

[ CASE REPORT ]

## Efficacy of a Short-term Six-food Elimination Diet and Reintroduction Therapy in Pediatric Eosinophilic Gastroenteritis

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### Abstract:

A 13-year-old boy presented to the hospital with a 3-month history of repeated vomiting and abdominal pain. Results of esophagogastroduodenoscopy revealed a diagnosis of eosinophilic gastroenteritis (EGE). We initiated a short-term six-food elimination diet (SFED) and reintroduction therapy over five days. On the third day of SFED, the patient's abdominal symptoms completely disappeared. However, he experienced unbearable abdominal pain six hours after the reintroduction of milk and peanuts. His symptoms remain completely controlled at present after eliminating milk and peanut products. The SFED and reintroduction therapy for EGE may be effective even for short-term treatments over a five-day period.

**Key words:** eosinophilic gastroenteritis, eosinophilic esophagitis, 6-food elimination diet therapy, reintroduction therapy, pediatric

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### Introduction

Eosinophilic gastroenteritis (EGE) is defined as the presence of gastrointestinal symptoms and eosinophilic infiltration involving multiple intestinal segments. Eosinophilic esophagitis (EoE) is defined as eosinophilic infiltration of the esophageal mucosa without involvement of other intestinal segments (1, 2). Established treatments for EoE include proton pump inhibitors (PPIs), topical steroids (oral fluticasone), and elimination diet therapy (3). However, no treatment protocol has been established for EGE (4-6).

Elimination diet therapy for EoE is shown to be effective, even in children (6-8); however, it is not an established treatment for EGE (4, 5). After remission is achieved with elimination diet therapy, foods are reintroduced sequentially to identify specific food triggers, but this method has not been standardized for the treatment of either EoE or EGE (9).

We previously reported a case of pediatric EoE that was effectively treated with a short-term six-food elimination diet (SFED) and reintroduction therapy (10). We herein report

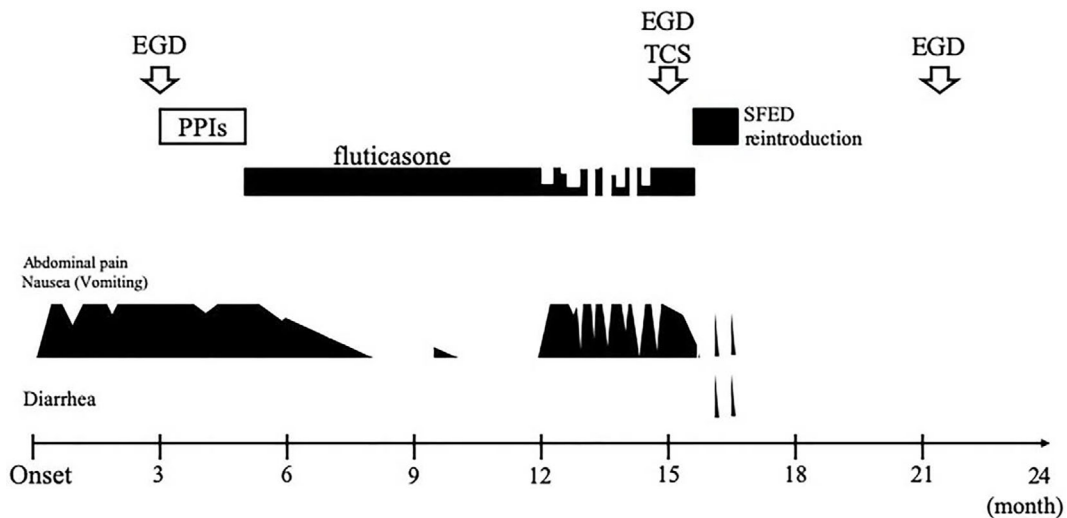
the case of a pediatric patient with EGE who was successfully treated with a short-term SFED and reintroduction therapy.

