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WIRELESS CAPSULE ENDOSCOPY EXPLORATION FOR DISEASES OF THE SMALL INTESTINE IN CHINA

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ABSTRACT

For small bowel diseases, it is difficult for the ordinary enteroscopy to reach due to its specific curvature and length. Capsule endoscopy (CE) is a unique tool to visualize the mucosa of the small intestine. The aim of this study was to evaluate the detection rate and diagnostic yield of CE in a large group of patients with suspected digestive diseases in China. One hundred and two consecutive patients (75 male, mean age 50 years, range 32-87 years) underwent CE in our Gastroenterology Units, for a total of 102 procedures. Referrals were obscure occult/overt gastrointestinal bleeding group (19 patients) and suspected small bowel disease group (83). In our study, the whole detection rate was 92 % (94/102), with a definite diagnosis yield of 63 % of the patients in the obscure gastrointestinal bleeding and 39 % of the patients in the suspected small bowel diseases. None of the patients developed symptoms of signs of mechanical obstruction, although the capsule was retained in the stomach in 2/102 patients for their somatostatin taken. CE seems to be a very safe, painless and effective procedure with a high diagnostic yield. Accurate selection of indications and critical evaluation of the results are essential to explore these diseases.

Keywords: Capsule endoscopy, small bowel disease, diagnostic yield

INTRODUCTION

With the advent of the capsule endoscopy (CE), the small bowel no longer appears a mysterious territory troubles patients and doctors (Fritscher-Ravens and Swain, 2002). This noninvasive tool plays a very important role in gastrointestinal disease, particularly in small bowel diseases.

There are several methods for screening digestive diseases, including the primary barium X-ray, Computer Tomography (CT) and enteroscopy. However, in small bowel diseases, the mucosal inflammatory and flat lesions can't be clearly observed by barium X-ray or CT (Costamagna et al., 2002; Eliakim et al., 2003; Filippone et al., 2007; Hara et al., 2004). Although the improved double balloon endoscope（DBE） was widely applied in the small bowel diseases, it is an invasive procedure and expert endoscopists are still needed. In recent years, there is increasing evidence that CE plays a very important role in the diagnostic of small bowel diseases, especially in gastrointestinal (GI) obscure bleeding, suspected small bowel diseases, and other indications (Sturniolo et al., 2006; Park et al., 2007; Ziegler et al., 2005; Thomson et al., 2007; Maunoury et al., 2007). Moreover,

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with the improved new techniques, including the "blood indicator" and the "patency capsule," might make the examination much safer than before (Signorelli et al., 2005; Costamagna et al., 2004).

Although CE is sensitive and specific for detecting small bowel lesions, it is only seven years since the advent of the CE (Iddan et al., 2000; Appleyard et al., 2000). Moreover, in China, only a few medical institutions carried out CE detection for small bowel diseases. Therefore, more procedures are still needed to explore the safety, detective and diagnostic value of the CE in Chinese group of patients.

PATIENTS AND METHODS

Patients

Between May 2005 to January 2007 a total of 102 patients (75 male), mean age 50 years (range 37-82 years) underwent CE for a total of 102 procedures. Patients were enrolled in the Gastroenterology Units, in 401 hospital of PLA, Qingdao, China.

In all patients, previous upper and lower GI endoscopies were negative. Findings of other investigation were not significant in explaining the clinical picture. Referrals were obscure occult/overt gastrointestinal bleeding (19 patients) and suspected small bowel disease (83) and none of them have contraindicating EC. Four patients were on somatostatin, three were on anticoagulants, and two were on anti-inflammatory drug (NSAID).

All patients gave their informed consent and the study was approved by the Ethic Committees of the 401 Hospital of PLA, China.

Capsule endoscopy procedure

After bowel cleaning with a 250 ml solution of mannitol and an overnight fast of 12 h, patients ingested the wireless capsule (PillCam, Given Imaging). Before this, an array of eight sensors was attached to the abdominal wall of each patient, and a recorder with a battery, attached to a belt, was worn around each patient's waist. Patients were allowed to drink 2 h after ingesting the capsule and to eat 4 h later. After ingestion of the capsule with a small amount of water, patients were free to pursue their own activities. The capsule takes two imagines per second during eight hours, depending on battery power. The frames are transmitted directly to a recorder and after the examination they are unloaded onto a computer. About 50.000 frames can be reviewed one by one or as a video sequence, and the results were related to the experience of the investigator.

