

Endoscopic video capsule retention, a new medical-surgical disease: case series

Retención de videocápsula endoscópica, una nueva enfermedad médico-quirúrgica: serie de casos

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Abstract

Background: The endoscopic video capsule (EVC), a minimally invasive method of study of the gastrointestinal system indicated in occult gastrointestinal bleeding, has as main complication the retention of endoscopic capsule (CR), currently it is managed with direct extraction using double-balloon enteroscopy; however, when it fails due to its location or associated pathologies, the surgical intervention results in the most successful approach. **Objective:** The objective of the study was to evaluate clinical characteristics and management of patients with video capsule endoscopy retention. **Methods:** From January 2001 to December 2018, a retrospective search was carried out in three centers, of patients with CR diagnosis, clinical variables, and approach were evaluated, in addition to a critical review of the literature. **Results:** 15 patients with a diagnosis of CR (8 women and seven men), average age 65 (range: 45-77). Seven required surgical management, three endoscopic and five medical management. **Conclusions:** The CR is a new pathology of low prevalence, the surgical management resulting from a second therapeutic line when the removal of the VCE has not been possible endoscopically, this pathology requires special attention in the patient's medical history and symptoms for diagnosis and management.

Keywords: Dark digestive hemorrhage. Laparotomy. Intestinal obstruction. Patency capsule. Endoscopic capsule retention. Video endoscopic capsule.

Resumen

Antecedentes: La videocápsula endoscópica (VCE), método mínimamente invasivo de estudio del sistema gastrointestinal indicado en hemorragia digestiva oculta, tiene como principal complicación la retención de la cápsula endoscópica (RCE). Actualmente se maneja con extracción directa empleando enteroscopia de doble balón; sin embargo, cuando falla por su localización o por patologías asociadas, la intervención quirúrgica resulta el método de mayor éxito. **Objetivo:** Evaluar las características clínicas y el manejo de pacientes con RCE. **Métodos:** De enero de 2001 a diciembre de 2018 se realizó un búsqueda retrospectiva, en tres centros, de pacientes con diagnóstico de RCE. Se evaluaron variables clínicas y de manejo,

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y además se realizó una revisión crítica de la literatura. **Resultados:** Se hallaron 15 pacientes con diagnóstico de RCE (ocho mujeres y siete hombres), con una edad promedio de 65 años (rango: 45-77). Siete requirieron manejo quirúrgico, tres manejo endoscópico y cinco manejo médico. **Conclusiones:** La RCE es una patología nueva de baja prevalencia. El manejo quirúrgico resulta ser una segunda línea terapéutica cuando la extracción de la VCE no ha sido posible endoscópicamente. Para su diagnóstico y manejo, esta patología requiere una especial atención a la historia clínica, los antecedentes y los síntomas de los pacientes.

Palabras clave: Hemorragia digestiva de origen oscuro. Laparotomía. Obstrucción intestinal. Patency capsule. Retención de cápsula endoscópica. Videocápsula endoscópica.

Introduction

Endoscopic video capsule (EVC) has become the most useful tool for the study of the small bowel, allowing its direct visualization with better tolerance¹⁻⁵. Video capsule endoscopy (VCE) is classically used in the study of occult gastrointestinal (GI) bleeding, but in the last decade its usefulness has been demonstrated in the diagnosis and follow-up of other type of diseases, such as Crohn's disease, when small bowel tumors are suspected, and in the diagnosis and follow-up of hereditary polyposis syndrome^{2,6-9}.

This procedure is not without complications, with endoscopic capsule retention (CR) being the most important, with an incidence of < 2%, which generally requires medical, endoscopic or surgical management for extraction^{3,10-12}.

At present, CR is managed with direct extraction using double-balloon enteroscopy; however, if the patient presents with signs of high-grade mechanical bowel obstruction or GI bleeding, surgical intervention should be considered as a tool that allows not only the extraction of the EVC, but also the diagnosis and treatment of the cause of retention in a single procedure¹³⁻¹⁶.

Herein, we present our experience in the management of CR at three institutions, with a series of 15 cases, in addition to a critical analysis and literature review.

