Case Report

Diffusion-weighted magnetic resonance imaging predicts prognosis in hypoglycemic encephalopathy: Case report

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Abstract

Hypoglycemia may present with neurological symptoms. Diffusion weighted magnetic resonance imaging (DW-MRI) may be useful for prediction of prognosis. We report a comatose patient who had severe hypoglycemia due to sepsis with lesions on MRI. The localization of lesions on MRI and prognosis of hypoglycemia were discussed. The hypoglycemia associated MRI lesions located in diffuse cerebral cortex is associated with a worse prognosis.

Introduction

Hypoglycemia might provoke neurologic symptoms such as confusion, seizures, and coma. It can be caused by a number of medical conditions including overuse syndromes, oral hypoglycemic agents, and undiagnosed insulinomas (1,2). In case of severe hypoglycemic encephalopathy (HE), diffusion weighted imaging (DWI) demonstrating hyperintensity and reduction of apparent diffusion coefficient (ADC) by constructing ADC map in the cerebral cortex, hippocampus and basal ganglia are useful in evaluation of the patient (3). We presented a comatose patient with severe hypoglycemia who had hypoglycemic injury demonstrated by DWI sequence of magnetic resonance imaging (MRI).

Case Report

A 72-year-old woman was admitted to our hospital in an unconsciousness state. Her medical history included diabetes mellitus, which could not be kept under control with parenteral insulin and oral metformin. The patient had frequent hypoglycemic attacks, and last attack was began 16 h ago.

Neurologic examination of the patient showed flexor response of the upper extremities to painful stimulation, bilateral extensor plantar response and amaurotic right pupil. Her left pupil was reactive. She has been assigned a glasgow coma scale score of 5 (she did not open the eyes or had no verbal response).

Physical examination revealed a blood pressure of 90/60 mm Hg, pulse rate of 92 beats per min, a tympanic temperature of 37.8° Celsius, and a respiratory rate of 24 breaths per min. Radiological studies demonstrated a bronchopneumonic infiltration. Arterial blood gas parameters revealed respiratory acidosis. Her blood glucose was 55 mg/dL. In spite of rapid infusion of 50% dextrose solution and rapid normalization of blood glucose, there was no clinical improvement. Her blood glucose was repeatedly monitored and found to be low for the first 48 h of follow-up under continuous glucose infusion. Cerebrospinal fluid analysis with an initial opening pressure of 20 cm H2O and normal cell count showed no crystal formation.

Computed tomography (CT) of the brain demonstrated diffuse brain edema. An electroencephalogram showed diffuse slowing and no typical epileptic discharge. After 17 h of beginning of unconsciousness, patient was gone MRI. MRI revealed diffuse brain swelling whereas DWI showed symmetrical hyperintense lesions located in bilateral cortical areas (Figures 1 and 2). MR angiography and MR venography studies were normal.

The patient was intubated because of deteriorating respiratory status and arterial blood gas values. She...
died of septic shock and repeated hypoglycemic attacks 10 days after admission despite parenteral antibiotherapy and continuous intravenous dextrose infusion.

Discussion

MRI scanners use strong magnetic fields and radio waves to form images of the body. The contrast provided between grey and white matter makes it the optimal choice for many conditions of the central nervous system including demyelinating diseases, dementia, cerebrovascular disease, infectious diseases, and epilepsy, etc.. The diagnostic efficacy of MRI in hypoglycemia is controversial in predicting clinical long-term outcome. DWI is a special method, which allows the measurement of the diffusion alteration of water within the extracellular space and between intracellular and extracellular spaces. Therefore, DWI is more effective in demonstrating cerebral lesions of HE caused by hypoglycemia compared to those seen on other MR sequences. DWI and ADC sequences of MRI revealed the localization of the deep hypoglycemia associated lesions in the cerebral cortex, hippocampus, splenium, basal ganglia and internal capsule (2,4). Similarly, our patient had lesions located in cerebral cortical areas, which were demonstrated on DWI and ADC mapping.

The severity and duration of hypoglycemia were related with the prognosis or neurologic sequelae of HE (1,4). DWI was reported to be useful in predicting the outcome (5). The patients with hyperintense lesions located in white matter and the hyperintense lesions regress on follow-up images would likely recover without a neurologic deficit (5,6). However, if the lesions are detected in the cerebral cortex, basal ganglia, or hippocampus and do not regress on second imaging, the prognosis will be poor (2,5,6). However, in a case series by Witsch et al. including 15 patients with HE, no correlation was found between MRI findings (lesion diameter and localization) and clinical outcome (7).

In HE, some pathogenetic mechanism including energy failure, excitotoxic edema, and asymmetric cerebral blood flow have been proposed as causes of restricted diffusion. In the case of energy failure and excitotoxic edema, HE is usually transient, and pathologic findings on DWI normalize following removal of the causative pathologic factors. However, in the hypoglycemic hypoperfusion, the perfusion diminishes unequally in the brain. Therefore, focal loss of autoregulation results in focal abnormalities on the single photon emission CT (8).

Reversible diffusion restrictions as in hypoglycemia can also be seen in various different conditions including seizure, drug toxicity, viral encephalitis, and metabolic encephalopathy (1,4). However, most of these conditions are associated with other certain abnormalities. Therefore, in diagnosis of HE, it is not difficult to distinguish between several different conditions, even if they show reversible diffusion abnormalities on MRI.

DWI is a useful tool for determining early involvement for HE. Widespread cerebrocortical and basal ganglia involvement in HE has a poor prognosis (1,9). Our patient had widespread cortical hyperintense lesions. Age, sepsis and long period of hypoglycemia also an important factor for patients prognosis and mortality. This finding is consistent with the literature.
References


