OMCR

Oxford Medical Case Reports, 2018;11, 391–393

doi: 10.1093/omcr/omy091
Case Report

CASE REPORT

Beriberi disease in an 11-year-old girl with total colectomy

Shafee Salloum[1,*], Ajay Goenka[2] and Adam Mezoff[3]

[1]Department of Pediatric Hospital Medicine, Dayton Children's Hospital, Dayton, OH, USA, [2]Department of Pediatric Neurology, Dayton Children's Hospital, Dayton, OH, USA, and [3]Department of Pediatric Gastroenterology, Dayton Children's Hospital, Dayton, OH, USA

*Correspondence address. Department of Pediatric Hospital Medicine, Dayton Children's Hospital, One Childrens Plaza, Dayton, OH 45404, USA. Tel: +1-937-641-3841; Fax: +1-937-641-4226; E-mail: SalloumS@childrensdayton.org

Abstract

Beriberi or vitamin B1 deficiency is a rare disease in the developed world and more common in developing countries due to poverty and malnutrition. It usually presents with neurological manifestations (dry beriberi) or cardiovascular signs (wet beriberi). We report a case of dry beriberi in an 11-year-old girl with total colectomy who presented to our hospital with ataxic gait and muscle weakness. Her symptoms started 1 week after she underwent cholecystectomy for her chronic abdominal pain. Nerve conduction study showed sensory demyelinating neuropathy and she had low levels of serum vitamin B1. Her condition improved significantly after taking vitamin B1 supplementation. To the best of our knowledge, this is the first case report of thiamine deficiency in a child with a total colectomy.

INTRODUCTION

Beriberi or vitamin B1 deficiency is a rare disease in the developed world and more common in developing countries due to poverty and malnutrition. It usually presents with neurological manifestations (dry beriberi) or cardiovascular signs (wet beriberi). There are few case reports of vitamin B1 deficiency in children with gastrointestinal dysfunctions like eating disorders, short bowel syndrome, and after gastric bypass surgeries in obese adolescents. We present a case of dry beriberi in an 11-year-old girl with a total colectomy in infancy due to Hirschsprung disease. We also discuss several etiologies that could resulted in thiamine deficiency in this case.

CASE REPORT

An 11-year-old girl, with history of total colectomy in infancy due to Hirschsprung disease, was admitted to our hospital due to acute onset of ataxia and chronic abdominal pain. Her pain started 2 months prior to admission, thought initially to be related to cholelithiasis evident on ultrasonography, and her gallbladder was subsequently removed. Despite that, she continued to complain of abdominal pain associated with intermittent nausea and decreased appetite, but no fever or vomiting. One week after her cholecystectomy, she developed unsteady gait and weakness, progressed to inability to walk without assistance. The patient had an ileo- anal pull-through as a young child, and currently has fecal incontinence controlled with loperamide. She also takes metronidazole, 1 week a month, for suspected small intestinal bacterial overgrowth (SIBO), although no hydrogen breath test or other confirmatory tests were performed. She lost 2.6 kg (~ 5% weight loss) since her abdominal pain started over the last 2 months. She was developmentally appropriate, and her immunizations were up to date. No sick contacts were reported. On physical examination; weight 49.6 kg (86th percentile), temperature 36.3°C, heart rate 95 beats/min, blood pressure 110/66 mmHg,

Received: June 7, 2018. **Revised:** August 18, 2018. **Accepted:** August 31, 2018

respiratory rate 20 breaths/min, and oxygen saturation 98% on room air. She was alert and oriented, in no acute distress. She had normal cranial nerves examination with a muscle strength of 4/5 in the lower extremities. Deep tendon reflexes were present +2. She was unable to stand or walk without assistance and when she did, she could not maintain her balance. Romberg's test was positive.