### Case Report

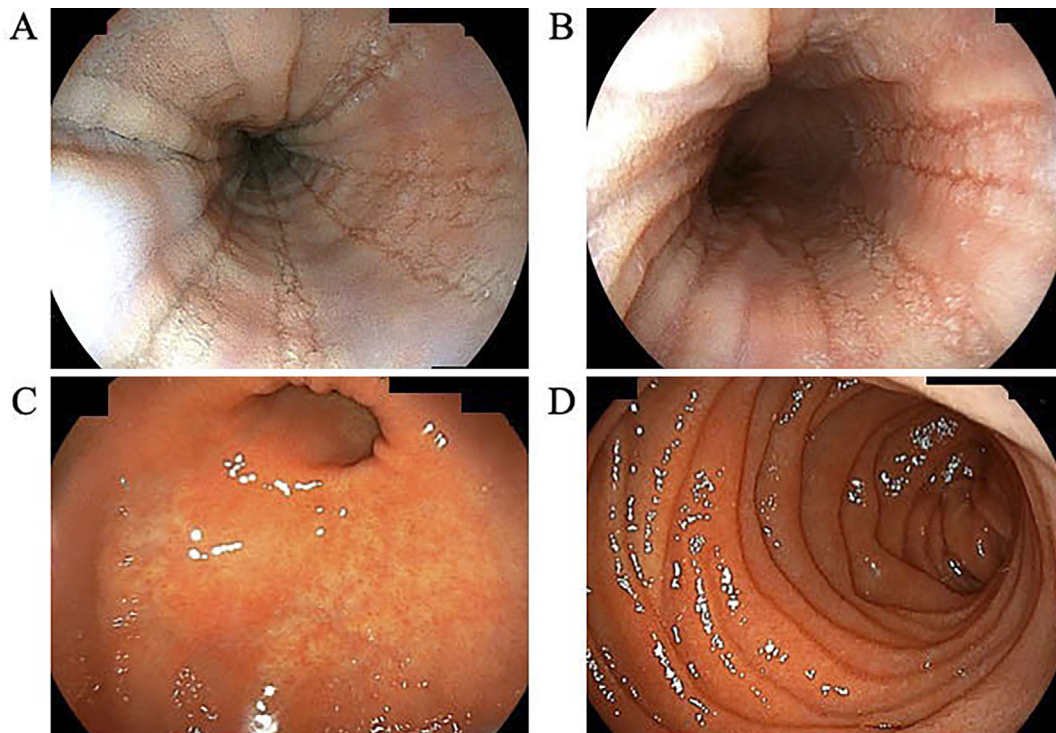
A 13-year-old boy presented to another hospital with a 3-month history of repeated vomiting and abdominal pain after breakfast. He had tomato allergies but no bronchial asthma, atopic dermatitis, or allergic rhinitis. When eating tomatoes at the age of eight, itching around the lips appeared, and since then, he avoided eating it completely. Other than that, his medical history was unremarkable. His growth and development were in the normal range. There was no apparent infection before the appearance of abdominal symptoms. Fig. 1 illustrates the patient's clinical course.

Esophagogastroduodenoscopy (EGD) revealed linear furrows, esophageal rings, and white exudates in the esophagus and no abnormal findings from the stomach to duodenum at three months from the onset of abdominal symptoms (Fig. 2). A rapid urease test at the time of EGD was negative. The fecal *Helicobacter pylori* antigen test was also

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**Figure 1.** Clinical course. EGD: esophagogastroduodenoscopy, TCS: total colonoscopy, PPIs: proton pump inhibitors, SFED: 6-food elimination diet