Patients were asked to look for the capsule in the feces. All capsules were retrieved 12 h to 5 days after ingestion. All patients were contacted 1 month after completing the study for a survey of late complications.

RESULTS

Follow-through time of the capsule

After the patients swallowed the capsule in the supine position, the median esophagus transit time was 2.46 min (0.5-21.38 min), the median gastric transit time was 47.4 min （11.73-510 min） including two patients had a gastric distention of 2 hours, and the median small bowel transit time was 275.82 min (124.8-508.8 min). All patients underwent the examination without discomforts and complications. The average recording time was about 4.64 hours (2.08-8.48 hours).

Endoscopic findings

The overall detection rate of the EC was 92 %. Different abnormities including erosion, ulcer, angiodysplasia, polyp, diverticulum and tumor were detected by the CE (Table 1). Moreover, Findings were located in the duodenum (at the third portion) in 17.6 % of patients, in the jejunum in 35.2 % of patients, and in the ileum in 48.1 % of patients. Localization of findings was determined by the external localization system supported by the capsule device, the clini-

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cian estimations, and surgery in those patients who needed surgical therapy.

Table 1: Total abnormal findings in the study group

Diagnosis	N
Positive findings	94
Duodenitis	13
Duodenal ulcer	4
Duodenal cancer	1
Angiodysplasia	4
Small-bowel erosions	16
Small bowel ulcer	13
Simple intestinal polyp	15
Intestinal diffuse lymphangectasia	10
Intestinal interstitialoma	2
Lymphoid hyperplasia	11
Small bowel diverticula	2
Crohn's disease	6
Multiple intestinal polyps	8
Small bowel tumors	2
Negative findings	8

Obscure GI bleeding

Obscure GI bleeding was defined according to the position of the American Gastroenterological Association. It includes occult obscure bleeding and overt obscure bleeding and the formed was defined by the presence of positive fecal blood test and chronic iron-deficient anemia, without any clinically evident bleeding episode from at least 6 months, whereas the latter indicated a history of recurrent bleeding episodes of melena or lower GI bleeding in the last 6 months (Sturniolo et al., 2006).

In our study, nineteen procedures were performed to investigate the obscure GI bleeding, including 6 patients with overt obscure bleeding and 13 patients with occult obscure bleeding, among all the patients, there were 15 males, mean age was 51 years (range 34-81), mean Hb value 7.9 ± 3.2 g/dl, 42 % with previous blood transfusion.

The overall detective rate in this group of patients was 100 %, whereas some findings (single polyps, small and scattered erosions) were considered not related or adequate to explain the clinical picture. Thus, the overall diagnostic yield was 63 % (12 medical significant lesions/19 valid explorations) and the detailed types of the lesion detected by CE in this group were as the followings: multiple small bowel erosions with bleeding in 8 cases (Fig. 1), severe intestine ulcers with bleeding in 2 cases, activated post bulbar ulcer of duodenal in 1 case (Fig. 2), and jejunal tumor with activated bleeding in 1 case (Fig. 3). All the abnormities were not known prior to the CE detection.

Figure 1: Multiple erosions with bleeding was observed in the small bowel

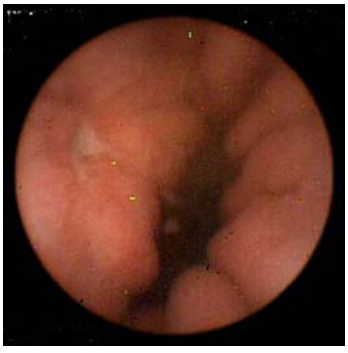

Figure 2: Activated post bulbar ulcer of duodenal was detected by wireless capsule

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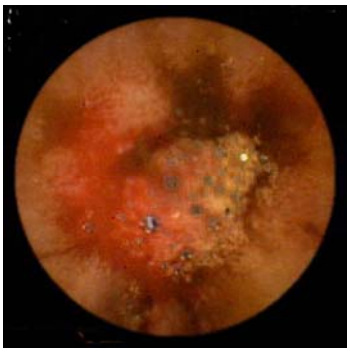

Figure 3: Tumor with activated bleeding was observed in the jejunal

Suspected small bowel disease

In 83 cases (60 male), mean age 48 years (range 32-87), capsule endoscopy was performed for persistent digestive symptoms (e.g., diarrhea, abdominal pain) or biochemical abnormities (e.g., increased inflammatory tests, low serum protein) suggestive of small bowel disease. In particular, the indication was chronic diarrhea in 31 patients, abdominal pain in 24, malabsorption in 20, and suspected Crohn's disease (CD) in 8.

