

First Application of Ketogenic Diet on a Child With Intractable Epilepsy in Ghana

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Abstract

The prevalence of epilepsy in sub-Saharan Africa is higher than in other parts of the world, but it is short of the effective measure on treating intractable epilepsy. Epilepsy surgery is not easy to be performed due to the high cost and demand of operational skills. The authors planned to perform ketogenic diet therapy for the children with intractable epilepsy in Ghana with regard to its low cost and simple procedure. The candidate is a 10-month-old girl with epilepsy with unknown etiology. Her seizures couldn't be controlled by more than 3 antiepileptic drugs. Her development delayed severely due to frequent seizures. The authors successfully applied ketogenic diet for her. Her seizures were completely controlled after 2 weeks' therapy. Her mental condition was improved after that. The authors get much experience from this case for further developing ketogenic diet in Africa. This is the first report that ketogenic diet was applied to control intractable epilepsy in West Africa.

Keywords

ketogenic diet, intractable epilepsy, West Africa, Ghana, treatment

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Ketogenic diet therapy is an effective and feasible method for children with intractable epilepsy which has been demonstrated by many previous studies.¹⁻⁴ However, to the best of our knowledge, there are no reports of its use in West Africa. As a visiting pediatric neurologist with the China Medical Team, the idea of initiating a ketogenic diet after seeing so many intractable cases was discussed with my neurology department in China. The authors donated some ketogenic diet milks and planned to perform ketogenic diet therapy in September 2014. The authors applied ketogenic diet on an intractable epilepsy Ghanaian infant after obtaining the permission of Ethic and Protocol Committee of College of Medicine and Dentistry, University of Ghana in October 2014. This is the first case with epilepsy treated by ketogenic diet in Ghana as well as in West Africa according to current information available.

Case History

A 10-month-old Ghanaian girl had seizures with unknown etiology from the second day after birth. There was no family history of epilepsy or other neurological disorders. The mother had normal pregnancy and delivery course. Head computed tomography (CT) had been done on the first month after her

birth. It showed diffuse atrophy on the brain cortex. Electroencephalography (EEG) showed independent epileptic discharges on the bilateral hemispheres. Hypoglycemia, glucose transporter 1 deficiency, and pyridoxine-dependent epilepsy had been excluded by related investigations. However, some other metabolic disorders such as urea cycle defects, non-ketotic hyperglycinemia, pyruvate dehydrogenase deficiency, and organic acidurias couldn't be excluded due to the unavailability of these investigations. Some antiepileptic drugs including sodium valproate and carbamazepine had failed to control her seizures. She was on phenobarbital and levetiracetam after then. She still had daily seizures. The average frequency was about 4 times per day during 2 weeks before her admission. Her habitual seizure was partial posture tonic seizure which included

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head version, upper limbs' lift, and body turning. The seizure did not fix at one side. The seizure duration was about 2 minutes on average. The mother was hesitant when she was informed about the ketogenic diet being probably effective for her daughter's seizure the first time. The authors told her to get more knowledge about the ketogenic diet on the Internet and discuss with her husband. The parents decided to accept ketogenic diet therapy and signed the consent 1 week later.

Initiation of Ketogenic Diet

The baby was treated with the Johns Hopkins Hospital protocol with an initial fasting stage of about 24 to 48 hours and a diet lipid-to-nonlipid ratio of 2:1.⁴ She was provided an energy intake of 80 kcal/kg/d, with 1.5 g/kg of protein supplemented with potassium citrate, multivitamins, and essential minerals. The baby was admitted as an inpatient and closely monitored for any acute adverse effects at the first week. She was fasted without restriction of water after some investigations had been done. The blood glucose was monitored every 6 hours after 12-hour fasting. She had not developed hypoglycemia during the fasting. The urine ketone body was monitored by urine check strip each time when the urine was collected after 12-hour fasting. Fasting was stopped when her urine ketone body got 3 plus (+++) which indicated she had achieved the ketone state.

Qitong ketogenic liquid milk (Zeneca; Guangdong, China) was predominantly used as the ketogenic formula at the initial stage, which has lipid-to-nonlipid ratio 2:1, with 60% of the total lipid long-chain triglyceride and 40% medium-chain triglyceride. One-third of full amount of ketone milk was divided into 3 times within the first 24 hours. The baby had mild vomiting after the first feeding. There were no other gastrointestinal side effects including abdominal pain, diarrhea, and constipation after that. The baby lost her appetite a little. She couldn't finish the amount of milk as planned. The amount of calories that she had as intake was about 60 kcal/kg. The duration of seizures became shorter, although the frequency showed no significant change within the first 3 days after ketogenic diet therapy. The frequency of seizure decreased to twice a day when she had been on ketogenic diet therapy for 1 week.

