Balloons for Deep Enteroscopy: Single-balloon, Double-balloon, or Balloon-guided

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Introduction

Starting with the double-balloon enteroscopy (DBE), which was introduced by Dr. Yamamoto in 2001, balloon-assisted systems enabled direct visualization of small bowel mucosa and intervention toward small bowel lesions effectively and as a result, a remarkable advance has been achieved in the diagnosis and treatment of the small bowel disorders. Another balloon-assisted enteroscopy, single-balloon enteroscopy (SBE) has been introduced in 2007, and currently, both DBE and SBE are used in the various clinical situations which need deep enteroscopy. More recently, a through-the-scope balloon catheter device was developed and a few studies reported that this novel balloon-assisted device allowed deep intubation to the small intestine with standard colonoscopes.

Double-balloon Enteroscopy (DBE)

1. Principle of DBE and insertion technique

Insertion of the enteroscope into the small intestine using simple push method will eventually lead to bending and stretching of the bowel loop, and at a certain point, the insertion force will not transmit toward the distal end of the scope and the scope cannot move forward any more. In DBE system, a balloon-inflated overtube can hold the intestine at a certain position and advancing the scope through the overtube can minimize further stretching of the intestine and loop formation. Using this principle, the insertion force will transmit to the distal end of the scope effectively. After advancing the scope, the balloon of the scope can hold the intestine again, and the balloon-deflated overtube can advance along the scope using it as a guide-wire. These coordinated push-and-pull movements using the two balloons (one at the overtube and the other at the end of the enteroscope) can help the bowel to be shortened effectively during insertion.

2. Clinical application, diagnostic yield, and total enteroscopy rate

Suspected mid-gastrointestinal (GI) bleeding is the most common indication of DBE in clinical practice. According to a systematic review, the pooled detection rate of DBE was 68% and the vascular lesion (angiectasia, arteriovenous malformation, varix, and active bleeding) and inflammatory lesions (Crohn’s dis-
ease, erythema, erosions, and ulcers) were the most common and second most common positive findings, respectively, when the indication of DBE was suspected mid-GI bleeding. The other main indications of DBE include small bowel obstruction, Crohn’s disease, neoplastic lesions, abnormality detected in other modalities, and so on. The pooled detection rate of DBE was 85.8% for small bowel obstruction and 63.4% for Crohn’s disease. The intestinal perforation, pancreatitis, bleeding, and aspiration pneumonia have been reported as the major procedure-related complications. The total enteroscopy rate of DBE had been reported 18-86%.

Single-balloon Enteroscopy (SBE)

1. Principle of SBE and insertion technique

Both DBE and SBE use a balloon-attached overtube to transmit the insertion force toward the end of the scope effectively. However, instead of the balloon of the scope in DBE system, SBE uses the angulation of the tip of the scope before the pulling maneuver in order to hold the distal part of the intestine. Otherwise, the principle of insertion technique is not different between SBE and DBE.

2. Clinical application, diagnostic yield, and total enteroscopy rate

The indications of SBE are similar to DBE and thus suspected mid-GI bleeding is the most common indication of SBE. Like the systematic review for DBE, angioectasias, ulcers and polyp or mass are the most commonly detected lesions in the small intestine. Diagnostic yield and therapeutic yield of SBE ranged 37-61% and 5-48%, respectively. However, according to the meta-analysis based on 4 randomized-controlled trials (RCTs), diagnostic yield of SBE was similar to DBE and therapeutic yield between DBE and SBE was not different. Total enteroscopy rate of SBE ranged 0-22% in three RCTs and SBE was inferior to DBE in terms of complete enteroscopy. Pancreatitis and perforation were the major procedure-related complications in SBE studies and there was no difference in complications between SBE and DBE.

Balloon-guided endoscopy using through-the-scope balloon catheter

1. Principle of through-the-scope balloon catheter

Both DBE and SBE need a dedicated enteroscope which can pass through the overtube, but the new through-the-scope balloon catheter allows enteroscopy with standard adult colonoscope. It consists of a single-use balloon catheter which is inserted through the working channel of the colonoscope. The insertion technique using this balloon catheter had been firstly described as “balloon-guided-endoscopy” in 2008. The catheter is introduced through the working channel and advanced ahead of the endoscope into the small intestine in a blind fashion. After then, the balloon is inflated to anchor the small bowel and the scope is advanced along the catheter. Because the currently available through-the-scope balloon catheter requires a minimum working channel diameter of 3.7 mm, an adult colonoscope is necessary to perform enteroscopy.

2. Development of devices and clinical application

The safety and feasibility of balloon-guided enteroscopy and through-the-scope balloon catheter have been reported in a few studies until now. A recent pilot study reported that technical success rate was 100% in
both antegrade and retrograde approaches. Diagnostic yield was 45.5% in antegrade approaches and 58.8% in retrograde approaches and therapeutic yield was 36.4% and 47.1% in each approach. Although no serious adverse events have been reported in the limited number of studies, further studies should be followed to evaluate the efficacy and safety of this novel device.

Conclusions

Remarkable advance in the diagnosis and therapy of small bowel disorder has been achieved since the development of balloon-assisted enteroscopy. DBE and SBE are two representative forms of the balloon-assisted endoscopy system having similar principle of insertion technique and diagnostic yields, although DBE is superior to SBE in terms of total enteroscopy. Recently developed through-the-scope balloon catheter allows deep enteroscopy using a standard adult colonoscope. However, additional studies and more extensive clinical experiences should be followed to evaluate the safety and clinical efficacy of this new device.

References