Diagnostic performance of capsule endoscopy and findings from patients with obscure gastrointestinal bleeding at the Hospital Pablo Tobon Uribe in Medellin, Colombia

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Abstract

Objectives: Capsule endoscopy (CE) has revolutionized diagnostic evaluation of patients with obscure gastrointestinal bleeding (OGB). The aim of our study was to evaluate diagnostic performance of CE in patients with OGB at our center. **Methods:** This retrospective study reviewed the medical records of 60 consecutive patients who had undergone capsule endoscopy because of OGB at the Hospital Pablo Tobon Uribe between September 2009 and September 2011. CE findings were interpreted according to degree of clinical relevance for definitive diagnosis: normal (P0), not very relevant (P1) and highly relevant (P2). **Results:** The diagnostic performance of CE for patients with OGB was 57%. No significant difference was found among patients with obvious and hidden relevant lesions (P2) OGB (63% vs. 52%, p: 0.49). 26% of relevant lesions (P2) found by EC could have been found with upper endoscopy (17%) or total colonoscopy (9%). Of the P2 lesions found, 47% were vascular, 44% were neoplastic and 9% were inflammatory. Patients with P2 lesions were older than those with P1 and P0 lesions (p: 0.05). **Conclusion:** The diagnostic performance of CE for OGB in our series is similar to that reported in international publications. The most frequently found P2 lesions were vascular lesions.

Keywords

Capsule endoscopy, obscure gastrointestinal bleeding, diagnostic performance, angiectasias.

INTRODUCTION

With the advent of new diagnostic methods the classification of gastrointestinal bleeding according to location has changed. Today, upper gastrointestinal bleeding is considered to be bleeding which originates anywhere from the mouth to the ampulla of Vater, middle gastrointestinal bleeding is considered to be bleeding from the ampulla of Vater to the ileocecal valve, and lower gastrointestinal bleeding is considered to be bleeding located in the colon. These definitions are based the facts that upper gastrointestinal bleeding is easily detected by upper endoscopy, identification of middle gastrointestinal bleeding requires CE or balloon assisted enteroscopy (BAE) and lower gastrointestinal bleeding can be identified with colonoscopy (1). Obscure gastrointestinal bleeding (OGB) is defined as recurrent or persistent bleeding of unknown origin after initial diagnostic evaluation including upper gastrointestinal endoscopy, terminal ileum colonoscopy and radiological study of the small intestine (bowel movements with or without enteroclysis) have negative results for bleeding. OGB is classified as visible or obvious bleeding if there is evidence of bleeding from the mouth or rectum which manifests as hematemesis, melena or hematochezia. It is classified as occult bleeding when there is iron-deficiency anemia and/or a positive fecal test for occult blood (2). Iron deficiency anemia occurs in 2% to

5% of adult men and postmenopausal women and is the reason for 4% to 13% of all referrals to gastroenterologists (22).

OGB accounts for 5% of all cases of gastrointestinal bleeding and 75% of these are located in the small intestine. This represents a challenge for the gastroenterologist. The remaining 25% are found in the esophagus, stomach, duodenum or colon which cannot be seen in an initial endoscopic evaluation (3).

Small bowel endoscopy has evolved in the 21st century from invasive intraoperative enteroscopies, to probe and "push" enteroscopies, to the CE studies which have revolutionized the study of small intestine pathologies by allowing a complete display of a high 85% to 90% of cases. Moreover, this procedure is non-invasive and very well tolerated by the patient. Its limitations are that the capsule cannot be maneuvered and cannot take biopsies which mean that diagnosis must be based on endoscopic appearance. CE cannot be used therapeutically and the view obtained depends on the preparation of the mucosa. The quality of the reading requires previous training and experience, and there is a risk of retention in areas of stenosis (1-1.5%) (4). At the same time that CE appeared and taking into account its limitations, balloon-assisted enteroscopies (BAE) and deep spiral enteroscopies with were developed. These have allowed therapeutic intervention which complement CE in the study of small intestinal pathologies (5).

