

Brown Bowel Syndrome that Developed after Total Gastrectomy – A Case Report –

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The brown bowel syndrome (BBS) is an uncommon disorder, which is characterized by brown pigmentation of the intestine due to the accumulation of lipofuscin in the smooth muscle cells. Vitamin E deficiency has generally been considered as the cause of this malady. BBS has been reported in a wide variety of malabsorptive diseases involving the pancreas, liver and gastrointestinal tract. We report here on a case of brown bowel syndrome that occurred in a 73-year-old man who had undergone total gastrectomy 11 years ago for gastric adenocarcinoma. He has complained about intestinal obstructive symptoms for several years, and these symptoms were recently aggravated. He showed a low serum concentration of total protein, albumin and cholesterol, and he had been treated for megaloblastic anemia due to vitamin B12 and folate deficiency several months ago. The resected small bowel showed lipofuscin deposition in the muscle layer of the intestine and large vessels. The electron microscopic examination revealed multiple electron dense lipofuscin deposits with irregular shapes and sizes in the cytoplasm.

Key Words : Lipofuscin; Ceroid; Enteropathy; Postgastrectomy syndrome

The brown bowel syndrome (BBS) is also called lipofuscinos or ceroid enteropathy, and this is an uncommon disorder that is characterized by brown pigmentation of the intestine, which is due to the accumulation of lipofuscin in the smooth muscle cells of the intestinal tract. It may be related with vitamin E deficiency and it has been reported in patients with a wide variety of malabsorption syndromes that are associated with diseases of the pancreas, liver and gastrointestinal tract, such as chronic pancreatitis, fibrocystic disease of the pancreas, cirrhosis, congenital biliary atresia, diverticuli, peptic ulcer, hypertrophic gastritis, Crohn's disease, Whipple's disease, intestinal lymphangiectasia, protein-losing gastroenteropathies, nontropical sprue, idiopathic steatorrhea, non-specific chronic diarrhea and Friedreich's ataxia, etc.¹ The surgical operations on the gastrointestinal tract can cause malabsorption, vitamin E deficiency and the resulting BBS. In fact, a case of myometrial lipofuscinosis, after intestinal bypass surgery for obesity 19 years ago, had been reported.²

Total gastrectomy usually causes various degrees of malnutrition, which is considered as an unavoidable consequence of this surgery.^{3,4} But BBS has not been reported in connection with

gastrectomy. We reported here on a case of brown bowel syndrome that developed in a patient who had undergone total gastrectomy 11 years ago for gastric adenocarcinoma.

CASE REPORT

A 73-year-old man was admitted for vomiting, epigastric pain and abdominal distention for several days. He had undergone total gastrectomy and gastrojejunostomy with Hunt-Laurence pouch reconstruction 11 years ago due to gastric adenocarcinoma, stage III (T3N1M0). He was treated with radiotherapy for the next 7 months. He had intermittently suffered from gastrointestinal symptoms such as indigestion, abdominal pain and tenderness for 8 years. The symptoms have been aggravated for 5 years and partial intestinal obstruction was suspected; he was treated with conservative management. The simple abdomen, erect and supine views that were checked 9 months ago showed retained fecal material in the entire colon with a normal bowel gas pattern. In addition, the gastroenteroscopy done at that time showed food material in the jejunal pouch, which

suggested an intestinal passage disturbance. He also had been treated for megaloblastic anemia due to vitamin B12 and folate deficiency 5 months ago.

The body weight and height were 50 kg and 165 kg, respectively (body mass index: 18.4). On the physical examination, he showed direct abdominal tenderness and slightly decreased bowel sounds. The laboratory tests showed normal levels of BUN, creatinine, glucose, sodium and potassium. The hemoglobin level was 11.6 g/dL and the white blood cell and platelet counts were normal. The serum total protein was 5.9 g/dL (normal: 6.6-8.4), the albumin was 2.7 g/dL (normal: 3.7-5.2) and the cholesterol was 100 mg/dL (normal: 130-250). The serum

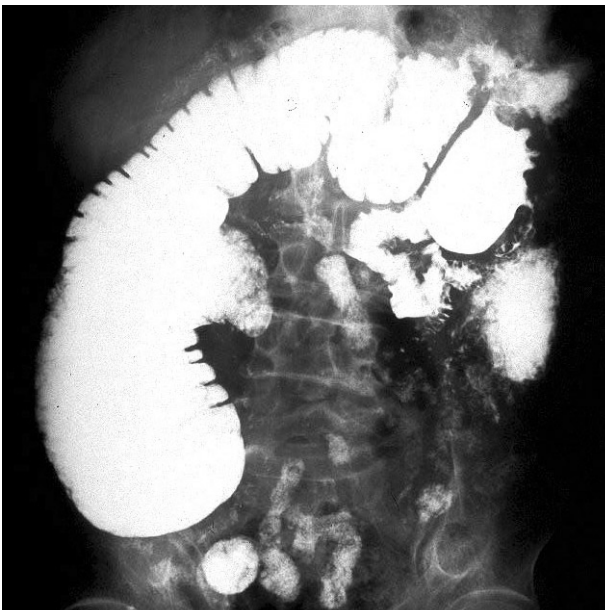


Fig. 1. Small bowel series revealed markedly dilated intestinal loops with multiple narrowings.

vitamin E level was not measured.

