

CASE REPORT

Epileptic seizures in a patient by immersing his right hand into hot water

YI-CHUNG LEE[†], DER-JEN YEN[†], JIING-FENG LIRNG[‡] & CHUN-HING YIU[†]

[†] Department of Neurology, The Neurological Institute, Taipei Veterans General Hospital and School of Medicine, National Yang-Ming University, Taiwan, Republic of China; [‡] Department of Radiology

Correspondence to: Der-Jen Yen MD, Department of Neurology, The Neurological Institute, Taipei Veterans General Hospital, 201 Sec. 2, Shih-pai Road, Shih-pai, Taipei, Taiwan 11217, Republic of China. *E-mail*: ycli@vghtpe.gov.tw

We report on a 22-year-old assistant cook, presenting with seizures evoked by immersing his right hand into hot water of 40–46 °C. His seizure pattern consisted of either simple partial seizures of a tingling sensation arising in the right hand and marching to the right shoulder or a similar attack evolving to a complex partial seizure. Video-EEG monitoring recorded habitual seizures originating from the left centro-temporo-parietal region, compatible with lesions seen on brain magnetic resonance imaging. He responded well to antiepileptic drug treatment and wearing gloves while working in the kitchen. In this patient, hot water of 40–46 °C could maximally stimulate skin warm thermoreceptors in the right hand whereby afferent impulses subsequently activated the epileptogenic focus, adjacent to or in the sensory cortex, and elicited seizures.

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Key words: epilepsy; epileptic seizures; simple partial seizures; complex partial seizures.

INTRODUCTION

Epileptic seizures may be precipitated by simple visual, auditory, or tactile stimuli, or more complicated modalities including reading, eating, or calculating¹. 'Hot water epilepsy' (HWE) or 'water immersion epilepsy' is commonly reported in patients in southern India, often complex partial seizures or generalized seizures occurring after pouring hot water onto the head or bathing in a tub^{2–7}.

We describe a young man with partial epilepsy provoked by immersing his right hand into hot water. There were magnetic resonance imaging (MRI) lesions over the left temporo-parietal region, correlating to this unusual type of 'reflex epilepsy'.

CASE HISTORY

A 22-year-old male was referred to the Epilepsy Monitoring Unit (EMU) at Taipei Veteran General Hospital in June 1999. He was born at full-term with a normal spontaneous delivery and developmental milestones. There was no past history of CNS infection, febrile

convulsion, or severe head injury. He is left-handed. After graduating from high school at age 19, he became an assistant cook at a Chinese restaurant; unfortunately, his seizures appeared some months later. His seizures often started with an indescribable discomfort in his head, chiefly left occipital, and followed by a tingling sensation marching from the right hand to the right shoulder, which lasted 2–3 seconds. A lapse of consciousness was found sometimes by his colleagues, however, he never experienced generalized convulsive seizures. He soon noted that seizures almost always occurred immediately after his right hand touched hot water, especially while washing dishes in the kitchen and, rarely, during showering. His antiepileptic drugs (AEDs) included carbamazepine 600 mg/day and valproate 2000 mg/day, nonetheless, seizures occurred about five times per month.

On admission, physical examination was normal. Neurological examination revealed no focal weakness or sensory impairment. Routine blood cell counts, chemistry, chest film and electrocardiogram were normal. MRI showed infolding heterotopic gray matter along a cleft in the left temporo-parietal region, posterior to the central sulcus (Figs 1(a) and 1(b)).

