MRI of Pallidal Involvement in Beta-Ketothiolase Deficiency

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Introduction

❖β-ketothiolase deficiency is a rare autosomal recessive metabolic disorder, which can cause an episodic severe metabolic acidosis in those affected.

❖Average onset of disease is from 6 to 24 months, although this is variable Imaging findings relating to this entity have rarely been reported.

❖This is a case of a 5-year-old girl with β-ketothiolase deficiency that showed isolated focal T2 hyperintensities involving the Globi Pallidi which demonstrated restricted diffusion, not previously reported in the setting of BKT deficiency.

Case History

❖A 5-year-old Caucasian female patient with known β-ketothiolase deficiency presented to an outside facility with vague complaints of decreased oral intake, fevers, and mild constipation.

❖On further evaluation, she was found to have a severe metabolic acidosis due to her condition, exacerbated by a UTI.

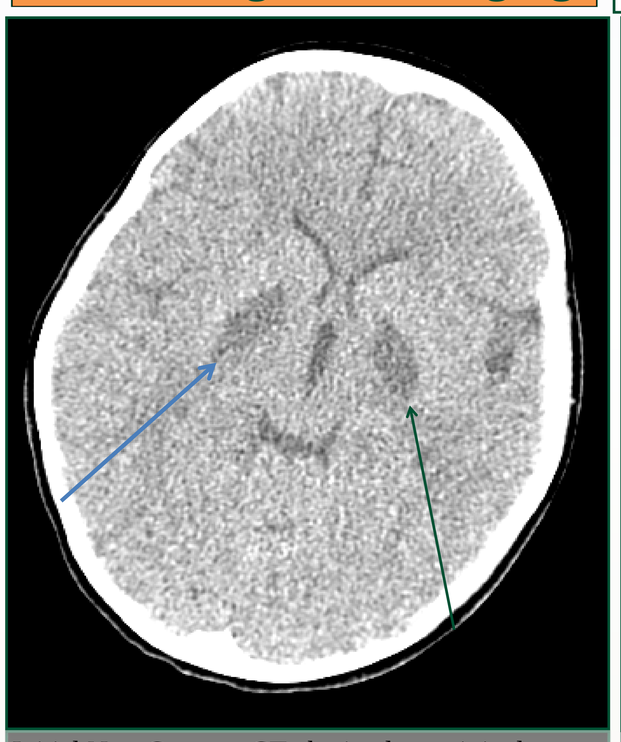
❖She was transferred to our hospital when she was noted to have an acute neurological decompensation, which included dystonic posturing.

❖Her original presentation was one year prior, when she also had suffered an acute neurologic decompensation. This was proven by a concordant serum and urine analysis. Further genetic workup revealed homozygosity of I323V for acetyl-CoA acetyltransferase 1 (*ACAT1*) mutation, which has been well established as well as a cause of β-ketothiolase deficiency [4].

