

Advances in Pediatric Small Bowel Imaging



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KEYWORDS

- Enteroscopy • Balloon-assisted • Double-balloon • Single-balloon • Children
- Pediatric • Small bowel

KEY POINTS

- Deep small bowel enteroscopy using balloon-assisted techniques provides an innovative, minimally invasive modality for diagnosing and treating small bowel diseases in children.
- Balloon-assisted enteroscopy in children has been proved to be safe and effective.
- Specific pediatric indications for balloon-assisted enteroscopy include the diagnosis and management of obscure GI bleeding, evaluation of suspected Crohn disease or established inflammatory bowel disease, and the management of polyposis syndromes.

INTRODUCTION

In the twenty-first century, it is currently possible to image, diagnose, and therapeutically treat diseases of the small bowel in children in a safe and minimally invasive manner. Although the various technologies that can accomplish small bowel imaging and allow therapeutic treatment have only been recently available to pediatrics, to some extent there has been a steady march toward these approaches over the past century. Radiologic imaging of the small bowel has been available dating back to the discovery of X-rays in 1895 by Wilhelm Roentgen. This advancement was a tremendous step forward to improving the evaluation of internal organs, including the gut. However, traditional radiologic studies have been grossly limited by their inability to tissue sample or to allow treatment when an abnormality is identified. Early on, the assessment required to confirm a diagnosis was left to invasive surgical resection and tissue sampling. Percutaneous sampling of intra-abdominal abnormalities was developed as an improvement on open surgical procedures for diagnostic purposes, whereas therapeutic capability continued to rely on surgical methods. In the 1990s, the advent of wireless capsule endoscopy (WCE) introduced another tool that could be used to noninvasively visualize the full length of the small bowel.

Disclosure Statement: The author has nothing to disclose.

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Gastrointest Endoscopy Clin N Am 26 (2016) 155–168

<http://dx.doi.org/10.1016/j.giec.2015.09.004>

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Although a remarkable innovation, WCE has also had its own set of limitations, including perhaps most importantly, a lack of therapeutic capability.

In 2001, Yamamoto and colleagues¹ described the first balloon-assisted enteroscopy (BAE) device, double-balloon enteroscopy (DBE; FUJIFILM Medical Systems, Wayne, NJ), named for its unique system using two attached inflatable balloons and an overtube over an endoscope. Additional devices have since been developed and are commercially available, including single-balloon enteroscopy (SBE; Olympus, Tokyo, Japan) (Figs. 1 and 2) and spiral enteroscopy (SE; Endo-Ease Discovery SB, Spirus Medical, Stoughton, MA) (Fig. 3). The BAE systems (DBE and SBE) have proven diagnostic and therapeutic benefits in the adult population, with similar identified advantages in children.²⁻⁸ The earliest published experience on the use of BAE in children was in 2006 and 2007.^{9,10} To date, SE has not been described in pediatrics, and indeed may have limited usage in children because of the relative larger size of the overtube thus restricting its application in smaller patients.

This comprehensive overview looks at pediatric enteroscopy and its defined diagnostic and therapeutic applications to date. We compare and contrast how enteroscopy in children differs from its use in adults, in terms of its indications and its therapeutic potential.

OVERVIEW OF ENTEROSCOPY

The development of balloon-assisted enteroscopes has revolutionized the minimally invasive approach to treating small bowel disorders in children and adult patients. To date, three technologies exist (DBE, SBE, and SE). Yamamoto and colleagues¹ first described the double-balloon technique in 2001 that was followed by the introduction of the single balloon¹¹ and spiral¹² technologies.

Irrespective of the technology used, the process of enteroscopy is the same: progressive pleating of the small bowel over the enteroscope with gradual greater depths of advancement of the scope tip deep into the small bowel. Full small bowel visualization has been described as technically feasible in adult and pediatric series.^{2,6,13,14} This has been accomplished unidirectionally (antegrade alone) and also in the combined approach of antegrade and retrograde examinations.

It is important to recognize that complete small bowel visualization in many cases is not required, and should not necessarily be the objective of all enteroscopy



Fig. 1. Small intestinal videoscope: Olympus SIF Type Q180. (Courtesy of Olympus, Tokyo, Japan; with permission.)

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