Endosonographic Evaluation in Two Children With Esophageal Stenosis

By Katsunori Kouchi, Hideo Yoshida, Tadashi Matsunaga, Yasuhiro Ohtsuka, Erena Nagatake, Yoshiharu Satoh, Keita Terui, Tetsuya Mitsunaga, Takenori Ochiai, Miwako Arima, and Naomi Ohnuma
Chiba, Japan and Saitama, Japan

The authors report the successful use of endoscopic ultrasonography (EUS) for finding the etiology and subsequent treatment strategy for esophageal stenosis in 2 children. In case 1, EUS showed anterior wall thickening and multiple low echoic regions in the mp layer. These regions were believed to be cartilage. Esophageal resection therefore was performed. In case 2, EUS showed disruption of the sm and mp layers at the stenosis, leading us to speculate that the stenosis was caused by gastroesophageal reflux. After balloon dilatation, he underwent antireflux surgery of Nissen's fundoplication. EUS was useful for determining the etiology of esophageal stenosis and, thus, the appropriate treatment strategy.

INDEX WORDS: Endoscopic ultrasonography, esophageal stenosis, esophageal atresia.

TREATMENT for esophageal stenosis is determined by its etiology. In cases caused by gastroesophageal reflux, balloon dilation is the first choice of treatment. However, this procedure carries the risk of esophageal perforation in cases involving tracheobronchial remnants.[1] Here, the preferred treatment procedure involves esophageal resection and reanastomosis. Accordingly, clinicians must determine the etiology of esophageal stenosis to plan the optimal therapeutic strategy.

MATERIALS AND METHODS

In the current study, a 15-MHz catheter-type sonographic probe was used to determine the etiology of esophageal stenosis in 2 pediatric cases. By inserting the probe into the forceps channel, we were able to accurately examine the area into which the endoscope cannot be inserted. The normal esophageal wall was visualized as a 7-layered structure by a 15-MHz catheter-type sonographic probe.[2] The first (m1) and the second (m2) layer correspond to the interface echo and the mucosal layer; the third (m3) layer corresponds to the submucosal (sm) layer; The proper muscular (pm) layer consists of 3 layers (fourth to sixth layers). The fourth (P1), the fifth (P2), and the sixth (P3) layer correspond to the circular smooth muscle, the intermuscular connective tissue, and the longitudinal smooth muscle; the seventh (A) layer corresponds to the adventitia layer.

From the Department of Pediatric Surgery, 2nd Department of Surgery, School of Medicine, Chiba University, and the Department of Gastroenterology, Saitama Cancer Center, Japan.

Address reprint requests to Katsunori Kouchi, Department of Pediatric Surgery, 2nd Department of Surgery, School of Medicine, Chiba University 1-8-1, Inohana, Chuou-ku, Chiba, 260-8677, Japan.

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CASE REPORT

Case 1

A 6-month-old boy had dysphasia. He had undergone surgery for esophageal atresia at the day of birth after prenatal diagnosis by ultrasonography. An esophagogram showed a stenosis in the lower esophagus, into which an endoscope of 6 mm in diameter could not pass. Endoscopic ultrasonography (EUS) showed a focal thickness of the anterior esophageal wall in the mp layer (Fig 1A), and multiple low echoic regions also were detected in this layer. We found these regions to be cartilage, indicating that the stenosis resulted from tracheobronchial remnants. Therefore, esophageal resection and reanastomosis subsequently were performed. Histologic examination showed thickening of the mp layer and several sizes of cartilagenous remnants in this region (Fig 1B). These findings were compatible with those of EUS.

Case 2

A 7-month-old boy was referred because he frequently vomited milk. An esophagogram showed severe stenosis in the lower esophagus and dilation of the upper region. Esophageal endoscope identified pinhole stenosis (Fig 2A). EUS showed a disruption of the sm and mp layers at the stenosis (Fig 2B), with the 7-layered structure of the esophageal wall almost interrupted at the stenosis. Therefore, we determined that the stenosis was caused by gastroesophageal reflux. After dilatation using a PET balloon dilator, the patient underwent antireflux surgery using Nissen's fundoplication.