Methods

A retrospective search was carried out from January 2010 to July 2018 at three centers in Bogota, Colombia, looking for patients diagnosed with CR. The pathology for which the EVC was retained and clinical and sociodemographic characteristics were evaluated, among which age, gender, the indication for VCE, retention time, and clinical symptoms at the time of assessment

(abdominal pain, peritoneal irritation, and bowel obstruction) were taken into account, as well as extraction method (medical, endoscopic, open, and laparoscopic), surgical time, cause of retention, hospitalization days, bleeding, intensive care unit admission requirement, complications, and mortality.

A possible approach was considered for the patients that were found, from medical treatment, to endoscopic or surgical management, whichever was required.

The study protocol was approved by the ethics committee of the three institutions and implemented in accordance with the provisions of the Declaration of Helsinki and the good clinical practice guidelines.

Statistical analysis

Since the study involved an observational retrospective cohort, a descriptive analysis of data was prospectively performed using Microsoft Excel databases and SPSS1 v. 22.0. Continuous variables were analyzed by ranges. Variables are summarized using medians, minimum and maximum values, and percentages.

Results

In the three centers, 15 patients were found who presented with CR, the sociodemographic characteristics of whom are described in table 1. Average age of patients was 65.5 years (range: 45-86); 53.3% were females, and 46.7% were males. Average capsule retention time was 2.6 weeks; 33.3% of cases were resolved with medical management, 20.0% underwent endoscopic management, and 46.6% required surgical management.

All patients underwent VCE for occult GI bleeding, defined by double upper GI tract endoscopic examination and two colonoscopies without conclusive findings for bleeding.

Table 1. Demographic distribution of the population

Variables	n (%)
Gender	
Males	7 (47)
Females	8 (53)
Indication	
Middle or obscure GI bleeding investigation	15 (100)
Abdominal pain	
Yes	9 (60)
No	6 (40)
Cause of retention	
Neoplasm (ileocecal valve)	4 (30)
Crohn's disease	3 (20)
Radiation enteritis	3 (20)
Peutz-Jeghers syndrome	2 (13)
Meckel diverticulum	1 (6.6)
Nonsteroidal anti-inflammatory drug-induced enteropathy	1 (6.6)
Postoperative stenosis	1 (6.6)
Definitive management	
Medical	5 (33.3)
Endoscopic	3 (20)
Laparotomy	7 (46.6)

The causes of retention were neoplastic disease (three neoplasms at the level of the ileocecal valve and one tumor of the gastrointestinal stroma), Crohn's disease (three), radiation enteritis (three), Peutz-Jeghers syndrome (two), Meckel diverticulum (one), non-steroidal anti-inflammatory drug-induced enteropathy (one), and post-operative stenosis (one).

Three patients with CR were diagnosed with *de novo* Crohn's disease, and in two of them, CR was resolved with medical management using corticosteroids; the other patient had stenosis and fibrosis in a proximal ileum segment and, thus, resolving the CR required surgical management with enterotomy and intestinal plasty for the stenosis.

Patients with CR secondary to neoplasms had lesions at the level of the ileocecal valve and terminal ileum, and since they failed to respond to medical management due to the mechanical CR generated by the mass, they underwent surgical management.

In the case of the patient in whom nonsteroidal anti-inflammatory drug-induced enteropathy was found (due to chronic consumption for more or less 6 months), in the examination for occult bleeding, widening the investigations with a degradable EVC was decided, but since this technology is not available in our institutions, a conventional EVC was used; the patient developed CR, which was medically resolved (Table 2).

Table 2. Type of management of endoscopic capsule retention according to diagnosis

Causes with management	n (%)	Laparotomy	Endoscopy	Medical
Neoplasm	4 (26)	4	0	0
Crohn's disease	3 (20)	1	0	2
Radiation enteritis	3 (20)	1	0	2
Peutz-Jeghers syndrome	2 (13)	0	2	0
Meckel diverticulum	1 (6.6)	1	0	0
Nonsteroidal anti-inflammatory drug-induced enteropathy	1 (6.6)	0	0	1
Postoperative stenosis	1 (6.6)	0	1	0

Within the group of patients with surgical management, 100% underwent open surgery due to significant loop distension, which precluded using the laparoscopic approach. Average surgical time was 94.2 min, average bleeding was 90 cc, and average hospital stay was 10.8 days. Only two post-operative complications were reported: one Grade II surgical site infection and one case of community-acquired pneumonia.

