



Therapeutic Lymphatic Embolization in Pediatric Primary Intestinal Lymphangiectasia

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Primary intestinal lymphangiectasia (IL) can cause leakage of lymphatic fluids into the gastrointestinal tract, eventually leading to protein-losing enteropathy. A 15-year-old male patient, whose disease began at the age of 8 years, recently felt worsening general weakness. After diagnosing abnormal lymphatic lesions in the duodenum through endoscopy with biopsy and contrast-enhanced magnetic resonance lymphangiography, glue embolization of the leaking duodenal lymphatic channel was successfully performed. This procedure is typically reserved for adult patients, although as shown in this case, it can be properly performed in children. His serum albumin level was initially 1.5 g/dL, but elevated to 5.0 g/dL after two sessions of lymphatic embolization. Accordingly, we suggest that embolization could potentially be considered a first-line treatment for focal lesions of primary intestinal IL.

Key Words: Primary intestinal lymphangiectasia, focal lymphangiectasis, duodenum, protein-losing enteropathy, children, lymphatic embolization

INTRODUCTION

Protein-losing enteropathy is characterized by an excessive loss of serum protein and lymphocytes into the gastrointestinal tract. Its symptoms include generalized edema, general weakness, and diarrhea. Serum albumin levels, immunoglobulin levels, and lymphocyte counts of patients with protein-losing enteropathy are decreased under normal limits,¹ while alpha-1 antitrypsin clearance is elevated in stool because of enteral protein loss.²

Primary intestinal lymphangiectasia (IL) is one of a few dis-

eases that can cause protein-losing enteropathy. Endoscopy with biopsy is the choice of diagnosis. Its treatment includes dietary modifications, medication, and surgical correction depending on the severity of symptoms. With advances in lymphatic imaging techniques and lymphatic interventional procedures, some lymphatic disorders can be radiologically diagnosed and even treated. Herein, we present a case of intractable focal duodenal IL in a 15-year-old male patient who was successfully treated with two rounds of lymphatic embolization using glue.

CASE REPORT

A 15-year-old male patient visited our outpatient clinic for a second opinion on symptoms of generalized edema in January 2020. He had been previously diagnosed with primary IL in the duodenum a few years earlier at another hospital where supportive therapies, including albumin replacement and parenteral nutritional support, were applied to relieve the edema. In November 2018, the patient reported worsening symptoms to which everolimus and later sirolimus were applied; however, both treatments failed to have a positive impact on symptom progression. The patient had no other prior medical reports or any prior surgeries. Octreotide had never

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been tried.

On admission, his symptoms were general weakness, weight loss, and vomiting. His laboratory tests revealed hypoalbuminemia (albumin 1.9 g/dL), electrolyte imbalance (Na 132 mmol/L, K 2.7 mmol/L, Cl 104 mmol/L), hypomagnesiemia (Mg 1.2 mg/dL), and hypocalcemia (ionized calcium 0.92 mmol/L). Alpha-1 antitrypsin levels in stool were estimated at 167.66 mg/mL (normal range <100 mg/mL). Echocardiography and abdomen computed tomography indicated nothing of particular interest, whereas contrast-enhanced magnetic resonance lymphangiography (Fig. 1) revealed abnormal lymphatic flow toward the second portion of the duodenum. Esophagogastroduodenography and capsule endoscopy revealed focal IL around the minor papilla in the second portion of the duodenum. Results did not show any fluid collections in the other third spaces (e.g., pleural space and retroperitoneum space).

Two treatment options, surgery or lymphatic embolization, were extensively discussed in multi-departmental conferenc-

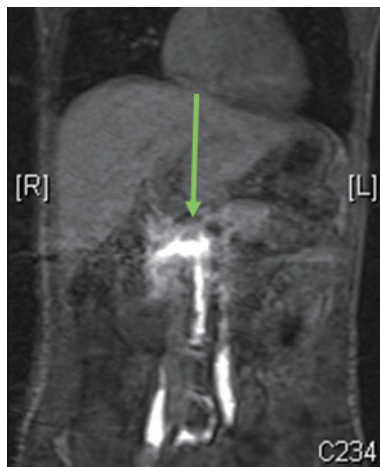


Fig. 1. Contrast enhanced MR lymphangiography image demonstrating an abnormal lymphatic structure between the cisterna chyli and the duodenum. Dynamic images (not shown here) revealed probable leakage into the duodenum.

