Selenium Deficiency in Crohn's Disease on Long-term Enteral Nutrition: Report of a Case.

Fumitoshi KUROKI, Takayuki MATSUMOTO, Kazunori HOSHIKA and Mitsuo IIDA

Division of Gastroenterolgy, Department of Medicine, Kawasaki Medical School, Kurashiki 701-0192, Japan

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ABSTRACT. A case of Crohn's disease accompanied by selenium deficiency during enteral nutrition is reported. Exclusive enteral nutrition was chosen as the method of therapy after a diagnosis of Crohn's disease was made. Two years later, palpitation and deformity of the fingernails developed. A diagnosis of selenium deficiency was made based on reductions in the serum selenium concentration and glutathione peroxidase activity. After selenite supplementation, those normalized with subsequent improvement in clinical symptoms. There appears to be some danger of selenium deficiency for Crohn's disease patients on long-term exclusive enteral nutrition lacking in selenium.

Key words: selenium deficiency — enteral nutrition — Crohn's disease

In Japan, total parenteral nutrition and enteral nutrition are widely accepted as essential therapies for the management of Crohn's disease. It has been reported that these therapies not only improve nutritional status but also clinical activity and the morphologic degree of intestinal inflammation.[1,2] However, they are also been known to induce various nutritional disturbances.[3-6] In this report, we describe a case of Crohn's disease in whom a selenium deficiency developed during long-term enteral nutrition.

CASE REPORT

A 31-year-old male with an established diagnosis of Crohn's disease was admitted to our division in August 1994 because of transient palpitations. At 24 years of age, he experienced abdominal pain and diarrhea, which later developed into an intestinal obstruction in July 1993. At that time, a diagnosed of typical Crohn's disease of the ileitis type with segmental, skipped ulcers, a cobblestone appearance and stenosis was made. Because he manifested massive intestinal bleeding of such an amount as to result in a 15% reduction in his hematocrit, he received total parenteral nutrition for two months. His Crohn's disease improved uneventfully, and thereafter he received total enteral nutrition as an outpatient. During that period, he ingested 1800 kcal/day of elemental diet (Elental, Morishita-Roussel, Tokyo, Japan) and received 250 ml/week of 20% lipid emulsion (Intralipos, Yoshitomi, Osaka, Japan) intravenously without taking any standard diet. Although there were no clinical signs suggestive of recurrence of Crohn's disease, he intermittently experienced palpitation without chest pain in July 1994.

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His physical findings were normal except for deformity of fingernails. The surface of the nails was rough and wavy (Fig 1a). A plain chest X-ray film revealed neither cardiomegaly nor abnormalities in the lung field. A double-contrast study of the small intestine showed eccentric deformities in the middle of the small intestine, but there were no active intestinal lesions (Fig 2). While an electrocardiogram identified neither arrhythmia nor abnormalities suggestive of cardiomyopathy, echocardiography revealed a slightly decreased contraction with an ejection fraction of 45%.

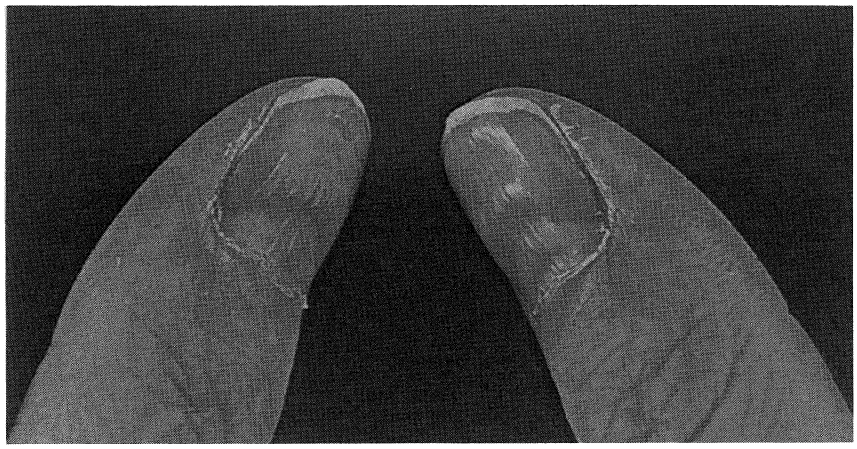

Fig 1a. Thumbnails of the patient prior to selenium supplementation. The nails are rough and wavy.