A recent systematic review evaluated 227 articles covering 22,840 CE studies which were published between 2000 and 2008. It found a 60.5% rate of successful diagnoses. 66% if these were for OGB. Angioectasias accounted for 50%, ulcers for 26.8% and neoplasia for 8.8% (6). A meta-analysis that analyzed 20 prospective studies of 537 patients with OGB showed that CE's diagnostic performance was better than that of enteroscopy (56% vs. 26%, $p < 0.00001$) and radiological studies of the small intestine (42% vs. 6%, $p < 0.00001$). CE's number needed to diagnose (NND) was 3 compared with other tests. CE was most useful for diagnosis of vascular and inflammatory lesions (7). A second meta-analysis of 17 studies and 526 patients showed that CE has a higher diagnostic detection rate than push enteroscopy and radiological studies for subgroup of patients with OGB, with an NND of 3 (8).

The purposes of this study were to establish CE's diagnostic performance and types of findings and to its performance in follow up monitoring of a series of patients with indications of OGB at our institution.

MATERIALS AND METHODS

Study Design

Since 2009 the Hospital Pablo Tobon Uribe in Medellin has had a CE service with medical and nursing staff trained to perform this procedure. This retrospective study reviewed medical records and CE studies of patients who had been diagnosed with OGB. If needed, additional information was obtained through telephone interviews. CE findings were reviewed and classified according to their clinical relevance by one of the study's (FJ). All patients had undergone upper endoscopies and total colonoscopies at least six months before CE. For patients with a history of ingestion of anti-inflammatory drugs (NSAID's), the study was deferred until two months following their last dose in accordance with international recommendations (9). All subjects prepared for CE with a liquid diet and 2 liters of polyethylene glycol the day prior to the procedure. This preparation was adopted on the basis of a recent meta-analysis (10) which showed better diagnostic performance and better visualization of the mucosa of the small intestine in patients with prior preparation with laxatives than in patients who were unprepared. Patients had fasted for at least 8 hours on test day. Each patient ingested a tablet of 10 mg of domperidone as a prokinetic 30 minutes before ingestion of the endocapsule. Studies were conducted with an Olympus EndoCapsule which captures two images per second throughout the digestive tract. The images are transmitted by radio to an external receiver. Since the charge of the battery in the capsule lasts for 8 to 9 hours, the recorder is switched off after that and the images are downloaded to the computer to be read later. Reading the test is done at a speed of 10 to 15 images per second. The measurement of intestinal transit time is obtained by setting the time from entrance to the pylorus to arrival at the cecum. All studies were monitored in real time one hour after ingestion of the capsule. In cases where it did not move into the small intestine it was monitored again 2 hours later. If it remained in the stomach, an upper endoscopy was performed and the capsule was captured with a Dormia basket and moved to the duodenum by means of the endoscope. After passage of the endocapsule into the small intestine had been confirmed, the patient was sent home if she or he was ambulatory. A liquid diet was prescribed for the next two hours 2 hours, with a normal diet beginning four hours later. Patients returned to the institution 8 hours later.

Outcome measurements and definitions

OGB was defined as obvious bleeding (recurrent or persistent) or hidden bleeding (iron deficiency anemia and/or positive fecal occult blood test (FOBT)) of unknown origin after an initial negative diagnostic evaluation. This evaluation included upper gastrointestinal endoscopy, terminal ileum colonoscopy and a radiological study of the small intestine (intestinal transit with or without enteroclysis). According to the World Health Organization, anemia

is defined as a hemoglobin concentration of less than 13 g/dl in men over 15 years of age and a hemoglobin concentration of less than 12 g/dl in women over 15 years of age who are not pregnant. Iron deficiency anemia is diagnosed when ferritin levels are less than 15 g/L when inflammation is absent (22).

CE findings were classified according to the degree of relevance to the patient's final diagnosis as normal (P0), clinically irrelevant (P1) and highly relevant (P2) as established in previous studies. Significant lesions categorized as P2 only if angiectasias, masses, erosions and ulcers were present. Other lesions such as varicose veins, lymphangiectasia, and xanthoma were considered to be of little clinical relevance and were classified as P1. Good diagnostic performance was defined as the identification of clinically significant lesions P2 which were responsible for OGB (11). The quality of preparation was considered adequate when few liquids and residues were seen and when they did not interfere with complete visualization of the mucosa. The quality of preparation was considered inadequate when liquids and digested residues which hindered or prevented complete visualization of the mucosa were present (12, 13). Recurrent bleeding was defined when iron deficiency anemia, a positive FOBT or obvious bleeding were present during follow-up.