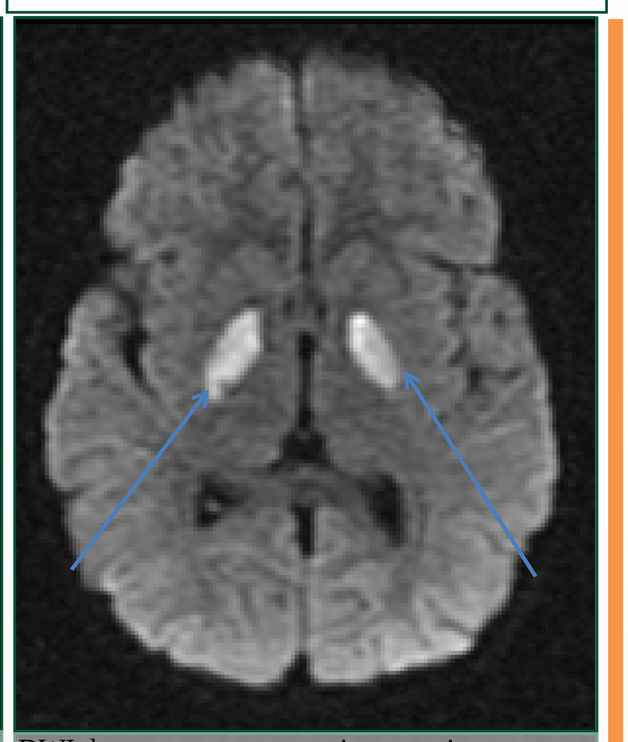
Discussion

- ❖ β-Ketothiolase deficiency is a rare and serious inborn error of metabolism that involves dysfunction of a specific step in isoleucine and ketone body metabolism, which results in the accumulation of various intermediate metabolites and organic acids.
- ❖ It manifests clinically with episodic symptoms similar to toxic encephalopathy such as vomiting, poor feeding, seizures, abnormal tone, lethargy, and even coma.
- ❖ This disorder is known to be caused by a mutation in the ACAT1 gene, as in this case .
- ❖ The natural history involves episodic exacerbations, commonly precipitated by infections, fasting or an increase in dietary protein consumption [1,2].
- ❖ CNS symptoms are extremely common, possibly due to encephalopathy from acidotic state or accumulation of metabolic intermediates. [2].
- ❖ There have been 2 studies which have demonstrated imaging findings is this condition. Brismar, Et. Al previously reported the MRI findings of a series of patients with various rare organic acidemias, including β-ketothiolase deficiency. In the 3 patients with β-ketothiolase deficiency, high T2 intensity changes were seen only in the postero-lateral putamina. Ozand, et. Al reported similar findings of focal high T2 signal intensity in the posterior putamina in three other patients [5,6].
- ❖ The differential diagnosis of globus pallidus signal abnormalities includes metabolic, toxic, degenerative, vascular, inflammatory/infectious, and neoplastic etiologies. [5-7]
- ❖ The mechanism is thought to possibly involve reduced local blood flow and/or aberrations in oxidative metabolism. [7]