A simple abdomen showed multiple air-fluid levels with a stepladder appearance that suggested intestinal obstruction. A small bowel series showed a markedly dilated jejunum with several constrictions (Fig. 1). An abdominal sonography exam showed a dilated duodenal third portion that was filled with food material. On laparotomy, a fibrous band obstructed the short segment of the bowel loop at the mid portion of the jejunum, about 50 cm distal to the gastrojejunostomy site. A segmental jejunal resection with end-to-end anastomosis and adhesiolysis was then done.

The resected bowel was 12 cm in length. There was a focal dense fibrotic thickening at the mesenteric fat tissue of the middle portion of the bowel. The mucosa was grossly unremarkable. Microscopically, the muscularis propria showed focal necrosis of the muscle cells with inflammatory infiltrates that were predominantly eosinophils, and adjacent mesenteric fibrosis was also seen (Fig. 2). Most of the smooth muscle cells of the muscularis propria contained large amounts of lipofuscin, which was stained with periodic acid schiff (PAS) stain (Fig. 3). Lipofuscin deposition was also noted at the muscle layer of the large vessels, but not in the muscularis mucosae. The mucosa showed no atrophy or chronic inflammation. Tlectron microscopic examination was done with the paraffin embedded tissue. There were multiple electron dense lipofuscin pigment granules with irregular shapes and sizes in the cytoplasm of the muscle cells (Fig. 4).

DISCUSSION

The BBS is a kind of morphologic manifestation of chronic

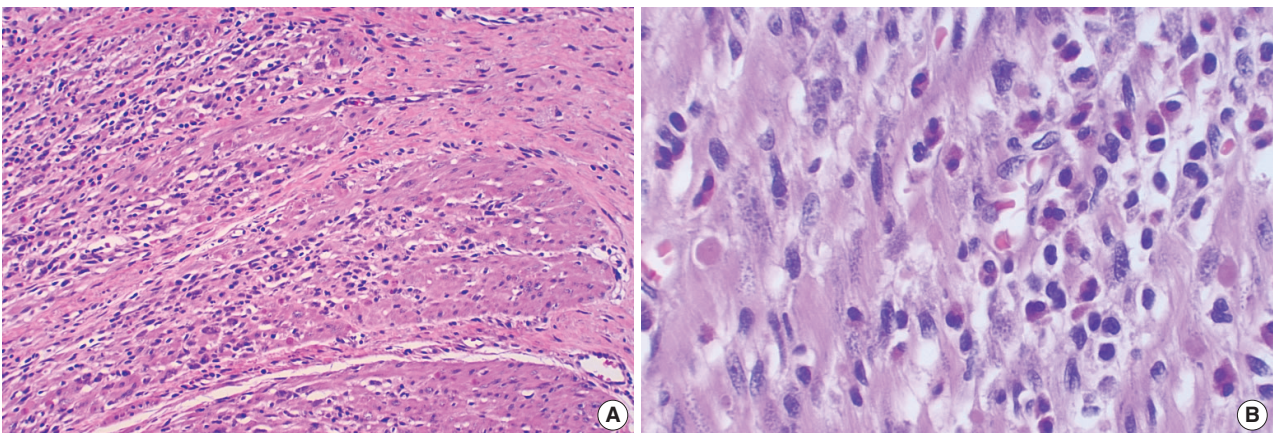


Fig. 2. Resected jejunum showed focal inflammatory infiltrates, predominantly eosinophils, with necrosis of muscle cells and adjacent mesenteric fibrosis (A, B).

