

APPLICATION OF CAPSULE ENDOSCOPY IN SMALL INTESTINE DISEASES: ANALYSIS OF 28 CASES IN KAOHSIUNG MEDICAL UNIVERSITY HOSPITAL

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Capsule endoscopy (CE) is used to diagnose small intestine disease. Many studies have shown a better lesion detection rate in obscure gastrointestinal (GI) bleeding than with other surveyed techniques. Our study investigates the diagnostic value of CE in patients with suspicious small intestine diseases. Between October 2004 and January 2006, patients who had suspected small intestine disease underwent CE in Kaohsiung Medical University Hospital. Presenting symptoms included obscure GI bleeding, abdominal pain, diarrhea, microcytic anemia, and other indications. CE results were analyzed as a proportion of total lesion detection rate and also with regard to obscure GI bleeding and abdominal pain for analysis. A total of 28 patients, including 12 males and 16 females, were enrolled for CE examination. Overall, small intestine lesions were detected in 20 cases (71.4%), with negative findings in eight cases. For obscure GI bleeding, the total lesion detection rate was 85.7% (12 of 14 patients) but the diagnostic rate was only 35.7% (five of 14 cases). In patients with abdominal pain, four of seven (57.1%) had small intestine lesions. In conclusion, CE survey has a good lesion detection rate for small intestine disease, especially for patients with obscure GI bleeding, and is helpful in the diagnosis of unexplained abdominal pain.

Key Words: abdominal pain, capsule endoscopy, obscure gastrointestinal bleeding, small intestine disease, small intestine tumor
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The small intestine is unreachable by endoscopic examinations, and diseases of this portion of the intestine is difficult to diagnose. Diagnostic strategies for

small intestine disease, especially obscure gastrointestinal (GI) bleeding, include push enteroscopy, small intestine radiography, abdominal computed tomography (CT), angiography, and red blood cell (RBC) scan. However, low diagnostic yield is a common drawback. Capsule endoscopy (CE), a wireless capsule that takes images of the GI tract, is a new diagnostic modality for the small intestine. Many studies have reported a higher diagnostic rate (40–83%) than with other diagnostic methods in the setting of obscure

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GI bleeding [1–10], while other studies have been performed to compare sensitivity of CE with that of push endoscopy, small intestine radiography, or other standard tests [2,6–10]. Video CE has been found to be superior to push enteroscopy and small bowel radiography in the evaluation of small bowel diseases [2,5,7,8,10]. The complication rate (e.g. capsule jammed in the GI tract) is also reported to be favorably low at 1.5% [9]. Accordingly, our study aims to investigate the diagnostic value of CE in patients with suspicious small intestine diseases.

METHODS

Between October 2004 and January 2006, 28 patients underwent CE examination in Kaohsiung Medical University Hospital. Patients had melena, hematochezia, iron-deficient anemia, abdominal pain, chronic diarrhea, or family history of GI malignancy, and had undergone upper and lower GI surveys. After a detailed explanation, they agreed to undergo CE examination and submitted signed consent forms. Most patients had had an esophagogastroduodenoscopic (EGD) and/or colonoscopic examination that could not explain their symptoms. Abdominal CT, angiography, small intestine barium study, and RBC scan were performed only when the clinical condition warranted it. All patients received abdominal radiography to exclude the possibility of bowel obstruction. None of our cases were pregnant or had pacemaker implantation.

Equipment

The capsule endoscope (Given Imaging M2A; Given Imaging Ltd., Yoqneam, Israel) used was 11 × 26 mm in size, 3.7 g in weight, and had a battery life of 8 hours. The camera takes two images per second and transmits the images via radio frequency to a sensor array in a belt that is worn by the patient around the abdomen. After the completion of the procedure, images were downloaded and analyzed by proprietary software (RAPID; Given Imaging Ltd.). The images were examined by two gastroenterologists after downloading to a computer.

Preparation

Patients were instructed to take the laxative Fleet® Phospho-Soda® (C.B. Fleet Co., Inc., Lynchburg, VA,

USA) 90 mL with as much water as they could tolerate, or polyethylene glycol and electrolytes (Klean-Prep®; Helsinn Birex Therapeutics Ltd., Dublin, Ireland) two packs with 1,000 mL water in each pack, 16 hours before starting the examination. All of them fasted for at least 12 hours prior to the procedure. The capsule was swallowed with a glass of water and their swallowing difficulties were monitored. Patients were allowed to drink clear liquids 2 hours later, soft diet 4 hours later, and a normal meal after the examination was complete. They were asked to observe their stools to note whether or not the capsule passed out. If not (or when obstruction signs such as nausea or vomiting were found), the condition was recorded and monitored with proper management such as follow-up with plain abdominal X-ray for the capsule site, fasting with intravenous fluid supply, or operation for removal of the capsule.

