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Copper-deficiency anemia after esophagectomy: A pitfall of postoperative enteral nutrition through jejunostomy

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ABSTRACT

INTRODUCTION: Copper deficiency leads to functional disorders of hematopoiesis and neurological system. There have been some reports of copper deficiency occurring to the patients on enteral nutrition through a jejunostomy in long-term-care hospitals. However, it is extremely rare to find patients with copper deficiency several months after esophagectomy, regardless of enteral nutrition through the jejunostomy. To the best of our knowledge, this is the first case report of a patient who experienced copper-deficiency anemia after esophagectomy and subsequent enteral nutrition through the jejunostomy.
PRESENTATION OF CASE: A 73-year-old man presented with pulmonary failure after esophagectomy for esophageal cancer with video-assisted thoracoscopic surgery, and needed long-term artificial ventilator support. Nutritional management included enteral nutrition through a jejunostomy from the early postoperative period. Copper-deficiency anemia was detected 3 months postoperatively; therefore, copper supplementation with cocoa powder was performed, and both serum copper and hemoglobin levels subsequently recovered.
DISCUSSION: Copper-deficiency anemia has already been reported to occur in patients receiving enteral nutrition in long-term care hospitals. However, this is the first case report of copper deficiency after esophagectomy despite administration of standard enteral nutrition through the jejunostomy for several months.
CONCLUSION: It is extremely rare to find copper-deficiency anemia several months after esophagectomy followed by enteral nutrition through the jejunostomy. However, if anemia of unknown origin occurs in such patients, copper-deficiency anemia must be considered among the differential diagnoses.

1. Introduction

Copper plays a role as a cofactor for various enzymes in the human body, and is indispensable for myeloid and neurological structure and function.[1,2] Copper deficiency leads to functional disorders of hematopoiesis such as anemia and neutropenia, as well as neurological disorders such as myelopathy.[3–5] Copper is absorbed mainly from the duodenum and proximal jejunum, and partly from the stomach.[6,7] Some recent reports have noted that patients on enteral nutrition through a jejunostomy in long-term-care hospitals sometimes experience copper deficiency.[8] However, it is extremely rare to find patients with copper deficiency several months postoperatively, regardless of enteral nutrition through the jejunostomy. We report herein the case of a patient who experienced copper-deficiency anemia after esophagectomy and subsequent enteral nutrition through the jejunostomy. This patient recovered with copper supplementation.

2. Presentation of case

A 73-year-old man with a chief complaint of dysphagia was diagnosed with thoracic esophageal cancer at a local hospital. He was then referred to our hospital for further examination and treatment. He had no medical history of copper metabolic disorders such as Menkes disease or occipital horn syndrome, and family history

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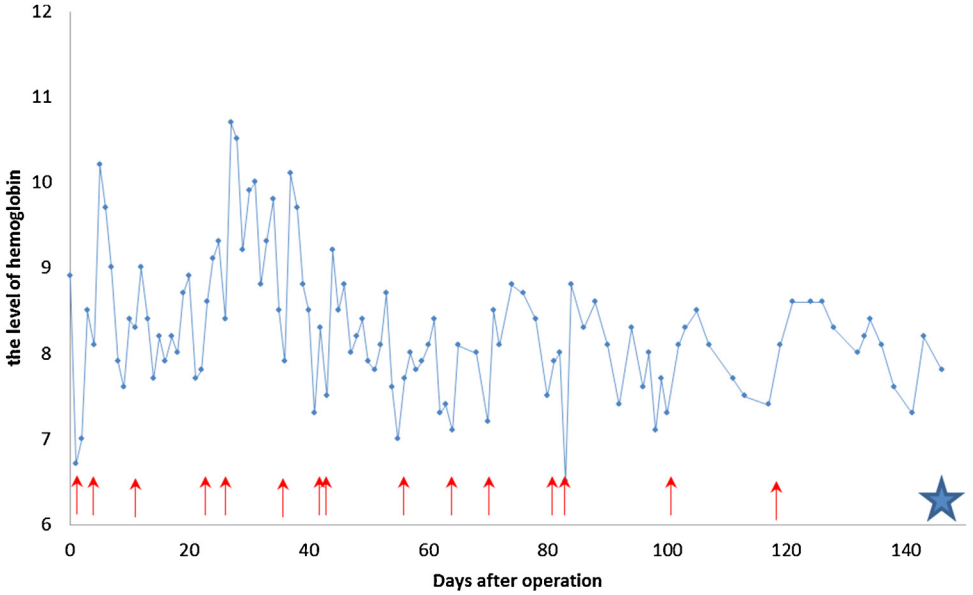

Fig. 1. Postoperative hemoglobin levels. Arrows, transfusions; star, first day of copper supplementation.

was not contributory. He had been smoking 20 cigarettes a day for 30 years and drinking 200 ml of red wine a day for 50 years. His preoperative laboratory tests and pulmonary function tests were within normal limits.