DISCUSSION

Stenosis of the esophagus in children is commonly caused by congenital malformations (membranous web, fibromuscular stenosis, and tracheobranchial remnants), gastroesophageal reflux, or achalasia.[3] Conventional evaluations of esophageal stenosis involve upper gastrointestinal radiography, esophageal manometry, and the use of an esophageal scope.[4] However, these investigative techniques are not afforded visualization of detailed structures at the stenosis. Therefore, clinicians usually

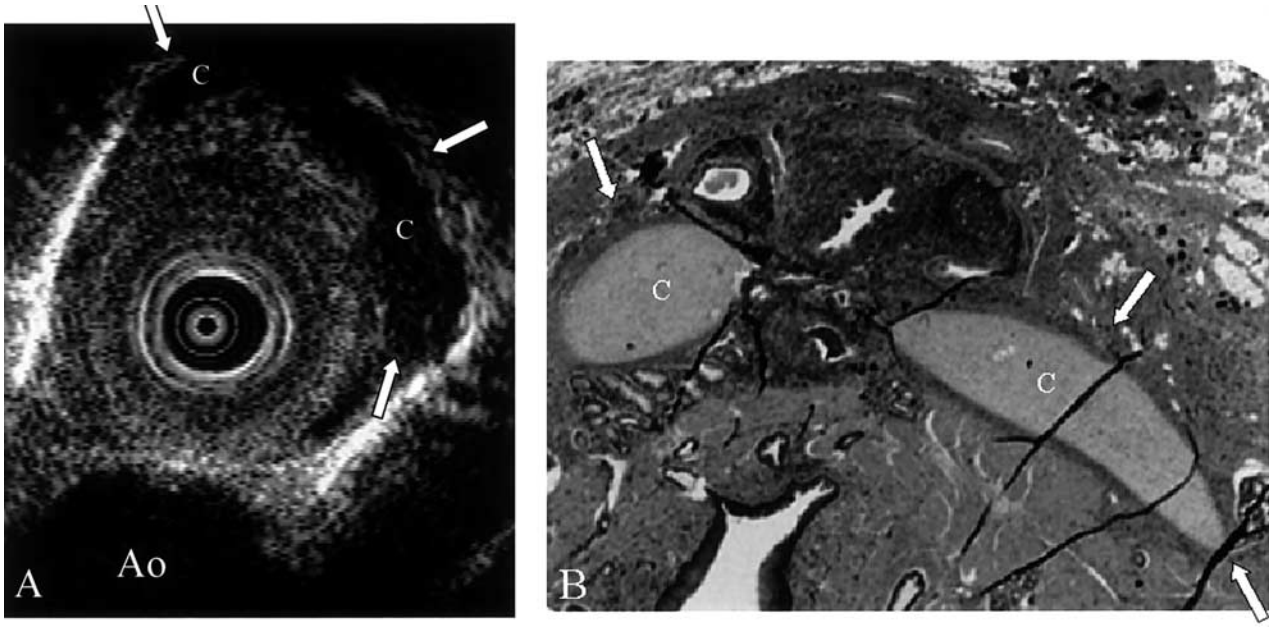

Fig 1. (A) EUS showed a focal thickness of the anterior esophageal wall in the mp layer. White arrows show multiple low echoic regions in the mp layer. (B) Microscopic image of the resected esophagus. Cartilage (white arrows) and mucus glands were observed in the mp layer. Microscopic findings were compatible with those viewed on the EUS image. Ao, Aorta; C, cartilage.

determine the likely etiology from the patient's history or position of the stenosis and decide on initial treatment, which involves either balloon dilation or esophageal resection.