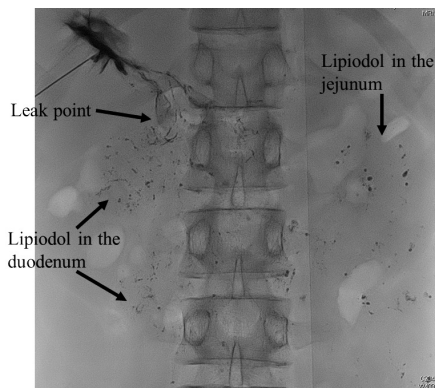
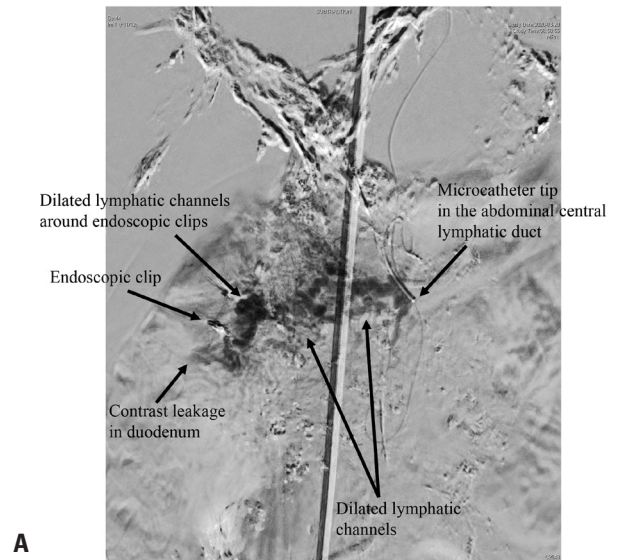


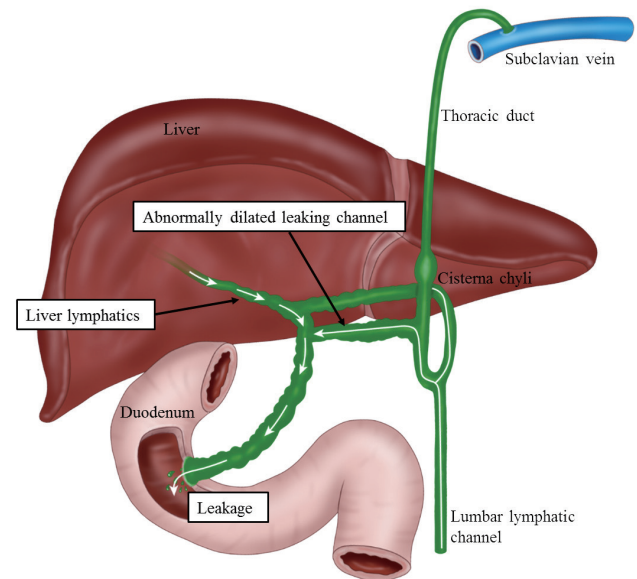
Fig. 2. Lymphangiography via liver lymphatics showing leakage of lipiodol droplets into the duodenal lumen.

es. Surgical resection required pylorus-preserving pancreatoduodenectomy as focal changes were located near the minor papilla. From a surgeon’s point of view, this kind of major resection is rarely performed in this age group due to the risk of poor surgical outcomes. Therefore, a less invasive lymphatic intervention was chosen.

To investigate the anatomic details and lymphatic flow dynamics, lymphangiography was first performed through the inguinal lymph node, and hepatic lymphatics were depicted using ultrasound guidance. The intra-nodal lymphangiogram



A



B

Fig. 3. A lymphangiographic image performed on the patient in this case and an anatomical illustration for understanding. (A) Lymphangiographic image showing leaking dilated and tortuous lymphatic channel(s) converging to endoscopic clips in the duodenal second portion. Selective embolization was performed using diluted glue (not shown). (B) An illustration of abnormal lymphatic channels around the cisterna chyli and the duodenum causing lymphatic leakage.

showed leakage of Lipiodol into the second portion of the duodenum. Liver lymphangiography was performed using a 23-G needle placed in the periportal space and revealed contrast agent leakage into the same locations identified by intranodal lymphangiography (Fig. 2).

