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Case Report

Usefulness of ketogenic diet in a girl with migrating partial seizures in infancy

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Abstract

Migrating partial seizures in infancy (MPSI) are an age-specific epilepsy syndrome characterized by migrating focal seizures, which are intractable to various antiepileptic drugs and cause severe developmental delay. We report a case of MPSI with heterozygous missense mutation in *KCNT1*, which was successfully managed by ketogenic diet. At age 2 months, the patient developed epilepsy initially manifesting focal seizures with eye deviation and apnea, then evolving to secondarily generalized clonic convulsion. Various antiepileptic drugs including phenytoin, valproic acid, zonisamide, clobazam, levetiracetam, vitamin B6, and carbamazepine were not effective, but high-dose phenobarbital allowed discontinuation of midazolam infusion. Ictal scalp electroencephalogram showed migrating focal seizures. MPSI was suspected and she was transferred to our hospital for further treatment. Potassium bromide (KBr) was partially effective, but the effect was transient. High-dose KBr caused severe adverse effects such as over-sedation and hypercapnia, with no further effects on the seizures. At age 9 months, we started a ketogenic diet, which improved seizure frequency and severity without obvious adverse effects, allowing her to be discharged from hospital. Ketogenic diet should be tried in patients with MPSI unresponsive to antiepileptic drugs. In MPSI, the difference in treatment response in patients with and those without *KCNT1* mutation remains unknown. Accumulation of case reports would contribute to establish effective treatment options for MPSI.

Keywords: Migrating partial seizures in infancy (MPSI); Ketogenic diet; *Potassium channel subfamily T member 1 (KCNT1)*; Bromide

1. Introduction

Migrating partial seizures in infancy (MPSI) were originally reported by Coppola et al. [1]. Important characteristics of MPSI include onset of focal seizures within the first 6 months of life associated with autonomic features and developmental arrest. Ictal EEG reveals migrating ictal discharges. Most of the MPSI were intractable to various therapies [2].

In this report, we describe a case of MPSI with heterozygous missense mutation in *Potassium channel subfamily T member(KCNT)1*, which did not respond to most antiepileptic drugs but improved by ketogenic diet.

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2. Case report

The girl was born at 39 weeks of gestation with birth weight of 3006 g and head circumference of 32 cm. She showed normal development until the onset of epilepsy.

At age 2 months, she developed focal seizures with eye deviation, later associated with apnea and secondarily generalized clonic convulsions. She was admitted to a local hospital. Various antiepileptic drugs including phenytoin (PHT), valproic acid (VPA), zonisamide (ZNS), clobazam (CLB), levetiracetam (LEV), vitamin B6, and carbamazepine (CBZ) were not effective. High-dose phenobarbital (PB) (serum concentration 50 μg/ml) allowed discontinuation of midazolam infusion.

At age 6 months, MPSI was suspected by ictal scalp EEG and she was transferred to our hospital for further investigations and treatment. At admission, her mental development had regressed. She could not drink and lost the ability of eye tracking and smile while being dandled. Seizure frequency while on PB, ZNS and CLB was 40 to 80 times per day. Epileptic seizures consisted of autonomic seizures such as apnea, and inconspicuous focal motor seizures such as head and eye deviations. Apnea during seizures occurred approximately 20 times per day, and oxygen saturation decreased to around 60% during apnea. Interictal scalp EEG showed multifocal spikes with background slowing. Ictal scalp EEG showed rhythmic fast discharges arising from the migrating foci, which continued for approximately 5–10 min (Fig. 1). Brain MRI showed diffuse atrophy with hypomyelination in the bilateral occipital lobes (Fig. 2A). Genetic screening conducted by the referring doctor revealed heterozygous missense mutation in *KCNT1* [NM_020822.2:c2800G>A(p.Ala934Thr)] in the patient but no abnormality in her parents. Finally, MPSI was diagnosed.