Laboratory data revealed a slight increase of C-reactive protein (1.0 mg/dl) and a positive fecal occult blood. Liver and thyroid functions were all within normal limits. Creatine phophokinase was not increased. However, analyses of trace minerals showed a marked decrease of serum selenium concentration (0.8 μg/dl, normal range ; 9.8 - 16.0 μg/dl). Serum glutathione peroxidase activity was also decreased (97 IU/l, normal range ; 171 - 285 IU/l). Serum concentrations of other trace minerals were normal (copper ; 90 μg/dl, normal range ; 78-131 μg/dl) or slightly low (iron ; 45 μg/dl, normal range ; 55-193 μg/dl, zinc ; 63 μg/dl, normal range ; 65-110 μg/dl). Based on these clinical and laboratory findings, a diagnosis of selenium deficiency was made.

His serum selenium concentration increased (3.0 μg/dl) after oral selenium supplementation for seven days (100 μg/day of selenite). Because his serum selenium concentration decreased to 0.9 μg/dl in February 1995, selenium supplementation was carried out again. He was administered 50 or 100 μg/day of selenite. In addition, 500 kcal/day of Harmonic-M (Yoshitomi, Osaka, Japan) and 400 kcal/day of Enterued (Terumo, Tokyo, Japan) were given for the management of Crohn's disease, because both formulas contain higher amounts of selenium than Elental. Under this management, he received 74 μg/day of selenium for 47 days and 114 μg/day for 14 days. After the supplementation, both the serum selenium concentration and serum glutathione peroxidase activity returned to their normal ranges (9.8 μg/dl, and 295 IU/l, respectively) (Fig 3). The patient's palpitation also disappeared, the deformities

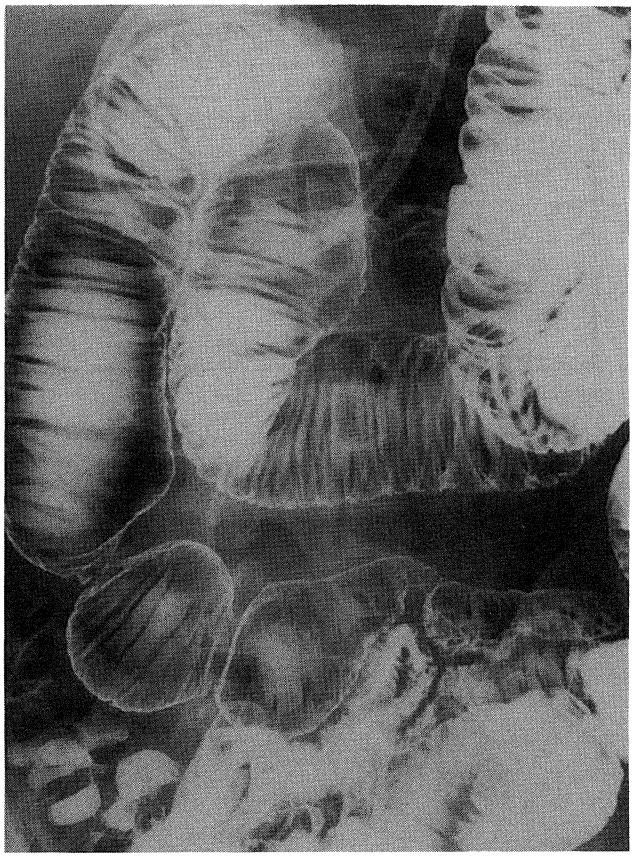

Fig 2. Double-contrast study of the small intestine in August, 1994 reveals some eccentric deformities in the middle of the small intestine. Active intestinal lesions are not observed.

in his fingernails improved (Fig 1b), and the ejection fraction increased (53%). Since then, his selenium concentration has been carefully monitored with periodical selenium supplementation.

