

Balloon-assisted enteroscopy: double or single?

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Endoscopic accessibility to the small bowel has been a challenge to the gastroenterologist for decades. Videocapsule endoscopy (VCE) and balloon-assisted enteroscopy have revolutionized the diagnosis and management of patients with small bowel disorders and particularly, those with small bowel tumors (SBTs). Despite its limitations, VCE may well be the most reasonable initial diagnostic strategy to evaluate patients with suspected SBTs, leaving balloon-assisted enteroscopy as a complementary method.

The advent of small-bowel VCE allowed for the first time direct visualization of the entire small bowel with minimal discomfort for the patient. Since its introduction in practice in 2000, VCE has proved to be an accurate endoscopic examination of the small bowel, and several studies have shown its diagnostic superiority over other methods for evaluation of small bowel disorders such as small bowel follow-through (1), push enteroscopy (2,3), angiography (4), erythrocyte scintigraphy, CT-enterography, and magnetic resonance enterography (1,5). Recently published studies (6-8) showed that VCE and double-balloon enteroscopy (DBE) are nearly equal in their diagnostic accuracy for small bowel lesions. The main advantage of VCE is its ability to visualize all of the small bowel during a single examination, whereas reported rates of panenteroscopy with double-balloon enteroscopy (DBE) are widely variable, ranging from 8% to 86% (9-11). The main disadvantage of VCE is the lack of therapeutic capabilities. Because of its ease to use, VCE should be used first for initial diagnosis and to direct the choice of route of balloon-assisted enteroscopy, followed by DBE or single-balloon enteroscopy (SBE) for confirmation of the diagnosis and endoscopic therapy.

Balloon-assisted enteroscopy is a generic term for endoscopic examination of the small bowel by any endoscopic

method that includes balloon-assisted progression. The concept of attaching a balloon to the distal end of an endoscope to propel the instrument into the proximal small bowel was proposed a half of century ago by Margot Shiner (12), but the technique was not adopted. Sonde enteroscopy, introduced in 1986 (13), was also abandoned because it was uncomfortable for the patient.

Push enteroscopy, with use of a pediatric colonoscope, remained the most frequently performed procedure for the evaluation of proximal small bowel for many years (14), but the technique has several limitations (looping of the endoscope, patient discomfort), and it has been replaced in recent years by balloon-assisted enteroscopy.

Intraoperative endoscopy, in spite of a high complication rate, and need for a surgeon as well as an endoscopist, has remained the gold standard for small bowel imaging (15). This procedure is performed during abdominal surgery, and the endoscope is introduced either orally or via an enterotomy; the progression of the endoscope through the small bowel is facilitated by the manual assistance of the surgeon. Indications for intraoperative endoscopy are very limited by the invasiveness of the procedure.

Double-balloon enteroscopy, also known as "push-and-pull" enteroscopy, invented by Hinori Yamamoto in 1997 (16), has revolutionized the way we view and treat small bowel disorders. Stabilization of the small bowel by gripping the intestinal wall with a balloon attached to the distal end of a flexible overtube enables the enteroscope to go deeper through the tube by preventing looping of the bowel. Another balloon is attached to the enteroscope tip to prevent the withdrawal of the endoscope tip during the advancement of the overtube. By intermittent inflation and deflation of these two balloons with air from a pressure-controlled pump system, combined with instrument insertion and retraction, deep (even complete) intubation of the small bowel is obtained. Oral or anal routes, alone or in combination, are used to achieve complete small bowel examination. DBE allows tissue sampling and therapeutic procedures such as polypectomy and hemostasis. However, DBE is an invasive,

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complex and difficult procedure, with risk of complications, and therefore should only be performed by two experienced endoscopists under conscious sedation or general anesthesia.

Currently, three types of DBE are available from Fujinon Company: the diagnostic enteroscope (EN 450 P5; Fujinon, Saitama, Japan) has an outer diameter of 8.5 mm, an accessory channel of 2.2 mm, and a working length of 200 cm; the Fujinon therapeutic enteroscope (EN 450 T5; Fujinon) has an outer diameter of 9.4 mm and an accessory channel of 2.8 mm; shorter version of therapeutic enteroscope (EC-450B15; Fujinon) has the outer diameter and accessory channel similar to EN 450 T5, but the working length is only 152 cm.

The single-balloon enteroscopy (SBE) was introduced in 2007, with the aim to avoid the difficulty of attaching the enteroscope balloon to the distal end of the scope, and eliminate the need of inflating and deflating two balloons in multiple steps encountered in DBE technique. The equipment includes a high-resolution video enteroscope (SIF Q260; Olympus Optical Co., Tokyo, Japan) with an outer diameter of 9.2 mm, an accessory channel of 2.8 mm, and working length of 200 cm; a flexible overtube (ST-SB1; Olympus) with an working length of 132 cm and an outer diameter of 13.2 mm, and a pressure-controlled pump system (OBCU; Olympus). The Olympus Single Balloon Splinting Tube is attached to the distal tip of the overtube and is inflated and deflated with air from a pressure-controlled pump system (OBCU Olympus Balloon Control unit). Data for SBE performances are very limited, the majority of world's literature on balloon-assisted enteroscopy has focused on DBE. Recently, May et al (17) in a prospective multicenter trial comparing DBE and SBE in patients with small bowel disorders have reported that with DBE the rate of enteroscopy had been three fold higher than with SBE going along with a higher diagnostic yield, and therefore DBE must continue to be regarded as the gold standard procedure for deep small bowel enteroscopy.

In the current issue of *Chirurgia*, Trifan et al report their preliminary experience with SBE for diagnosis of the small bowel tumors. The authors found SBE safe and efficient for final diagnostic approach of small bowel tumors suspected on VCE. As balloon-assisted enteroscopy, either double or single, is unable to visualize the entire small bowel in approximately one third of patients even by using combined (oral and anal) route, we are still waiting for an ideally non-invasive method for endoscopic examination of the small bowel, having both diagnostic and therapeutic capabilities, a dream, we hope, not far away. Until then, double or single-balloon enteroscopy remains standard practice in investigating small bowel tumors.

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