Intramyelinic edema in maple syrup urine disease

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Introduction

Maple syrup urine disease (MSUD) is a rare inborn error of metabolism. Here we describe a case of MSUD and its typical Magnetic resonance imaging features.

Case Report

A 37-day-old female child, fourth born of second degree consanguineous parents, admitted with seizures, lethargy, poor feeding, and failure to gain weight. She was born of a cesarean delivery with a birth weight of 2.9 kg. She cried immediately at birth and there was no history of respiratory distress or neonatal jaundice. Her two elder siblings died in the newborn period with history of seizures. Mother noticed an abnormal odor of urine at times. Examination revealed a lethargic child weighing 1.8 kg with no lateralizing signs or neurocutaneous markers. Complete hemogram, renal parameters, liver function tests, and serum electrolytes were normal. Seizures were controlled with phenobarbitone. Serum lactate, pyruvate, and ammonia were within normal limits. Urine screening was negative. Cerebrospinal fluid (CSF) analysis did not reveal any abnormality. Magnetic resonance imaging (MRI) brain showed bilateral symmetrical lesions involving posterior limb of internal capsule, thalmi, brainstem, and centrum semiovale [Figures 1-8]. Serum high-performance liquid chromatography (HPLC) amino acid profile showed an elevation of leucine — 4,529 (47-155), isoleucine — 286 (31-86), and valine — 575 (64-294) suggestive of maple syrup urine disease (MSUD). Urine for organic acids did not reveal any abnormality. Baby was started on carnitine and thiamine supplementation. Enzyme assay could not be done due to want of facilities. Baby developed respiratory distress and died ten days after hospitalization.

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Discussion

MSUD is a rare inborn error of branched-chain amino acid metabolism. There is defective decarboxylation of these amino acids causing accumulation of branched chain amino acids and their ketoacids in the body. Whether the irreversible neurotoxicity is due to myelin breakdown and neuronal loss or there is hypomyelination of the involved region is unknown.[1] The typical areas of involvement in MSUD includes the deep cerebellar white matter, dorsal brainstem, cerebral peduncles, posterior limbs of the internal capsule, perirolandic white matter, and sometimes, globus pallidi.[2] Patients with MSUD can be divided into five phenotypes: Classic, intermittent, intermediate, thiamine responsive, and dihydrolipoyl dehydrogenase deficient forms. Among them, classic MSUD is characterized by a neonatal onset of encephalopathy and is the most common and most severe form.[3] In MSUD encephalopathy, there are two types of edema seen in MRI. First is intramyelinic edema and other is vasogenic-interstitial edema. Electron microscopy studies in animal models of MSUD have demonstrated that intramyelinic vacuoles are formed through water accumulation between the myelinic lamellae to form intramyelinic edema. Whereas, vasogenic-interstitial edema is due to alteration in blood-brain barrier usually observed in unmyelinated areas.[4] In MSUD encephalopathy, it has been hypothesized that myelinated areas show hyperintensity on diffusion-weighted (DW) images because of intramyelinic edema; whereas, unmyelinated areas show hypointensity because of vasogenic interstitial edema.[5,6] Hence in MSUD, DW imaging is more useful than other sequences as it detects both types of edema. Because intramyelinic edema in MSUD encephalopathy are considered to be associated with myelination, it may be speculated that they change along with the age-dependent progression of myelination.[7] Both brain alterations and MRI findings in MSUD are reversible with treatment and normal neurologic development can be achieved with successful treatment.[8]

Conclusion

MSUD is a very rare inborn error of metabolism (IEM). Knowledge about the classic MRI findings will help us to narrow down the vast differential diagnosis of

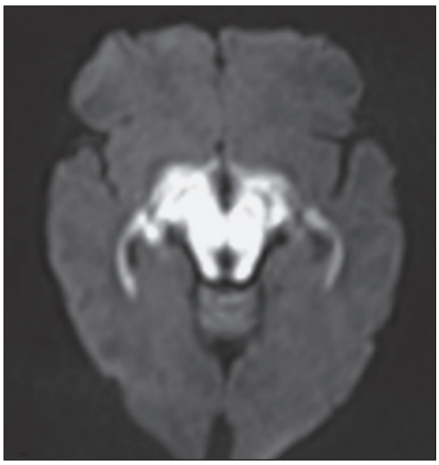

Figure 1: Axial diffusion-weighted imaging (DWI) magnetic resonance imaging (MRI) shows restricted diffusion in midbrain

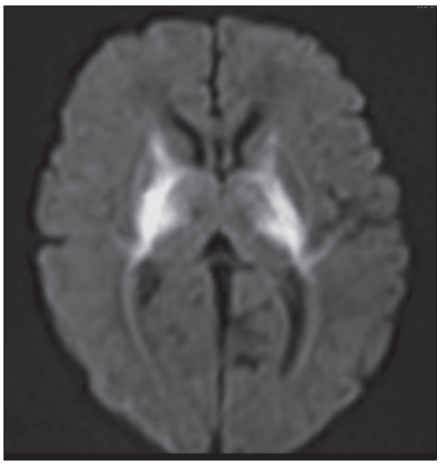

Figure 2: Axial DWI shows restricted diffusion in posterior limb of internal capsule