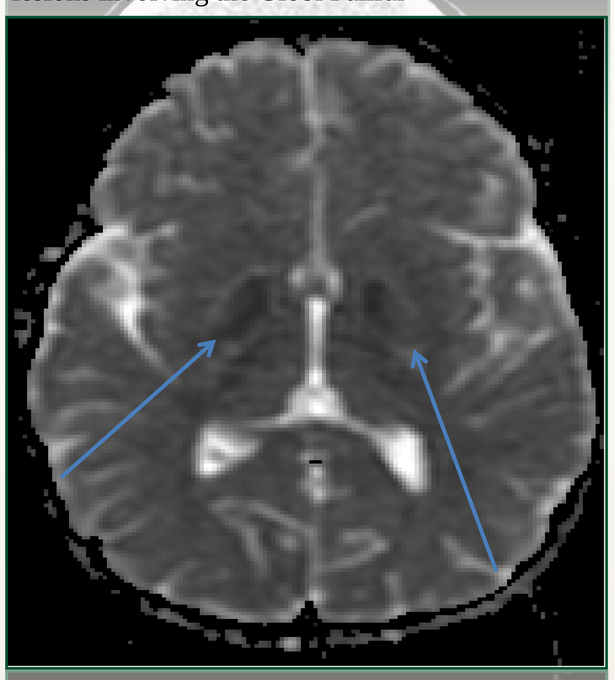
Initial Diagnostic Imaging



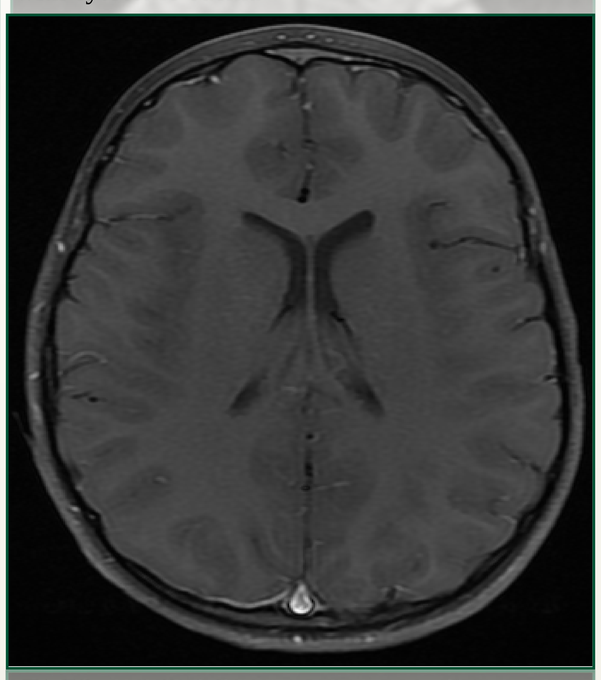
Initial Non-Contrast CT obtained on original clinical presentation demonstrates hypodense lesions involving the Globi Pallidi



DWI demonstrates symmetric-appearing restricting lesions in the Globi Pallidi, consistent with cytotoxic edema