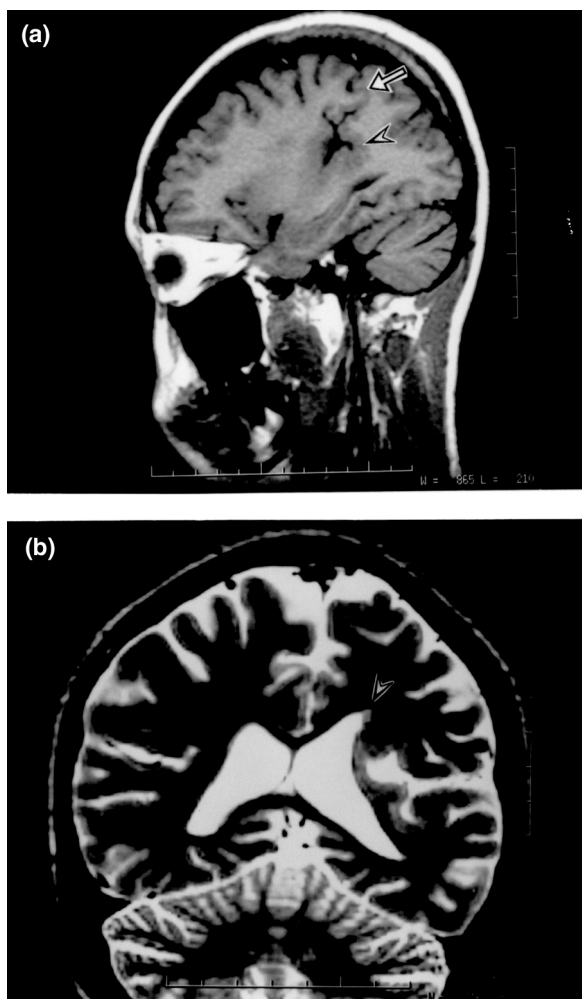


Fig. 1: (a), Sagittal T1-weighted MRI demonstrating a cleft in the left temporo-parietal region (arrowhead), posterior to the central sulcus (arrow). (b), Coronal T2-weighted MRI demonstrating infolding heterotopic gray matters in the cleft which does not communicate with the lateral ventricle. Some heterotopic nodules were noted in the ventricular wall (arrowhead).

Positron emission tomography revealed normal activity along the infolding cortex. Four-vessel cerebral angiography was normal. During several days of video-EEG monitoring in the EMU, scalp electrodes and sphenoid electrodes were applied (with his AEDs acutely withdrawn). Interictal EEG showed intermittent slow waves with epileptiform discharges over the left centro-temporo-parietal electrodes (Fig. 2(a)).

We performed the following tasks to provoke seizures.

1. He immersed his right hand into hot water of varied temperatures (28–54 °C) during several attempts. His habitual aura and simple partial seizures occurred only after immersing his right hand into hot water at 40–46 °C. Two episodes evolved to a complex partial seizure with lapse

of consciousness, left hand automatisms, and right hand tonic posturing (which lasted approximately 90 seconds with postictal confusion). A postictal refractory period of 3–4 hours was noted, during which no more seizures could be induced by a similar task. Ictal EEG recording of simple and complex partial seizures showed a clear onset originating from the left centro-temporo-parietal electrodes (Fig. 2(b)).

2. Immersing other part of his limbs into hot water at 40–46 °C for up to 5 minutes elicited no seizures (including the right elbow, right forearm, individual right-hand fingers, left upper limb or lower limbs).
3. Putting his right hand into a specially designed carton box, in which air was heated and maintained at around 45 °C by a blower, for 5 minutes caused no clinical seizures or epileptic activity in his EEG.
4. Unexpectedly pricking his right hand with a toothpick also failed to induce seizures.

He was advised to continue his AED treatment and to wear gloves while working in the kitchen. He also made some marks in his shower faucet to regulate temperature setting. He reported rare simple partial seizures (<1 per month) after discharge, mostly related to his forgetting to wear gloves during work.

DISCUSSION

Our case demonstrates an unusual form of ‘reflex epilepsy’ and broadens the described trigger areas for HWE to the right hand, other than the head and body as described previously. He had partial seizures and regional MRI lesions posterior to the central sulcus, compatible with cortical dysplasia with gray matter heterotopia rather than closed-lip schizencephaly⁸. To our knowledge, HWE has not been described with neuroblast migration disorders.