Preoperative diagnosis was cT1bN0M0 cStage IA (UICC TNM classification, 7th edition), and the patient underwent esophagectomy with two-field lymphadenectomy followed by reconstruction with a gastric tube via retrosternal route and jejunostomy. The jejunostomy tube (9 Fr) was inserted through the antrum of gastric tube, and the end of it was located at the ligament of Treitz through pylorus. Operation time was 9 h 52 min, and blood loss was 2420 ml, which was highly invasive to him. Moreover, the upper lobe of the right lung was twisted during the operation. It was fixed through emergent reoperation on the same day, but the patient developed subsequent severe pulmonary failure and required long-term artificial ventilatory support.

Oral intake was impossible due to his deteriorated deglutition ability; therefore, nutritional management started from postoperative day 3 as enteral nutrition with a small amount of standard nutrient solution through the jejunostomy. His general condition improved, and thus the amount of nutrient solution was gradually increased to 1210 kcal of energy and 1.6 mg of copper by 1 month postoperatively. By 3 months postoperatively, inflammatory response had completely disappeared, and no signs of bleeding or deficiency of serum iron, ferritin, folic acid or vitamin 12 were noted. However, the patient was suffering continuous anemia, and required intermittent transfusions (Fig. 1). Serum levels of copper and ceruloplasmin were 7 μg/dl (normal range, 68–128 μg/dl) and 8 mg/dl (normal range, 21–37 mg/dl), respectively. It was considered that copper deficiency was attributable to problems with the nutrition pathway, leading to copper malabsorption despite the seemingly ample copper administration. Copper supplementation using cocoa was then started. Ten grams of commercially available cocoa powder (0.4 mg of copper) was mixed with 100 ml of warm water, and then administered through the jejunostomy once daily in the morning (Fig. 2). No side effects arose from cocoa supplementation, and the 9-Fr nutritional tube did not become clogged by the cocoa/water mixture.

Serum levels of copper and hemoglobin gradually increased, reaching 76 μg/dl and 9.8 g/dl, respectively, by 61 days after starting cocoa supplementation. During the supplementation period, no transfusions were administered. As copper levels increased, zinc

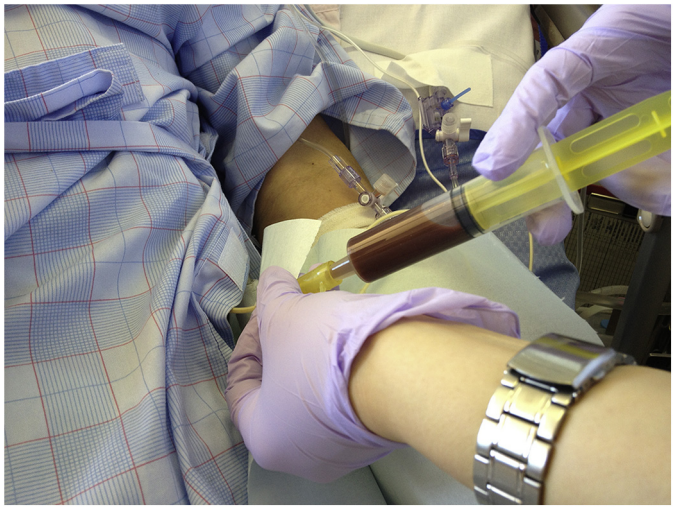

Fig. 2. Copper supplementation with cocoa powder through the jejunostomy.

levels decreased; however, none of the symptoms were attributable to zinc deficiency (Fig. 3). Since anemia was alleviated and the general condition of the patient improved, he was referred to another hospital to continue long-term rehabilitation.

3. Discussion

Copper-deficiency anemia has already been reported to occur in patients receiving enteral nutrition in long-term care hospitals.[9] However, to the best of our knowledge, this represents the first case to be reported of copper deficiency after esophagectomy despite administration of standard enteral nutrition through the jejunostomy for several months. The standard nutrient solution has been noted to lack the requisite amount of copper,[9] so most of the formulae for current nutrient solutions have been improved to meet this requirements. The recommended daily allowance of copper by the US National Academy of Sciences is 900 μg per day for adult men and women.[10] Japanese government recommends a dietary allowance of 700 μg per day in woman and 800 μg per day in men aged 18 years old and older.[11] The patient in the present case