She had tingling of her toes with rare stabbing pain in the feet while walking. Her abdomen was diffusely tender to palpation, but no rebound or guarding. Bowel sounds were normal. The rest of her examination findings were unremarkable. Laboratory showed normal complete blood count, electrolytes, renal, liver and thyroid function tests. She had normal C-reactive protein, erythrocyte sedimentation rate, lipase, creatine kinase and D-lactate levels. Magnetic resonance imaging (MRI) of the brain was normal. Nerve conduction study showed mild demyelinating sensory neuropathy. A micronutrient-deficit neuropathy was suspect, so addition laboratories were obtained (Table 1). She was treated empirically with 100 mg of vitamin B1 intravenously (IV), 0.4 mg folic acid IV and 500 μg of vitamin B12 intramuscularly before vitamins levels results were available. For her abdominal pain; the patient had an extensive gastrointestinal work-up including upper gastrointestinal series, abdomen MRI, upper and lower endoscopies; all were normal for her current anatomy. She was started on amitriptyline for her abdominal pain before she was discharged home with physical therapy follow up. Vitamin B1 serum level was reported low at 2 nmol/L after discharge (reference range: 4–15 nmol/L) and patient was diagnosed with dry beriberi. She was started on 50 mg of vitamin B1 orally, in addition to her multivitamin supplements. Her repeated B1 level 1 month later was normal at 11 nmol/L. At 3 months follow up; patient showed significant improvement; her ataxia almost resolved, and she was able to walk unaided with minimal imbalance. The tingling and stabbing pain in her feet had resolved as well, and her abdominal pain also improved. She returned to her normal diet and normal daily activities.

DISCUSSION

Thiamine (vitamin B1) is a water-soluble vitamin that plays a fundamental role in oxidative and non-oxidative metabolic pathways. In the oxidative pathway; thiamine is a co-factor for the pyruvate dehydrogenase enzyme that converts pyruvate, the end product of glycolysis, to acetyl CoA. The later participates in aerobic cell energy production through the Krebs cycle which highlights the importance of thiamine in high-energy dependent tissues within the nervous and cardiac systems. In the non-oxidative metabolism, thiamine serves as a co-factor for trans-ketolase reactions in the hexose monophosphate shunt pathway. This pathway is essential for fatty acid synthesis, maintenance of myelin sheath, and subsequently, nerve membrane function [1–3]. Thiamine is mainly absorbed in the upper jejunum, and its absorption is dependent on the overall nutrition status. Malnutrition can reduce thiamine absorption by 70% [1, 3, 4]. Alcohol intake can interfere with thiamine absorption even in non-malnourished individuals [1, 3, 5]. Recommended daily allowance (RDA) of thiamine in children is age- dependent; 0.5 mg/day for 1–3 years of age increases to 0.9 mg/day for 9–13 years of age [1, 3]. The limited body stores of thiamine, along with short half-life (9–18 days) and constant demand in carbohydrate metabolism results in the need for consistent intake [1, 3, 6, 7]. Thiamine deficiency results in beriberi disease which classically divided into two types; neurological or dry beriberi and cardiovascular or wet beriberi. A wide variety of neurological manifestations have been described in dry beriberi like peripheral neuropathy, paranesthesia, muscle weakness and gait ataxia. In its severe form, thiamine deficiency can result in Wernicke–Korsakoff syndrome where patients have ataxia, nystagmus, memory loss and psychosis [1, 2, 5, 6]. Thiamine status can be assessed by multiple laboratory tests, each of which has its own limitations. Serum thiamine represents <10% of the whole blood thiamine, so measuring serum thiamine levels lack sensitivity and specificity [1, 8]. In contrast, thiamine pyrophosphate levels in the whole blood is a more accurate means of assessing total body thiamine levels, although it may be still falsely reduced in systemic inflammation [3, 4, 8]. Erythrocyte trans-ketolase activity is a functional test that can be affected by hemoglobin concentration, and urinary thiamine excretion is more useful in identifying systemic adequacy as well as recent intake rather than true deficiency [1, 3, 4]. Thiamin deficiency has been reported in patients after gastric bypass surgery, gastrectomy for gastric cancer and eating disorders [2, 5, 7]. Decreased oral intake and frequent vomiting, along with limited body stores, are thought to be the main risk factors in these cases [4, 5, 7]. SIBO is associated with thiamine deficiency and it is proposed as contributing factor in obese patients after gastric bypass surgery [4]. SIBO not only can interfere with thiamine absorption, but medications used to treat it, like metronidazole, can inhibit thiamine pyrophosphorylation, presumably due to metronidazole role as thiamine analog [9]. Thiamine deficiency has been reported in patients with short bowel presumably due to malabsorption [10], and in total parental nutrition (TPN) dependent patients if thiamine was not added to their TPN [6, 11]. We believe that our patient developed thiamine deficiency in part due to her abdominal pain and nausea impacting her oral intake and therefore her nutritional status. In addition, the malabsorption caused by her SIBO interfered with her thiamine absorption. Serum folate level was elevated (Table 1) which is an indirect marker for SIBO [4]. Metronidazole might have also played an important role in this case through its pyrophosphorylation inhibitory effect as mentioned above. Some investigators found that colonic bacteria synthesize thiamine, and this as well could have predisposed our patient to thiamine deficiency due to her previous total colectomy [1, 3]. As thiamine is a water-soluble vitamin, cholecystectomy in this case was unlikely to cause malabsorption; however, stress associated with surgery might exacerbated her condition. Interestingly, abdominal pain and nausea in this case could represent early signs of an underlying thiamine deficiency (gastrointestinal beriberi) [12]. Nausea and anorexia are considered protective phenomenon against high calorie diets which would cause detrimental effects in thiamine deficiency. Although serum thiamine level lacks specificity as mentioned above, we felt that the patient's presentation and her response to treatment supports our diagnosis. To the best of our knowledge, this is the first case of thiamine deficiency in a child with a total colectomy. In summary, we report a case of dry beriberi in an 11-