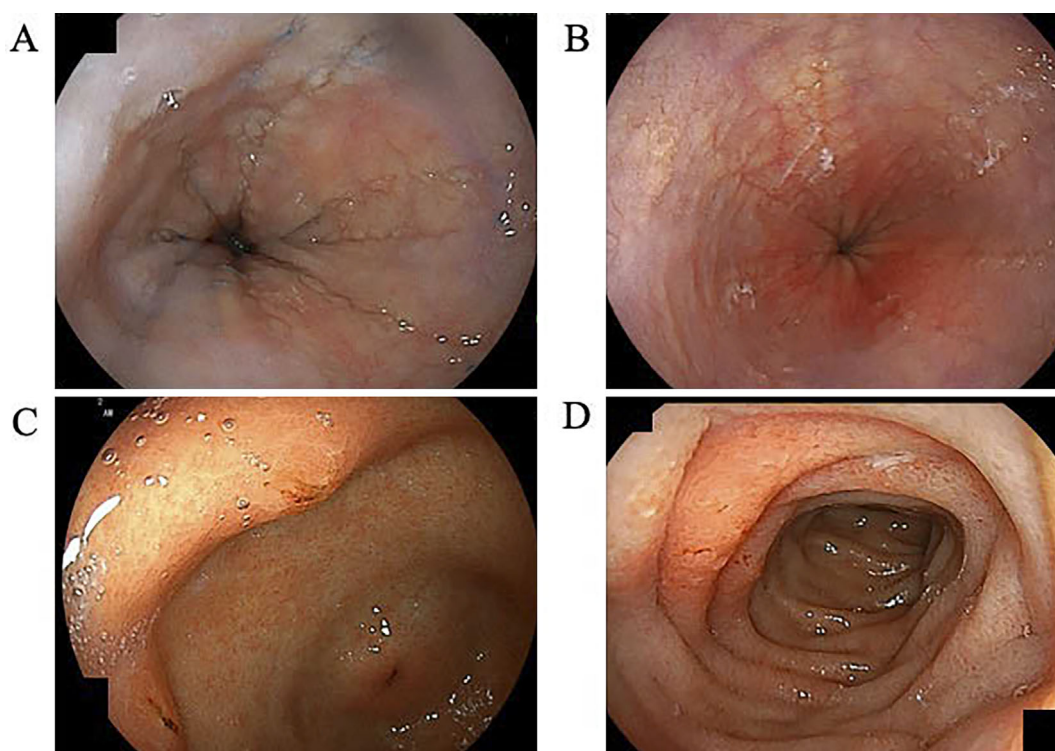
**Figure 2.** Initial esophagogastroduodenoscopy findings show linear furrows, esophageal rings, and white exudates in the esophagus (A, B) with no abnormal findings from the stomach (C) to the duodenum (D).

negative, and there was no infection with *H. pylori*. A gastric mucosal biopsy showed no apparent atrophy. Esophageal biopsy specimens only exhibited up to 205 eosinophils per high-powered field (HPF), and biopsies from the stomach and duodenum showed no more than 15 eosinophils/HPF; therefore, he was diagnosed with EoE (11).

However, neither his clinical symptoms nor endoscopic or pathological findings improved even after 8 weeks of treatment with proton pump inhibitors (PPIs; rabeprazole 20 mg per day). Topical steroid (oral fluticasone; 200 mg twice a day) therapy was administered, improving his clinical symp-

toms. Unfortunately, his symptoms reappeared each time the fluticasone was discontinued or the dosage reduced, so he was unable to stop taking the medication. As his medication adherence declined, the abdominal pain was exacerbated.

Follow-up EGD performed one year after the initial EGD examination revealed that the abnormal esophageal findings were slightly improved, but erosion and edematous changes were present in the stomach and duodenum (Fig. 3). In addition, eosinophils had infiltrated into the esophagus (190/HPF), stomach (135/HPF), and duodenum (239/HPF), and in the duodenum, thickening and fibrosis of the lamina



**Figure 3.** Follow-up esophagogastroduodenoscopy (EGD) findings one year after the first EGD revealed that the abnormal findings in the esophagus had slightly improved (A, B), but erosion and edematous changes in the stomach and duodenum were present (C, D).

propria were not observed, but infiltration of lymphocytes was observed in addition to eosinophils (Fig. 4). By this time, topical steroid (oral fluticasone; 200 mg twice a day) therapy had been performed for 2 weeks with good adherence.

