

The Contribution of the Video Capsule Endoscopy in Establishing the Indication of Surgical Treatment in the Tumoral Pathology of the Small Bowel

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ABSTRACT Background and aims: Capsule endoscopy (CE) represents a novel method which allows safe, non-invasive and rapid exploration of the small bowel. Our aim was to determine the feasibility CE has in assessing tumoral pathology of the small bowel and aiding surgical teams in determining appropriate treatment. **Material and Method** Our study was conducted on 11 patients who presented tumoral pathology of the small bowel, from a total of 50 patients investigated by VCE. Malignancy was determined on the surgical resection piece, by histological exam. Statistic analysis of the data was conducted using Fisher's Exact Test. **Results** Tumoral pathology was represented by: 3 intestinal polyps, 2 benign stromal tumors, 2 malign stromal tumors, 2 adenocarcinomas, one neuroendocrine malign tumor and one duodenal papilla carcinoma. We followed the presence of malign tumors in regards to age. All malign tumors (n=6) were recorded in patients over 60 years old, while benign tumors were recorded in most cases (80%, n=4) in people under 60 years old. One case of benign tumor (intestinal polyp) was observed above 60 years old. **Conclusion** Capsule endoscopy represents a real help for the surgeon, as it allows identification of small bowel pathology, giving information regarding the approximate localization of lesions, their size and orienting on their nature. Tumoral pathology is encountered mainly with the old age population and can be presented under a multitude of forms. We believe that an efficient method for incipient detection and a protocol to establish malignity is necessary

KEY WORDS *Adenocarcinoma, Capsule endoscopy, Small Bowel, Tumor*

Introduction

The present technological progress has made possible the introduction of new techniques of non-invasive exploration of the digestive tract.

The video capsule endoscopy (VCE) allows a non-invasive evaluation of each segment of the digestive tract, from the esophagus to the colon, presently being used mainly for the exploration of the small bowel, where it can identify lesions which can't be detected by conventional means. [1]

The number of applications for this method is steadily rising. VCE can be successfully used in diagnosing obscure gastrointestinal bleeding [2-5], Crohn's disease [6, 7] celiac disease and its complications (8, 9) intestinal vascular lesions [10] or tumor pathology [11, 12]

The introduction of the exploration of the small bowel by means of VCE represents a real help for the surgeon, because it allows the identification of the pathology affecting the small bowel and supply information regarding the approximative location of lesions, their dimensions and an orientation on their etiology.

Materials and Method

Patient characteristics

All VCE patients underwent upper digestive endoscopy or total colonoscopy with negative results. Main symptoms were represented by: signs of gastrointestinal bleeding (blood in stool or hematochezia); feriprive anemia of unknown origin; abdominal pain accompanied by diarrhea, inapetence and weight loss otherwise undiagnosed; suspicions of Crohn's disease and complications of non-steroidal anti-inflammatory drug treatment.

From a total number of 50 patients investigated by VCE in the June 2008 - March 2010 period within Internal Medicine and Gastroenterology Clinic 1 of the County Clinic Emergency Hospital of Craiova, 11 presented tumoral pathology of the small bowel, establishing the indication of surgical treatment.

All patients gave informed consent for all medical procedures and sample collection, and the study had the necessary approvals of the Ethics Committee of the hospital.

Capsule endoscopy: technical details

The video capsule is an 11/26 mm device that weighs 3.8 grams. It is capable of sending 2 images per second on a radio system (an average 8 hour recording containing over 50 000 images), the visibility field being of 145 degrees, with a zoom rate of 1:8 and depth of field of 1 to 30 mm. It allows the visualization of lesions with dimensions of a minimum of 0.1 mm. Its main components are an optic dome and a lens system, 6 LEDs (light emitting diodes) for illumination, the CCD (Charge Coupled Device) camera module, internal circuits designed to process video data and adjust lightning and an antenna that helps transmitting images to the electrodes attached to the body. A portable storage device permits data recording as well as real-time viewing. [15]

Capsule endoscopy: procedure

Each patient was administered the video capsule after a preliminary preparation. Standard preparation consisted of alimentary restrictions for 12–16 hours before the exploration, associated with intestinal lavage with a solution of polyethylenglycol (PEG) (two liters) administered the day before exploration 10–14 hours before starting the recording. We did not usually use the preparation of the small bowel with prokinetics because recent information has shown that such techniques are not always necessary [13]. Patients were able to consume clear liquids two hours after ingesting the capsule and a light lunch four hours after ingesting the capsule [13, 14]. Patients were monitored for eight hours. Collected data were analyzed by an experienced gastroenterologist who pointed the diagnostic and recommended surgical intervention where necessary.

