CASE REPORT

Night Blindness Secondary to Vitamin A Deficiency in a Patient with Cystic Fibrosis and Short-Gut Syndrome

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INTRODUCTION

Pancreatic exocrine dysfunction in patients with cystic fibrosis can result in deficiencies of fat-soluble vitamins, necessitating supplementation of these vitamins. The authors report a case of night blindness and central scotoma secondary to vitamin A malabsorption in a patient with cystic fibrosis and short-gut syndrome who was receiving vitamin supplementation.

CASE REPORT

A 38-year-old man with cystic fibrosis was admitted to hospital with possible pneumonia. At the time of admission, he reported progressive worsening of night vision over the previous few weeks and more recent visual scotoma, to the point that he could no longer see at night and his daytime vision was severely impaired. His medical history included cystic fibrosis with pancreatic exocrine insufficiency requiring pancreatic enzyme supplementation, chronic abdominal pain, repeated partial bowel obstruction, 2 previous bowel resections, and narcotic dependency.

At 2 days of age, the patient underwent bowel surgery with resection of 20 cm of ileum for meconium ileus. As a child he was asymptomatic, but over a period of many years, cramping and abdominal pain resistant to medical management increased. These symptoms were managed with long-term opiate therapy. The pain became more frequent and severe, and laparotomy (with resection of 35 cm of the terminal ileum and 26 cm of the right colon and an end-to-end anastomosis of the mid ileum to the mid transverse colon) was performed 6 months before the current admission. After the surgery, the patient experienced up to 30 bowel movements per day, despite taking loperamide, codeine, and cholestyramine. With time and adaptation, his diarrhea decreased somewhat, but he still had at least 10 to 15 bowel movements per day, and this condition had failed to respond to antibiotics, increased replacement of pancreatic enzymes, or the addition of histamine-2 receptor blockers. The chronic high-volume diarrhea was attributed to functional short-gut syndrome.

Medications before the current admission consisted of pancreatic enzymes, oral multivitamin (vitamins A, D, E, and K [ADEK], 1 tablet twice daily), tobramycin 160 mg twice daily by nebulizer, and pentazocine 50 to 100 mg PO up to q4h prn, as well as loperamide and codeine prn and cholestyramine 4 to 8 g PO q8–12h prn.

On the day of admission, the patient had mild hypoxia with arterial oxygen pressure (Pao_2) of 66 mm Hg (normally above 70 mm Hg). Hemoglobin, at 123 g/L (normal value above 135 g/L), was slightly below normal, as were hematocrit (0.37; normal value above 0.4) and erythrocyte count (3.91×10^{12}/L; normal value above 4.5×10^{12}/L). The international normalized ratio (INR) was elevated (2.6; normal range 0.9 to 1.1), as was the partial thromboplastin time (PTT) (44 s; normal value less than 38 s). The INR and PTT before the laparotomy 6 months previously had been high normal (1.3 and 34 s, respectively). Serum concentrations of vitamin A and vitamin E obtained on admission and reported later were 0.4 mmol/L (normal value above 1.2 mmol/L) and 8 mmol/L (normal value 18 to 29 mmol/L), respectively.

Intravenous multivitamin therapy was started (Multi-9+3, Baxter Corporation; 10 mL daily, containing vitamin A 6600 IU, vitamin D 200 IU, and vitamin E 10 IU per dose). Within hours, the patient reported dramatic improvement in his vision and the next day reported that he could see well. While in hospital, he continued to receive daily IV (as described above) and oral (ADEK 1 tablet tid, including 4000 IU vitamin A) vitamin supplementation.

While the patient was still in hospital he underwent small-bowel follow-through, which showed an oral-to-

colon transit time of less than 30 min. The patient also received tobramycin 540 mg IV daily and ceftazidime 2 g IV q8h and was given vitamin K 10 mg parenterally to correct the elevated INR. He continued to experience multiple bowel movements daily, depending on his oral intake.

The patient was discharged home after 2 weeks in hospital and was to be followed in clinic for assessment of symptoms and levels of fat-soluble vitamins.

