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Small-Bowel Capsule Endoscopy: Indications and Results in Endoscopy Unit

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Abstract

Small-bowel capsule endoscopy (SBCE) is used widely because of its non-invasive and patient-friendly nature. SBCE can visualize entire small-intestinal mucosa and facilitate detection of small-intestinal abnormalities. Indications for SBCE are obscure gastrointestinal bleeding, Crohn's disease, small-intestinal polyps, tumors and celiac disease. ***Materials and methods*:** We report a study from September 2018 to February 2022, including 59 patients who underwent SBCE type PillCam SB3®. All our patients previously had a normal endoscopic assessment (oesogastro-duodenal fibroscopy and ileo-colonoscopy). CT enterography and MR *enterography* realized in 54.2% of cases were normal. The preparation used is PEG (2l the day before and 0.5l after ingesting the capsule) with clear broth the day before the examination and 10 days off oral iron if taken. ***Results*:** The mean age was 53.9 years, with a female predominance (sex ratio: 0.52). 16.9% of the patients had a history of heart disease, 8.4% are chronic renal failure, 5% are followed for Crohn's disease and 3.3% for celiac disease. 10.1% of patients were on anticoagulants and 5% on antiplatelet agents. The indication for SBCE was Obscure gastrointestinal bleeding (OGIB) in 86,3%, Crohn's disease (CD) in 5%, celiac disease in 3,3%, chronic diarrhea in 3,3%, and unexplained edematoascites syndrome in 1,6%. SBCE found small bowel angiodysplasia lesions in 40.6% of patients, small bowel inflammatory lesions in 15% of patients, a submucosal tumor appearance in 6.7% of patients and active small bowel bleeding in 5% patients. The examination did not objectivate small bowel lesion in 25.4% of patients. Non-small bowel lesions have been demonstrated in the form of gastric (16.9% of cases) and cecal (10.1% of cases) angiodysplasia responsible for OGIB. ***Conclusion*:** In our study, SBCE showed lesions in 74,6% of cases; dominated by angiodysplasia followed by inflammatory lesions and submucosal tumors and whose indication was essentially OGIB. Enteroscopy with biopsies or with therapeutic gesture, remains essential in the management of these patients.

Keywords: Small-bowel, capsule endoscopy, PillCam SB3®.

INTRODUCTION

SBCE has completed the endoscopic visualization of the entire luminal gastrointestinal tract. It was introduced by Iddan *et al*., in 2000. SBCE is used widely because it is non-invasive tool and patient-friendly. The aim of our study is to analyze the indications of SBCE and results.

MATERIALS AND METHODS

From September 2018 to February 2022, were included all patients who underwent SBCE PillCamSB3®. All our patients previously had a normal endoscopic examination (upper digestive endoscopy and ileo-colonoscopy). CT enterography and MR *enterography* realized in 63% of cases were normal. The preparation used is PEG (2l the day before and 0.5l after ingesting the capsule) with clear broth the day before the examination and 10 days of oral iron stoppage in case of taking.

RESULTS

59 patients were included: an average age 53.9 years, with a female predominance (sex ratio: 0.52). 16,9% of patients had a history of heart disease, 8,4% are chronic kidney failure and 13,5% are followed for portal hypertension. 10,1% of patients were on anticoagulants, 5% on antiplatelet agents and 1,6% on nonsteroidal anti-inflammatory drugs. The mean time between symptomatology and SBCE was 33 months. The indication for SBCE was unexplained exteriorized gastrointestinal bleeding type melena in 45,7% of patients with an average hemoglobin level of 5.82g/dl, iron deficiency anemia in 40,6% of patients with an average hemoglobin level of 7.14g/dl, Crohn's disease

(CD) in 5%, celiac disease in 5%, chronic diarrhea in 3,3%, and unexplained edematoascites syndrome in 1,6%.