Table 1: Micronutrients levels in our patient before treatment

	Patient	Reference range
Serum zinc	78 ug/dL	60–120 ug/dL
Serum folate	>22.3 ng/mL	5–21 ng/mL
Vitamin B12	218 pg/mL	180–914 pg/mL
Vitamin D, 25 hydroxy	14 ng/mL	>20 ng/mL
Vitamin B1 serum	2 nmol/L	4–15 nmol/L

year-old girl with total colectomy after she underwent cholecystectomy for chronic abdominal pain. She presented with weakness and ataxic gait, and her symptoms improved significantly after taking vitamin B1 supplementation. We emphasize the importance of checking for vitamin B1 deficiency in children with total colectomy who present with neurological manifestations especially if they develop SIBO and/or take metronidazole.

ACKNOWLEDGEMENTS

None.

CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to disclose.

FUNDING

The authors have no financial relationships relevant to this article to disclose.

REFERENCES

1. Frank LL. Thiamin in clinical practice. *JPEN J Parenter Enteral Nutr* 2015;**39**:503–20.
2. Renthal W, Marin-Valencia I, Evans PA. Thiamine deficiency secondary to anorexia nervosa: an uncommon cause of peripheral neuropathy and Wernicke encephalopathy in adolescence. *Pediatr Neurol* 2014;**51**:100–3.
3. Hiffler L, Rakotoambinina B, Lafferty N, Martinez Garcia D. Thiamine deficiency in tropical pediatrics: new insights into a neglected but vital metabolic challenge. *Front Nutr* 2016;**3**:16.
4. Lakhani SV, Shah HN, Alexander K, Finelli FC, Kirkpatrick JR, Koch TR. Small intestinal bacterial overgrowth and thiamine deficiency after Roux-en-Y gastric bypass surgery in obese patients. *Nutr Res* 2008;**28**:293–8.
5. Towbin A, Inge TH, Garcia VF, Roehrig HR, Clements RH, Harmon CM, *et al*. Beriberi after gastric bypass surgery in adolescence. *J Pediatr* 2004;**145**:263–7.
6. Barnes D, Kerner J. Severe lactic acidosis in a parenteral nutrition-dependent teenager with ulcerative colitis. *Dig Dis Sci* 2016;**61**:2804–6.
7. Iwase K, Higaki J, Yoon HE, Mikata S, Miyazaki M, Kamiike W. Reduced thiamine (vitamin B1) levels following gastrectomy for gastric cancer. *Gastric Cancer* 2002;**5**:77–82.
8. Lu J, Frank EL. Rapid HPLC measurement of thiamine and its phosphate esters in whole blood. *Clin Chem* 2008;**54**:901–6.
9. Iwadate D, Sato K, Kanzaki M, Komiyama C, Watanabe C, Eguchi T, *et al*. Thiamine deficiency in metronidazole-induced encephalopathy: a metabolic correlation? *J Neurol Sci* 2017;**379**:324–6.
10. Rodan LH, Mishra N, Tein IMR. Spectroscopy in pediatric Wernicke encephalopathy. *Neurology* 2013;**80**:969.
11. Hahn JS, Berquist W, Alcorn DM, Chamberlain L, Bass D. Wernicke encephalopathy and beriberi during total parenteral nutrition attributable to multivitamin infusion shortage. *Pediatrics* 1998;**101**:E10.
12. Donnino M. Gastrointestinal beriberi: a previously unrecognized syndrome. *Ann Intern Med* 2004;**141**:898–9.