

Role of Endoscopic Ultrasound in Pediatric Disease



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KEYWORDS

- Pediatric endoscopic ultrasound • Fine-needle aspiration • Pancreatitis
- Choledocholithiasis • Endoscopic cystgastrostomy • Autoimmune pancreatitis

KEY POINTS

- The application of endoscopic ultrasound (EUS) in children is growing, but remains limited because of lack of availability in pediatric centers and pediatric gastroenterologists trained in this advanced endoscopic procedure.
- Special technical considerations must be considered when performing EUS in very small children.
- Performing EUS before ERCP may represent a promising means of avoiding unnecessary ERCP in children with suspected choledocholithiasis.
- Further studies are required to evaluate the diagnostic and therapeutic potential of EUS in children.

INTRODUCTION

Endoscopic ultrasound (EUS) is a procedure that uses an ultrasound transducer built into the tip of a flexible endoscope to obtain high-resolution images of the gastrointestinal (GI) mucosal layer and adjacent organs, such as lymph nodes, pancreas, bile duct, liver, mediastinum, and kidneys. EUS is widely used in adults, especially in the diagnosis and treatment of pancreaticobiliary disease and in GI malignancy staging. Diagnosis with fine-needle aspiration (FNA) or core-needle biopsy (CNB) can be performed along with therapeutic procedures, such as injections, celiac plexuses neurolysis, and pancreatic or biliary fluid collection drainage.

Disclosure Statement: The authors have nothing to disclose.

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Gastrointest Endoscopy Clin N Am 26 (2016) 137–153

<http://dx.doi.org/10.1016/j.giec.2015.08.001>

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Although EUS is a well established procedure in adult populations, experience in children is more limited (**Table 1**).¹⁻⁷ Nevertheless, the application of EUS in children has been growing, with most literature describing its use in pancreaticobiliary diseases. In addition, uses for EUS have expanded in other pediatric diseases, including congenital GI anatomic anomalies, pyloric stenosis, inflammatory bowel disease (IBD), vascular lesions, and liver disease.

There are two types of EUS imaging: radial and curvilinear (**Fig. 1**). The radial echoendoscope allows a 360° view, perpendicular to the transducer. This gives an image similar to that seen on axial images of a computed tomography (CT) scan. A curvilinear array (CLA) echoendoscope provides a 180° view, parallel to the transducer.

Although both EUS modalities are equally suitable for diagnostic imaging, most CLA echoendoscopes are designed with a working channel and elevator (similar to a duodenoscope) to allow for FNA, CNB, and other therapeutic instruments to be used under real-time sonographic visualization.

High-resolution EUS probes are also available to be used through the working channel of gastroscopes, colonoscopes, and duodenoscopes. These probes are available at frequencies ranging from 12 to 30 MHz and provide higher detailed imaging of individual GI layers compared with the radial or CLA echoendoscopes. Therefore EUS probes are frequently used to study mucosal and submucosal lesions. The trade-off of these high-frequency probes providing such high-resolution images is the reduced depth of penetration and visualization (**Fig. 2**).

All EUS transducers described previously also provide Doppler flow, which can be used to differentiate vessels from ducts, and vascular lesions from solid masses or cysts.

Special Technical Considerations

Standard EUS endoscopes are relatively large and at times challenging to intubate the esophagus, especially in smaller patients. Echoendoscope tip sizes vary depending on the manufacturer, with diameters range from 11.4 to 13.9 mm. Most echoendoscopes provide an oblique endoscopic view that requires a semiblind esophageal intubation, although newer forward-viewing EUS endoscopes are now available and have been described in the literature.⁸⁻¹⁰ The length of the angled echoendoscope tips is also longer than those of standard gastroscopes.

It is important to recognize that esophageal intubation of a small child with a standard EUS scope carries an increased risk of cervical esophageal perforation. Nevertheless, there are studies reporting successful EUS with “standard” echoendoscopes in children 6 months to 3 years of age.^{2,6} Radial echoendoscopes with smaller insertion diameters are more technically feasible in smaller children, but the inability to perform FNA or CNB under direct sonographic visualization limits the radial echoendoscopes to diagnostic procedures.

In addition to the technical limitations of performing EUS in the smallest of pediatric patients, EUS is also not widely available in pediatric centers because of lack of formal training programs for pediatric gastroenterologists. Even in adult gastroenterology, EUS is performed by a minority of gastroenterologists and only recently has EUS become available in community hospitals. The availability of EUS for children is limited by the small number of adult gastroenterologists who are able to perform the procedure in children, and the very few pediatric gastroenterologists who have been appropriately trained to perform it.

INDICATIONS

Many indications for EUS exist and more continue to be studied (**Table 2**). This section discusses various GI indications for EUS in children, and is organized anatomically.

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