The macroscopic findings were normal on total colonoscopy, which was performed concurrently with EGD (Fig. 5), but the pathological findings revealed that the eosinophilic infiltration exceeded the diagnostic criteria (terminal ileum, 106/HPF; cecum, 191/HPF; ascending colon, 118/HPF; transverse colon, 88/HPF; descending colon, 90/HPF; sigmoid colon, 167/HPF; rectum, 48/HPF). No findings were suggestive of inflammatory bowel disease. There was almost no lymphocyte or mast cell infiltration and no findings suggestive of inflammatory bowel disease. Abdominal computed tomography showed no intestinal wall thickening but did reveal mesenteric lymphadenopathy and a small amount of ascites. The patient was diagnosed with EGE and admitted to our hospital at one year and three months from the onset of abdominal symptoms (12).

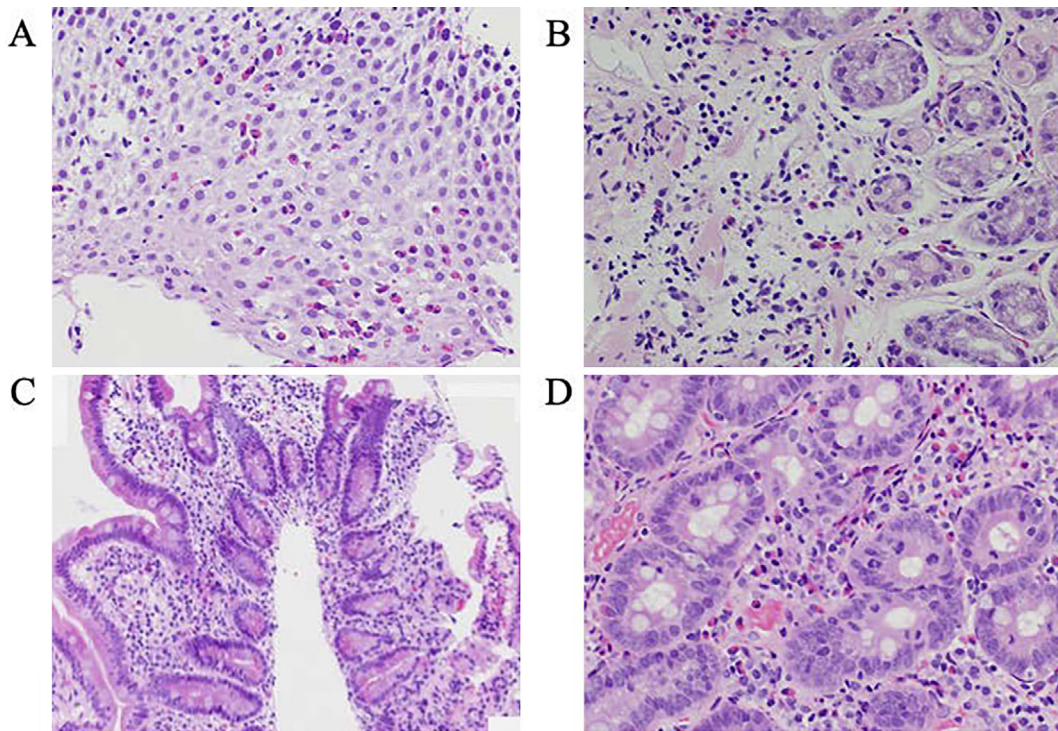
All medications were discontinued upon admission, and we started a food elimination diet therapy. His serum immunoglobulin E (IgE) level was 4,320 IU/mL, and antigen-specific IgE antibodies were positive for eggs, milk, soy, wheat, peanuts, shrimp, and crab (Table). We designed and initiated an SFED including the six major food allergen groups (wheat, milk, soy, peanuts, eggs, and seafood) and reintroduction therapy over a five-day period, according to our previous report (10). No clear standard was set for the

amount of food to be consumed, and the amount was enough to prevent the patient from feeling hungry. The order of food load in the reintroduction therapy was set according to the wishes of the patient. Fig. 6 illustrates the patient's clinical course of SFED and reintroduction therapy.

