

Research Article



Evaluation of wireless capsule endoscopy in diagnosis of patients with obscure gastro-intestinal bleeding

***Hany Haroun Kaisar^a, MD; Gamal Fawzy^b, MD; Ahmed A Darwish^b, MD**

^aDepartment of Internal Medicine, Ain Shams University, Cairo, Egypt

^bDepartment of General Surgery, Ain shams University, Cairo, Egypt

*Corresponding author

Abstract

Background: Capsule endoscopy (CE) is a relatively new procedure used for the investigation of the mucosa of the small intestine. Although this procedure has been found to be applicable for the evaluation of several clinical conditions, including Crohn's disease, celiac disease and small bowel tumors, it is primarily used for the evaluation of patients with obscure gastrointestinal bleeding (OGIB). This study aims at evaluating the use of capsule endoscopy in diagnosis of OGIB. **Methods:** This study included thirty patients with OGIB at Ain Shams University Hospitals during the period from October 2012 till November 2014. Colonoscopy and upper GI endoscopy were done in all patients and revealed no bleeding. Patients underwent capsule endoscopy to identify the source of bleeding, then surgical exploration was done to deal with the source of bleeding in the small bowel. **Results:** Provisional diagnosis on capsule was as follows: 11 patients (36.6%) diagnosed to have jejunal angiodysplasia. 7 patients (23.3%) diagnosed to have ileal angiodysplasia. 1 patient (3.3%) diagnosed to have duodenal neoplasm. 2 patients (6.6%) diagnosed to have jejunal neoplasm. 5 patient (16.6%) diagnosed to have ileal neoplasm. No definite lesions were detected in 4 patients (13.3%). On surgical intervention, the diagnostic accuracy of capsule endoscopy was 80% (24 patients). **Conclusion:** Capsule endoscopy is a suitable method for the non-invasive and painless examination of the entire small bowel and is proved to be cost effective.

Keywords: Capsule endoscopy, small bowel, obscure GI bleeding.

Introduction

The diagnosis and management of patients with obscure gastrointestinal bleeding was challenging for the gastroenterologist until the development of small bowel capsule endoscopy. This technique has revolutionized the management of patients with obscure GI bleeding. Detection of lesions such as small intestinal angioectasias has become possible with the advent of capsule endoscopy ¹.

In the past, the investigations of small bowel diseases were limited and the available options were small bowel follow through, enteroclysis, push enteroscopy, sonde (pull) enteroscopy and intraoperative enteroscopy ².

Overall, lesions in the small intestine account for approximately 5% of causes of obscure GI bleeding. Medical imaging of the small intestine has been a very difficult and limited undertaking. Several factors account for the difficulty encountered in small bowel visualization. The length of the small intestine, in addition to its free intraperitoneal location, vigorous contractility, and overlying loops, confounds the usual diagnostic techniques ¹.

Capsule endoscopy is now an important diagnostic modality for the analysis of OGIB, as it has a higher diagnostic yield compared to other imaging techniques of the small bowel, including push enteroscopy and

small bowel barium radiography, and a comparable diagnostic yield as double balloon endoscopy³.

Video capsule endoscopy permitted, for the first time ever, a complete and reliable inspection of the small intestine with very high image quality and minimal patient discomfort⁴.

Materials and Methods

Thirty patients with obscure gastrointestinal bleeding who fulfilled the criteria e.g. no identifiable cause with upper GI endoscopy or colonoscopy or CT scan or angiography were included in this study. This prospective study was conducted at Ain Shams University Hospital from October 2012 till November 2014.

Patients were subjected to preoperative assessment which included:

1. Age and gender.
2. Full clinical assessment which included:
 - a. Full medical history
 - b. Full clinical examination.
3. Full laboratory investigations: Haemoglobin level at admission and follow up, hematocrit value, liver profile, kidney profile, coagulation profiles, and fecal occult blood test in case of occult bleeding whenever possible.

The procedure of the capsule endoscopy was discussed with each patient and it was carried with the same team including the interpreter of the images achieved by the capsule endoscopy and is carried out by the same type of capsule.

The surgical interference is carried out by the same surgical team throughout the study.