Follow-Up

She was discharged after 1 week's admission and follow-up maintained every Monday in the neurology clinic of pediatric department. The authors provided her the ketogenic diet milk and urine check strips free of cost. The authors requested the mother to record all side effects and seizure frequency and monitor the urine ketone body. The mother told us the baby's seizure disappeared from the second week. The urine ketone body ranged from ++ to +++. No other side effects were reported. Her appetite recovered and she could finish almost all amounts of milk as planned. The body's weight remained the same as before. She became more active than before.

Discussion

Ketogenic diet is a high-fat, low-carbohydrate, and restricted protein diet that has been found useful in patients with refractory epilepsy.⁵ One systematic review showed complete cessation of seizures in 16% of children, greater than 90% reduction in 32%, and greater than 50% reduction in 56% with the use of the ketogenic diet.⁶ The ketogenic diet has also been found effective in children with refractory epilepsy in a randomized controlled trial.⁷ A recent Cochrane review concluded that the ketogenic diet results in short- to medium-term benefits in seizure control, the effects of which are comparable to modern antiepileptic drugs.⁸ Although ketogenic diet has been widely used in refractory epilepsy, there is no report in Africa. The authors don't know whether it is effective and safe for African people or not. The authors first applied ketogenic diet for a child with refractory epilepsy in Ghana.

The exact prevalence of epilepsy in Ghana is unknown. However, it is estimated that the prevalence of active convulsive epilepsy is about 10.1 in 1000 people.⁹ There are about 300 000 active patients with convulsive epilepsy in Ghana. Here, most patients have to use old antiepileptic drugs including sodium valproate carbamazepine, phenobarbital, phenytoin and benzodiazepines; because the new antiepileptic drugs such as levetiracetam, lamotrigine, topiramate are not covered by the medical insurance and unaffordable by most local populations. The percentage of uncontrolled cases with epilepsy is much higher than developed countries.

Besides that, the investigation for patients with epilepsy is not yet satisfactory. Electroencephalography is commonly performed for every new case when they are suspected as epilepsy, although the report is too simple to clarify the type of seizure and epilepsy syndrome. No tracings are attached on the EEG report because most doctors have little knowledge on EEG. The EEG recording usually takes 30 minutes and doesn't cover the sleep course. Head CT or magnetic resonance imaging will be recommended by doctors if it is necessary. However, the cost is too much to be paid by most parents. The scans for metabolic disorders are not available.

Generally, most Ghanaian dishes are made up of a starchy portion (rice, fufu, banku, tuo, gigi, akplidzii, yekeyeke, etew, ato, etc) and a sauce or soup saturated with fish, snails, meat, or mushrooms. It is a little difficult for patients or parents to accept ketogenic diet because there is strict limitation of carbohydrates and proteins. It is crucial to emphasize the risk seriously to them because some of them are not well educated and rely much on doctors. Although it is difficult to exclude some metabolic disorders that are probably contraindicated to ketogenic diet, the history and clinical features are useful for us to exclude some common metabolic disorders. The authors must carefully observe the adverse effects at the initiation stage because some cases with metabolic disorders can't tolerate immediately after fasting.

The authors successfully carried out ketogenic diet for 1 child with refractory epilepsy in Ghana. This is the first report on application of ketogenic diet in West Africa. Considering

the age and tolerance of the baby, the lipid-to-nonlipid ratio of ketogenic diet was set as 2:1, which is not classic ketogenic diet protocol. To avoid hypoproteinemia, the amount of protein was set as 1.5 g/kg/d. The energy intake was set as 80 kcal/kg/d at the initiation stage, which was decreased to 60 kcal/kg/d due to her tolerance. It can be adjusted according to her body weight. The seizures were completely controlled, and no obvious side effect was observed till now. The efficacy and side effect of ketogenic diet will be followed up. Anyway, it provides a good experience for applying ketogenic diet on patients with refractory epilepsy in sub-Saharan Africa or low- and middle-income countries.

Author Contribution

DC and EB are co-first authors and did the main job. YZ, XZ, and YH discussed and helped to plan the work. JL, the corresponding author, planned the work.

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The authors confirm that they have read the Journal's position on issues involved in ethical publication and affirm that this report is consistent with those guidelines.

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