No patient required management at the intensive care unit, all their symptoms were resolved after the surgical procedure was performed, there was no mortality and follow-up was at 6 months without complications.

Discussion

Dr. Paul Swain and engineer Gabriel Iddan, after 20 years of research, in 2001 obtained approval by the United States Food and Drug Administration for the endoscopic video capsule (EVC)^{1,5,12,13}, a 11 × 33-mm capsule that successfully integrated a miniature camera, a light source, batteries and a radio transmitter¹⁷. Since then, video capsule endoscopy (VCE) has become the standard technique for small bowel comprehensive evaluation^{5,7,12}, given that it offered advances for the patient because it is a physiological diagnostic method that reduces discomfort as it passes through the GI tract, and that little or nothing alters patient everyday life, since it does not require sedation or anticoagulation discontinuation and does not limit physical activity^{17,18}.

The procedure starts with an overnight fasting period, followed by the ingestion of 2 L of polyethylene glycol in 2 h, with its consumption starting 4 h before ingesting the capsule^{6,13,14,16}. The patient should be given detailed instructions (oral and written) about the need to carefully check the feces to detect capsule excretion, to subsequently inform the treating physician^{6,7}. The EVC is expected to be excreted in the feces 12-72 h after its ingestion^{2,9}. However, there is a 14-day period for its excretion¹⁸, after which CR should be strongly suspected (Fig. 1) and medical, endoscopic or surgical measures must be taken for retrieval^{13,9,10}. Acquisition of images of the cecum is a positive indicator due to the low levels of obstruction produced in the colon⁷. An examination in which visualizing the first cecal image is not possible during the recording time is known as incomplete examination, although this does not necessarily imply retention¹⁸. The factors associated with incomplete examination include: prolonged gastric transit time, gastroparesis, diabetes mellitus, poor intestinal preparation, hyperthyroidism, prior intestinal surgery, hospitalized patients, and especially those who are bedridden and in the intensive care unit^{11,14}. A study carried out by Stanich et al.¹⁴ showed the relationship between increased physical activity and shorter intestinal transit time, but no association is demonstrated with a decrease in cases of incomplete examinations.

Despite being the most common complication, CR has a low incidence, with records in the literature that range between 0.3 and 2%^{1,2,7}. These figures have not changed over the past 10 years⁷, and there is still no standardized method for retention to be prevented^{6,10,17}. A study carried out by Han et al.⁶ using the OMOM or Miro Cam capsules included a total of 5,348 patients, among whom 77 were diagnosed with CR after 14 days of non-expulsion and an X-ray that revealed the presence of the capsule in the abdomen. CR is suspected in asymptomatic patients in whom there is no evidence of expulsion within 14 days after EVC ingestion and in patients who develop clinical obstruction with or without perforation, as it is the case in 40% of our patients, and who also show no evidence of capsule excretion^{6,7,13}.

In asymptomatic patients, X-ray is the tool of choice for CR to be confirmed. Even if the patient has implants, such as pacemakers, they rarely prevent an X-ray from showing the capsule location, even if it has been reduced in small fragments^{7,15}. Computed tomography has shown better performance, since it allows the location of the capsule in the GI tract to be specified and a possible cause of retention to be identified, as in our series of patients⁷ (Fig. 2). There have been

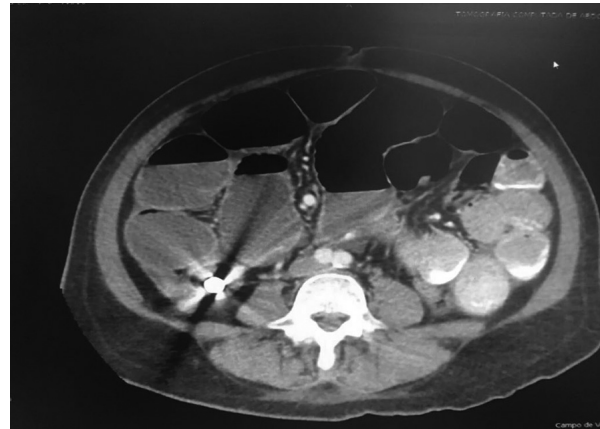


Figure 1. Contrast-enhanced abdominal computed tomography showing a high-grade intestinal obstruction with endoscopic video capsule retention at the level of the distal ileum. No clear cause of retention is identified.