All the patients agreed to participate in the capsule endoscopy as well as the study and they signed a written consent.

The main steps in this study is to perform capsule endoscopy to the included patients and try to detect the site and the source of bleeding then to perform surgical intervention according to the findings detected both by capsule endoscopy and intraoperatively.

Resuscitation:

The patient is infused by crystalloids and colloids to support the blood pressure of the patient.

Blood transfusion is started if the Hb level is below 9 gm% as soon as the blood is ready.

Vital data chart is done every hour till stabilization of the blood pressure above 100/60 then every 4 hours.

Monitoring of the bleeding is done by serial Hb levels to detect any change.

The patient is subjected to the capsule endoscopy if the conventional upper GI endoscopy and colonoscopy in addition to other modalities as the CT scan, angiography and nuclear scan if performed are negative.

Procedure of capsule endoscopy

The Given Imaging video capsule system was applied.

Preparation

The day before CE patients were kept on a fluid diet for 24 hours and a fasting period started at midnight. 8 hours before the examination 2 litres of oral purge was given.

Steps

The method is that the patient swallows a 26x11 mm video capsule acquiring video images during natural propulsion through the digestive tract.

The patient wears the recording device held in a waist belt that can store nearly 60,000 wireless transmitted images from the capsule during an 8-hour period.

The recording system consists of eight skin electrodes placed on the thorax and abdomen of the patients and linked to a portable digital recorder.

Images are sent through these electrodes to the recorder and stored.

The maximal duration of the recording is currently 8 h, as it is limited by the lifetime of the batteries powering the capsule.

At the end of the recording, the video is transferred to a computer.

The video chip camera takes 2 images every second with a total of approximately 55 thousand images in 8 hours. The images then are analyzed at the workstation by a physician using specified software.

After the procedure:

Excretion of the capsule in the stool was followed-up in all cases. If the excretion of the capsule failed after 3 days, then we checked the position of the capsule with plain film of the abdomen.

Interpretation:

Lesions with high bleeding potential were defined as definitive bleeding sources (typically angiodysplasia, large ulceration, diffuse inflammation, tumour, active bleeding without visible lesion and stenosis).

Red spots, small erosions and nodules without mucosal break were assessed as uncertain bleeding sources. The third group included patients by whom CE did not detect any bleeding sources.

We evaluated CE findings positive if we found definitive bleeding sources. We assessed CE findings

negative if we found uncertain bleeding sources or found no bleeding sources. The localization of the lesions was estimated depending on the small bowel transit times.

Surgical intervention:

The surgical intervention is carried out according to the findings detected by capsule endoscopy to manage the cause e.g. resection anastomosis in case of tumors or angiodysplasia limited to one location.

Intraoperative endoscopy is carried out if the lesion was difficult to identify during surgical exploration.

The patient is explored through a midline incision. The average distance from the duodenum is detected according to the time taken by the capsule endoscopy to reach the lesion.

In case of GIST tumors, the lesion is evident by the naked eye.

In case of angiodysplasia some lesions are visible while others are detected by the intraoperative endoscopy.

The affected small intestine loop is resected and the two ends are anastomosed by 2/0 vicryl in two layers.

The rest of the bowel is explored to detect any other lesions.



Fig. (1) Endocapsule (Olympus) for the small bowel is 26 x 11 mm, weighs 3.8 g, has a field of view of 145 degrees, uses 6 white LEDs, and has a battery life of 8 hours.

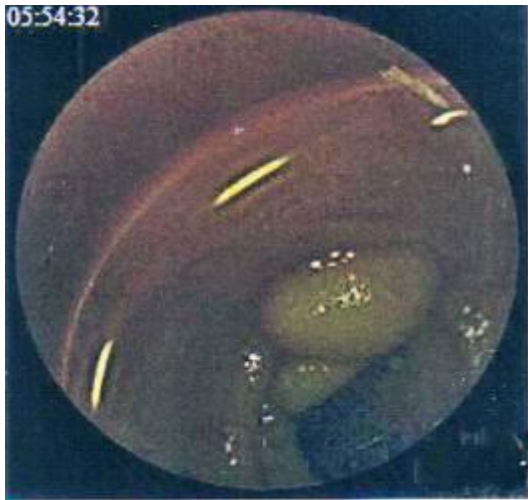


Fig. (2) Submucosal lesion that may be the potential source of bleeding in a 72 years old male.