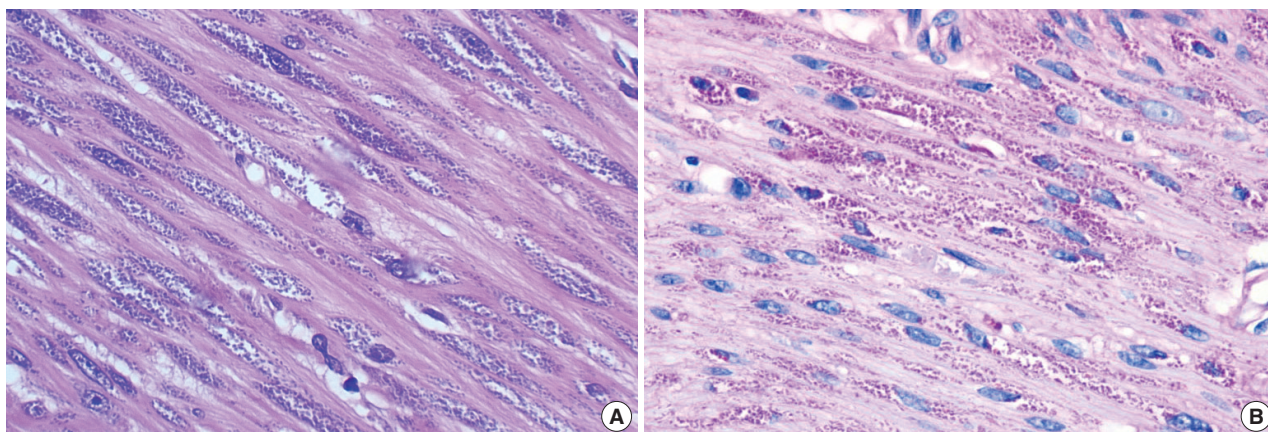


Fig. 3. Smooth muscle cells of muscle layer of the jejunum demonstrating abundant lipofuscin granules in the cytoplasm (A) which are positively stained with PAS (B).

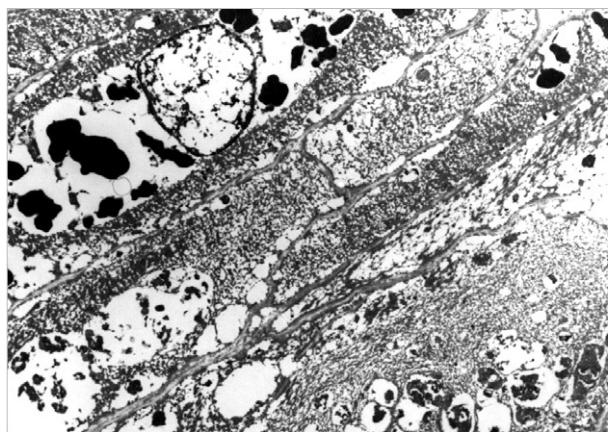


Fig. 4. Ultrastructural study showed multiple electron dense lipofuscin pigment particles with irregular shapes and sizes in the cytoplasm of muscle cells ($\times 6,800$).

malnutrition, which is characterized by lipofuscin pigment accumulation in the smooth muscle cells of the gut. Since Pappenheimer and Victor⁵ first suggested that BBS is caused by vitamin E deficiency, many investigators have reported vitamin E is associated with lipofuscinosis of the intestinal smooth muscles in both animals and humans.^{6,7} Vitamin E is a strong antioxidant and it prevents the mitochondrial membrane damage by free radicals that are formed during oxidative phosphorylation in the mitochondria. The free radicals are not oxidized by vitamin E, but by the phospholipids of the mitochondrial membranes when vitamin E is deficient. As a result, the degraded membranous components of the mitochondria produce lipofuscin in the smooth muscle cells of the gut.⁸ In BBS, lipofuscin pigmentation is also observed in the smooth muscle cells of other organs such as the gallbladder, urinary bladder, uterus and blood

vessels. However, the muscularis mucosa of the gut and the erector pili muscle of the hair follicles are usually spared from lipofuscinosis. It's been suggested that the pigment deposition might preferentially affect smooth muscle cells that have a strong functional activity.^{1,9}

Total gastrectomy, with or without pouch reconstruction, usually results in various degrees of malnutrition as a late complication. The possible causes of it are an inadequate caloric intake, bacterial overgrowth due to the absence of gastric acid, the relative pancreatic enzyme insufficiency due to inadequate mixing of pancreatic enzymes with nutrients, the changes in the mucosa of the small intestine and a shortened small intestinal transit time.^{3,4} The malabsorption of protein and fat produces hypoproteinemia, hypoalbuminemia and hypocholesterolemia with steatorrhea. As a consequence of reduced absorption of fat, lipid-soluble vitamins such as vitamin A, D, E and K are also poorly absorbed and a systemic deficiency can develop.

The BBS is usually found incidentally in those patients who have had a wide variety of malabsorption diseases for a long time. Lipofuscin is not directly toxic to myofibrils, and the bowel function is maintained with the remaining myofibrils. However, the loss of the mitochondrial energy supply may impair muscle function, like the mitochondrial myopathy of skeletal muscles, with an accumulation of lipofuscin.¹⁰ In rare cases, intestinal pseudo-obstructions with dilatation of the small and large intestines have been reported.^{9,11-14} In our case, although the dilatation of the jejunum was regarded as a direct result of a fibrous band of mesenteric fat tissue, the passage disturbance could possibly have been combined with the atonic smooth muscles of the muscularis propria. Considering the malnutrition state of our case with the patient's low body mass index and the

low serum level of total protein, albumin and cholesterol, the vitamin E deficiency may have caused lipofuscin deposition in the muscles cells, although the serum vitamin E level was not measured.

Vitamin E supplementation may be effective to improve bowel function, especially during the early stages of the disease, and it may prevent further progression of lipofuscinosis. Therefore, vitamin E supplements should be given whenever vitamin E deficiency with malabsorption is suspected.

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