The following data were collected from each patient in an SPSS format database for analysis:

1. OGB type: obvious or hidden
2. Age at time of study
3. Gender of patient
4. Recorded CE Date
5. Patient Origin: inpatient or outpatient
6. History of previous hospitalizations
7. Hemoglobin level (g/dl) prior to completion of CE
8. Additional studies including computerized axial tomography, angiography, and scintigraphy prior to CE
9. Time elapsed between occurrence of bleeding and performance of CE in patients with evident OGB
10. CE preparation quality
11. Anatomic location of lesion found by CE
12. Complete visualization of the small intestine
13. Complications associated with procedure
14. Type (vascular, inflammatory or neoplastic) and relevance (P0, P1 and P2) of lesions found by CE
15. Type of treatment after study: medical, endoscopic, radiological or surgical
16. Recurrence of iron deficiency anemia and/or obvious bleeding during follow-up.

Statistic Analysis

A descriptive analysis of frequencies of categories of clinical variables was conducted. Then the mean and median of measures of variability were calculated according to normal distributions for continuous variables. The Pearson Chi^2 test was used to cross match variables, the Mann Whitney U test was used compare ranges. The Kruskal-Wallis non-parametric test for analysis of variance by ranks was also used. A logistic regression using explanatory findings as the dependent variable was run for comparison with cases of non-explanatory findings and no findings. The analysis was performed using SPSS 19 software.

Ethical Issues

Prior to conducting this study its protocol was submitted to the committee of research and ethics of the Hospital Pablo Tobon Uribe which approved the protocol. Confidentiality of information was guaranteed. Informed consent was not required since because the study did not involve additional intervention in patients and retrospective collection of information from clinical records is defined as "No Risk" research under Article 11 of Resolution 8430, 1993 of the Ministry of Health of Colombia.

RESULTS

Between September 2009 and September 2011 78 CE studies were performed at the Hospital Pablo Tobon Uribe. 68 of these (87.1%) were considered to have indications of both obvious and hidden OGB. Of those 68 CE studies, 8 failed to obtain clinical data. The remaining 60 studies were included in this study for analysis. 33 (55%) had hidden OGB and 27 (45%) had evident OGB (Figure 1).

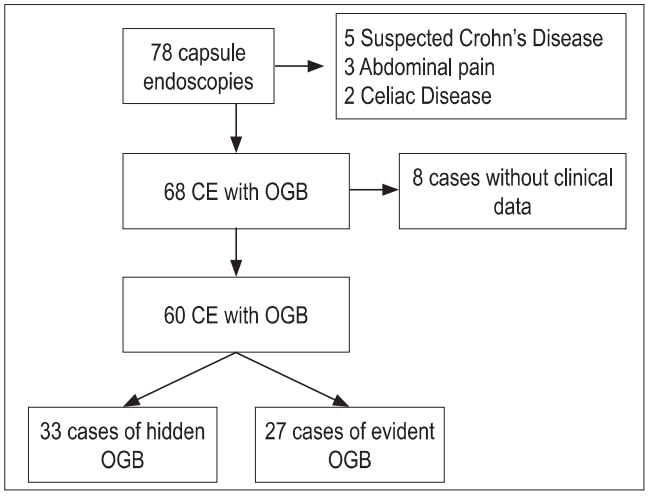

Figure 1. Flowchart of patients with Capsule Endoscopy and Obscure Gastrointestinal Bleeding.

The median follow-up time for patients was 14 months (range: 0-23). Average follow-up time for those with hidden

OGB was 13 months (0-23) while for those with evident OGB it was 14 months (0-21). This difference was not significant (p: 0.84). The median age of all patients was 64 years (range: 8 to 90 years). The median age of patients with obvious OGB was 69 years (range: 8 to 90 years). For patients with hidden OGB it was 60 years (range: 16 to 86 years). This difference was not significant (p: 0.34). Of the 60 patients with OGB, 22 were men (37%) and 38 were women (63%). Among subjects with obvious OGB, 48% were men while only 27% of those with hidden GB were men. This difference was not significant (p = 0.09) (Table 1).

Table 1. Clinical and demographic characteristics of CE 60 patients with obscure GI bleeding.