Three weeks after the initiation of potassium bromide (KBr, 40 mg/kg/day), epileptic seizures decreased to around 30 times a day. However, seizure frequency

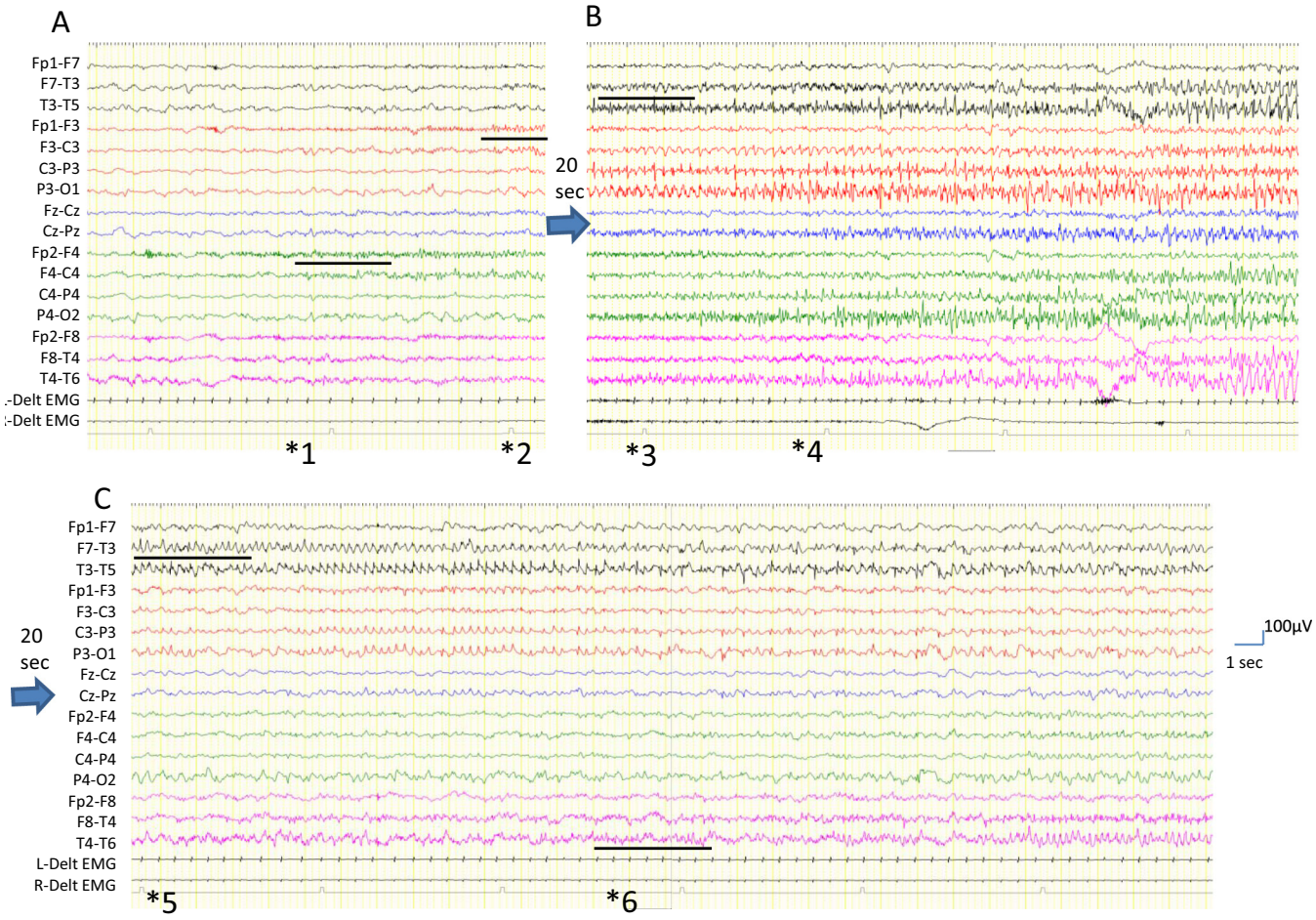

Fig. 1. A series of ictal scalp EEG findings showing migrating ictal discharges (A → B → C). (A) Ictal epileptic discharges started at F4 (*1), becoming dominant at F3 (*2). In this early period, epileptic symptoms consisted of inconspicuous focal motor seizures such as head and eye deviations. (B) Twenty seconds later, ictal discharges migrated to P3 (*3) and then to O2 (*4), accompanied by apnea. (C) Twenty seconds later, ictal discharges migrated to T3 (*5) and evolved to P3-O1. Before the disappearance of P3-O1 spikes, T4 spikes started (*6). Such migrating discharges continued for approximately 5–10 min, associated with apnea and inconspicuous focal motor seizures.