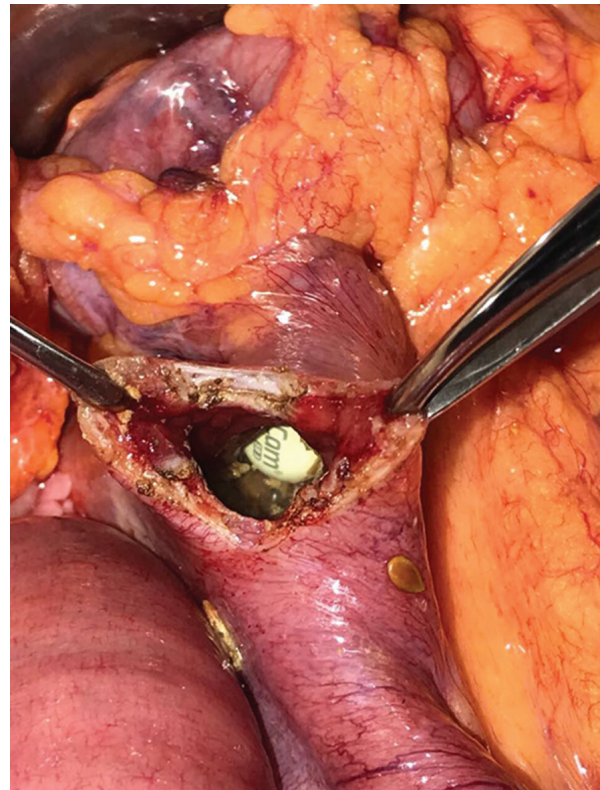


Figure 2. Exploratory laparotomy showing endoscopic video capsule retention at distal ileum secondary to the presence of an ileocecal valve mass.

cases in which clinical symptoms of acute obstruction occur even years after EVC ingestion^{2,7}.

An alternative that has shown good results for the incidence of CR to be avoided is the use of the patency capsule (PC), a biodegradable capsule that degrades at more or less 30 h of its ingestion¹ and

prevents the patient from radiation exposure. It is relatively inexpensive and can be repeated in case doubts persist. This way, possible obstruction by EVC can be detected with a specificity of 83% and sensitivity of 97%, which can be as high as 100% when images of sectioned slices associated with PC are used^{7,9}. Despite its benefits, its systematic use is not yet indicated¹, with inflammatory bowel disease (IBD) being the main indication for PC⁹.

Indications for VCE are highly specific, and include obscure GI bleeding (occult, overt or iron deficiency anemia) as the most common, with figures that range between 60 and 70% of patients. However, in our study, 100% of patients had this indication. This situation is defined as bleeding that persists or recurs after the performance of a gastroscopy and a colonoscopy with negative results (due to intermittent bleeding or human error)^{10,13}. After obscure GI bleeding, indications include inflammatory bowel diseases, such as non-stenosing Crohn's disease, small bowel tumors with no suspected stenosis (which account for only 3-6% of all GI tract tumors, and occur with symptoms such as obscure GI bleeding, abdominal pain, nausea, vomiting, weight loss, and anorexia)¹, hereditary polyposis syndromes (familial adenomatous polyposis and Peutz-Jeghers syndrome) and celiac disease, which is correlated with the findings in our series^{13-16,18}.

In patients with obscure GI bleeding, a negative VCE examination has low rates of rebleeding, of 4.6%, compared to 48% of rebleeding in patients with positive VCE findings^{12,13,18}. A higher prevalence has been found in patients younger than 40 years with small bowel tumors, Meckel diverticula, Dieulafoy's lesion and Crohn's disease¹, as well as in those older than 40 years with vascular lesions and lesions secondary to nonsteroidal anti-inflammatory drugs¹³⁻¹⁵.