	Total	Hidden	Evident
N	60	33 (55%)	27 (45%)
Age**	59,8 (±21) 64 (8-90)	57,8 (±20) 60 (16-86)	62,2 (±22) 69 (8-90)
Months of Follow-up**	12,0 (±7) 14 (0-23)	11,9 (±7) 13 (0-23)	12 (±8) 14 (0-21)
Gender:			
Male	22 (36,7%)	9 (27,3%)	13 (48,1%)
Female	38 (63,3%)	24 (72,7%)	14 (51,9%)
Inpatient - Outpatient			
Inpatient	23 (38,3%)*	4 (12,1%)	19 (70,4%)
Outpatient	37 (61,7%)*	29 (87,9%)	8 (29,6%)
Bleeding episodes**	2 (±2) 1 (1-6)		2,1 (±2) 1 (1-6)
Hemoglobin**	8,6 (±2) 8,7 (4,5-12,6)*	9,3(±2) 9,8 (5-12,6)	7,7 (±2) 7,4 (4,5-10,8)
Prior Hospitalization	10 (16,7%)	4 (12,1%)	6 (22,2%)

* significant differences with p <= 0.05
**quantitative variables: Mean (±DE) Median (Min-Max).

CE was performed on an inpatient basis for 62% of the patients and on an outpatient basis for 38% of the patients. 70% of patients with apparent GB received inpatient care while 88% of the patients with hidden OGB received outpatient care. This difference was significant (p = 0.0001). Patients with obvious OGB had experienced two bleeding episodes on average (1 to 6). Hemoglobin levels prior to the completion of CE were on average 9.2 g / dl (5.0-12.6 g / dl) for hidden OGB and 7.7 g / dl (4.5-10.8 g / dl) for evident OGB. This difference was significant (p = 0.02). Four patients (12%) with hidden OGB were hospitalized and 6 subjects (22%) with evident SGO were hospitalized. This difference was not statistically significant (p = 0.24) (Table 1).

All patients underwent complete colonoscopy and upper endoscopy prior to CE. Eight (13%) of the 60 patients had additional studies including three abdominal CAT scans, two mesenteric arteriographies, two marked red blood cell scans, and one double-balloon enteroscopy.

CE Findings

Significant lesions explaining the cause of bleeding (P2) were found in 34 (57%) of the 60 patients in the study (Figure 2). Of these 34, 17 (52%) were among the 33 patients with hidden OGB and 17 (63%) were among the 27 patients with obvious OGB. This difference was not significant (p = 0.49) (Figure 3). Of the remaining 26 patients, 13 had normal CEs (P0) and 13 (22%) had non-significant lesions (P1). Of the 34 patients with lesions which caused bleeding (P2), six (17%) had bleeding located in the stomach, 25 (74%) had bleeding located in the small intestine, and 3 (9 %) had bleeding located in the colon. Out of the 34 patients with significant lesions which caused OGB, 9 (26%) were within the reach of upper endoscopy or full colonoscopy (Figure 4). 16 (47%) of the lesions that caused significant bleeding (P2) in the 34 patients were vascular, 15 (44%) were inflammatory, and 3 (9%) were neoplastic. Ten of the 17 patients (59%) with obvious OGB and P2 lesions had vascular lesions, six (35%) had inflammatory lesions and one (6%) had a neoplastic lesion. Of the 17 subjects with hidden OGB and P2 lesions, nine (53%) had the inflammatory lesions, six (35%) had vascular lesions, two (12%) had neoplastic lesions. These differences were not significant (p = .38) (Figure 5).

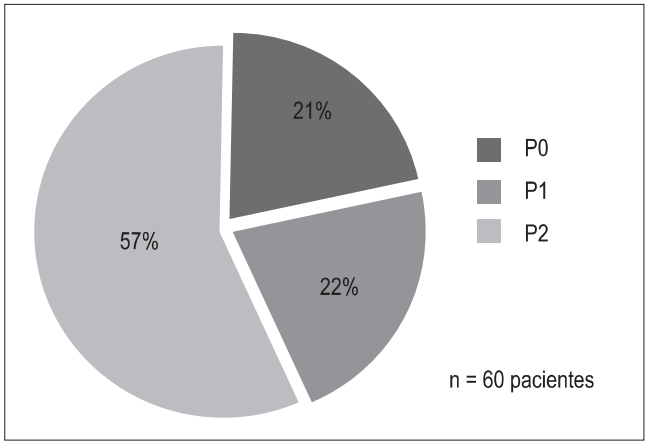

Figure 2. Type of lesions found in endoscopic capsule.

The cecum could be seen during capture of the endocapsule 55 (92%) out of 60 patients. There were retentions or other complications in any of the patients 50 (83%) of the 60 patients had adequate preparation, but 10 (17%) had inadequate preparation. We found no significant difference in the detection rates of significant findings (P2) for patients who had adequate preparation and for patients

with inadequate preparation which were 54.0% and. 70.0% respectively (p: 0.56) (Table 2).