Fig. (3) A magnified image of the previous lesion as seen by capsule endoscopy.



Fig. (4) Bleeding angiodysplasia detected on surgical exploration



Fig. (5) The bleeding angiodysplasia from the mucosal aspect after opening of the intestinal lumen.



Fig. (6) The resected part of the small intestine.

Results

Our study involved thirty patients with gastrointestinal bleeding of obscure origin who were admitted to Ain-Shams University Hospitals. They were selected upon the selection criteria adopted for this study.

Patient demographics:

This series involves 30 patients. The mean age is 52.5 years ranging from 33-74 years.

Male to female ratio is 60% (18 males) to 40% (12 females).

Presenting symptoms among the patients

Melena is present in 12 patients (40%). Bleeding per rectum is present in 3 patients (10%). Anemic symptoms are present in 26 patients (86.6%). Abdominal pain is present in 2 patients (6.6%). Syncope is present in 12 patients (40%).

Table (1) Distribution of the presenting symptoms among the patients.

	No. of patients
Melena	12 (40%)
Bleeding /rectum	3 (10%)
Anemic symptoms	26(86%)
Abdominal pain	2 (6%)
Syncope	12 (40%)

Provisional diagnosis of bleeding achieved by capsule endoscopy is as follows: 11 patients (36.6%) diagnosed to have jejunal angiodysplasia. 7 patients (23.3%) diagnosed to have ileal angiodysplasia. 1 patient (3.3%) diagnosed to have duodenal neoplasm.

2 patients (6.6%) diagnosed to have jejunal neoplasm. 5 patients (16.6%) diagnosed to have ileal neoplasm. No definite lesions were detected in 4 patients (13.3%).

Table (2) Provisional diagnosis detected by capsule endoscopy.

	No. of patients
Jejunal angiodysplasia	11(36.6%)
Ileal angiodysplasia	7(23.3%)
Duodenal neoplasm	1(3.3%)
Jejunal neoplasm	2(6.6%)
Ileal neoplasm	5(16.6%)
No definite diagnosis	4(13.3%)

Definitive diagnosis on surgical intervention was as follows: 10 patients (33.3%) diagnosed to have jejunal angiodysplasia. 6 patient (20%) diagnosed to have ileal angiodysplasia. 5 patients (16.6%) diagnosed to have jejunal neoplasm, one is adenocarcinoma and four are GIST. 7 patients (23.3%) diagnosed to have

ileal neoplasm, 3 are GIST, one is carcinoid, one is adenocarcinoma and two are lipomas. 1 patient (3.3%) diagnosed to have ileal Crohn's ulcer. 1 patient (3.3%) diagnosed to have duodenal neoplasm (Adenocarcinoma).

Table (3) Definitive diagnosis by surgical intervention

	No. of patients
Jejunal angiodysplasia	10(33.3%)
Ileal angiodysplasia	6(20%)
Duodenal neoplasm	1(3.3%)
Jejunal neoplasm	5(16.6%)
Ileal neoplasm	7(23.3%)
Ileal chron's ulcer	1(3.3%)

No recurrence of bleeding was detected in 6 month duration follow up of the patients after surgical intervention.

The capsule endoscopy detected findings were accurate in 24 patients (80%). The 6 inaccurate cases were as follows: 1 case of jejunal angiodysplasia diagnosed by capsule endoscopy (CE) was diagnosed to have jejunal neoplasma on surgical intervention. 1 case of ileal angiodysplasia was diagnosed as ileal Crohn's disease on surgical intervention. 2 cases with no definite lesions on CE were diagnosed to have jejunal neoplasms on surgical intervention. 2 cases with no definite lesions on CE were diagnosed to have ileal neoplasms on surgical intervention.