DISCUSSION

This patient presented with symptoms of hypovitaminosis of various fat-soluble vitamins, in particular, below-normal levels of vitamins A and E and elevated INR consistent with vitamin K deficiency. The INR improved with parenteral vitamin K given during his stay. This patient was already at risk of deficiencies of the fat-soluble vitamins (A, D, E, and K) because of his cystic fibrosis, which became clinically important in the presence of surgically induced short-gut syndrome.

About 80% of vitamin A is absorbed from the diet, such as animal tissues rich in retinyl esters and leafy green vegetables containing ß carotene precursors.[1] Once absorbed, vitamin A is incorporated into chylomicrons, which are then transported to the liver for storage. Vitamin A deficiency due to malnutrition is rarely seen in developed countries and can be difficult to diagnose in the early stages. Ocular symptoms, in particular night blindness, are among the early manifestations of hypovitaminosis A, as vitamin A plays a key role in the elaboration of visual pigment.[1,2] Clinical signs may include wrinkled, red, and lustreless conjunctiva, hyperkeratosis and xerosis of the skin and mucous membranes, and blepharitis. After prolonged deficiency, aggressive xerophthalmia may lead to corneal ulceration and permanent blindness.

There were 2 potential causes of fat malabsorption in this patient: pancreatic exocrine insufficiency secondary to cystic fibrosis and recent bowel resection. Low vitamin A concentrations have been reported in patients with cystic fibrosis despite adequate pancreatic function or supplementation with pancreatic enzymes and vitamins.[3-5] However, some patients may not experience any clinical signs and symptoms of hypovitaminosis A.[4] In the case reported here, the patient's visual disturbances first began about 6 months after his bowel surgery. It is therefore likely that he had chronically low but asymptomatic vitamin A concentrations and that his bowel surgery worsened his fat malabsorption, which led to clinical symptoms of vitamin A deficiency.

Short-gut syndrome is common after resection of the terminal ileum.[6] Symptoms include profuse watery diarrhea exacerbated by oral intake, which leads to fluid disturbances, weight loss, malnutrition, and vitamin deficiencies. The ileum is responsible for absorbing fats bound to bile salts as well as fat-soluble vitamins and vitamin B_{12}. Unabsorbed bile salts result in diarrhea by stimulating fat and water secretion in the colon, as well as causing steatorrhea secondary to fat malabsorption. The degree of malabsorption depends on the location and extent of resection. Resection of 100 cm or more of terminal ileum may result in severe malabsorption and diarrhea.[6] Although only 35 cm of the terminal ileum had been resected in this patient (in addition to the 20 cm removed during his original surgery as an infant) there was likely a predisposition to vitamin A deficiency because of pancreatic insufficiency.

In summary, a patient with cystic fibrosis and short-gut syndrome presented with ocular symptoms consistent with vitamin A deficiency. The symptoms were corrected with appropriate parenteral therapy. Ongoing, intermittent parenteral vitamin A therapy has been required to prevent recurrence of the visual problems.

References

1. Russell RM. Vitamin and trace mineral deficiency and excess. In: Braunwald E, Fauci AS, Isselbacher D, Kasper DL, Hauser SL, Longo DL, et al, editors. *Harrison's online.* New York (NY): McGraw-Hill; c2001-2004 [cited 2004 May 20]. Available from: www.accessMedicine.com Available by subscription only.
2. Watson NJ, Hutchinson CH, Atta HR. Vitamin A deficiency and xerophthalmia in the United Kingdom. *BMJ* 1995;310:1050-1. Erratum in: *BMJ* 1995;310:1320.
3. Huet F, Semama D, Maingueneau C, Charavel A, Nivelon JL. Vitamin A deficiency and nocturnal vision in teenagers with cystic fibrosis. *Eur J Pediatr* 1997;156:949-51.
4. Ansari EA, Sahni K, Etherington C, Morton A, Conway SP, Moya E, et al. Ocular signs and symptoms and vitamin A status in patients with cystic fibrosis treated with daily vitamin A supplements. *Br J Ophthalmol* 1999;83:688-91.
5. Lancellotti L, D'Orazio C, Mastella G, Mazzi G, Lippi U. Deficiency of vitamins E and A in cystic fibrosis is independent of pancreatic function and current enzyme and vitamin supplementation. *Eur J Pediatr* 1996;155:281-5.
6. Jeejeebhoy KN. Short bowel syndrome: a nutritional and medical approach. *CMAJ* 2002;166:1297-302.

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