Surgical treatment

Surgical intervention was performed in each of the 11 cases with suspected small bowel tumors, practising a segmentary enterectomy in 10 cases (91%) and cephalic duodeno-pancreatomy in one

case. The surgically collected samples were sent to the Pathology Department of the Clinic Emergency Hospital of Craiova, where they were histopathologically prepared and processed. The malignancy diagnosis was given by the histopathological exam.

Statistics

Statistical processing of results and description of groups were made using the methods of descriptive statistics and the Fisher's Exact Test (test for verifying the statistical significance which is used on small size groups) [16].

Results

A total number of 50 patients were investigated by VCE. The main indication for VCE was obscure gastrointestinal bleeding (70%, n=35), 15 of these also presenting anemia. The other patients presented symptoms specific to Crohn's disease (8%, n=4), celiac disease (6%, n=3) and other non-specific symptoms, otherwise not explained (16%, n=8). After investigation, we obtained negative VCE results in 9 (18%) patients.

The study group contained 11 patients suffering from small bowel tumoral pathology, investigated by VCE and surgically intervened on. All these patients underwent VCE for either sings of obscure gastrointestinal bleeding or abdominal pain and diarrhea. The structure of the group was: 54.54% men (n=6) and 45.45% women (n=5), ages between 54 and 79 years of age, average being 63.72 years; standard deviation 7.11, confidence interval (CI) 95% 4.77. The group was divided according to sex, age and pathology for statistical analysis.

Tumoral pathology of patients included in the study consisted of: 3 intestinal polyps (**Fig. 1**), 1 benign stromal tumor, 3 malignant stromal tumors (**Fig. 2**), 2 adenocarcinoma, 1 neuroendocrine malignant tumor, 1 duodenal papilla carcinoma. (**Table I**)