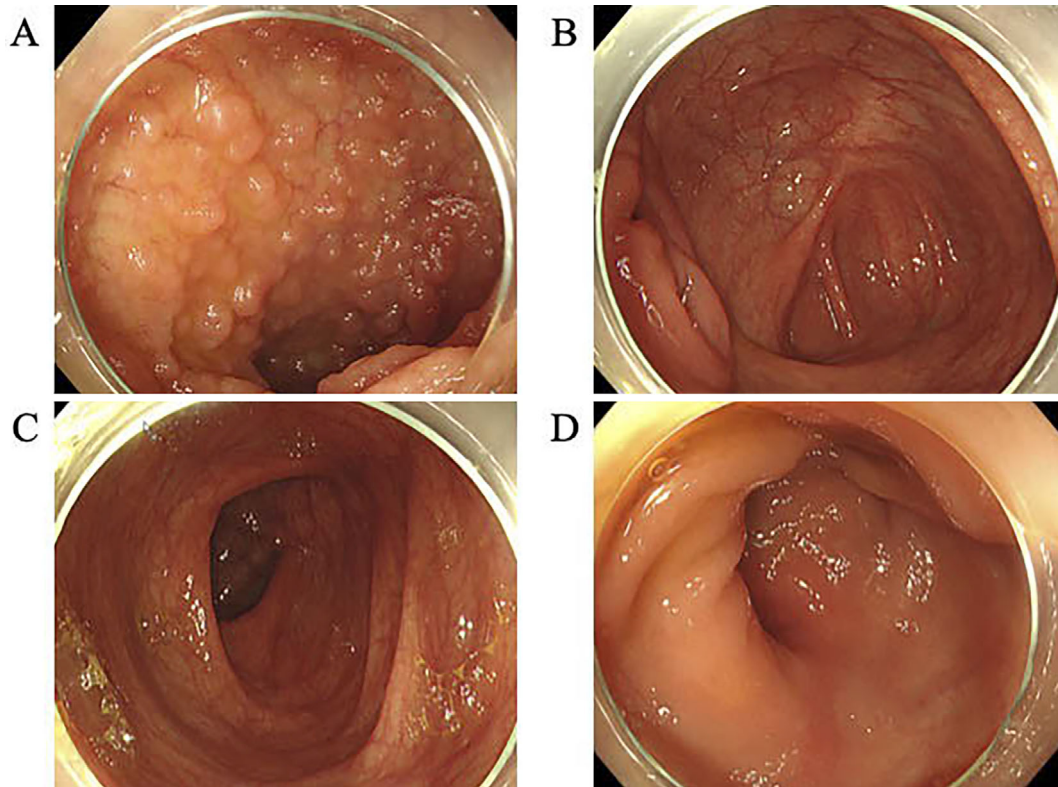
On the third day of treatment, his abdominal symptoms completely disappeared. Soy was initially reintroduced for five days, and his abdominal symptoms did not return. Next, eggs were reintroduced for five days with no significant adverse reaction. However, he developed unbearable abdominal pain 6 h after the reintroduction of milk (0.3 L ingested) and abdominal pain and diarrhea several hours after the reintroduction of peanuts (about 40 tablets ingested). Once these foods were discontinued, his symptoms improved within 24 h. He did not exhibit abdominal symptoms in response to wheat or seafood. Therefore, milk and peanuts were completely eliminated from his diet. The patient has not experienced recurrence since then and receives no pharmacological therapy, remaining completely free of symptoms through the total avoidance of milk and peanuts.