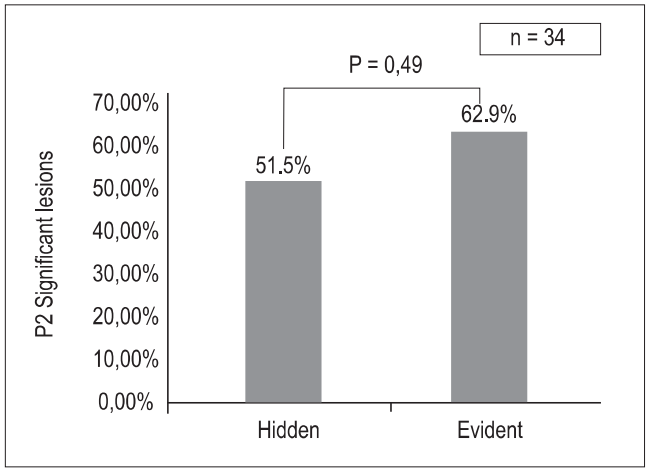

Figure 3. Diagnostic performance of capsule endoscopy according to the presentation of obscure gastrointestinal bleeding.

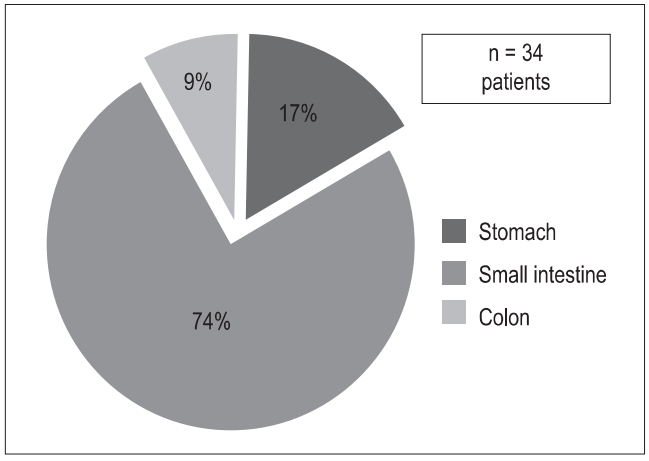

Figure 4. Location by capsule endoscopy of the cause of obscure gastrointestinal bleeding.

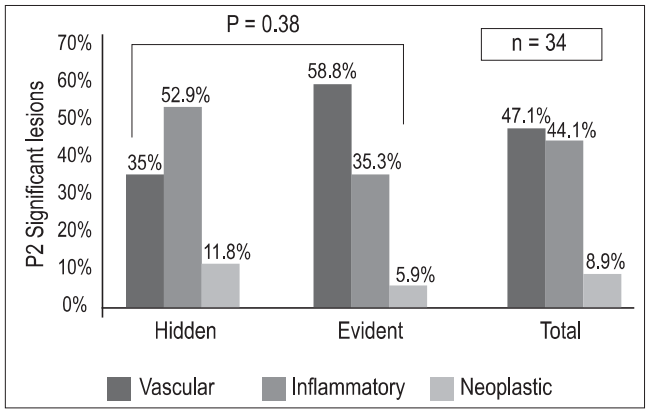

Figure 5. Significant lesion type (P2) found and presentation of obscure gastrointestinal bleeding.

Table 2. EC Findings and follow-up of patients with obscure GI bleeding.

Variable	Obscure Hidden (%)	Obscure Evident (%)	Total (%)
Lesion Location:			
Gastric	11,8	23,5	17,6%
Small Intestine	70,7	76,5	79,4
Colon	17,6	0	8,8%
Lesion Type:			
Vascular	35	58,8	47,1
Inflammatory	52,9	35,3	44,1
Neoplastic	11,8	5,9	8,9
Preparation quality:			
Good	76,5	82,4	79,4
Inadequate	23,5	17,6	20,6
Treatment:			
Medical	82,4	70,6	76,4
Endoscopic	5,9	17,6	11,7
Surgical	11,8	0	5,8
Interventional Radiology	0	11,8	5,8

All patients with hidden OGB had iron deficiency and 25 of these 33 patients (76%) tested positive for fecal occult blood. Although a clinical difference was found between the percentage of findings of lesions that explained the cause of bleeding (P2) among patients who tested positive for fecal occult blood (62.5% - 10/16) and those who tested negative (33.3% - 3/9), it was not statistically significant (p: 0.11).

