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# Diagnostic value of double balloon enteroscopy for small-intestinal disease: experience from China

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**Background:** Diseases of the small intestine include, among others, ulceration, chronic inflammation, Meckel's diverticula, vascular deformities, and cancer.

**Objective:** To study the diagnostic value of double balloon enteroscopy (DBE) for small-intestinal disease in a Chinese patient cohort.

**Design:** DBE was performed via the mouth, anus, or both approaches to diagnose small-intestinal disease.

**Patients:** We studied 155 patients with clinically suspected small-intestinal disease: 110 men and 45 women. Their age ranged from 6 to 75 (mean 41). There were 92 cases with small-intestinal hemorrhage, 39 with abdominal pain, 7 with diarrhea, 13 with abdominal distention, 3 cases with malnutrition, and 1 with diarrhea and refractory hypoalbuminemia.

**Results:** Among the 155 patients, lesions were found in 126 (81.3%). These lesions found were small-intestinal ulcers (including Crohn's disease), chronic inflammation, Meckel's diverticulae, vascular deformities, and carcinoma. Eighty-five of the 92 patients with suspected intestinal hemorrhage were confirmed, with a positive rate of 92.4%. Also confirmed were 24 of the 39 patients with abdominal pain (positive rate of 61.5%); 16 of the 23 patients with diarrhea, abdominal distention, or malnutrition (positive rate of 69.6%); and 1 patient with refractory hypoalbuminemia. Among the 126 patients with positive findings, the lesions were located in the small intestine in 116 patients, in the stomach and duodenum in 9 patients, and in the colon in 1 patient. In the 45 patients with small-intestinal ulcer, 29 patients had recurrent hemorrhage, 9 had abdominal pain, 4 had abdominal distention, 2 had malnutrition, and 1 had diarrhea. Ulcers were located in the jejunum in 20 patients, in the ileum in 20 patients, and in both the jejunum and ileum in 5 patients. For 7 patients with small-intestinal ulceration diagnosed as Crohn's disease, the concordance rate of diagnosis between preoperative and postoperative diagnosis was 57.1%, lower than other diseases ( $P < .01$ ). One patient had a perforation.

**Conclusion:** DBE is effective and safe for the diagnosis of small-intestine disease in a Chinese patient cohort. (Gastrointest Endosc 2007;66:S19-21.)

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Small-intestinal disease is common and cannot be detected by gastroscopy or colonoscopy. Because the intestine is long, tortuous, far from both ends of the digestive tract, and unfixed in position, clinical diagnosis is relatively difficult. Yamamoto et al<sup>1</sup> reported the clinical application of the double balloon enteroscope in 2003. Because this new instrument can help to observe the entire intestine, obtain biopsy samples, mark lesions, and carry out treatments, it has drawn the attention of researchers all over the world. In 2003, we used double balloon enteroscopy (DBE) in 155 patients with suspected intestinal disease, and herein we report the results.

## METHODS

### Patients

Of the 155 patients with clinically suspected intestinal disease, 110 were men and 45 were women. Their ages ranged from 6 to 75 years with an average of 41 years. There were 92 cases of small-intestinal hemorrhage, 39 cases of abdominal pain, 7 cases of diarrhea, 13 cases of abdominal distention, 3 cases of malnutrition, and 1 case of diarrhea and refractory hypoalbuminemia.

### Preoperative preparation

**Via the mouth.** The procedure was the same as that used for gastroscopy. After pharyngeal anesthesia, the patient was placed in a left lateral decubitus position with the mouth mat fixed and electrocardiogram and blood oxygen saturation monitored. Intravenously, 50 to 70 mg of

**TABLE 1. DBE findings in 155 patients with suspected intestine diseases**

Diagnosis	Cases (%)
Intestinal ulcer (Crohn's disease, lymphoma)	45 (29.0)
Meckel's diverticulum	19 (12.3)
Intestinal interstitial tumor	16 (10.3)
Vascular deformity	8 (5.2)
Carcinoma	3 (1.9)
Chronic nonspecific inflammation	19 (12.3)
Strongyloidosis	1 (0.6)
Ancylostomiasis	1 (0.6)
Intestinal adhesion	1 (0.6)
Multiple diverticula	1 (0.6)
Polyposis	1 (0.6)
Esophageal varices	1 (0.6)
Peptic ulcer	7 (4.5)
Stomach cancer	1 (0.6)
Colonic vascular deformity	1 (0.6)
Ulcerative colitis	1 (0.6)
No apparent abnormality	29 (18.7)
Overall positive rate	126/155 (81.3)

pethidine, 10 mg of diazepam, and 10 mg of scopolamine butylbromide were given before operation.

**Via the anus.** The procedure was same as with colonoscopy.

### Instrument and preparation

The Fujinon EN-450 double balloon enteroscope (Fujinon Inc, Saitama City, Japan), which is 200 cm in length, comprises a TS-12140 overtube 145 cm in length, BS-1 balloon, balloon controller PB-10, injection needles, and a biopsy forceps. Two double balloon enteroscopes were used, via the mouth and anus, respectively. Before inspection, the endoscope was covered with the overtube, which was slipped onto the near end while the front balloon was fixed. Two injection/drawing catheters to pump air were connected to the overtube balloon and endoscope. The injection/drawing effect of the air pump was tested on the 2 balloons. Water was injected into the space between the endoscope and overtube via the overtube injection catheter to increase lubrication.

### Manipulation

With the patient under radiograph, the operator manipulated and advanced the endoscope, and the assistant helped to advance the overtube. Of the 155 patients, 64

were examined via the mouth, 33 via the anus, and 58 via the mouth and anus. Manipulation was per the routine method.<sup>2-4</sup> As soon as the lesion was found, it was washed with water, dyed with indigo carmine, and observed carefully while photos were taken. Some tissue was then obtained for pathologic examination. The lesion was marked by injecting India ink into the surrounding mucosa, and its body surface projection and surrounding circumference were observed by spraying indigo carmine via the biopsy channel.