Milk and peanuts had been ingested after the previous hospital visit. Before the abdominal symptoms occurred, he had loved milk and peanuts and consumed large amounts daily. In the past seven months since eliminating these foods from his diet, the patient has been free of epigastric pain, urticaria, and anaphylactic symptoms suggestive of food allergies. He had no issues eating nuts other than peanuts. At 1 year 10 months from the onset of abdominal symptoms, EGD findings demonstrated marked improvement of white





**Figure 4.** Eosinophil infiltration spread to the esophagus and duodenum. Esophageal (A), gastric (B), and duodenal (C, D) biopsy specimens revealed up to 190, 135, 210 and 239 eosinophils per high-powered field, respectively. In the duodenum, thickening and fibrosis of the lamina propria were not observed, but infiltration of lymphocytes was observed in addition to eosinophils. A and C magnification 200 $\times$ ; B and D magnification 400 $\times$ .



**Figure 5.** Total colonoscopy performed simultaneously with EGD showed normal macroscopic findings.

exudates only (Fig. 7). Pathological findings revealed that the eosinophilic infiltration in the esophagus (10/HPF), stomach (32/HPF), and duodenum (2/HPF) was significantly improved. In the stomach, the lamina propria was edematous, and in addition to eosinophils, the infiltration of lymphocytes, plasma cells, and eosinophils (32/HPF) was observed. (Fig. 8).

## Discussion

We herein report a pediatric case of EGE that was improved with the short-term use of an SFED and reintroduction therapy. Few such studies have been performed in adults (13); however, pediatric cases are extremely

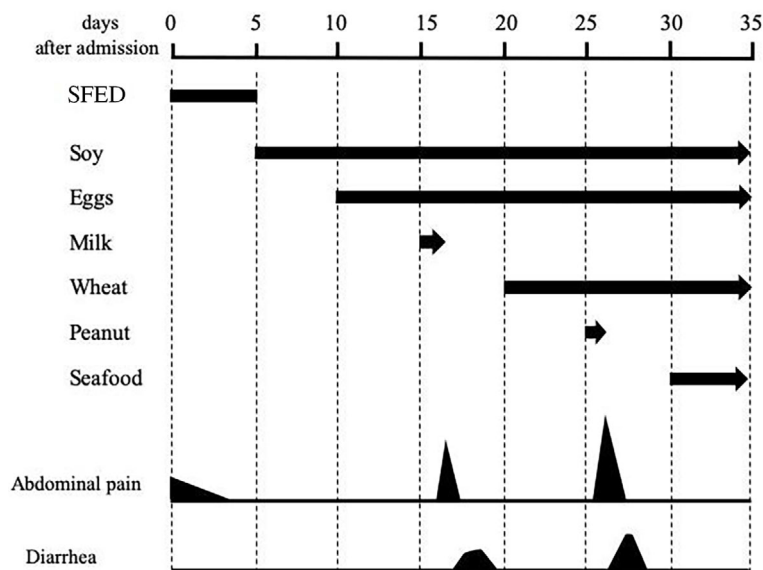
**Table. The Values of Antigen-specific IgEs before 6-food-group Elimination Diet Therapy.**

Egg white	0.62 IU/mL
Egg yolk	0.44 IU/mL
Ovomucoid	0.39 IU/mL
Milk	1.71 IU/mL
Alpha-lactalbumin	1.62 IU/mL
Beta-lactoglobulin	0.89 IU/mL
Casein	0.63 IU/mL
Soy	12.2 IU/mL
Wheat	15.0 IU/mL
Peanut	15.6 IU/mL
Shrimp	2.58 IU/mL
Crab	4.95 IU/mL
Tomato	29.1 IU/mL

rare (14, 15). Similar to our previously reported EoE case (10), a short-term SFED and reintroduction therapy can also be effective treatment for EGE.

