Neurological Case Reports

Case Report
Published: 02 May, 2023

Brain Magnetic Resonance Spectroscopy (MRS) in Neurometabolic Disorders: An Invaluable Tool

Ravi S[1], Hansashree P[1], Debjyoti D[1], Dinesh S[2], Karthik K[2], Rohan M[1], Bidisha B[3], Pooja M[1] and Mathuranath PS[1]*

[1]*Department of Neurology, National Institute of Mental Health and Neurosciences (NIMHANS), India*

[2]*Department of Neuroimaging & Interventional Radiology, National Institute of Mental Health and Neurosciences (NIMHANS), India*

[3]*Department of Pediatrics, Manipal Hospital, India*

Abstract

Background: In the era of genetics, the authors would like to highlight the role of Magnetic Resonance Spectroscopy (MRS) in developing countries where genetic analysis might not always be feasible.

Case Report: We report a case of a 26-month-old girl, born of consanguineous parentage who had presented to us with late-infantile neuro-regression. Biochemical investigations showed elevated serum lactate. Neuroimaging showed symmetrical cystic leukoencephalopathy with transverse pontine fibers affection. Diffusion restriction was present in callosal genu and periventricular white matter. MRS of the periventricular lesions marked the distinctive succinate peak at 2.4 ppm which is characteristically seen in succinate dehydrogenase deficiency. Genetic testing was deferred due to financial constraints. In the absence of genetic analysis, MR Spectroscopy clinched the diagnosis of succinate dehydrogenase deficiency in our patient.

Conclusion: SDH deficiency should be considered as a differential diagnosis in early onset psychomotor regression with leukoencephalopathy wherein the MRS shows a succinate peak.

Keywords: MR spectroscopy; Neuroregression; Cystic Leukoencephalopathy; Succinate Peak; Elevated lactate; Neurometabolic disorders

OPEN ACCESS

Correspondence:
Hansashree Padmanabha, Department of Neurology, National Institute of Mental Health and Neurosciences (NIMHANS), Bengaluru - 560029, India, Tel: 91-9781136777; E-mail: hansa777@gmail.com

Received Date: *14 Apr 2023*
Accepted Date: *26 Apr 2023*
Published Date: *02 May 2023*

Citation:
Ravi S, Hansashree P, Debjyoti D, Dinesh S, Karthik K, Rohan M, et al. Brain Magnetic Resonance Spectroscopy (MRS) in Neurometabolic Disorders: An Invaluable Tool. Neurol Case Rep. 2023; 6(1): 1037.

Abbreviations

MRI: Magnetic Resonance Imaging; MRS: Magnetic Resonance Spectroscopy; SDH: Succinate Dehydrogenase

Case Presentation

A 26-months-old girl, second-born of third-degree consanguineous parentage presented to us with features of neuro-regression of 3 months duration. Development was at par till 23-months of age when she was able to run around; had vocabulary of 100 words; could make short-sentences and was dry by day. Thereafter, precipitated by a short febrile illness, child had subacute onset slowness in activities followed by rapid psychomotor regression. Within next 3 months, there was loss of ambulation and neck control. Social and language domains deteriorated in parallel and she became incontinent. Birth and perinatal history were uneventful. Family history was not contributory. On examination, she had microcephaly (HC: 44 cm, < -3 Z-score, WHO), and anthropometric measurements suggested failure to thrive (weight: 8 kg; height: 79 cm). Neurologically, she was irritable had normal fundus examination, spasticity in the lower limbs with scissoring, ankle clonus, positive Babinski and dystonic tremors in right upper limb.

Investigations showed normal blood counts, vitamin B12, homocysteine, serum ammonia and blood tandem mass spectrometry. Fasting serum lactate level was elevated [29 mg/dl; reference 4.5 mg/dl to 19 mg/dl]. Cerebrospinal fluid lactate was normal. Visual evoked potentials, brainstem evoked response audiometry, nerve conductions and electroencephalogram were normal. Magnetic Resonance Imaging (MRI) brain showed symmetrical cystic leukoencephalopathy with transverse pontine fibers affection (Figure 1A-1C). Diffusion restriction was present in callosal genu and periventricular white matter (Figure 1D). MR Spectroscopy (MRS) of the periventricular lesions marked the distinctive succinate peak at 2.4 ppm which is characteristically seen in succinate

