**EDITORIAL**

Preventing incomplete and inadequately cleansed capsule endoscopy examinations. Is it possible?

The introduction in clinical practice of small bowel capsule endoscopy (SBCE) represented, not only for doctors specifically dealing with diseases of the small intestine, an epochal diagnostic progression. Since 2001, the year of its first clinical use, numerous scientific studies have shown its utility as a non-invasive technique for the diagnosis of small bowel disorders. The term “capsule endoscopy” returns more than 4,000 items in PubMed, but the most robust scientific evidence for the use of SBCE refers to patients with suspected small bowel bleeding, Crohn’s disease, and small bowel neoplasms. New diagnostic algorithms for diagnosing these disorders have been developed (1,2).

Since the image quality of SBCE is high, its diagnostic yield (DY), and potentially the patient’s clinical outcome, may be significantly limited by two confounders that hamper SBCE performance: a) incomplete evaluation of the small bowel within the capsule's battery life; and b) poor luminal visualization. When SBCE results are negative and/or inconclusive, and complete enteroscopy is not achieved, concerns remain over missed small bowel conditions, which eventually lead to further examinations and increased costs.

In this issue of The Spanish Journal of Gastroenterology (Revista Española de Enfermedades Digestivas), Ponte et al. (3) assessed the predictive factors for incomplete SBCE and inadequate small bowel cleanliness. Consecutive patients with incomplete SBCE using a Mirocam® CE system were retrospectively included over a 7-year period (2009-2016). These were compared to all consecutive patients with a complete SBCE exam over a 2-year period of time (2014-2016). Patients who underwent SBCE within the latter period, including those with incomplete procedures, were evaluated in order to identify predictive factors for inadequate small bowel cleansing. It is noteworthy that a validated quantitative index and a qualitative evaluation scale for grading small bowel cleansing for SBCE were used in this study. This represents an important quality measure for assessing this parameter. Thirty-one incomplete and 122 complete SBCE examinations were included in the assessment of factors associated with an incomplete procedure. Three independent predictive factors were found: degree of dependency, inpatient status, and prior abdominal surgery. Among 130 patients, two independent predictive factors for inadequate preparation were found according to both indices: male gender and prolonged small bowel transit time.

The results of this interesting retrospective study further confirm what is already known with regard to the problem of incomplete SBCE, and also provide important points for discussion. It is known that the rate of incomplete SBCEs is approximately 15-20% (4), a figure that should be regarded as too high. For comparison, if we were measuring cecal intubation rates for colonoscopy at around 80%, this would be considered unacceptably low, and every effort would be made to improve it. Therefore, significant work needs to be done to develop interventions that consistently achieve a 100% completion rate for capsule endoscopy studies. Some factors have been associated with an incomplete small bowel examination, including inpatient status and previous small bowel surgery (5-7), while the effects of age and diabetes mellitus remain controversial.

There are no clear-cut explanations for incomplete small bowel examinations in inpatients, but the number and severity of comorbidities, the use of medications potentially affecting small bowel transit time, and the reduced physical activity associated with inpatient status have all been postulated as potential contributing factors. It is therefore recommended that SBCE be performed on an outpatient basis whenever possible, since completion rates are higher for outpatients than for inpatients (8).

In some clinical scenarios SBCE timing is, however, a crucial issue (9). In patients with acute overt bleeding, which often occurs during hospital stays, clinical guidelines (1,2) suggest performing SBCE as soon as possible after the event (ideally within 24-72 hours). When clinically indicated, this examination should not be postponed simply because the patient is an inpatient. Therefore, in such situations all actions that may facilitate a complete examination should be implemented.

Although prolonged gastric transit time has not been found to be associated with incomplete SBCE by Ponte et al. (3), other studies have consistently reported this factor as a leading cause of incomplete small bowel examination (5). Individuals at risk of delayed gastric emptying include inpatients, patients with diabetic neuropathy, severe hypothyroidism, or renal insufficiency, and/or patients using psychotropic or narcotic medications. Recent technical guidelines (8) suggest that, in such cases, a real-time viewer may guide the appropriate intervention (administration of a prokinetic agent and/or endoscopically assisted capsule delivery into the duodenum) to optimize a SBCE examination (10). The use of newer SBCE devices with longer battery times may potentially be helpful in this situation. One additional key benefit of complete SBCE cannot be underestimated—the approach selected for device-assisted enteroscopy (oral or anal) is usually determined by the timing of the lesion as per SBCE. This crucial step is largely determined by small bowel transit time based on complete SBCE (8).
An issue no less important is quality small bowel cleansing during SBCE. Optimal patient preparation for SBCE has been a controversial topic. Manufacturers do not recommend preprocedure purgative use for SBCE; the only recommended requirement is a low-fiber diet on the day before the procedure with clear liquids only in the evening and a 12-hour fast. To date, five meta-analyses have concluded that the oral administration of 2 L of PEG solution prior to capsule ingestion improves visualization of the small bowel mucosa. However, the evidence relating to completion rates and DY remains inconclusive, and the optimal timing of purgative use is yet to be established (11-15), while the most recent meta-analysis of randomized controlled trials has casted doubts on the effective usefulness of purgative preparation before SBCE for improving both DY and the quality of small bowel mucosal visualization (16).

In conclusion, large controlled, prospective trials will be required to identify strategies to solve the issues raised by Ponte et al. (3). A complete knowledge of risk factors for incomplete SBCE or inadequate small bowel cleansing will allow to selectively target these factors in future procedures in order to reduce such events. This should lead to improved diagnosis, help minimize additional investigations, and assist the use of targeted enteroscopy for appropriate patients.

**REFERENCES**