The SBCE objective small bowel angiodysplasia lesions (Fig 1) in 35% of the patients, a submucosal tumor (Fig 2) in 6,7% of the cases, small bowel ulcerations (Fig 3) in 6,7% of the patients, terminal ulcerative ileitis compatible with CD (Fig 4) in 6,7%, active small bowel bleeding which unable any exploration (Fig 5) in 5% of patients, cracked-mud appearance of duodenojejunal mucosa characteristic of celiac disease in 3,3%, congestive duodenojejunal mucosa in 6,7%, hemorrhagic erosive jejunoileal mucosa in 3,3%, small bowel diverticula diverticulum with ulceration of the neck (Fig 6) in one patient (1.6%), and duodenal lymphangiectasia extended to the jejunum suggestive of Waldmann's disease in one patient. SBCE did not objectivate small bowel lesion in 25.4% of patients. Non-grelic digestive lesions have been diagnosed: it was gastric angiodysplasia (16.9% of cases) (Fig 7) and cecal angiodysplasia (10.1% of cases) (Fig 8) responsible for unexplained gastrointestinal bleeding.

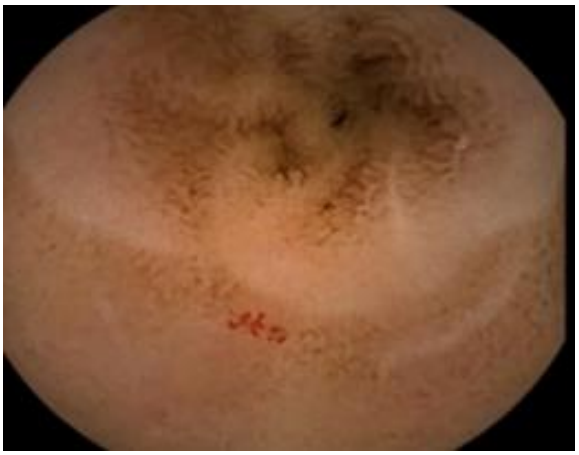
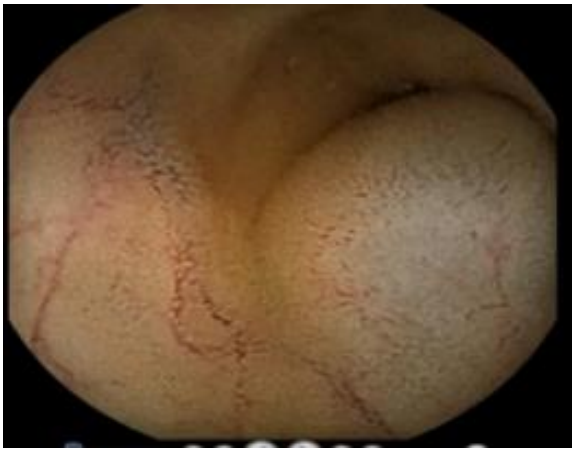


Figure 1



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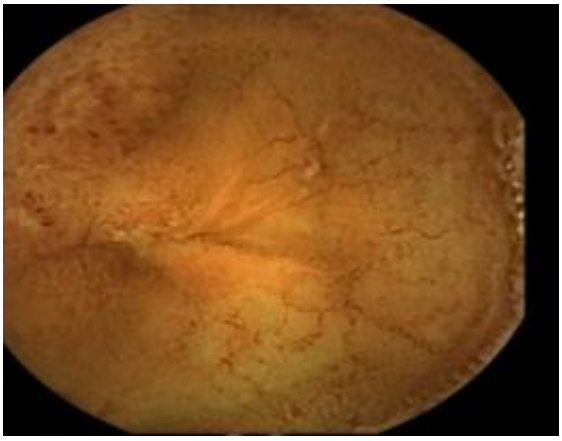

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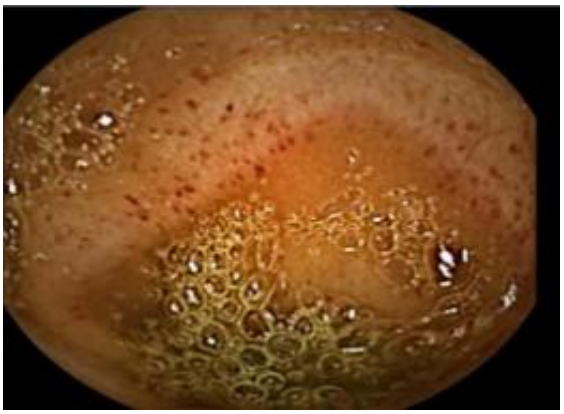