Result reading and definition

CE findings were reviewed separately by two gastroenterologists. The endoscopic diagnoses of GI lesions were according to the *Atlas of Capsule Endoscopy* [11]. The findings were defined as: (1) diagnostic when the findings could explain the symptoms/signs well or be confirmed after treatment; (2) positive when findings showed only lesions without blood/coffee grounds or when only blood or coffee grounds were found over the small intestine but the cause of bleeding could not be identified; and (3) negative when findings of the small intestine were normal. The lesion detection rate included diagnostic and positive findings.

RESULTS

Characteristics of patients and overall CE findings

Among the 28 patients who underwent CE survey, 16 were female (57.1%) and 12 were male (42.9%). The mean age was 56.82 ± 13.8 years (range, 31–81 years). The main symptoms/signs were obscure GI bleeding ($n=14$, 50%), abdominal pain ($n=7$, 25%), and diarrhea ($n=3$, 10.7%). Four had other conditions (14.3%): one had a gastric carcinoid tumor for small intestine polyps survey; one asked for a survey due to a family history of GI tract cancer; one had gastric and colonic polyposis and asked for a survey of the small intestine polyp; and one had microcytic anemia. For those with

Table. Capsule endoscopic findings

Symptoms	Findings	<i>n</i>	
Obscure GI bleeding		14	
	Angiodysplasia	6*	
	Suspected small intestine tumor	1	
	Small intestine ulcers	2 [†]	
	Bleeding without defined lesion	2	
	Third-portion duodenal polyp	1 [†]	
	Negative	2	
Abdominal pain		7	
	Suspected jejunal tumor	2	
	Small intestine ulcers	1	
	Submucosal tumor	1	
	Negative	2	
Diarrhea		3	
	Crohn's disease	1	
	Lymphangiectasia	1	
	Parasites	1	
Others		4	
	Family history of GI malignancy	Normal	1
	Microcytic anemia	Normal	1
	Gastric/colon polyp	Negative	1
	Gastric carcinoid tumor	Jejunal polyps	1

*Two patients' images showed active bleeding from lesion as diagnostic, but four had positive findings with angiodysplasia but no bleeding when examined; [†]lesion with active bleeding noted during examination. GI = gastrointestinal.

obscure GI bleeding, 10 presented with melena (black stool) passage, three had hematochezia (bloody stool), and two had anemia with occult blood in the stool revealed by guaiac test. The number of other tests performed included EGD 26 cases (92.9%), colonoscopy 25 cases (89.3%), abdominal CT 20 cases (71.4%), small intestine series 15 cases (53.6%), angiography six cases (21.4%), and RBC scan four cases (14.3%). Only two patients did not receive EGD survey due to symptoms of diarrhea and not favoring upper GI origin disease. Colonoscopy was not performed in three patients who refused the survey.

CE findings among the patients are listed in the Table. Overall, abnormal findings in the small intestine were found in 20 of 28 patients (71.4%), while a normal picture of the small intestine was seen in the remaining eight. The findings included angiodysplasia in six (21.4%), small intestine ulcers in four

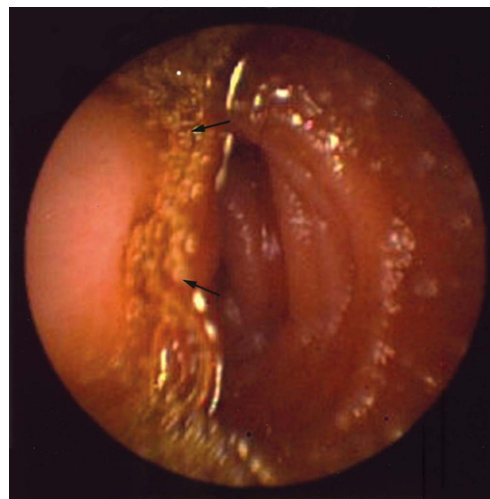


Figure 1. Jejunal tumor in a 64-year-old man with tarry stool. The arrows indicate the tumor site.

(14.3%), suspicion of small intestine tumors in three (10.7%) (Figure 1), a positive finding of bleeding but no definite lesions in two, small intestine polyps in two, lymphangiectasia in one, submucosal tumor in one (Figure 2), and active parasitic infection in one patient (Figure 3).