The pathogenesis of HWE is not fully clear. Satishchandra *et al.*² suggest an interaction of complicated tactile and temperature-dependent stimuli. In our patient, the immediate response to hot water indicates that skin stimulation is more important than core temperature change⁷. In addition, his seizures could only be provoked by hot water at 40–46 °C which may correlate to physiologic reactions of thermoreceptors in the skin. In man, discharges of the warm thermoreceptors are maximally enhanced between 32–45 °C, and decline when the skin is cooled or warmed beyond 48 °C⁹. The fact that putting the patient’s right hand into hot air at 45 °C provoked no seizures implies that

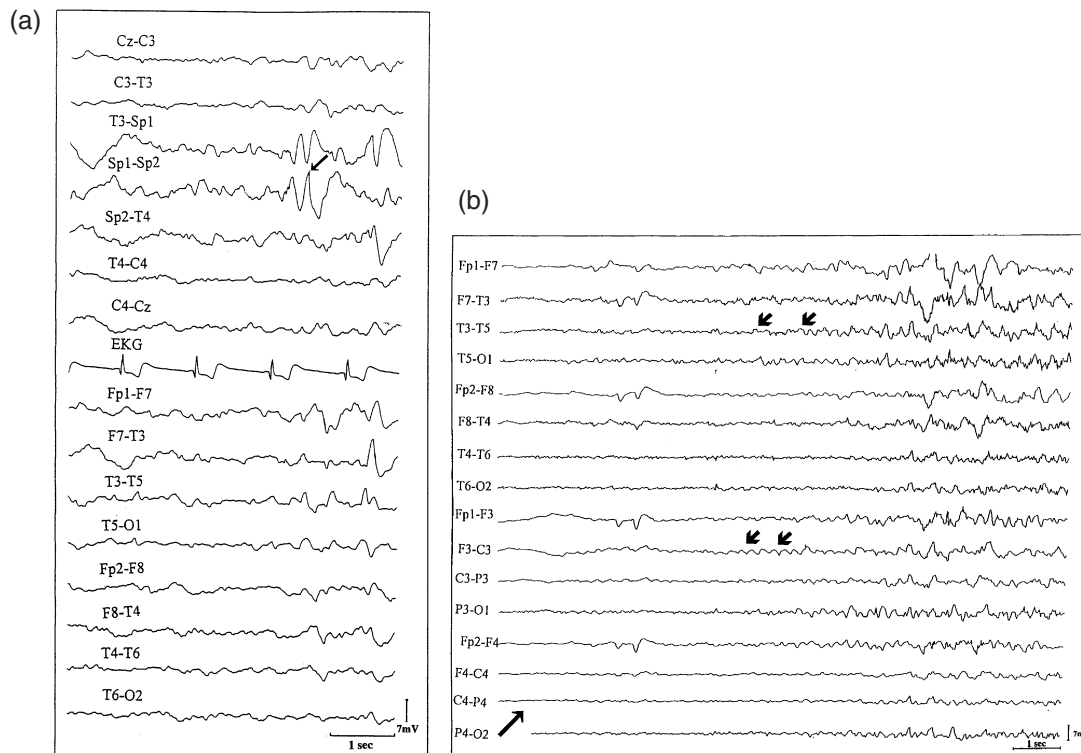


Fig. 2: (a), Interictal EEG showing sharps over the left centro-temporal electrodes (arrow). Sp1 and Sp2 = left and right sphenoid electrodes. (b), Typical ictal EEG changes of increasing amplitude and decreasing frequency originating from the left centro-temporo-parietal electrodes (short arrow) in a complex partial seizure, 3–4 seconds after immersing his right hand into hot water (long arrow).

the conduction media is also a determinant; air is not as good as water at heat conduction. A startle reaction does not seem important in HWE because unexpectedly pin-prickling the patient's right hand did not elicit seizures.

A coexistence of cortical lesions could also attribute to HWE in this patient. Afferent impulses from the skin of the right hand, especially after 40–46 °C of hot water stimulation, could reach the sensory cortex, adjacent to or in the epileptogenic focus, and initiate ictal EEG discharges. Subsequent activation of nearby neurone was reflected by the march of the tingling sensation from the right hand to the right shoulder. Immersing parts of his limbs, other than the right hand, into various temperatures of water dispatched skin impulses normally to the sensory cortex (because the patient felt the temperature changes). However, the fact that hot water stimulation at 40–46 °C provoked no seizures in other parts implies that cortical areas representing these parts are distant from the epileptogenic focus.

Invasive intracranial EEG recording with cortical stimulation or surgical treatment was not indicated in this patient (although these procedures provide more information). Since, he responded to AEDs and wearing gloves at work and the epileptogenic focus was lo-

calized to a MRI lesion, which was not a tumor. Clinical observations in this patient are, nonetheless, interesting and helpful in understanding HWE.

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