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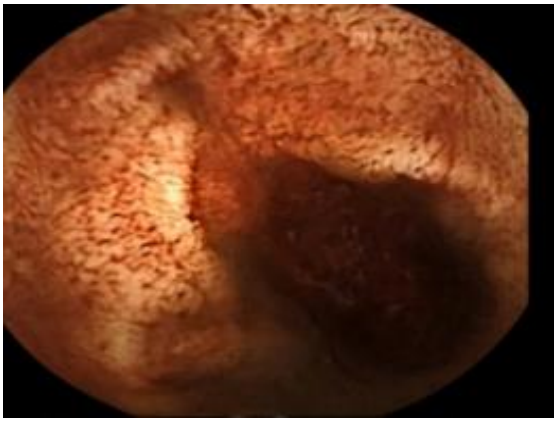

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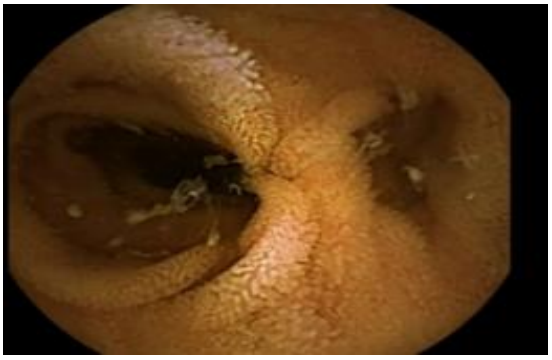

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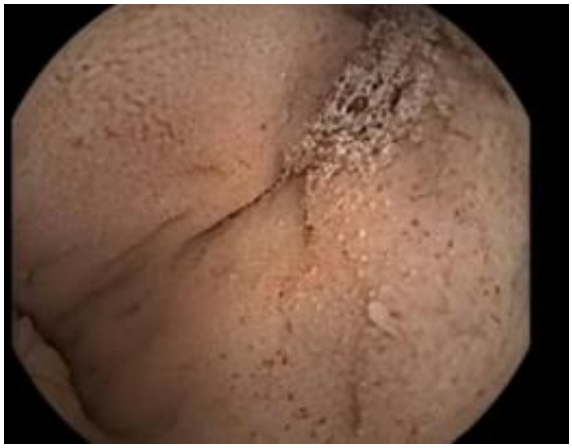

Figure 7

Figure 8

DISCUSSION

SBCE has revolutionized the management of small-bowel diseases owing to its convenience and noninvasiveness. Capsule endoscopy is a common method for the evaluation of obscure gastrointestinal bleeding, Crohn's disease, small-bowel tumors and polyposis syndrome.

Several platforms of SBCE are available worldwide. In Japan, two types of platforms, PillCam (Given Imaging [eventually purchased by Medtronic], Yokneam, Israel) and EndoCapsule (Olympus, Tokyo, Japan), are available. Given Imaging developed the first SBCE device, named the M2A capsule.3 The M2A capsule was eventually renamed PillCam SB. The size of PillCam SB (first generation) was 11 mm 9x26 mm, which was same size as second- and third-generation capsules (Fig. 9). PillCam SB can take 2 pictures/s and has a 140° field of view. A second-generation SBCE device, PillCam SB2, has a wider angle of view (156°), an automatic light control, higher-resolution camera and longer battery life (12 h) 4,5 as compared with the first-generation SBCE device (M2A) [1, 2].

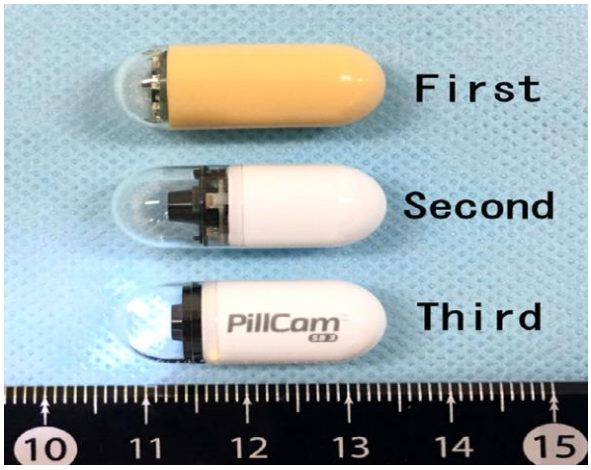

Figure 9: The difference between the first-, second- and third-generation PillCam [1]

Diagnostic yield of SBCE on the proximal part of an SB tumor is considered to be relatively low.7,8 To overcome this issue, a third-generation SBCE device, PillCam SB3, has a high-resolution camera equipped with an adaptive frame rate system that is able to increase automatically from 2 images/s to 6 images/s if the capsule is accelerated by peristalsis. This third-generation SBCE device can communicate with an external data recorder (DR3) to recognize the location and speed of the capsule [3].