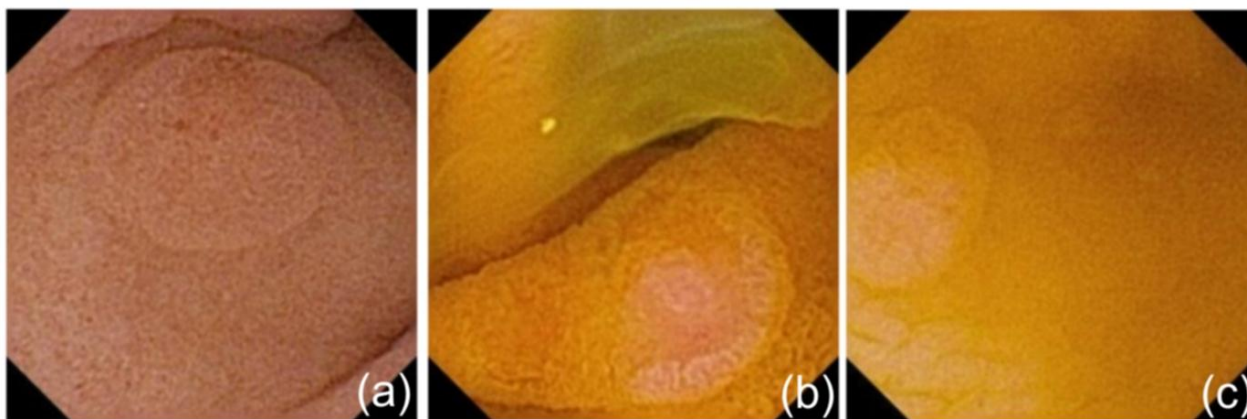


Fig 1. a, b, c. Videocapsule Endoscopy images of intestinal polyps

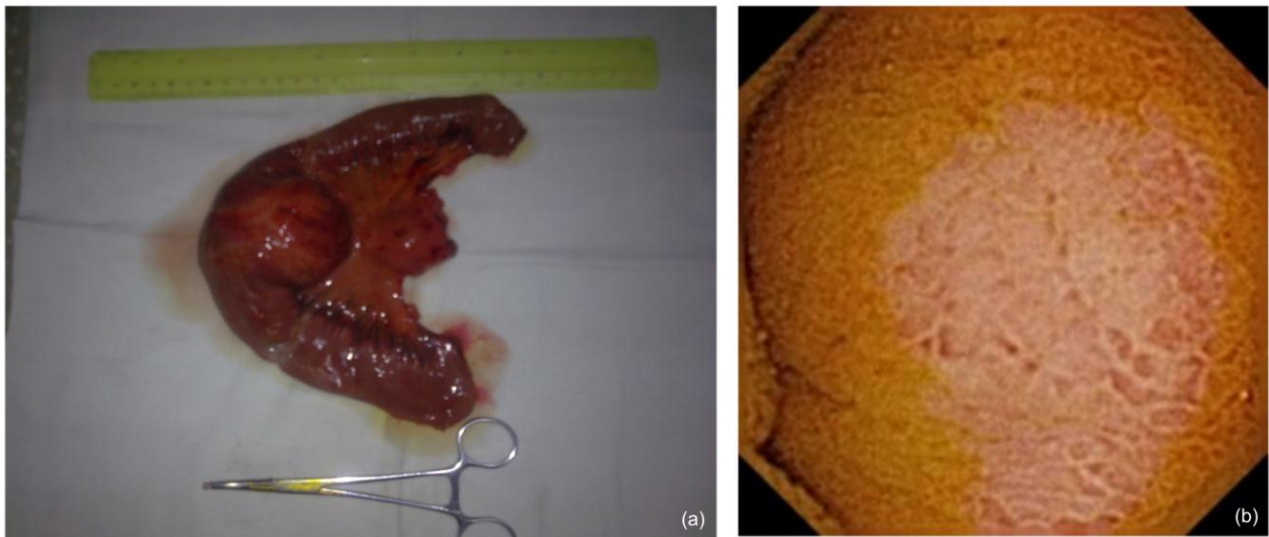


Fig 2.a. Intestinal malignant lymphoma, operatory piece; b. Intestinal malignant polyp: Videocapsule endoscopy aspect.

Table 1. Repartition by Sex of Tumor Pathology

	Men	Women
Polyps	2	1
Benign Stromal Tumor	0	1
Malignant Stromal Tumor	3	0
Neuro-endocrine Tumor	0	1
Adenocarcinoma	1	1
Duodenal Papilla Carcinoma	0	1
Total	6	5

Benign tumors represented 45.45% of the total (polyps 27.27%; benign stromal tumors 18.18%), while malignant tumor pathology was represented thus: 18.18% malignant stromal tumors, 18.18% adenocarcinoma, 9.09% neuroendocrine tumors, and 9.09% duodenal papilla carcinoma. Of the six men included, 33.3 % (n=2) presented benign tumors (intestinal polyps), the others being diagnosed with malignant tumors (3 stromal malignant tumors and 1 case of adenocarcinoma).

Of the five women included, 40 % (n=2) presented benign tumors (one intestinal polyps, one benign stromal tumor), the others being diagnosed with malignant tumors (one neuro-endocrine tumor, one adenocarcinoma and one duodenal papilla carcinoma).

Table 3. Tumor Pathology Repartition by Etiology and Age Groups

	Benign Tumors (45.45%)		Malignant Tumors (54.54%)				Total
	Polyps	Stromal Tumors	Neuroendocrine Tumors	Adenocarcinoma	Stromal Tumors	Duodenal papilla carcinoma	
<60 years	2 (18.18%)	2 (18.18%)	0	0	0	0	3 (27.27%)
>60 years	1 (9.09%)	0	1 (9.09%)	2 (18.18%)	2 (18.18%)	1 (9.09%)	8 (72.72%)
Total	3 (27.27%)	2 (18.18%)	1 (9.09%)	2 (18.18%)	2 (18.18%)	1 (9.09%)	11 (100%)

We tracked the repartition of malignant and benign tumors by age, starting from the hypothesis that malignant pathology appears predominantly over 60 years of age, while benign tumors appear predominantly before this age. The age of 60 years was taken as a reference point in dividing the group, since it is close to the average age of the group. For the application of Fisher's Exact Test, the group was subdivided in two subgroups, over and under 60 years. All the malignant tumors (n=6) were observed on patients over 60 years, while the majority of benign tumors (80%, n=4) were observed under 60 years. (Tables II and III) A single case of a benign tumor (intestinal polyp) was recorded in a patient aged above 60 years. By applying Fisher's Exact Test a p value of 0.01515 2-Tail (CI 95% threshold value 0.05) was obtained, a statistically significant result which verifies the initial hypothesis.

