Mistakes in capsule endoscopy and how to avoid them

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Capsule endoscopy is a noninvasive technique intended for studying the small bowel and/or colon. The capsule endoscope consists of a small, wireless, pill-sized camera that can be swallowed and allows direct visualization of the gastrointestinal mucosa. The design of the capsule differs depending on the part of the gastrointestinal tract to be studied. The small-bowel capsule has one optical dome and is generally used in patients who have suspected bleeding or to identify evidence of active Crohn’s disease. By contrast, the colon capsule has two optical domes, a higher frame rate and can be considered as an alternative to conventional colonoscopy, especially for cases when the examination was incomplete. There is also a new capsule with two optical domes that is designed for the panendoscopic study of both the small bowel and colon.

The main characteristic of capsule endoscopy is the wireless technology, which enables it to be very well tolerated. However, this feature is also one of its drawbacks, as the capsule cannot be directly controlled by the physician. The capsule moves through the gut depending solely on intestinal motility, and the examiner is not able to drive it back and forth or to stop it to look more carefully at any finding. Moreover, the visualization relies heavily on the adequacy of intestinal cleansing as rinsing with water and aspiration are not possible. Capsule endoscopists should be aware of these shortcomings, as they directly affect the reading and diagnosis. Here we discuss frequent errors that are made when performing capsule endoscopy, based on the published literature and more than 15 years’ experience.

Mistake 1 Mistaking the ampulla for a polyp
The ampulla is visualised in up to 20% of capsule endoscopy videos. In a small proportion of patients, the capsule re-enters the stomach (occasionally more than once). If there is a marked time lag to re-entry into the small bowel, the new landmark for entry into the duodenum should be marked separately. This is of particular importance so that the capsule reader correctly identifies the ampulla in the proximal small bowel and does not mistake it for a polyp.

Mistake 2 Making a diagnosis of Crohn’s disease based solely on capsule endoscopy findings
In patients who have suspected Crohn’s disease and negative ileocolonoscopy findings, the ESGE recommends small-bowel capsule endoscopy as the initial diagnostic modality for investigating the small bowel, in the absence of obstructive symptoms or known stenosis. However, it has been reported that erosions may be present on capsule endoscopy for as high as 13–21% of healthy volunteers. Moreover, studies have also shown that patients may be surreptitiously taking NSAIDs, which could be responsible for ulceration seen on capsule endoscopy. Furthermore, the findings on capsule endoscopy of NSAID enteropathy may be indistinguishable from that of Crohn’s disease. Patients who have co-existing comorbidities and take drugs such as nicorandil may also have evidence of small-bowel mucosal injury on capsule endoscopy. Taking a thorough history, including a detailed drug history (past and present), is, therefore, pertinent prior to reporting capsule endoscopy findings and labelling them as small-bowel Crohn’s disease, thereby reducing the possibility of misdiagnosis.

Mistake 3 Over reporting the significance of finding angioectasias on capsule endoscopy
Angioectasias are a frequent finding in patients over the age of 50 years who present with obscure gastrointestinal bleeding. Angioectasias in the small bowel are frequently located in the proximal small bowel and can be single or multiple, with or without the presence of active bleeding. The finding of angioectasia—including the number, size and stigmata of bleeding—must be assessed in the context of the clinical presentation. If the findings are minor compared with the severity of bleeding, it is imperative this is highlighted appropriately in the capsule endoscopy report to guide the referring clinician on further management, including looking for other potential sources of bleeding.

Mistake 4 Confusing submucosal bulges with ‘look-a-likes’
Reporting of submucosal bulges remains a challenge for capsule endoscopists because there are look-a-likes. Studies have shown that even the use of 3D imaging does not help experts to distinguish submucosal bulges from look-a-likes although it may improve the accuracy of novices. Parameters that can help...
reporting of submucosal bulges include bleeding, mucosal disruption, vascular changes and/or application of the smooth protruding lesion index score on capsule endoscopy (Spice Score).9 Using the Spice Score may help the reader to distinguish a submucosal mass from a bulge or a protrusion of an adjacent loop. The Spice Score confers a sensitivity and specificity of 83% and 89%, respectively, for the detection of small-bowel tumours.5–11

Appropriate further management to verify capsule endoscopy findings, particularly in indeterminate cases, should include radiological investigation and pursuing histology with device-assisted enteroscopy if clinically appropriate. We would also remind novice readers that capsule endoscopy may also cause false-negative results, especially when there is a limited field of vision, the suspicious lesion appears in only one frame, there is a rapid transit time (e.g. in the duodenum) or poor bowel cleansing, and in cases of incomplete studies.