SBCE can be performed in both hospitalized and ambulatory patients. Patients are generally recommended to remain on a clear liquid diet the day before VCE administration. 1 Bowel preparation with 2 L of polyethylene glycol is common and provides relatively comparable preparation quality and diagnostic yield to a 4-L polyethylene glycol preparation. Newer low-volume bowel preparations using MoviPrep or Pico-Salax have also been suggested to have comparable efficacy. Simethicone may be administered before VCE to reduce the presence of bubbles in the small bowel [4, 5].

Narcotics and other medications such as anticholinergics and antihistamines, which may cause gastroparesis, should be stopped if possible 2 to 3 days before SBCE administration. Alternatively, patients can receive either metoclopramide 10 mg 3 times daily before meals or erythromycin 250 mg every 8 hours for 2 to 3 days before. Cessation or dose reduction of anticoagulants, including warfarin or the novel anticoagulants, is not recommended before SBCE administration, and diagnostic yield may actually be increased if bleeding is provoked during the study [6].

The preparation protocol used in our series is 2 liters of polyethylene glycol (PEG) the day before and 0.5 liters after ingestion of the capsule with clear broth the day before the examination.

Administration can be performed using 2 methods: swallowing the SBCE by mouth or endoscopic deployment of the SBCE into the small bowel. Oral SBCE administration is more common, with obvious benefit by foregoing an additional invasive procedure with all associated risks, and marked cost savings of the endoscopic procedure and sedation. Following oral SBCE administration, patients may ingest clear liquids 2 hours later and may have a light meal 4 hours after SBCE administration. Endoscopic deployment should be considered in patients with known or anticipated difficulty of the SBCE passing from the mouth to the small bowel in a safe and timely manner to enable maximal small bowel mucosal visualization and to ensure a complete capsule study. These factors include patients with known inability to swallow (oropharyngeal, esophageal, or both, such as after a cerebrovascular accident, musculoskeletal disorders, poor nutrition with undiagnosed dysphagia, and known dysphagia), gastroparesis, opioid usage with delayed gastric transit, hospitalized patients, especially those who are bedbound and patients in the intensive care unit, and those with prior capsule failing to reach the cecum [6, 7].

Following an overnight fast, the patient swallows a small capsule measuring 26 mm x 11 mm and weighing 3.4 g (PillCam). It consists of a camera, light source, and a wireless circuit for the transmission of signals. As the capsule moves via peristalsis through the gastrointestinal tract (GIT), images are transmitted to an external data recorder worn by the patient. The study usually lasts about 8 hours which is the lifespan of the battery. The data recorder is then connected to a computer and the images uploaded. These are then reviewed and analyzed by a trained endoscopy reader [8].

Possible indications for SBCE are Obscure gastrointestinal bleeding (OGIB), Crohn's disease (CD), small-intestinal polyps and tumors, and celiac disease.

Obscure gastrointestinal bleeding is defined as bleeding from the GIT that persists or recurs without an obvious etiology after esophagogastroduodenoscopy, ileocolonoscopy or radiological evaluation. OGIB can be subdivided into occult (iron deficiency anemia and/or positive fecal occult blood test) and overt OGIB, accounting for ~5–10% of all patients presenting with gastrointestinal bleeding, is the main indication for SBCE. The diagnostic yield of SBCE for OGIB is 30–70%. There are many possible causes of OGIB from the small bowel including: angiodysplasias, ulcerations, tumors, gastrointestinal stromal tumors, carcinoids, lymphoma, and Crohn's disease [8, 9].

A clinical guideline published recently in Canada suggests that SBCE should be recommended for patients with pathognomonic symptoms of CD in the presence of a negative ileocolonoscopy and radiological studies. SBCE is recommended in patients with established CD showing clinical features unexplained by ileocolonoscopy or crosssectional imaging. SBCE is also recommended in established CD to confirm the small-intestinal mucosal healing [9].

In patients with known polyposis syndromes such as Peutz–Jeghers syndrome, or where there is a suspected small bowel tumor, SBCE can be very helpful for both detecting polyps and assessing their distribution as a prelude to deep enteroscopy or surgery [8].