DISCUSSION

Selenium is an essential trace element and is included as a component of glutathione peroxidase, an enzyme which protects membrane structures by detoxifying oxygen species. Various clinical symptoms, such as cardiomyopathy, muscle pain and weakness, erythrocyte macrocytosis, and nail whitening, have been reported in association with selenium deficiency.[7] Cardiomyopathy is a particularly serious manifestation and it occasionally contributes to a fatal outcome.[8]

Our patient was diagnosed as having selenium deficiency with deformities in his fingernails and decreases in his serum selenium concentration and serum glutathione peroxidase activity. These physical and laboratory changes were improved by selenium supplementation. His palpitation might also be

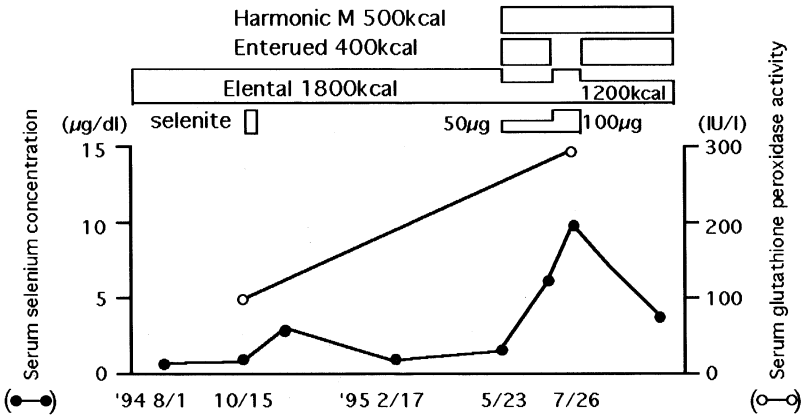

Fig 3. Serial changes in selenium concentration and glutathione peroxidase activity of the case. Closed circles indicate selenium concentrations and open circles indicate glutathione peroxidase activities.

Fig 1b. The rough and wavy changes in the nails have improved after selenium supplementation.

attributable to possible cardiomyopathy induced by selenium deficiency, since the symptom disappeared after selenium supplementation.

Because the selenium is ubiquitous in the diet, a deficiency in this mineral rarely occurs in general, except in some specific geographic areas with a low selenium content in the soil. However, total parenteral nutrition and exclusive enteral nutrition, which contain little selenium, may induce selenium deficiency.[4,6] The selenium contents of commercially available enteral diets are shown in Table 1.[9] The recommended dietary allowance (RDA) of selenium has been established to be 55-70 μg/day.[10] None of the available formulas is sufficient for the advised range of selenium intake if these are the only nutritional source. Our patient had been receiving 1800 kcal/day of Elental with avoidance of normal food for approximately two years. His selenium intake was 2.9 μg/day. This dose was strikingly lower than the RDA.

Depletion of blood selenium levels in patients with Crohn's disease has been previously reported and the decrease has been explained by poor intake

TABLE 1. Selenium content in commercially available enteral formulas

	Product	Selenium content* μg/2000 kcal
Elemenoal diet	Elental	3.2
Semi-elemental diet	Enterued	55.4
	Twinline	20.6
Polymeric diet	Ensure Liquid	14.6
	Clinimeal	18.6
	Besvion	26.2
	Harmonic-M	45.4

*The values were calculated from the data reported by Tanaka *et al*[9]

and/or malabsorption.[11,12] On the other hand, reduction of the total body burden of selenium induced by a large amount of bleeding and long-term enteral nutrition supplying less selenium than the RDA seem to have been the cause of selenium deficiency in our patient. Our case suggests that selenium status should be carefully monitored in patients with Crohn's disease who are being treated with long-term enteral nutrition.

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