The average age of patients classified as PO was 50.9 years (range 37.3 to 64.4 years), the average age of patients classified as P was 54.3 years (range: 41.1 to 67.4 years), and the average age of patients classified as P2 was 65.2 years (range 58.4 to 72.0). The difference between P2 and the others was statistically significant (p = 0.05) (Figure 6). A logistic regression analysis found that each additional year of age increases the probability of clinically significant findings from CE (P2) by 5% (p: 0.001). We found no significant difference between genders related to good diagnostic performance of CE (P2 lesions). 54.5% of men and 57.9% of women had P2 lesions (p: 0.96).

Within the group of 27 patients with obvious OGB, 5 patients (18.5%) underwent CE in the first 48 hours after the bleeding episode, 13 (48.1%) underwent CE between 48 hours and 7 days after, 6 (22.2%) underwent CE between 7 and 30 days after, and 3 patients (11.1%) underwent the study 30 days after the bleeding episode. Three out of the five patients (60%) who underwent CE in the first 48 hours had significant findings (P2), seven out of thirteen (54%) who underwent CE between 48 hours and 7 days later had significant findings (P2), four out of six (67%)

who underwent CE between 7 and 30 days later had significant findings (P2), two out of the three patients (67%) who underwent CE 30 days after the bleeding episode had significant findings (P2). There were no significant differences related to diagnostic performance of CE and the time of its completion in patients with obvious OGB (p = .88).

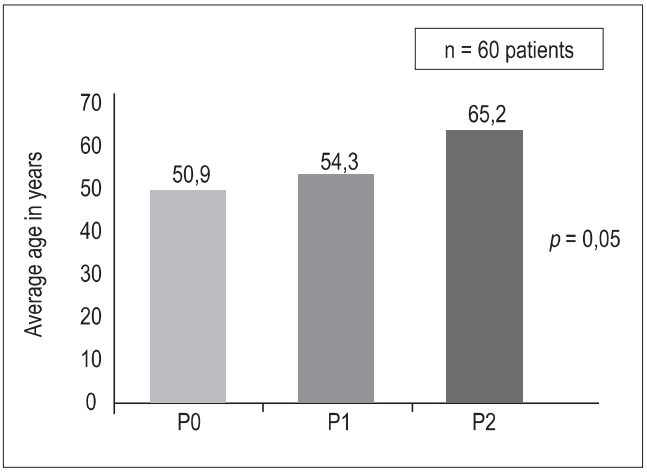

Figure 6. Average age and type of lesión found in endoscopic capsule.

The average hemoglobin level in patients with normal CEs (P0) was 8.7 g/dl (SD: 2.5). It was 8.6 g/dl (SD: 1.8) for those with non significant lesions (P1) and 8.5 g/dl (SD: 1.6) for patients with significant lesions (P2). No significant differences were found (p = 0.94). Patients who underwent CE on an inpatient basis had a similar proportion of significant lesions (P2) to those who underwent CE on an outpatient basis (47% and 53% respectively).

CE Outcomes

Of the 34 patients who had significant findings (P2), 26 patients (76%) underwent medical treatment including substitution of oral or intravenous iron and treatment for Crohn's disease treatment, 4 patients (12%) underwent endoscopic treatment, 2 subjects (9%) underwent surgical treatment and 2 individuals (6%) had interventional radiological treatment. Of the remaining 26 patients with normal CEs (P0) or without significant findings to explain the bleeding (P1), 65% received medical treatment and showed no recurrence of OGB during follow-up. Within the subgroup of patients with obvious OGB, 70% received only medical treatment while 82% of the patients with hidden OGB received only medical treatment (Table 2).

Of the 13 patients with normal CE findings (P0) 6 (46%) had no recurrence of bleeding during follow-up, 5 had iron deficiency anemia (39%) and only two (15%) had obvious recurrent bleeding. Similarly, of the 13 patients with non-significant CE findings (P1), 11 (85%) had no recurrence of bleeding during follow-up, none had recurrences of iron deficiency anemia and only 2 (15.4%) had obvious recurrent bleeding. Similarly, of the 34 patients with significant CE findings (P2, 16 (47%) had no recurrence of bleeding during follow-up, 15 (44%) had iron deficiency anemia, and only 3 (9%) had obvious recurrent bleeding.

The rate of recurrence of bleeding or iron deficiency anemia in patients with significant findings (P2) was 53% while it was 35% for those with other CE results (P0, P1). This difference is clinically important but not statistically significant (p = 0.07).