## RESULTS

### Diagnostic results and positive rate

Among the 155 cases, lesions were found in 126 (81.3%) (Table 1). These lesions mainly consisted of small-intestinal ulcers (including Crohn's disease), chronic inflammation, Meckel's diverticula, vascular deformities, and carcinoma of the small intestine. Eighty-five of the 92 patients with suspected intestinal hemorrhage were confirmed, with a positive rate of 92.4%. In 24 of the 39 patients with abdominal pain, the source of the pain was found (positive rate of 61.5%). The cause was also found in 16 of the 23 patients with diarrhea, abdominal distention, or malnutrition (positive rate of 69.6%), as well as for the single case of refractory hypoalbuminemia. The positive rate for patients with suspected intestinal hemorrhage was higher than that for the patients with abdominal pain, diarrhea, abdominal distention, or malnutrition (by  $\chi^2$  test,  $P < .01$ ).

### Location and number of lesions

Among the 126 patients with a positive finding, the lesions were located in the small intestine in 116 patients, in the stomach and duodenum in 9 patients, and in the colon in 1 patient. For the 116 patients with lesions in the small intestine, the number of lesions was 1 for 61 patients, 2 for 4 patients, and  $\geq 3$  for 51 patients.

### The clinical, endoscopic appearance and pathology of small-intestinal ulcer

Among the 155 patients, 45 were found to have small-intestine ulcer. In these 45 patients, 29 patients had recurrent hemorrhage, 9 had abdominal pain, 4 had abdominal distention, 2 had malnutrition and 1 had diarrhea. The number of ulcers was 1 for 12 patients, and multiple for 33 patients. In terms of location of small-intestine ulcers, they were located in the jejunum in 20 patients, in the ileum in 20 patients, and in both the jejunum and ileum in 5 patients. Chronic inflammation of mucosa was found histologically in all of the biopsy specimens ( $>6$  pieces for each patient) in 45 patients with intestinal ulcer.

## Comparisons between endoscopic diagnosis and surgery

Among the 126 patients with small-intestinal lesions, 37 underwent surgery. Meckel's diverticulum (n = 15), interstitial tumor (n = 10), carcinoma (n = 3), angiopathy (n = 1), and intestinal adhesion (n = 1) were found. In all of these cases, the endoscopic diagnosis was completely in agreement with the operative findings. However, for the 7 patients with small-intestinal ulcer who were diagnosed with Crohn's disease, the concordance rate of preoperative and postoperative diagnosis was just 4 out of 7 (57.1%), lower than that in the other diseases ( $P < .01$ ). The remaining 3 patients had intestinal lymphoma (n = 2) and intestinal tuberculosis (n = 1).

## Complications

Perforation occurred in 1 patient. The patient had clinically manifested recurrent hemorrhage, but no lesions were detected through the oral DBE approach. To make a mark in order to proceed with the anal pathway, methylene blue was injected into the submucosa, but the patient felt acute abdominal pain. The endoscopist discovered that the balloon had ruptured and radiograph showed subdiaphragmatic free air. Emergency operation confirmed perforation in the jejunal injection site and a Meckel's diverticulum. The patient recovered within 10 days of the operation.

## Manipulation time

In our series, DBE manipulation lasted from 12 to 180 minutes, with an average of 80.2 minutes.

## DISCUSSION

In our series of 155 cases with suspected small-intestinal disease, the positive rate of DBE was 81.3%. The positive rate was even higher (92.4%) in patients with suspected intestinal hemorrhage. In contrast, the rate was low (61.5%-69.6%) in patients with abdominal pain, diarrhea, or abdominal distention.

In 10 of our patients, lesions were located in the esophagus, stomach, duodenum, and colon, and they could have been detected by gastroscopy and colonoscopy. Thus, for some patients, especially those who are referred from other hospitals, gastroscopy or colonoscopy should be repeated carefully before proceeding with DBE. Among the 116 patients with small-intestinal lesions, the number of lesions was 1 in 61 patients, 2 in 4 patients, and  $\geq 3$  in 51 patients. In order to find all of the lesions, operators should perform DBE carefully and not be satisfied with finding 1 or 2 lesions.

It is important to mark the lesions for easy identification during subsequent operation. However, the marking should be made on the surrounding mucosa, not directly on the lesion because the dye can effuse in the wall of the intestinal tract and cover the lesions and therefore interfere with the pathologic diagnosis. Marking the submucosa around the lesions can avoid such interference.

Small-intestinal ulcer may be due to Crohn's disease, tuberculosis, lymphoma, chronic nonspecific multiple ulceration, or a drug-related ulcer. Such ulcers are difficult to distinguish by endoscopy alone. In our series, 45 patients were found to have small-intestinal ulceration, accounting for 29.0% of our cases; in all of them, biopsy specimens showed chronic inflammation. In the 37 patients who were subsequently operated on (ie, for Meckel's diverticulum or carcinoma), the endoscopic diagnosis was completely in concordance with the postoperative diagnosis. However, for ulcerative lesions (ie, Crohn's disease), the concordance rate was just 4 out of 7 (57.1%).

In this study, intestinal perforation occurred in 1 patient, at a rate of 0.65%. This can be due to marking and/or balloon rupture. Under such circumstances, the procedure should be terminated immediately.

In conclusion, DBE is efficient and safe for the diagnosis of small-intestine disease and disease localization, but in some cases, particularly in ulcerated lesions, the diagnosis may be elusive and surgery may be needed.

## DISCLOSURE

*The authors have no disclosures to make.*

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