As we divided these cases according to the symptoms, we found that CE had a good diagnostic rate in obscure GI bleeding and abdominal pain cases. For the 14 obscure GI bleeding patients, the lesion detection rate was 85.7% (12 of 14 patients), but a definite diagnosis was reached in only 35.7% (five of 14 patients). Five cases had small intestine lesions visualized but no blood or coffee ground-like substance was found. Two patients presented with small intestine coffee ground substance but no lesions were detected due to blood coverage.

Among the seven patients who presented with abdominal pain, four (57.1%) were diagnosed with small intestine lesions, including Crohn's disease in one, small intestine ulcers in one, and jejunum tumor in two patients.

Of the 28 patients, two had the capsule jam just above the lesion, and one had prolonged gastric emptying and the image recording stopped at the ileum. Our complication rate was 7.1%, with an incomplete data rate of 10.7%. Four patients received further operative management. One patient who had parasites in the small intestine received antiparasitic agents for treatment. Other patients received medical management according to their symptoms.

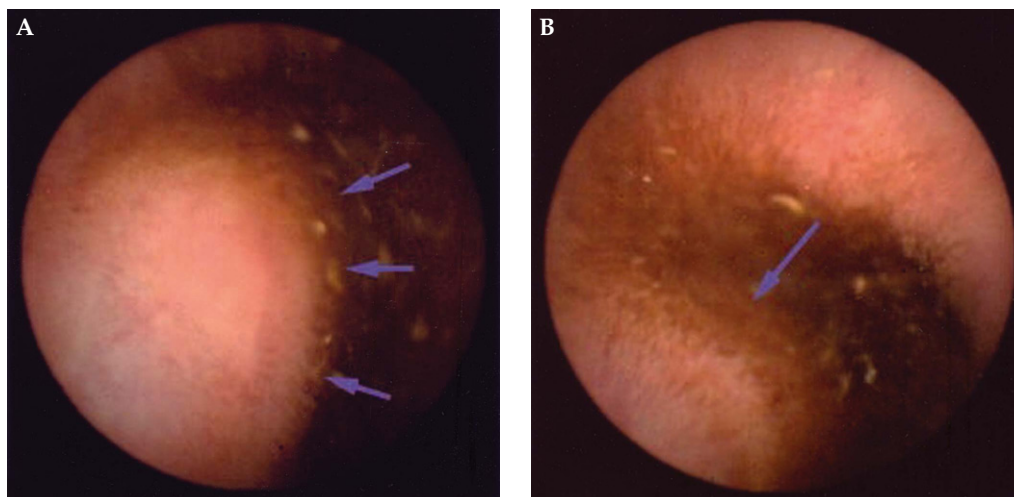


Figure 2. External compression over the distal jejunum suspected to be a submucosal tumor.

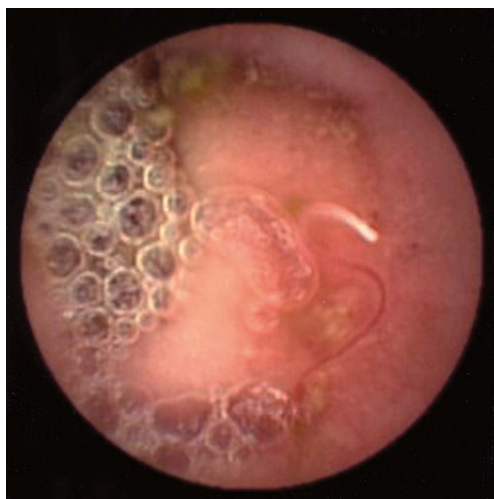


Figure 3. Parasite found in the jejunum and ileum.

For findings other than small intestine findings, four recorded stomach polyps, four had gastric erosions, one had a colonic polyp, one had diverticulum at the ascending colon, and one patient who had small intestine angiodysplasia also had colonic angiodysplasia. Neither discomfort nor swallowing difficulty was noted among these patients.

DISCUSSION

CE is a newly developed diagnostic method for small intestine disease. In our report, the overall lesion

detection rate was 71.4%. For those with obscure GI bleeding, the lesion detection rate was 85.7%, but the diagnostic rate was 35.7%. Many studies have also evaluated the diagnostic value of CE in obscure GI bleeding, and the lesion detection rate ranged from 40% to 83% [1–10]. The diagnostic rate in our study was found to be lower (35.7%), but including the positive finding cases, the lesion detection rate (85.7%) was good. In Chao et al's study [3], the lesion detection rate was 81% and the diagnostic rate was 37%, and the data found to be close to our study. This is because the exact source of bleeding is difficult to establish when bleeding stops during an examination, though possible lesions (e.g. angiodysplasia, small intestine ulcers or tumors) may be detected, and if multiple lesions are detected, then this makes it even more difficult to focus on the main bleeding source.