DISCUSSION

CE is a very good diagnostic tool for patients with OGB when there are strict criteria. We were able to establish good diagnostic performance and clinical findings in 60 consecutive patients who received underwent CE at our center. The most common indication for EC was OGB (87%). The rate of good diagnostic performance in our study of 57% is similar to that obtained in other publications. Carey (14) found good diagnostic performance of 53% in a study of 260 patients using similar diagnostic criteria. Good diagnostic performance was higher for obvious OGB (60%) than for hidden OGB (46%) which is similar to the proportions found in our study (63 % vs. 52%). Various series show good diagnostic performance ranges from 30% to 92% depending on the definition of significant findings and the type of OGB studied (15, 16, 17, 18, 19, 35, 36). A recently published Canadian series had the largest number of CE studies (698) of OGB reported in a single center. It found a good diagnostic performance rate of 42% (36).

A systematic review of 227 published articles found a diagnostic performance of 60.5% for EC in patients with hidden OGB (6). A recently published systematic review of 26 studies with only OGB and iron deficiency anemia in 1,960 patients, among whom vascular lesions predominated (31%), found a good diagnostic performance rate of 66.6% (34). A meta-analysis of 10 studies which compared CE with double-balloon enteroscopy (DBE) for OGB also found a good diagnostic performance rate for CE of 60% (25).

The demographic characteristics of our population are very similar to those in other series. Our patients had a relatively advanced average age of 64 years. We also found a predominance of female subjects with hidden OGB which this was statistically significant. The average age of patients with significant CE findings (P2) of 65.2 years was higher than that of subjects with non-significant findings (P0, P1). This difference was statistically significant (p = 0.05). A recent study found ages of less than 60 years to be a clini-

cal predictor of significant CE findings (OR 1.2) among patients with OGB (35).

It is noteworthy that 9 of the 34 patients (26%) who with significant bleeding (P2) had lesions in the stomach or colon. This made it possible to avoid performance of CE, thereby reducing costs for the health system, if an upper endoscopy or total colonoscopy had already been performed. Other studies have found that 10%, 12.6%, 17.8% and 24.3% of lesions found by CE are within reach of upper endoscopy and colonoscopy (14, 35, 36, 20). For various reasons some lesions slowly or intermittently stop bleeding. In other cases lesions such as clots which are impossible to mobilize cannot be seen. Anemia, hypovolemia or poor preparation for colonoscopy can make these lesions look less obvious (3).

We found no significant differences in diagnostic performance of CE for patients with obvious OGB related to the length of time that elapsed between the last episode of bleeding and performance of CE. This differs from other studies that suggest better diagnostic performance when CE is performed early (14, 17, 23). Subjects with hidden OGB and iron deficiency anemia who tested positive on FOBTs had better diagnostic performance than did those whose FOBT results were negative (62.5% vs. 33.3%). Even though this is an important clinical difference, it is not statistically significant (p: 0.11). We also found no statistically significant differences in the detection of significant findings (P2) related to the quality of bowel preparation. A recent meta-analysis of 7 studies found that 69.5% of patients had been adequately prepared with laxative preparations. Although the 83% found in our study was slightly higher, the fact that the criteria for adequate/inadequate preparation of the 7 studies were not homogeneous might explain this difference (10). A systematic review by Liao et al. (6) found complete visualization of the small intestine by CE in 83.5% of cases while our study achieved 92% complete visualization. This is due in part to our real time monitoring of the location of the endocapsule during the first two hours following ingestion and to our practice of endoscopically advancing the capsule in cases in which the capsule remained in the stomach (as previously described) (21).

The type of bleeding lesion (P2) we encountered most frequently were vascular lesions (47%). This is very similar to the report of a recent meta-analysis that 50% of the lesions which caused OGB were vascular (6). Nevertheless, the predominance of vascular inflammatory lesions subjects among patients with hidden OGB was not statistically significant which can be explained in part by the fact that our hospital is a referral center for patients with inflammatory bowel disease.

The OGB recurrence rate during follow-up was high (45%) in our study. It was more frequent for P2 findings (53%) than for CE with non-relevant findings (35%) in 14 months of follow-up. McDonald et al. found a recurrence rate for bleeding of 28% in a study of 49 patients. It was highest in patients with positive CE results (42%) than among those with negative CE results (11%) in 17 months of follow-up (27). In contrast, a more recent Korean study by Park et al. found a bleeding recurrence rate of 35.3% in 51 patients in 31.7 months of follow-up. They found no significant differences related to positive and negative outcomes of CE (34.8% vs. 35.7%) (28). Laine et al. found a bleeding recurrence rate of 30% in CE patients with OGB in 12 months of follow-up (29).