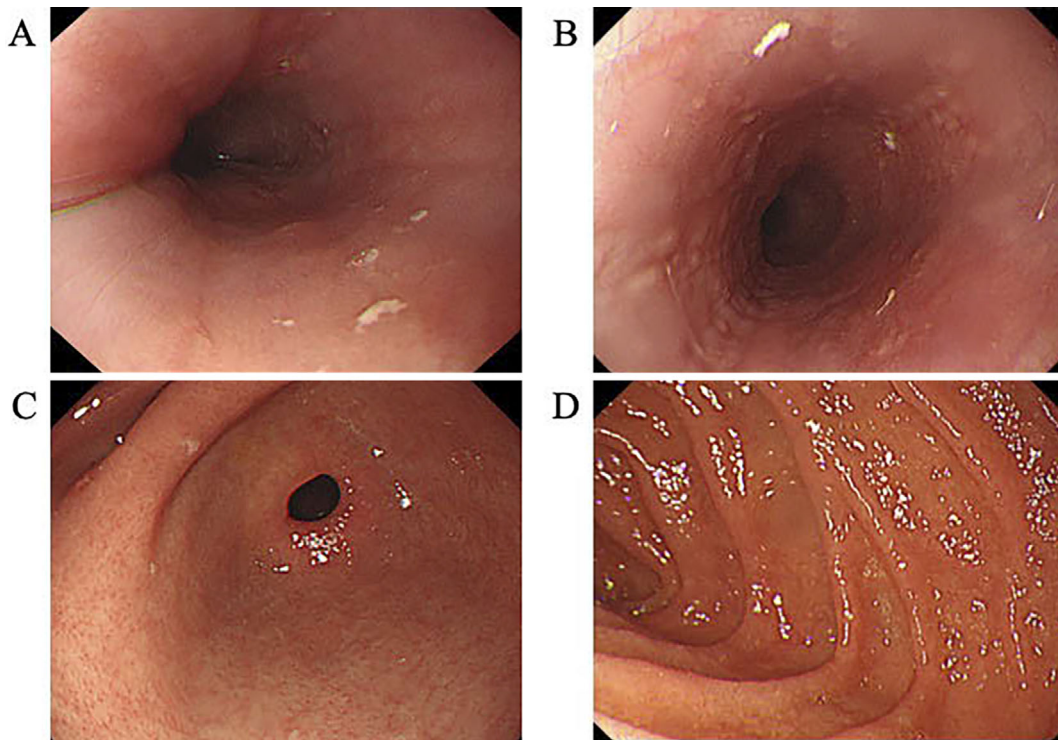
The treatment of EoE typically involves PPIs and topical steroid therapies, and an SFED is administered if no response occurs with traditional therapies (3). An SFED for EoE effectively resolves symptoms in many patients, even in pediatric cases (6, 16). However, no prospective randomized controlled trials have been performed for EGE; therefore, available treatments have not been empirically validated. An SFED, which is associated with a high remission rate in patients with EoE, is not a sufficient treatment for EGE when administered alone (4, 5).

In our case, the food-causing antigens responsible for EGE were milk and peanuts. Milk is the most frequent cause of EoE-associated symptoms (13, 16); however, no consensus exists regarding which food is the most likely cause of EGE. No SFED or reintroduction therapy procedures have been established for EGE (5); however, in our case, we used five days per food antigen as a single course according to the method in our previous report (10). This approach successfully identified the causative foods, indicating that it is possible to identify causative food agents even with a shorter observation period than previously described (13), which has the benefit of shortening the period to identify the causal food antigen and the period of dietary restriction for the patient. For the SFED, depending on the level of damage to the gastrointestinal mucosa, the duration of the SFED may be several weeks to several months. However, because our short-term SFED is effective, assessing the clinical symptoms may be sufficient even if the gastrointestinal mucosal disorder does not completely recover. Conven-