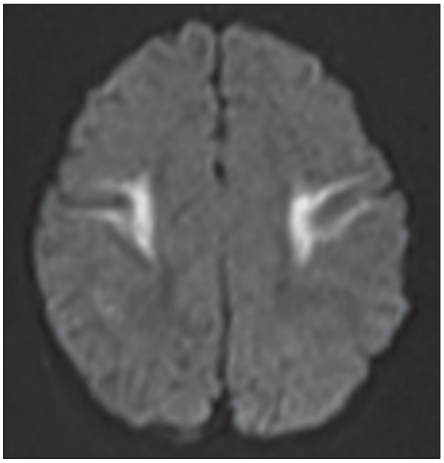

Figure 3: Axial DWI shows restricted diffusion in centrum semiovale

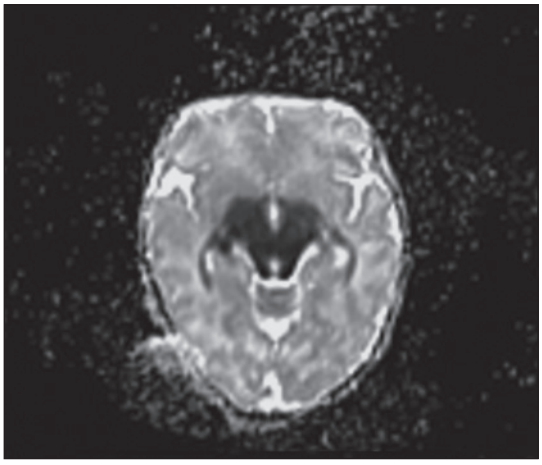

Figure 4: Axial apparent diffusion coefficient (ADC) shows restricted diffusion in midbrain

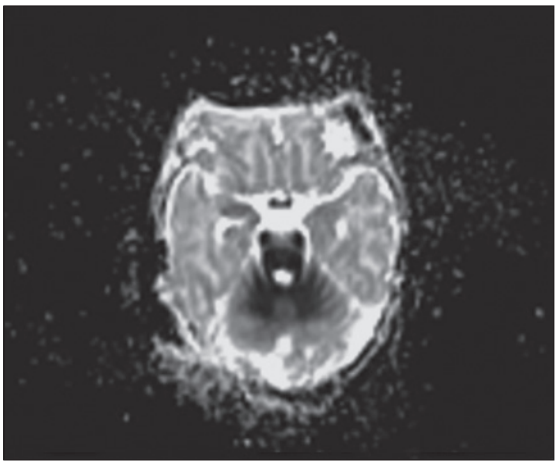

Figure 5: Axial ADC shows restricted diffusion in cerebellar white matter

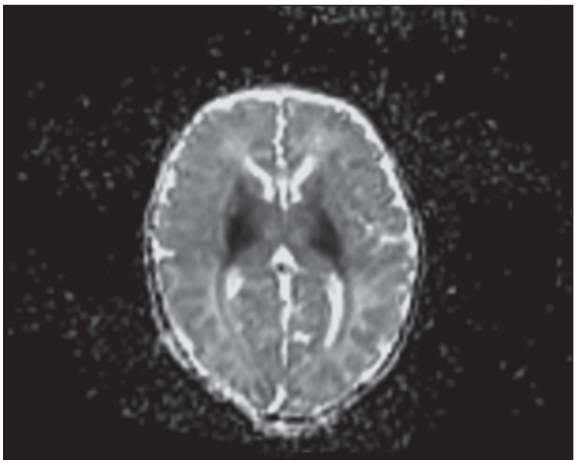

Figure 6: Axial ADC shows restricted diffusion in posterior limb of internal capsule

IEM. In MRI, DW imaging is more useful than other sequences as it can detect both types of edema in MSUD. The diffusion restriction that we see in MSUD is due to intramyelinic edema.

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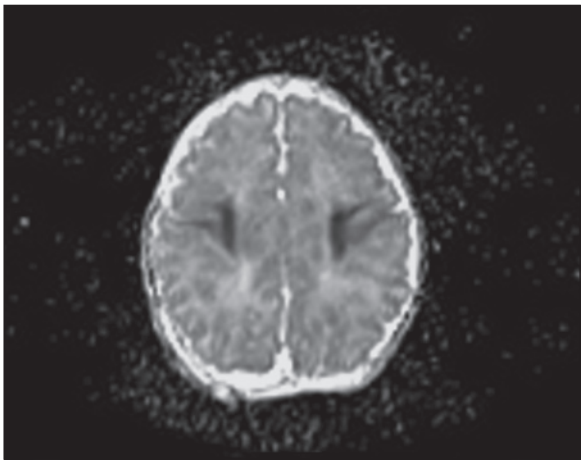

Figure 7: Axial ADC shows restricted diffusion in centrum semiovale

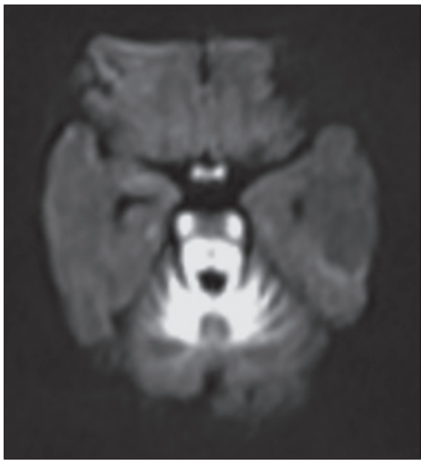

Figure 8: Axial DWI shows restricted diffusion in cerebellar white matter

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