Although CE can detect lesions that explain the cause of OGB, these lesions often are not susceptible to definitive endoscopic, surgical, or radiological treatment. Patients must be treated medically in many situations as was the case for 76% of our patients with significant lesions (P2). 65% of patients with P0 and P1 CE findings received medical treatment. There were no recurrences of iron deficiency anemia and no cases of obvious bleeding during follow-up which speaks of the good clinical outcomes achieved for cases with negative or non-significant findings in initial CEs. In this type of patient population, medical treatment is a reasonable option as has been reported by other authors (30).

Sometimes advanced age and comorbidities make it impossible to proceed with more aggressive treatment such as intraoperative enteroscopy or EAB. In other cases, patients who underwent CE at our institution were referred elsewhere after performance of the procedure which made it impossible to follow up on these patients and to guarantee strict treatment despite inclusion of treatment suggestions in our reports. This is important, especially for those patients who had significant CE findings. Another difficulty encountered is that some insurers which are adverse to costs do not easily approve performance of EAB because it does not appear in the mandatory health plan (POS). This is similar to problems encountered in the cases of vascular lesion management with argon plasma coagulation. In these cases the patient continues to suffer from gastrointestinal bleeding. All this may contribute to the high rate of recurrence of bleeding in our study during the follow-up period.

Recurrence of bleeding after a negative CE result may be the result of inability to visualize lesions. CE is not a perfect study because factors such as peristalsis, preparation of the mucosa, folds in the mucous surface, limited view angles, lack of insufflation, discontinuous image capture (2 per second) and occasionally incomplete visualization of the small intestine can contribute to a negative result. Some authors recommend repeating CE in high risk patients ("second look") as noted in a recent study that shows a diagnostic

performance of 41.6% in 293 patients with previous negative CEs. This is especially important for individuals whose hemoglobin levels are less than 4 g/dl and for cases in which hidden OGB becomes obvious, both of which are predictors of positive outcomes (31).

Although the average rate of retention of the endocapsule is about 1.2% (6), our study had no cases of retention. This is due to clinical evaluation of obstructive symptoms and abdominal examinations by gastroenterologists and nurses for patients prior to performance of CE. In addition, administration of NSAIDs and abdominal radiation were discontinued two months prior to performance of CE. Radiological studies of and the small intestinal were done prior to CE performance for patients suspected of having an intestinal obstruction or Crohn's disease. The latter is responsible for one third of the retentions of endocapsules according to the literature (6). In addition, if a patient did not produce any fecal output after the CE, simple abdominal X-rays were taken 15 days after the study was conducted to confirm removal.

In a previous Colombian publication, Galiano et al. (32) found lesions in 91% of 100 CE studies of patients. Our study found lesions in 79% (P2 + P1) of the CEs reviewed. An additional interesting finding was that Galiano et al. found intestinal parasites in 12% of CEs. In our center we performed 78 CEs but found only 1 patient with ascaris lumbricoides in the small intestine.

Several studies have shown that the diagnostic performance of CE is very similar to that for BAE for studying patients with OGB (6, 24, 25, 26, 33). However, CE examinations have advantages as a frontline study. They are easy to perform, non-invasive, and safe. Moreover, they do not require sedation, and have lower rates of complications and higher rates of complete visualization of the small intestine than does BAE (83.5% vs. 44%). CE can also be used to determine the route for performing BAE (forward or backward). A recent meta-analysis (25) proposed that BAE be reserved for therapeutic study after positive findings for OGB are found with CE since the diagnostic performance of BAE is greater among patients already diagnosed with OGB by CE. (75% vs. 27.5%, OR: 1.79). Based on this, our first choice at our center is the use of CE for the study of patients with OGB. We reserve BAE only for patients who have been diagnosed with OGB by CE and who require therapeutic intervention.

In conclusion, our study found that CE's diagnostic performance rate for patients with OGB is similar to those reported in the literature. CE's diagnostic performance rate improves with the age of the patient. Individuals with negative CE results for OGB and those without significant lesions have good prognoses during follow-up. One of the limitations of this retrospective study is the relatively short follow-up time.

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