It is important to note that no association has been found between capsule size and CR or patient age, but a close relationship has been observed with the clinical indications the procedure is carried out for; CR occurrence can be as high as 13% in patients at risk of IBD, and there are also differences if the VCE procedure is indicated to a patient with diagnosed or suspected IBD (5-13% vs. 1.4-3.5%)^{7,9,18}. However, these are not the highest recorded figures, since figures of 10-20% were found in patients undergoing VCE for subacute small bowel obstruction and of up to 25% in patients with small bowel tumors. The lowest percentages of CR (2%) were found in patients in whom the procedure was indicated for suspected



Figure 3. Surgical specimen of ileocecal valve mass that stenoses gastrointestinal tract lumen and generates endoscopic video capsule retention.

small bowel bleeding, chronic diarrhea, or abdominal pain. These data suggest that IBD can be considered a risk factor for CR, as prior small bowel resection, abdominal radiation therapy and nonsteroidal anti-inflammatory drugs chronic use also are, which reinforces the importance of a good anamnesis of the patient who is to undergo treatment with VCE^{4,5,7}. Other contraindications include obstructive symptoms, an ileocolonoscopy showing stenosis, radiological evidence, or suspicion of stenosis of the GI tract and follow-up of small bowel tumors¹¹⁻¹³.

The primary method for CR treatment has been shown to be double-balloon enteroscopy with or without device assistance, with a success rate of 56 to 100% in capsule retrieval^{2,6}, after localization work-up. Double-balloon enteroscopy is indicated to patients who show abdominal pain associated with CR, although in asymptomatic patients with CR, specific medical treatment may be maintained until the capsule is spontaneously passed or until obstruction symptoms appear, bearing in mind that 35-50% of patients excrete the capsule after 15 days without any therapy, as reported by Han et al.⁶ in a study of 77 patients with CR, out of whom 16 resolved the problem with no intervention.

Given the number of patients with bowel obstruction positive clinical symptoms, the performance of computed tomography first and then surgical procedure is decided if the patient obstructive condition is not resolved. Mandatorily, this must not be only for capsule retrieval but also as treatment of the cause of obstruction^{7,10}, as it was done in all different presented cases. Nemeth et al.³ carried out a study with 2401 patients,