Small bowel lesions were detected in 52 cases (63 %), whereas the exploration was considered insufficient in 3 (3 %) and negative in 28 (34 %) (Table 2), and in the latter group, 11 patients with ileum lymphoid hyperplasia were included. Capsule explorations were considered significant in 32 cases, final diagnosis being small bowel ulcers in 11 patients, intestinal diffuse lymphangectasia in 7, CD in 6 (Fig. 4), NSAID enteropathy in 6, and Whipple disease in 3. Thus the overall diagnostic yield of capsule endoscopy for patients with suspected small bowel disease was 39 %.

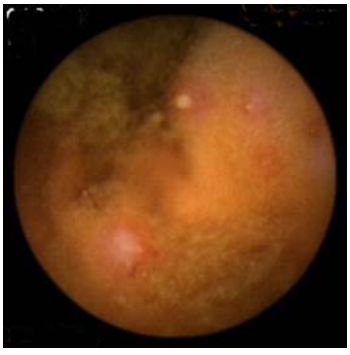

Figure 4: Crohn's disease was observed in the small bowel by wireless capsule

Table 2: Positive and negative findings in the patients with suspected bowel diseases according to the clinical symptoms

	Total number of patients	Positive findings (diagnostic yield)	No small bowel lesions (%)
Diarrhea	31	14 (45 %)	12 (39 %)
Abdominal pain	24	10 (42 %)	6 (25 %)
Mal-absorption	20	2 (10 %)	9 (45 %)
Suspected Crohn's disease	8	6 (75 %)	1 (13 %)
Total	83	32 (39 %)	28 (34 %)

DISCUSSION

In this study we evaluated the safety, detective and diagnostic value of CE in a large group of patients in China. Our findings demonstrated that a detection rate of 92 % was found, which was higher than the previous report in China (Ge et al., 2004). This higher detection rate might be associated with the more clinical pictures of the patients when they participated in this study, and the higher sensitivity values of CE in digestive diseases. Moreover, abdominal pain had a diagnostic yield of 42 % in our study, which was higher than Bardan's report (Bardan et al., 2003). The higher diagnostic yield was confirmed by the more patients with small bowel ulcers with staxis in our study group.

Compared with the ordinary enteroclysis, bleeding scanning with labeled red blood cells, push enteroscopy, and double balloon enteroscopy, the CE plays a very important role in the diagnosis of obscure

GI bleeding (Saperas et al., 2007; Leighton et al., 2006; Hadithi et al., 2006). In our study, there were several types of lesions including erosion; ulcer, Crohn's disease, and tumor were observed in patients with obscure GI bleeding, and the total diagnostic yield was 63 % in this group patient, slightly higher than the recent report (Jones et al., 2005). Our results showed that CE should be an ideal tool to explain the reason of obscure GI bleeding. However, for the suspected small bowel disease, the wireless capsule showed a lower diagnostic yield (39 %), although a higher diagnostic yield was found in the abdominal pain group patients (42 %). The results from our study were closely correlated with the patients' condition in China and the referrals selection.

For small bowel disease, double-balloon push enteroscopy (DBE) has increased its diagnostic yield currently, but it is still an invasive procedure and needs expertise endoscopists. In our study, we use CE to detect 8 cases of suspected CD, and found 6 cases of CD at early stage by the following findings: mucosal congestion and edema; mucosal polyps; scattered erosions; irregular ulcers, and mucosal atrophy. Our results indicated that the CE showed a great superiority in diagnosis of CD, thus contributed to early treatment, and prognosis of the CD. Polyp is one common small bowel lesion, and we found 15 cases of single intestine polyp of 0.2-0.3 cm which needed to follow-up. Moreover, 8 cases of multiple intestine polyps were observed in the upper jejunum and terminal ileum. The location of the polyps detected by the CE was accurate enough to direct polypectomy. Our findings suggest that CE does not only have the capacity to detect the small bowel abnormities but also has the potential to early treatment.

In conclusion, the wireless capsule endoscopy is a revolutionary technique which allows the visualization of the entire gastrointestinal (GI) track, especially the small intestine. Our results showed that the CE was safe and effective, with high sensitivity values and diagnostic yield in the small bowel diseases.

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