Canadian guidelines suggest that SBCE is not recommended in patients with chronic abdominal pain or diarrhea without evidence of increased levels of biomarkers. The overwhelming majority of patients with chronic abdominal pain have a functional disorder of the gastrointestinal tract, either irritable bowel syndrome or functional dyspepsia. While it has not been systematically documented, the diagnostic yield of capsule endoscopy in this context is extremely low [12], This symptom may be investigated by SBCE after careful colonoscopy and biopsy in order to exclude microscopic colitis, colonic tumor, or IBD. The finding of a small bowel cause of the diarrhea in the absence of weight loss or abnormal hematologic or biochemical data is likely to be very low. Nonetheless, patients with persistent severe diarrhea in whom no etiology can be found, or suspected severe diarrhea-predominant IBS may benefit from SBCE in order to identify occult causes such as Crohn's disease, or radiation enteritis, that may be overlooked as the patient may have had pelvic radiation in previous decades [10].

The indication of SBCE in our series was dominated by OGIB (86,3%) followed by Crohn's disease, celiac disease and chronic diarrhea.

There are multiple contraindications to SBCE administration, both relative and absolute. A known and symptomatic luminal obstruction or ileus should be considered as the only absolute contraindication to VCE. Pregnancy is a relative contraindication due to the elevated risk to the fetus if capsule retrieval is required. Crohn's disease with known or highly suspected small bowel structuring disease should be viewed as a relative contraindication. Altered mental status in a patient causing inability to follow commands is a relative contraindication, as oral SBCE administration may be high risk with non-swallowing of the SBCE or its aspiration, and the potential yield of the study may be compromised if the patient unwittingly removes the recording device before completion of the study [1, 10].

Advanced age should not be considered a contraindication to SBCE. Similarly, low SBCE adverse event rates of approximately 1% due to capsule

retention in those less than and more than 80 years of age has been found. Presence of an implantable cardiac device is not a contraindication to SBCE, as it has been shown to be safe in these patients, although small adjustments to device settings may be needed before SBCE [13, 14].

The main complication of SBCE is capsule retention. Thus, the main contraindication for SBCE is known or suspected GIT obstruction, unless intestinal patency is proven. In general, capsule retention occurs in approximately 1–2% of patients being evaluated for OGIB. Liao *et al*., conducted a meta-analysis and reported that the overall prevalence of retention was as low as 1.4%. They also reported that, categorized by indication, retention prevalence for OGIB was 1.2%, for CD (diagnosed or suspected) was 2.6% and for neoplastic lesions was 2.1% [1]. We didn't have any case of capsule retention.

It is important to provide a detailed description of SBCE findings and include VCE images in the reports. When lesions are encountered, they should be classified using the Saurin classification system, where P2 indicates a definite lesion (angiodysplasia, ulceration, or neoplasm) and P1 signifies a finding of unclear certainty (red spot or erosion). The quality of small bowel preparation should be assessed in each third of the small bowel, which is based on the ability to visualize the entire small bowel lumen not obscured by bubbles or other debris [15].

In our series, SBCE objectified small bowel lesions in 74.6% of cases dominated by angiodysplasia (40.6%) followed by inflammatory lesions and then submucosal tumours.

The primary aim of SBCE remains visualization of the small bowel; however, careful examination of gastric and colonic images to look for otherwise missed lesions is critical, especially in patients with obscure gastrointestinal bleeding. In patients with obscure gastrointestinal bleeding, VCE may detect up to 25% of upper gastrointestinal lesions in the esophagus and stomach that were not previously identified on upper endoscopy [9, 10].

SBCE had objectified non-grelic abnormalities in 32.2% dominated by gastric and ceacal angiodysplasias.

The limitations of VCE are: missed lesions due to reader error or technical malfunction; unable to obtain biopsies or perform therapeutic interventions; the position of the capsule cannot be accurately controlled; potentially obstructed views from inadequate bowel preparation; and subjectivity of interpretation of images [8].

CONCLUSION

SBCE plays a pivotal part in the diagnosis of small-bowel disorders and will not be replaced by an alternative device. However, SBCE will evolve with new functions. For example, SBCE devices will be advanced further, including high-frame-rate imaging, full spherical imaging and high-resolution imaging. With regard to capsule endoscopy software, artificial intelligence and computer assisted diagnosis will be applied to reduce the burden for SBCE readers.

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