Endoscopic dilation of the esophageal stenosis is the preferred treatment for benign esophageal stenosis,[5,6] although this technique is contraindicated in some cases with differing etiologies. Esophageal perforation has been induced by balloon dilation in patients with tracheobronchial remnants. In this study of the case of tracheobronchial remnants, EUS showed a focal thickness of the anterior esophageal wall. Therefore, we supposed that balloon dilation would dilate the esophageal wall equally and, thus, carry the risk of perforating

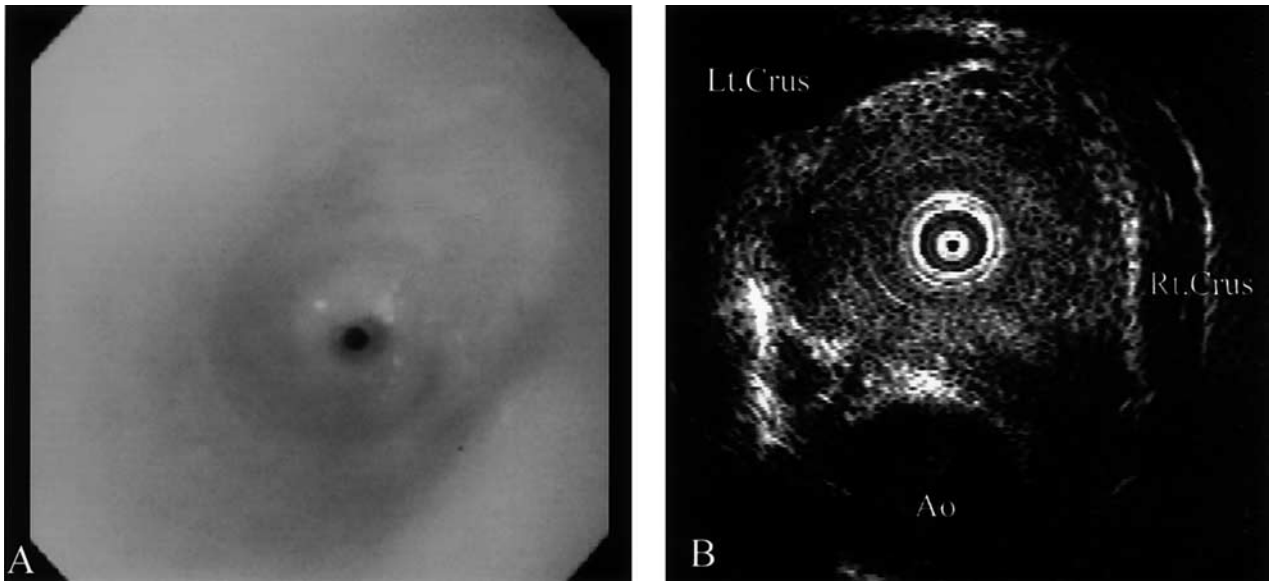

Fig 2. (A) Esophageal endoscopy showed a pinhole stenosis. Mucosa above the stenosis was edematous, and vessels on the esophageal surface were diminished. (B) EUS showed disruption of the sm and mp layers at the stenosis. The structure at the stenosis was interrupted and showed as a confused monolayer. Ao, Aorta.

the thin posterior wall. Here, EUS effectively provided us with detailed information of the esophageal wall that enabled us to determine optimal intervention.

A recent version of EUS probe has high frequencies of wavelengths up to 20 MHz, and provides high-resolution images of the gastrointestinal tract, pancreas, and bile duct.[7] EUS is used widely as an investigative tool to evaluate the depth of cancer invasion in adult patients, although reports of EUS use in pediatric patients are rare. In the current study, we used a catheter-type probe with 15-MHz frequencies. The probe produced high-resolution images of the normal esophageal wall, which was visualized as a 7-layered structure. Although we examined only 2 patients with esophageal stenosis using EUS in this study, the EUS images effectively enable us to observe the pathology of the stenosis in detail.

EUS is useful for revealing the etiology of esophageal stenosis. Based on EUS findings, we were able to decide the optimal strategy of treatment and start it earlier for children with esophageal stenosis.

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