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Non-ketotic hyperglycaemia presenting as epilepsia partialis continua

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ABSTRACT – Epilepsia partialis continua is a rare epileptic syndrome observed in patients with brain structural lesions and metabolic disorders. We report a patient with non-ketotic hyperglycaemia presenting as epilepsia partialis continua with reversible focal brain lesions. An 83-year-old woman visited our hospital due to sudden and repetitive left facial twitching lasting for two days. Initial laboratory data revealed serum glucose, osmolality, and sodium levels of 631 mg/dl, 310 mOsm/l, and 130 mEq/l, respectively. EEG was normal. Brain MRI showed low signal changes in the right frontal subcortical area and high signal changes in the surrounding right frontal cortical areas on T2-weighted, fluid-attenuated inversion recovery, and diffusion-weighted images. No seizures recurred after correcting blood glucose levels, hydrating the patient, and infusing valproate (900 mg/day). Follow-up MRI, six months later, showed complete resolution of the signal changes in the right frontal cortical and subcortical areas and no clinical seizures. When considering non-ketotic hyperglycaemia with epilepsia partialis continua in an elderly patient, early diagnosis and administration of the appropriate therapy is very important in order to decrease morbidity.

Key words: epilepsia partialis continua, non-ketotic hyperglycemia, brain magnetic resonance imaging

Epilepsia partialis continua (EPC) is a rare epileptic syndrome characterized by repetitive somatomotor seizures, but consciousness is usually maintained. The most common cause of EPC is a brain structural lesion, such as stroke, tumour, abscess, or head trauma. EPC can also result from a metabolic disorder, such as uraemic or hepatic encephalopathy and non-ketotic hyperglycaemia (NKH).

NKH is a clinical syndrome consisting of hyperglycaemia, hyperosmolality, and intracellular dehydration, but not ketoacidosis. Neurological manifestations, particularly partial seizures, may occur, but neuroimaging for seizures associated with NKH is usually normal (Raghavendra *et al*., 2007).

Here, we report a patient with NKH presenting as EPC with reversible focal brain lesions.

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Case study

An 83-year-old woman visited our hospital due to sudden and repetitive left facial twitching. The seizure frequency had increased gradually from once every six hours at initial symptom onset to once every five minutes two days later. The patient had no history of epilepsy or diabetes mellitus (DM), and no relevant family history was found. Her vital signs were within normal limits. A neurological examination was normal, except for mild dysarthria.

The serum glucose level was 631 mg/dl with no ketone bodies in the urine. Serum osmolality and sodium levels were 310 mOsm/l and 130 mEq/l, respectively. The haemoglobin A1C level was 11.7%.

EEG was normal during the ictal phase. Brain MRI on admission showed low signal changes in the right frontal subcortical area and high signal changes in the surrounding right frontal cortical areas on T2-weighted, fluid-attenuated inversion recovery (FLAIR), and diffusion-weighted images (*figure 1*).

The seizures did not recur after correcting blood glucose, hydration, and infusion of valproate (900 mg/day). She was diagnosed with EPC associated with NKH. After discharge, the patient had no more seizures, and her DM was well controlled. Follow-up MRI six months later, showed complete resolution of the signal changes in the right frontal cortical and subcortical areas. The follow-up haemoglobin A1C level was 5.4%.

Discussion

This report describes a patient with EPC as an initial manifestation of NKH. Complete resolution of the focal lesion in the right frontal area on MRI suggests that the lesion was a transient physiological response to the NKH and seizures.

NKH is seen most commonly in elderly patients with mild DM or as a first clinical manifestation of DM. Focal seizures may be induced by non-ketotic hyperosmolar diabetic comas accompanied by severe hyperglycaemia, hyperosmolality, and dehydration with minimal to no ketoacidosis. A previous NKH report stated that 19% of patients with NKH have focal seizures (Singh and Strobos, 1980), which are primarily simple motor seizures. The occipital lobe is the most commonly reported region, but the frontal and parietal lobes have also been reported (Huang *et al*., 2005). The seizures tend to occur during the early stages of hyperglycaemia with no ketosis, because ketosis itself has an anticonvulsant effect. Seizures associated with NKH are resistant to antiepileptic drugs but cease after correcting the hyperglycaemic state, however, they can recur if blood glucose is not controlled (Hennis *et al*., 1992).