Table 2. Tumor Pathology of the Small Bowel – Table of Incidence

	<60 years	>60 years	Total
Malignant Tumors	0	7 (54.54%)	7 (54.54%)
Benign Tumors	3 (27.27%)	1 (11.11%)	4 (45.45%)
Total	3 (27.27%)	8 (72.72%)	11 (100%)

Discussions

Although the small bowel represents 75 % of the length and 90 % of the absorption surface of the intestinal tract, malignant tumors present at its level represent less than 5 % of the total of gastrointestinal cancers. [17, 18] They also represent less than 0.3 % of the total of neoplasms and are often poorly diagnosed or discovered in very late stages [18, 19]. Recent studies have shown an increase in incidence of small bowel tumors all over the globe. [18, 20-24]. Hurst RD analyzed the annual diagnostics in the United States concluding that approximately 140 000 cases of colorectal cancer, 22 000 new cases of gastric cancers are diagnosed, compared to only 4.500 – 5000 cases of small bowel cancer [25].

In a recent retrospective study, Karl Y. Bilimoria *et al* [26] described the characteristics of a group of 65.843 patients included in the 1985-2005 period in the “National Cancer Data Base” (NCDB) and in the “Epidemiology and End Results” program (SEER, 1973-2004). Of these, 25.339 (37.4%) were diagnosed with carcinoid tumors, 25.053 (36.9%) with adenocarcinoma, 11.711 (17.3%) with lymphoma and 5.740 (8.4%) with stromal tumors. Repartition by sex showed a slight predominance of men (54% vs. 46%), while the average age was 67 years (ages between 56 and 76 years). An increase in incidence from 11.8 cases per million in 1973 to 22.7 cases per million in 2004 was noticed. It is worthy of note that the study did not include cases diagnosed by autopsy.

Total incidence in 2005 was of 8.4/100 000 people, of which 85%-90% were discovered by chance when autopsied. [27]

Due to the large number of cases recorded post-mortem, it is sufficiently clear that an efficient method of early discovery of this tumor pathology is necessary. Classic diagnosis methods for tumors of the small bowel include upper digestive endoscopy (for lesions of the duodenum and proximal jejunum), radiographic methods (computerized tomography or seriography). Lesions located beyond the ligament of Treitz are very difficult to diagnose because of the length of the small bowel. [28]

Thus, it becomes a necessity to find new means of diagnostic that are effective, well tolerated, and with a high diagnostic yield. The video capsule endoscopy system fulfills all the necessary conditions for such an investigation: ease of use, combined with good tolerability, a minimum number of side effects and a high diagnosis rate all recommending it as a high value diagnostic

method for early identification of small bowel pathology. [29, 30]

Histopathology examination gave the final diagnosis. The protocols used have shown histological characteristics specific to the types of benign or malignant tumors, supplying sufficient information to establish a precision diagnosis regarding malignity.

Immunohistochemistry is a relatively new method, which allows the localization of specific proteins by utilizing the antigen-antibody reaction. [31] It is successfully used in accurate diagnosis of malignant lesions, by identifying tumor markers that are specific to each type of malignant neoplasm.

Tumoral pathology of the small bowel is under-evaluated by comparison with the other segments of the digestive tract, detection rate during life being much lower than in other cases. It is predominantly occurring in third age persons and it presents under a multitude of forms. It is therefore necessary to find an efficient method of early identification of lesions and a protocol which would establish malignancy.

The video capsule endoscopy is, without doubt, a modern effective means of identifying tumoral lesions. It can prove to be of precious help to the surgeon in all steps of the diagnosis. Being a non-invasive technique and having a high degree of acceptability from patients, it can be successfully used in screening the multiple pathologies of the small bowel. When combined with the “patency” capsule and modern enteroscopic methods (SBE), it widens its diagnosis accuracy and eases the work of the surgeon, simultaneously helping the patient by reducing the extent of the surgical intervention.

By using histology and immunohistochemistry techniques it leads to a precise malignancy diagnosis for all tumors of the small bowel, directing therapeutic efforts and correctly evaluating the pathology.

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