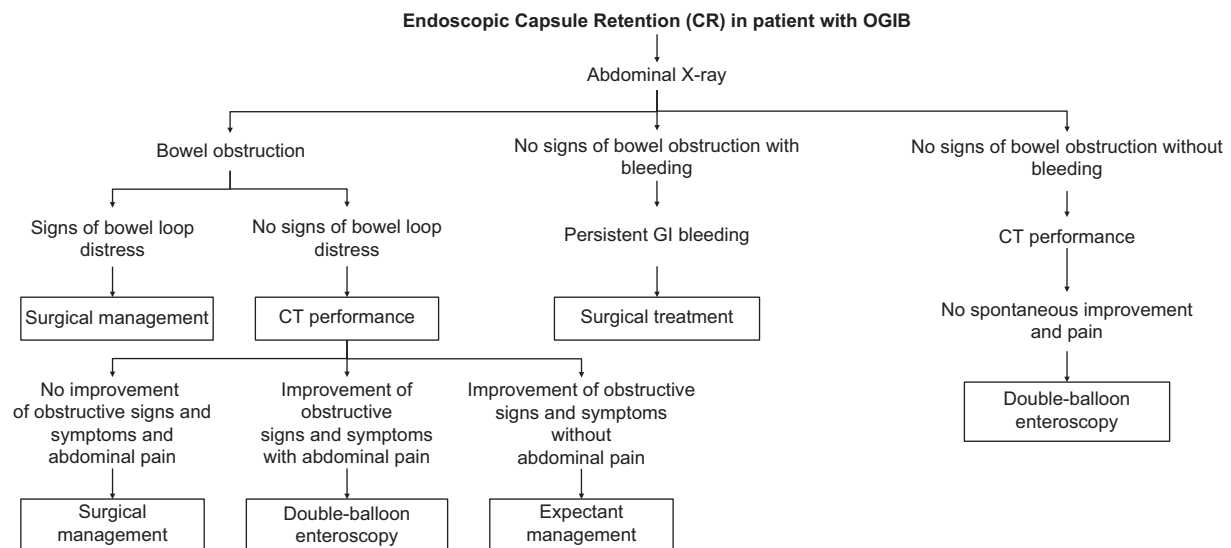


Figure 4. Algorithm for the management of patients admitted to the emergency department with signs and symptoms of intestinal obstruction associated with endoscopic capsule retention.

out of whom 25 had CR and eight received surgical management, although only two underwent emergency surgery due to the development of bowel obstruction; as in all our patients, this intervention eliminated the symptoms after its performance.

Surgical management can be delayed. Baichi et al.¹⁹ showed, in their series of patients, that, in oncological pathologies, the procedure should be performed as needed, taking into account the possible development of CR-associated symptoms.

As previously mentioned, clinical manifestations of obstruction have been found even years after the VCE procedure, as shown by Han et al.⁶ in their study, in which nearly 65% of patients with CR required surgical intervention within the ensuing 5 years. EVC extraction after CR diagnosis has been carried out mainly by surgery, which is the most commonly used retrieval method (45-60%). Spontaneous passage is accomplished in 3 to 15.8% and, finally, endoscopic approach is used in 7-12.5%, which in our series corresponded to 20%^{9,10,20}. Surgical management was resorted to in 46.6% of our patients, similar to the series by Lee et al.²⁰, who demonstrated, on a multivariate analysis, that when CR-associated obstructive symptoms were established, patients underwent open surgical management, which is also required in patients in whom endoscopic management fails or is unavailable²⁰.

Keeping in mind the morbidity and mortality any surgical intervention produces in the future, medical

treatment alternatives that allow avoiding invasive procedures have been searched. Han et al.⁶ treated 20 patients with Crohn's disease and CR with infliximab, and found that 80% resolved the stenosis and had EVC spontaneous expulsion. Rondonotti⁷ demonstrated that patients with small bowel inflammatory diseases benefit from steroid treatment, since up to 20-30% had EVC expulsion. However, subsequent studies have shown that steroids and immunosuppressants are less effective for eliminating EVC than surgical treatment and infliximab, since, among 35 patients with Crohn's disease who received steroids or immunosuppressants (without infliximab), only nine did not require surgical management⁶. The absence of laparoscopic resolution stands out, considering the proven benefits of this method.

Spontaneous expulsion or development of acute obstruction occurs 4-12 weeks after ingestion in patients with CR⁷. In asymptomatic patients, reasonable capsule retrieval times of between 3 and 6 months have been determined, with patients being informed about the risks of having the capsule inside the body, and surgical or endoscopic retrieval options. However, surgical intervention remains the first option in all cases where diagnostic tools unequivocally suggest the presence of neoplastic disease, as reported by Han, et al.⁶, who found that the need for surgical procedure was mainly due to intestinal obstruction in 62% of cases, suspected malignancy in 12%, small bowel bleeding persistence in 12% and severe fibrotic

stenosis identified by double-balloon endoscopy in 6%. In our case series, neoplastic disease (Fig. 3) is the leading cause of retention, and Crohn's disease occurs in equal numbers to radiation enteritis.

Taking into account the literature review and the described case series, we suggest an algorithm for the management of patients with signs and symptoms of intestinal obstruction associated with CR (Fig. 4).

CR is an uncommon pathology, secondary to an endoscopic diagnostic procedure, and generally it resolves spontaneously or using double-balloon enteroscopy. However, it may require surgical management in the presence of high-grade bowel obstruction and GI bleeding to effectively extract the EVC while treating the cause of retention.

Conflicts of interest

The authors declare that they have no financial, professional, or personal conflicts of interest.

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Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this research.

Confidentiality of data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. The authors have obtained informed consent from the patients and/or subjects referred to in the article. This document is in the possession of the corresponding author.

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