The pathogenesis of EPC in patients with NKH remains unclear. Hyperglycaemia may result in accumulation of extracellular glutamate and increased metabolism of gamma-aminobutyric acid, leading to a lowered seizure threshold. Associated metabolic disturbances induced by hyperglycaemia, such as hyperosmolality and hyponatraemia, may contribute to seizure. Hyperglycaemia also results in reversible focal ischaemia by decreasing cerebral blood flow (Duckrow *et al*., 1985). The pathogenesis of the reversible focal brain insult in patients with NKH is uncertain. The T2 and FLAIR hypointensities may be caused by an accumulation of free radicals, iron deposition, or petechial haemorrhages, as described previously in patients with early cortical ischaemia (Ida *et al*., 1994). Hyperviscosity

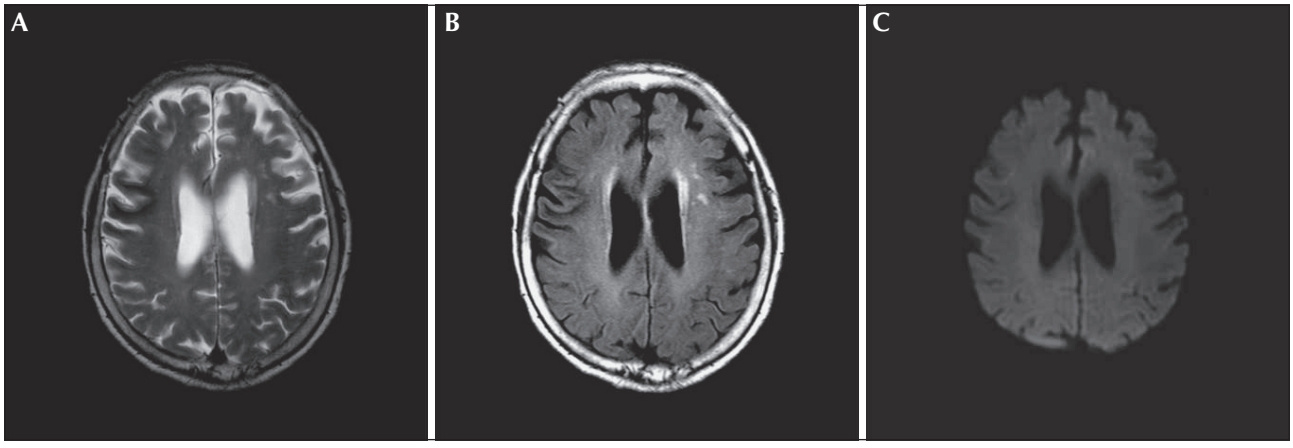

Figure 1. Brain MRI on admission shows low signal changes in the right frontal subcortical area and high signal changes in the surrounding right frontal cortical areas on T2-weighted (A), fluid-attenuated inversion recovery (B), and diffusion-weighted images (C).

and decreased red blood cell oxygen-carrying capacity induced by hyperglycaemia induce a relatively anaerobic environment that may lead to signal changes similar to those seen in the hypoxic-ischaemic state. Certain regions relatively vulnerable to hypoxic ischaemia in a hyperglycaemic state suffer axonal damage, leading to excessive production of free radicals or iron accumulation. However, it remains unknown how focal brain regions alone, without a pre-existing brain lesion, become vulnerable while hyperglycaemia affects the entire brain. The diffusion restriction and hyperintensities on T2 and FLAIR images in the surrounding cortices are considered generalized features related to seizure activity. The epileptic zone shows a hypermetabolic state and vasodilation during seizure to compensate for the energy requirement. A close temporal relationship is observed between MRI changes and seizures in patients with NKH. The complete resolution of the changes observed in the present case suggests a transient physiological response to the NKH and seizures.

It is very important to diagnose EPC and NKH early in elderly patients and to administer therapy in order to decrease morbidity. □

Disclosures.
The authors have no conflict of interest to declare.

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TEST YOURSELF

(1) What is the most common seizure type resulting from non-ketotic hyperglycaemia?

(2) What is the first treatment for patients with epilepsia partialis continua associated with non-ketotic hyperglycaemia?

Note: Reading the manuscript provides an answer to all questions. Correct answers may be accessed on the website, www.epilepticdisorders.com, under the section "The EpiCentre".