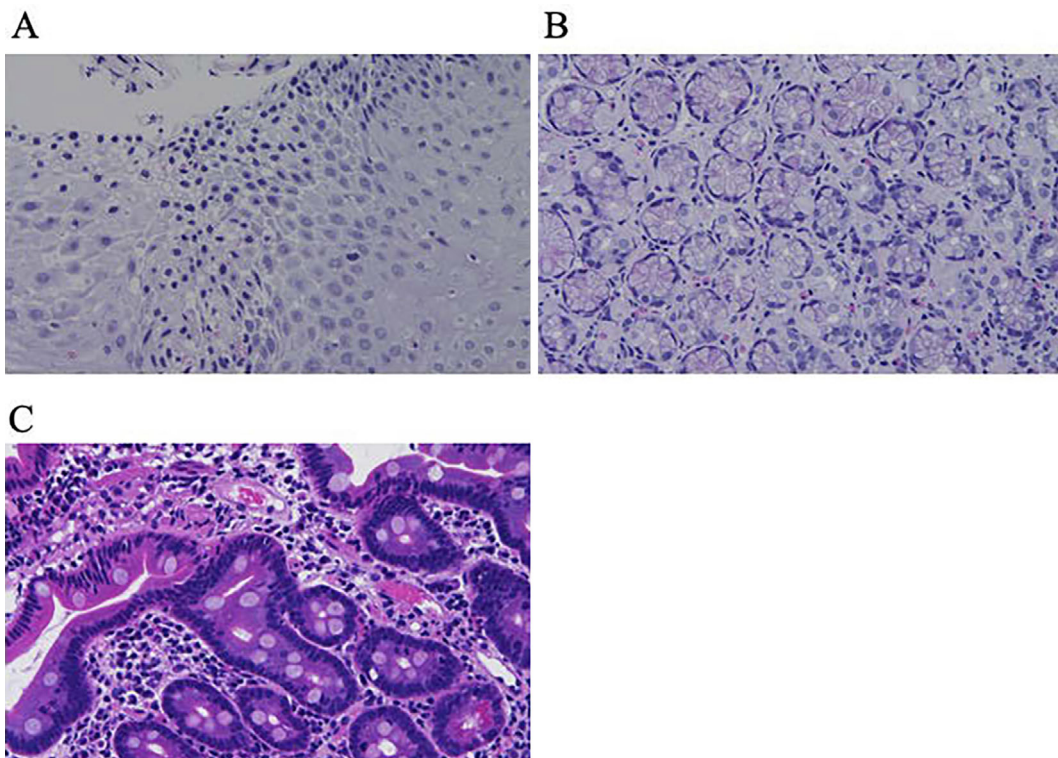


**Figure 6.** After five days of six-food elimination diet therapy, we reintroduced soy, eggs, milk, wheat, peanuts, and seafood for five days. Abdominal pain and diarrhea appeared a few hours after reintroducing milk and peanuts, and symptoms improved within one day after these foods were eliminated. Therefore, milk and peanuts were considered to be the causative food allergens. SFED: 6-food elimination diet.





**Figure 7.** At seven months after the short-term six-food elimination diet and reintroduction therapy, esophagogastroduodenoscopy findings show marked improvement of white exudates only (A, B) and no abnormal findings from the stomach (C) to the duodenum (D).



**Figure 8.** At seven months after the short-term six-food elimination diet and reintroduction therapy, the pathological findings revealed that eosinophil infiltration in the esophagus (A), stomach (B), and duodenum (C) had significantly improved compared with the initial findings. A, B, and C magnification 400 $\times$ .

tionally, in order to investigate the effect of an SFED, imaging and pathological examinations should be performed before reintroduction therapy; however, we did not follow that protocol in this case.

Despite elevated blood eosinophils and specific IgE positivity for multiple allergens, we were unable to identify the causal food allergen in EGE. In our case, IgE reacted to many types of allergens but only responded to milk and peanuts during the reintroduction phase, contiguous with the SFED. Further studies are needed to better elucidate this process.

In conclusion, similar to that seen with EoE, a short-term SFED and reintroduction therapy may be an effective strategy for managing pediatric patients with EGE.

**The authors state that they have no Conflict of Interest (COI).**

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