

# Balloon Enteroscopy: Single- and Double-Balloon Enteroscopy

Andrea May, MD, PhD

## KEYWORDS

- Double-balloon enteroscopy • Single-balloon enteroscopy
- Balloon-guided enteroscopy • Small-bowel endoscopy
- Push-and-pull enteroscopy

Until only a few years ago, it was not possible to access most of the small bowel using endoscopic techniques that avoided the need for surgery. Video capsule endoscopy and balloon enteroscopy thus represent decisive breakthroughs in this field. Capsule endoscopy is a safe method, which, in most cases, allows endoscopic visualization of the entire small bowel. A substantial disadvantage of the method is the inability to obtain histologic samples and carry out endoscopic treatments. In addition, the interpretation of nonspecific findings is not easy in some cases and requires confirmation and checking using a second procedure.

Flexible enteroscopy using push enteroscopy and balloon enteroscopy is a more invasive procedure in comparison with capsule endoscopy. However, it provides all the advantages of conventional endoscopy. Push enteroscopy became established in the 1980s, but it is associated with only a limited depth of penetration into the small bowel. This limitation was overcome through the development of balloon enteroscopy.<sup>1,2</sup> In optimal cases, the entire small bowel, or at least considerable proportions of it, can be visualized using balloon enteroscopy (usually by combining the oral and anal examinations). Depending on the endoscopist's level of experience, the rate of complete enteroscopy using the double-balloon method is around 40% to 80% (maximum 86%).<sup>3,4</sup> With single-balloon enteroscopy, the rates are currently up to a maximum of 25%.<sup>5</sup> In 2001, the DBE system developed by Dr. Yamamoto was presented for the first time in Japan, and in 2003 by the author's own research group in Germany.<sup>6,7</sup> In the meantime, the system has become established throughout the world for diagnostic and therapeutic small-bowel examinations, and it is now being used widely in routine clinical work. In addition to the classic indication for small-bowel endoscopy, the DBE technique has a variety of other potential uses as well, for

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Department of Internal Medicine II, HSK Wiesbaden, Teaching Hospital-Johannes Gutenberg University, Ludwig-Erhard-Strasse 100, 65199 Wiesbaden, Germany  
E-mail address: [andrea.may@hsk-wiesbaden.de](mailto:andrea.may@hsk-wiesbaden.de)

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example, in difficult colonoscopies, or for access to the pancreatic and biliary tract in patients with a surgically modified gastrointestinal tract, or for access to the stomach in patients who have undergone obesity surgery. Another balloon enteroscopy system was recently introduced that is equipped with only one balloon at the tip of the overtube and is, therefore, known as single-balloon enteroscopy (SBE).<sup>5</sup> The two systems and their potential clinical applications are briefly presented in the following sections.

### **DOUBLE-BALLOON ENTEROSCOPY**

The double-balloon enteroscopy (DBE) system (Fujinon, Inc, Saitama, Japan) consists of a high-resolution video endoscope, with a working length of 200 cm and a flexible overtube made of polyurethane. Latex balloons are attached at the tip of the enteroscopy and also on the overtube, and can be filled with air or emptied using a pressure-controlled pump. The principle of the DBE technique is based on alternating pushing and pulling maneuvers, allowing the small bowel to be threaded onto the overtube step by step.<sup>5,6</sup> Two different types of devices are currently available with the double-balloon system: the EN450-P5 model, with a working channel of 2.2 mm and an outer diameter of 8.5 mm, and the EN450-T5 model, with a working channel of 2.8 mm and an outer diameter of 9.4 mm. The corresponding overtubes have diameters of 12.2 and 13.2 mm respectively, with an overall length of 145 cm.

### **SINGLE-BALLOON ENTEROSCOPY**

The SBE system was recently introduced (Olympus, Inc, Tokyo, Japan). The enteroscope (XSIF Q260Y) is also a high-resolution video endoscope, with a working length of 200 cm. The enteroscope is equipped with a working channel that is 2.8 mm in diameter, and its outer diameter is 9.2 mm. The overtube has an overall length of 140 cm, consists of silicone, and has a latex-free balloon made of silicone at its distal end. In contrast to the DBE system, a balloon is not attached to the tip of the enteroscope, and stable positioning in the small bowel is achieved during withdrawal of the scope by angling the tip of the endoscope. Insufflation of the overtube balloon is performed using a pressure-controlled pump.

In principle, the double-balloon system can, of course, also be used as a single-balloon enteroscope, by dispensing with the balloon attached to the enteroscope tip.<sup>8,9</sup>

### **EXAMINATION PROCEDURE OF DBE AND SBE**

For both DBE and SBE, the examination procedures are described in detail elsewhere.<sup>2,5,6</sup> The patient only needs to fast before the oral examination (approximately 12 hours for food, approximately 4 hours for clear liquids). For a retrograde procedure, standard colonoscopy preparation is necessary. Preparation before antegrade procedures is not generally necessary but may be useful in patients with suspected stenoses or diabetic neuropathy with delayed transit.

The examination itself is usually performed either with conventional conscious sedation or with propofol. There is, however, a wide range of sedation options, and selection is related to local conditions and policies. In most cases of antegrade or retrograde balloon enteroscopy, conscious sedation (ie, with midazolam, pethidine, and/or fentanyl) is sufficient. For antegrade balloon enteroscopy that may last more than an hour, deep monitored sedation, for example, with propofol, is widely accepted. General anesthesia with intubation is not customary in Germany and is restricted to individual cases, for example, in children, but it is used more often in other countries. For retrograde DBE, as for colonoscopy, conscious sedation is sufficient in

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