In contrast, when there is excessive blood or coffee ground-like substance in the lumen, CE can only detect the site of bleeding and the definite lesion can be masked. Accordingly, it is useful to combine other diagnostic strategies such as small intestine radiography and abdominal CT to make a more accurate diagnosis. Additionally, a second-look examination may help to improve the detection rate and, in fact, one study has shown that repeated CE should be considered in patients with persistent obscure GI bleeding when the initial study is negative or inconclusive [4]. However, this is expensive and no study has yet been conducted to evaluate its cost effectiveness and benefit yield.

Most small intestine bleeding is self-limiting. For those with recurrent or severe bleeding, the source of bleeding revealed by CE helps in further operative management.

CE also has a good detection rate for those with abdominal pain where small intestine lesions are suspected. In our study, the detection rate was 57.1% (four of seven patients). Most studies mainly discuss the diagnostic rate in obscure GI bleeding cases. In abdominal pain cases where upper GI and colonic problems have been ruled out, CE also has a good lesion detection rate. Two cases were diagnosed with small intestine tumors with an image of the capsule showing much residual food in the lumen, narrowing the field to hyperemic, ulcerative, edematous mucosal change, and capsule stasis in the lumen. To-and-fro moving of the CE over the pre-lesion area may give false information of segmental lesions, so imaging findings may give us information about the presence of small intestine mucosal tumor lesions.

Many studies have described CE as possessing good detection value in Crohn's disease [3,5,9]. Positive findings range from areas of denuded villi, mucosal breaks to gross ulceration. However, other etiologies must be excluded before reaching the diagnosis of Crohn's disease, but a biopsy cannot be performed during CE examination and such limitations remain.

There remain some problems about the procedure and preparation that need to be solved. Firstly, some conditions such as gastric bubbles, residual food, and blood may interfere with the view. Some reports have indicated that gastric bubbles may be improved after simethicone use [9]. Residual food may hint at intestinal obstruction or mucosal ulcerations. The presence of blood may give us information about bleeding sites even when the main lesion cannot be identified. Besides these, good preparation is important. Some patients, especially those with diabetic neuropathy, have delayed bowel movement and constipation. We suggest that such patients fast for longer, take more water or even laxatives, although further observation and study should be made to evaluate the effects of these measures. Secondly, can what we see completely explain the patients' problems or not? For example, can it explain the cause of bleeding when we see angiodysplasia in multiple areas of the small bowel? How probable is it to have a masked bleeding lesion? Most patients in stable condition have self-limiting

small intestine bleeding. For those with severe or recurring bleeding, angiography or repeated CE survey may give us more information [4]. Again, further study is needed to evaluate the effect of second-look CE. Thirdly, incomplete CE survey is an important issue. We found the capsule jammed in the stenotic lumen in two cases, and another patient had delayed gastric emptying and the capsule ran out of battery power before reaching the ileocecal valve. Patients suffer when undergoing an operation for capsule removal and it is important to rule out the possibility of intestinal stenosis by abdominal radiography or small intestine series before subjecting them to such an operation. Otherwise, an operation should be previously planned in candidate patients who have been preinformed and who have already agreed to undergo it. Finally, CE cannot be used for treatment or collection of tissue for pathology, and its high cost is generally acknowledged. The capsule may need to be more delicately designed in the future.

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膠囊內視鏡於小腸疾病的應用 —

28 位病人的分析

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臨床上膠囊內視鏡適用於小腸疾病的診斷，許多研究顯示膠囊內視鏡在小腸未明出血處病灶的診斷率高，本篇探討於懷疑小腸病灶的病患使用膠囊內視鏡診斷率的分析。自 2004 年 10 月至 2006 年 1 月，在高醫懷疑小腸病灶之患者接受膠囊內視鏡檢查，這些病人表現症狀包括未明處之消化道出血、腹痛、腹瀉、小球性貧血、及其他接受檢查之狀況，膠囊內視鏡的結果進一步做病灶診斷率的分析及分組成消化道出血與腹痛做診斷率分析。共 28 人包括男性 12 人 (42.9%) 女性 16 人 (57.1%) 接受檢查。總共 20 人 (71.4%) 診斷有小腸病灶，8 人小腸檢查正常，就未明處之消化道出血而言，小腸診斷有病灶有 12 人 (85.7%)，而確定為出血出處診斷為 5 人 (35.7%)。就腹痛病人而言，4 人發現小腸病灶，診斷率 57.1%。結論膠囊內視鏡對小腸疾病診斷價值高，由對於未明處之消化道出血及腹痛的病人。

關鍵詞：腹痛，膠囊內視鏡，原因不明的消化道出血，小腸疾病，小腸腫瘤
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