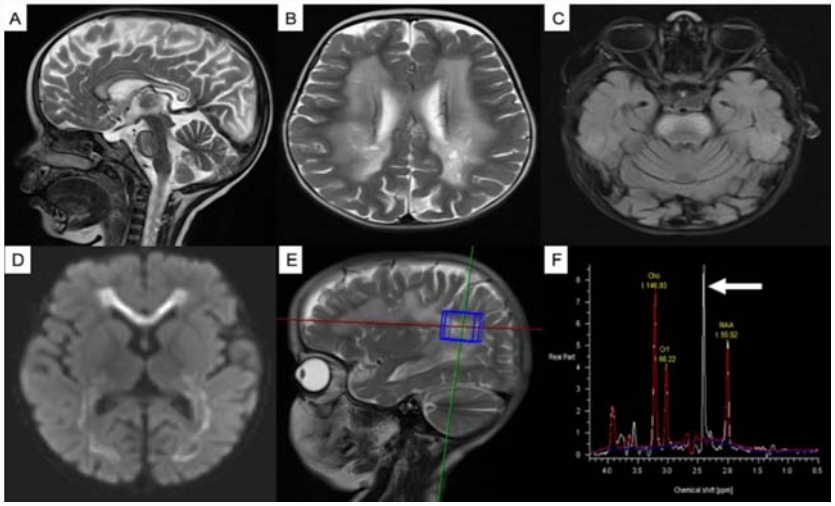

Figure 1: T2-weighted Sagittal (A) section showing diffuse involvement of corpus callosum with peripheral sparing of outer rim. T2-weighted Axial section (B) showing symmetrical involvement of bilateral periventricular and deep white matter with areas of cystic changes. FLAIR (C) axial image showing characteristic involvement of transverse pontine fibers. DWI (D) axial section showing restricted areas in genu of corpus callosum and periventricular white matter. (E and F) Single voxel 135 ms spectroscopy done in periventricular white matter shows characteristic succinate peak (marked with white arrow) at 2.4 ppm which is characteristically seen in succinate dehydrogenase deficiency.

dehydrogenase deficiency (Figure 1E, 1F). Genetic testing and muscle biopsy was deferred by parents. The above clinical and radiological findings were suggestive of succinate dehydrogenase deficiency.

Discussion

Succinate Dehydrogenase (SDH) enzyme plays an essential role in cellular respiration mainly oxidation of succinate in Krebs cycle and is an integral component of electron transport chain (Complex II). SDH is formed by four subunits which are encoded by discrete nuclear genes: SDHA, SDHB, SDHC and SDHD. Mutations in SDHA gene hamper oxidative phosphorylation and can manifest as various childhood onset neurological mitochondrial syndromes: Kearns-Sayre syndrome, Leigh syndrome, encephalopathy, optic atrophy, ataxia, and myopathy [1]. In a cohort of 37 patients of SDH deficiency, early onset psychomotor deficits, pyramidal signs and abnormal brain imaging were the most common findings which were seen in our case also [2]. In a normal brain, succinate goes undetected on MRS because of low concentration. SDH deficiency related leukoencephalopathy shows characteristic succinate peak at 2.4 ppm on MRS [3]. Brockmann et al. established a strong correlation of succinate peak to complex II deficiency in neuro-regressive cases with non-specific leukoencephalopathy [4]. Succinate peak has also been described in certain neuro-infections, brain abscesses and radiation-induced cerebral insults [4]. MRS is an indispensable non-invasive tool in pediatric neurology aiding in diagnosis of neurometabolic disorders [5]. Neuro-metabolic disorders with specific proton MRS findings include creatine metabolism disorder (lack of tCr), Canavan's disease (elevated tNAA), NAA deficiency (lack of tNAA) and mitochondrial disorders (lactate peak) to name a few [4,5].

Conclusion

SDH deficiency should be considered as a differential diagnosis in early onset psychomotor regression with leukoencephalopathy wherein the MRS shows a succinate peak. MRS is an invaluable tool in diagnosing SDH deficiency when there is non-availability of genetic analysis in resource-poor settings.

References

1. Baysal BE, Rubinstein WS, Taschner PE. Phenotypic dichotomy in mitochondrial complex II genetic disorders. J Mol Med (Berl). 2001;79(9):495-503.
2. Jain-Ghai S, Cameron JM, Al Maawali A, Blaser S, MacKay N, Robinson B, et al. Complex II deficiency-- A case report and review of the literature. Am J Med Genet A. 2013;161A(2):285-94.
3. Ohlenbusch A, Edvardson S, Skorpen J, Bjornstad A, Saada A, Elpeleg O, et al. Leukoencephalopathy with accumulated succinate is indicative of SDHAF1 related complex II deficiency. Orphanet J Rare Dis. 2012;7:69.
4. Brockmann K, Bjornstad A, Dechent P, Korenke CG, Smeitink J, Trijbels JM, et al. Succinate in dystrophic white matter: A proton magnetic resonance spectroscopy finding characteristic for complex II deficiency. Ann Neurol. 2002;52(1):38-46.
5. Panigrahy A, Nelson MD Jr, Blüml S. Magnetic resonance spectroscopy in pediatric neuroradiology: Clinical and research applications. Pediatr Radiol. 2010;40(1):3-30.