The first embolization was attempted via the liver lymphatics based on the short distance between the needle tip and the leakage site (Fig. 2). This procedure was partially successful. The patient's diarrhea decreased, and his albumin level elevated from 1.5 to 2.2 g/dL. However, hypoalbuminemia with generalized edema persisted.

After another multidisciplinary discussion, we decided to attempt a second round of lymphatic embolization. The thoracic duct was accessed via a retrograde approach from the left subclavian vein using a 5-Fr catheter and a 1.7-Fr microcatheter, advancing down to one of the lumbar lymphatic channels past the cisterna chyli. Lymphangiography was then performed using an iodine contrast agent to evaluate lymphatic drainage. The lymphangiogram demonstrated leakage from an engorged, tortuous lymphatic channel originating from the cisterna chyli into the duodenal lumen around the endoscopic clip previously deployed for guidance (Fig. 3). Embolization was successfully performed using diluted glue (1:3) and coils.

After the second treatment, the patients' albumin level increased, remaining stable at 3.7 g/dL. He could tolerate fat-rich foods without experiencing generalized edema. Eight months later, he visited our outpatient clinic for a regular checkup at which point his albumin level had further increased to 5.0 g/dL (Supplementary Fig. 1, only online). His nutritional status had also improved. His hemoglobin level had increased from the initial 8.8 to 15.2 g/dL, and his body weight had increased from 46 to 56.5 kg. His alpha-1 antitrypsin level was also normalized at 26 mg/mL.

The medical records of the patients were reviewed retrospectively with the approval of the Clinical Research Ethics Committee, and informed consent was obtained from the patient regarding the reporting and publication of this case report (IRB File No. SMC 2020-05-166-01).

DISCUSSION

This case report highlights a new therapeutic approach for treating primary IL based on the treatment experience of a 15-year-old male patient showing no improvement after initial medical therapy. Lymphatic embolization was chosen over surgery because of the high risk of surgical complications. After two lymphatic embolization interventions, the patient had completely recovered from the disease.

Dietary modification limiting long-chain triglycerides is a conventional treatment for protein-losing enteropathy caused by IL. Medical treatment with propranolol, octreotide, or im-

munosuppressants has been suggested, although their efficacy remains controversial. When IL is localized and refractory to medical treatment, surgery can be considered. However, surgery is limited if IL is too extensive or if it is surrounded by vital organs. Since, IL extent and location are major determinants when choosing a treatment option, MRL, lymphangiography, and endoscopy can provide essential information with which to make the final decision.^{3,4} In the current case, after the patient had undergone an extensive diagnostic evaluation, he was finally diagnosed with focal leakage of duodenal lymphatic channels.

Interventional treatments have become popular for the treatment of lymphatic disorders based on advantages of shorter hospital stays and lower invasiveness, compared to surgery. For example, embolization of postoperative lymphatic leakage (chylothorax) has largely replaced the older method of thoracic duct ligation.⁵ We assumed that this technique could also be applied to focal IL in our case. After two rounds of lymphatic embolization for focal IL in the duodenum, the patient's symptoms and laboratory results improved during the 8 months following the second procedure.

This study reports short-term recovery from focal duodenal IL in a case study of a child treated by lymphatic embolization. These data suggest that lymphatic embolization is another possible treatment option for this subset of IL. Given the success in this case report, lymphatic embolization could be a viable option when surgical resection or ligation is infeasible due to patient age or a likelihood of postoperative complications.

AUTHOR CONTRIBUTIONS

Conceptualization: Dongho Hyun and Mi Jin Kim. **Data curation:** Yiyoun Kwon and Eun Sil Kim. **Formal analysis:** all authors. **Investigation:** Yiyoun Kwon and Eun Sil Kim. **Methodology:** Yiyoun Kwon and Yon Ho Choe. **Project administration:** Yiyoun Kwon and Yon Ho Choe. **Resources:** Yiyoun Kwon and Yon Ho Choe. **Software:** Yiyoun Kwon and Dongho Hyun. **Supervision:** Dongho Hyun and Mi Jin Kim. **Validation:** Dongho Hyun and Mi Jin Kim. **Visualization:** Dongho Hyun and Mi Jin Kim. **Writing—original draft:** Yiyoun Kwon. **Writing—review & editing:** Dongho Hyun and Mi Jin Kim. **Approval of final manuscript:** all authors.

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