First successful antegrade single-balloon enteroscopy in a 3-year-old with occult GI bleeding

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Background: Balloon enteroscopy is an emerging technique to allow access to the small intestine for both diagnostic and therapeutic purposes. To date, there have been few published data documenting the safety and efficacy of balloon enteroscopy in small children.

Objective: To describe our experience with single-balloon enteroscopy (SBE) in a 37-month-old toddler with occult GI bleeding.

Design: A single case report.

Setting: A free-standing, academic children's hospital in Denver, Colorado.

Patient: The patient was a 37-month-old, 13.5-kg toddler with persistent heme-positive stools, severe microcytic anemia, and hypoalbuminemia. Previous workup was significant for eosinophilic inflammation in the antrum and a video capsule study showing erythematous lesions in the small bowel.

Intervention: An antegrade SBE was performed with the child under general endotracheal anesthesia, with biopsy specimens obtained from identified lesions in the jejunum and ileum.

Main Outcome Measurements: Complications and successful treatment of symptoms were the primary endpoints.

Results: The procedure was performed successfully in 85 minutes, passing an estimated 200 cm beyond the pylorus, without complications. Identification of the lesions as consistent with eosinophilic enteropathy led to successful treatment with an elimination diet and corticosteroids.

Limitations: The primary limitation of this study is that it is a single case report. Therefore, it is difficult to make a generalized statement regarding the safety and efficacy of balloon enteroscopy in toddlers of this size.

Conclusions: Antegrade SBE can be a well-tolerated and effective procedure to evaluate occult GI bleeding in children as young as 3 years of age. Further study is needed to better establish safety parameters for balloon enteroscopy in small pediatric patients.

The technique of double-balloon enteroscopy (DBE) was first described by Yamamoto et al[1] in 2001. Subsequently a single-balloon enteroscopy (SBE) was introduced, in which there is only a balloon on the tip of the overtube and not the enteroscope itself. To date, there have been several series published documenting the indications, safety, and efficacy of both SBE[2] and DBE.[3] The largest published pediatric experience is by Leung,[4] who reported 30 DBE procedures in 24 patients as young as 4 years. A single case report by Spahn et al[5] was published that documented the use of DBE for a jejunal polypectomy in a 46-month-old child. To our knowledge, there are no published reports of the use of SBE in small children.

Abbreviations: DBE, double-balloon enteroscopy; OD, outer diameter; SBE, single-balloon enteroscopy.

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PATIENT AND METHODS

A healthy 15-month-old Vietnamese-American female child was found to have a microcytic anemia on screening (hemoglobin, 4.9 g/dL; mean corpuscular volume, 65 fL; iron saturation, 7%; total serum iron, 24 μg/dL; iron binding capacity, 365 μg/dL; ferritin, 9 mg/mL), thought to be consistent with iron deficiency and subsequently treated with transfusion and iron supplementation. After 6

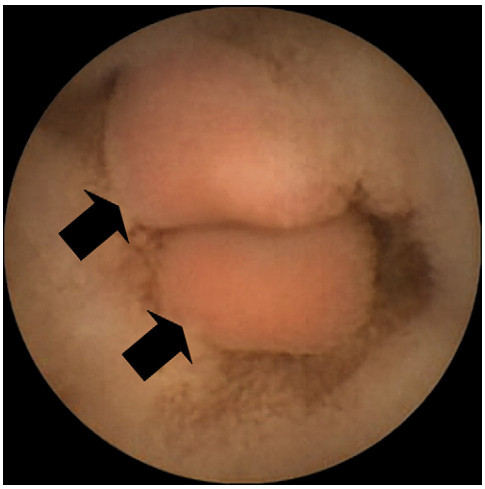

Figure 1. Video capsule image of small-bowel erythematous lesions (*arrows*).

Capsule summary

What is already known on this topic

- Balloon enteroscopy is an attractive option for providing small-bowel access for therapeutic interventions or biopsies.

