causes of neuropathology that can interact with these disorders and change their progression, especially if the person has a poor outcome.

The disruption of the excitatory or inhibitory balance of the nervous system is a common cause of all types of epilepsy[6,7]. Many patients with highly epileptogenic lesions such as FCD do not present with seizures until they have suffered from other traumatic brain injuries or disorders.[8,9] In this case, seizure control was achieved through the surgical resection of both the cortical malformation and hemosiderin deposition.

Conclusion:

Subarachnoid haemorrhage is typically associated with inflammation and cortical injury leading to neuronal dysfunction, resulting in late-onset, medically refractory, drug-resistant epilepsy, but it can be accompanied by FCD. In this case, the patient underwent surgery for previously unidentified FCD type 1a caused by second-hit pathology due to the haemorrhage. The subsequent improvement demonstrates the need to thoroughly investigate and treat patients with drug-resistant epilepsy after injury or illness, as well as to identify underlying neuroanatomical pathology. As a result, treatment will continue to improve following surgical or pharmacological interventions if possible.

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