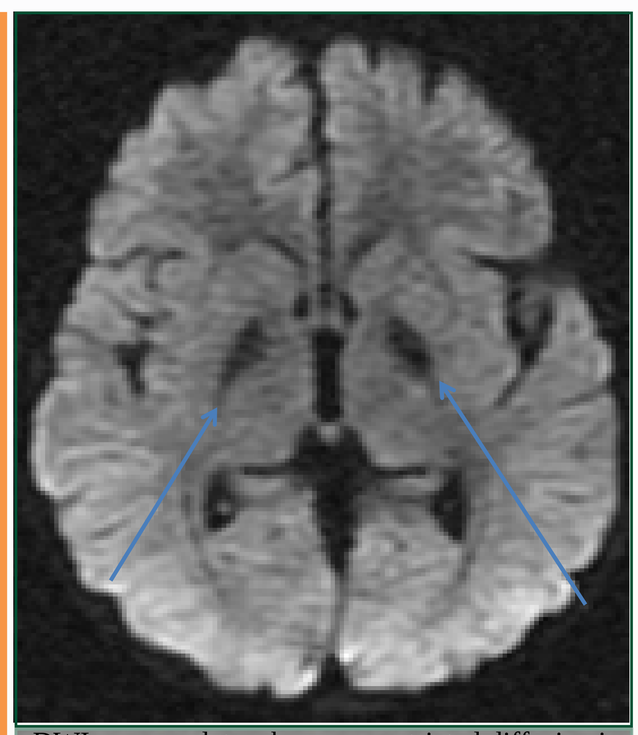


The corresponding areas are hypointense on the ADC map

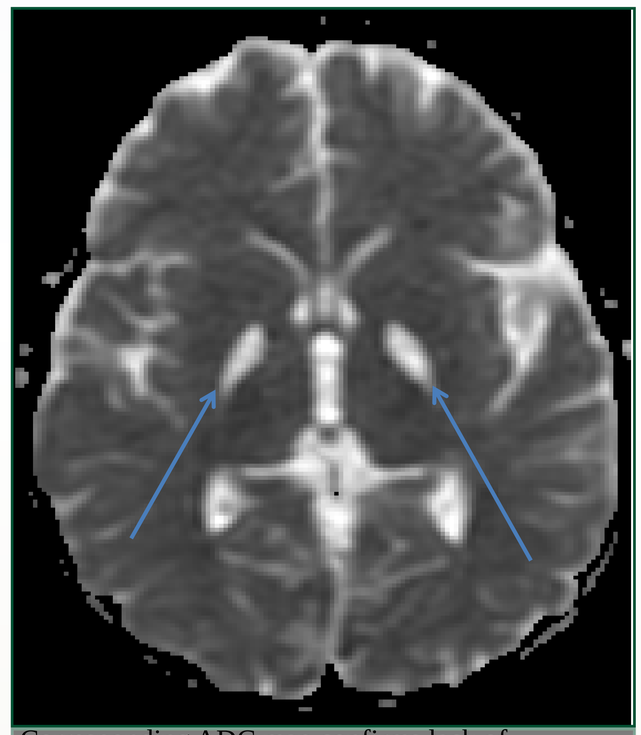


T1 FS post-Gad shows no corresponding enhancement in the Globi Pallidi

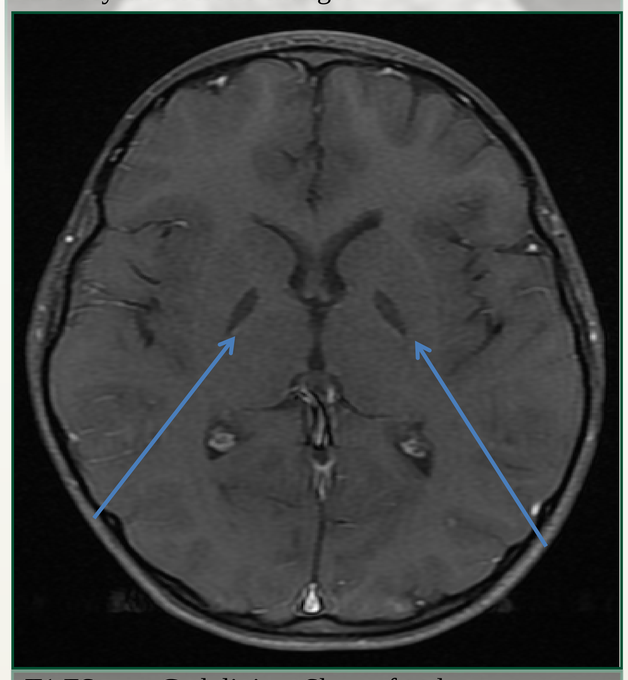
Follow-up Imaging Obtained One Year Later



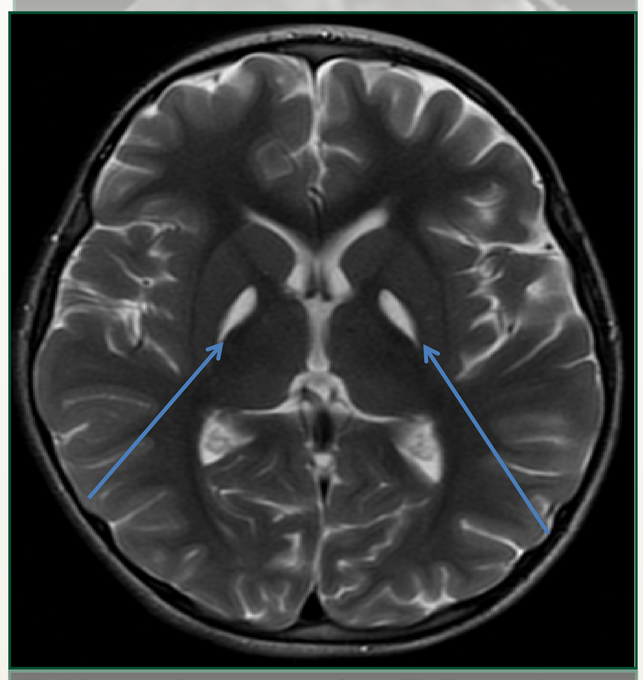
DWI one year later shows no restricted diffusion in the corresponding areas, likely representing microcystic necrotic changes



Corresponding ADC map confirms lack of restricted diffusion in these areas.



T1 FS post-Gadolinium Shows focal hypointensity in the Globi Pallidi bilaterally and no enhancement, in keeping with microcystic necrotic changes



T2-Weighted Image shows focal T2 Hyperintensity in the Globi Pallidi

References

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Conclusion

❖The early detection of the cause of organic academia is important not only because management of the various types of organic acidemias may differ significantly, but also for prognosis and genetic counseling.

❖To our knowledge, these particular MRI findings have not been reported in this setting

❖Although above MRI findings are not specific for BKT deficiency, early recognition may help to confirm the clinicial diagnosis.

❖Our hope is that recognition of these findings will then lead to earlier diagnosis and thus improved prognosis.