What this study adds to our knowledge

- Antegrade single-balloon enteroscopy was well tolerated and effective in the evaluation of occult GI bleeding in a 37-month-old child with persistent heme-positive stools, severe microcytic anemia, and hypoalbuminemia, resulting in the diagnosis of eosinophilic enteropathy.

months, her hemoglobin was 6.0 g/dL. She had no history of pain, diarrhea, constipation, or vomiting.

At 22 months, her total protein and albumin were low at 4.3 g/dL and 2.3 g/dL, respectively. She underwent an EGD and flexible sigmoidoscopy, which were significant for eosinophilia in the lamina propria of the stomach. A video capsule study showed multiple discrete areas of the proximal and mid small bowel with erythema and denudation, with normal-appearing surrounding mucosa (Fig. 1). The lesions were consistent in appearance with previously published descriptions confirmed by histology to be allergic in nature. The suspicion of an allergic etiology was supported by the eosinophilia observed in the gastric biopsy specimens.

Allergy testing was positive for seafood, which was then excluded from her diet. On follow-up at age 3 years, she again had hemoccult-positive stools, presumed to be secondary to persistent small-bowel inflammation at the site of the lesions identified on capsule endoscopy. Her hemoglobin was normal, but her albumin was low at 2.7 g/dL. Enteroscopy was scheduled to obtain biopsy specimens of the small-bowel lesions to determine whether they were secondary to an allergic process.

At 37 months of age and weighing 13.5 kg, she underwent SBE under general anesthesia. SBE was performed with an Olympus SIF-Q180 single-balloon enteroscope (Olympus Corp, Tokyo, Japan), with fluoroscopic assistance. The enteroscope has an outer diameter (OD) of 9.2 mm, and the overtube has an OD of 13.2 mm. An Olympus balloon control unit was used, with a set pressure of 5.4 kPa $\pm$ 2.6 kPa. The antegrade approach was chosen because of the location of the lesions in the proximal and mid small bowel on capsule endoscopy. The enteroscope was advanced a total of 5 times beyond the ligament of Treitz. Although the depth of advancement can be difficult to accurately measure, each was estimated at an average of 40 cm for a total advancement of approximately 200 cm beyond the pylorus. At this point, we observed a decrease in the thickness and frequency of the intestinal folds, suggesting a transition from the jejunum to proximal ileum. Fluoroscopy confirmed advancement into the distal small bowel, with 2 concentric loops of the endoscope visualized (Fig. 2). The esophagus, stomach, and duodenum were grossly normal. The jejunum had multiple discrete, coin-shaped areas of featureless mucosa (Fig. 3) every 2 to 3 cm through the jejunum, becoming less frequent in the ileum, consistent in location and appearance with those identified on capsule endoscopy. The entire procedure time was 85 minutes. She tolerated the procedure well and was discharged home that same day.

Biopsy specimens from the jejunal lesions showed an eosinophilic infiltrate, without granulomas or viral changes (Fig. 4). The duodenal biopsy specimens showed focally increased inflammatory cellularity and partial villous blunting. The gastric mucosa had chronic active gastritis with prominent eosinophils.

She was therefore diagnosed with mucosal eosinophilic enteropathy and was started on prednisolone at a dose of 10 mg/day. She had additional skin testing, which was positive for egg, milk, shellfish, nuts, soy, and beef. She was put on an elimination diet with clinical improvement and was weaned from corticosteroids over 8 weeks.

DISCUSSION

With more frequent use of capsule endoscopy in pediatric patients, there is a parallel increase in the need to have access to the small bowel for therapeutic interventions or biopsies. Balloon enteroscopy has emerged as an attractive option to provide this access. Both SBE and DBE have been successfully used in children, but there is little published literature to guide endoscopists in determining appropriate age and size limitations for these procedures, perhaps limiting the adoption of this technology in pediatric centers. The largest published series of pediatric balloon enteroscopy included children as young as 4 years of age, without documentation of the exact age or