Discussion

In the majority of gastrointestinal bleeding episodes, the source of bleeding is located in regions that can be reached by standard upper gastrointestinal endoscopy or colonoscopy. However, approximately 5% of bleeding sites are thought to be located in the small bowel, a proportion that increases in those patients classified as obscure gastrointestinal bleeding (OGB), because standard endoscopic examinations of the upper and lower gastrointestinal tract are negative⁵.

In patients with obscure GI bleeding, the bleeding rate may be slow or intermittent, thereby not allowing identification by either angiography or bleeding scan. The yield of a small bowel series for diagnosing tumors of the small intestine is quite low and barium studies, even enteroclysis, cannot diagnose angiectasias, which are the most common causes of small intestinal bleeding. The distal small intestine has been relatively inaccessible to endoscopic intubation despite the development of various enteroscopes. Because of the inability to localize a bleeding site in the small bowel, patients with obscure GI bleeding typically present with prolonged occult blood loss or recurrent episodes of melena or maroon stool without a specific diagnosis. In this group of patients, an early diagnosis of the bleeding site has been the exception rather than the normal until recently with the development of capsule endoscopy¹.

Wireless capsule endoscopy (CE) is a simple non-invasive technique that allows examination of the entire small bowel. The technique has been shown to be safe in the evaluation of OGIB⁶.

The advantages are multiple: the examination is easily accepted by the patient, the preparation for the examination is not difficult, there is no significant discomfort during the 8 hours of the exploration, the possibility to investigate accurately a long segment of the digestive tract: the small bowel, an organ very difficult to be examined through other methods⁷.

Capsule endoscopy is currently the preferred test for mucosal imaging of the entire small intestine and should be part of the initial investigation in patients with obscure bleeding. Its diagnostic yield is high and potentially it can produce earlier diagnosis. When integrated into a global approach to the patient, capsule endoscopy is helpful in achieving effective decision-making concerning subsequent investigations and treatments. This in turn could mean more timely treatment and lower overall utilization and cost. Large prospective studies are however necessary to better assess the impact of capsule endoscopy on clinical outcomes¹.

In our study, the capsule endoscopy detected findings were accurate in 24 patients (80%) out of the 30 patients with OGIB. The CE failed in 6 patients.

In the retrospective study by **Turenhout et al.**³ the accuracy of the CE (diagnostic yield) is 49%.

In a review by **Concha et al.**⁸ the diagnostic yield ranges from 32% to 76%.

In the study by **Bresci et al.**⁹ the diagnostic yield is 92%.

In the retrospective study by **Kovacs**¹⁰ the diagnostic yield in the overt group is 83% and in the occult group is 66% and 77.4% when combined.

In the study by **Scott et al.**¹¹ the yield of capsule endoscopy was 92.5%.

Table (4): Comparison of the diagnostic yield among different studies.

Study	Diagnostic yield
Bresci et al.,⁹	92%
Concha et al.,⁸	32-76%
Kovacs,¹⁰	77.4%
Scott et al.,¹¹	92.5%
Turenhout et al.,³	49%
Our study	80%

Our results confirm that effective therapy may be introduced in accordance with the majority of positive CE results. Based on positive CE results, different types of small bowel alterations such as angiodysplasias, tumors and bowel-stenosis with bleeding mucosal lesions may have effective surgical treatment. The first prerequisite of a successful surgery is the accurate localization of the bleeding source. Through our CE examinations the correct localization of the bleeding sources always provided a reasonable support to perform an optimal small bowel resection.

It should be highlighted that one of the advantages of non-invasive CE, as opposed to new enteroscopic methods, is that it can be performed during active bleeding. Furthermore, in such cases the diagnostic yield of CE is the highest. However, its disadvantage is the lack of histologic sampling.

Conclusion

"Wireless" endoscopy, introduced in 2000, revolutionized the diagnostics of the small bowel. This method is suitable for the non-invasive and painless examination of the entire small bowel. New light has been cast on bleeding, tumors, and inflammatory disease in the small bowel, as well as the detection of coeliac disease. The timely application of CE can spare numerous examinations with low diagnostic yield and high costs. Also, the examination takes less time and hospitalization is cut short. CE performed early on is proved to be cost effective.

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