**Mistake 5** Relying on a negative capsule endoscopy despite a high suspicion of gastrointestinal bleeding

Capsule endoscopy is the first-line modality for investigation of the small bowel in cases of obscure gastrointestinal bleeding.1 The literature suggests the pickup rate is significantly higher in older patients, also in patients who are transfusion dependent and in cases when the procedure is done close to the presentation of bleeding.2 However, despite this, capsule endoscopy may be negative. Indeed, clinicians must be aware that capsule endoscopy will not pick up all tumours (a 16.7% false-negative rate has been described),22 particularly tumours in the proximal small bowel. If the clinical suspicion remains high despite negative capsule endoscopy findings, alternative methods of investigation should be considered—a repeat procedure may be advocated for cases when the clinical presentation changes from occult to overt bleeding or there is a haemoglobin drop of >4g/dL.13

**Mistake 6** Having a high rate of incomplete colon examinations

A successful colon capsule examination needs complete visualization of the colon, starting with images of the cecum and finishing with a final image of the rectum obtained within the battery lifetime. The lifetime of the colon capsule battery is, on average, more than 10h. Several studies have reported a substantial rate of incomplete procedures, ranging from 8–88% of incomplete procedures, ranging from

<table>
<thead>
<tr>
<th>Colon preparation</th>
<th>Adequate cleansing level (%)</th>
<th>Complete procedure and booster rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEG 2L + 2L; SP 30ml + 15ml</td>
<td>81</td>
<td>88</td>
</tr>
<tr>
<td>PEG 2L + 2L; Sulfates 1 bottle + 1/2 bottle</td>
<td>80</td>
<td>92</td>
</tr>
<tr>
<td>PEG-asc 1L + 1L; PEG-asc 0.5L + 0.25L</td>
<td>82</td>
<td>76</td>
</tr>
<tr>
<td>PEG 2L + 2L; SP 40 ml/gastrografin 50 ml + SP 25ml/gastrografin 25ml</td>
<td>83</td>
<td>98</td>
</tr>
</tbody>
</table>

Table 1: Bowel preparations and boosters. PEG, polyethylene glycol; PEG-asc, PEG + electrolytes + sodium ascorbate + ascorbic acid; SP, sodium phosphate; Sulfates, sodium sulfate + potassium sulfate + magnesium sulfate.

68% to 81%, due to inappropriate early retrieval of the capsule system after 8h.23–25 If the colon capsule is not excreted within 8h, we suggest waiting until the end of the battery lifetime, as signified by the battery indicator.

A complete colon capsule procedure also relies on the use of boosters to improve colonic transit times within the lifetime of the battery, and selection of the right booster is essential. The ESGE colon capsule guidelines recommend boosters based on low-dose sodium phosphate if possible.25 When sodium phosphate is contraindicated (i.e. for patients with cardiac or renal conditions) it should be replaced by other boosters that have similar efficacy. This efficacy can be measured by the colon cleansing and completeness rate. Table 1 shows the most appropriate boosters compared with sodium phosphate.

**Mistake 7** Under or over use of a patency capsule

Capsule retention is the most notable complication of capsule endoscopy, although it occurs in just 1–2% of cases.23 Risk factors for capsule retention include clinical suspicion of an obstruction, known strictures, a history of abdominal radiation and previous abdominal surgery. However, these risk factors shouldn’t prevent clinicians from performing a capsule examination. To decrease the risk of capsule retention, a permeability test should be performed, preferably with a degradable capsule. There is only one degradable capsule currently marketed, the Agile™ Patency capsule, and it is about the same size as the small-bowel capsule carrying an RFID tag, which allows the capsule to be located by a plain x-ray or CT scan. After 36h the patency capsule starts to dissolve, so if the capsule has not been excreted before 30h, or if it is excreted distorted, a small-bowel stricture should be suspected, and capsule endoscopy is contraindicated.

In patients who have suspected Crohn’s disease, the risk of capsule retention is low, so using a patency capsule isn’t required routinely, unless patients report significant pain and/or other obstructive features.23 In patients who have known Crohn’s disease but no suspicion of strictures and/or abdominal complaints suggestive of small-bowel obstruction, there is no need to use a patency capsule.23 A patency test is recommended when the patient has previous occlusive symptoms, such as a combination of abdominal pain and distension, abdominal pain and nausea/vomiting and abdominal distension and nausea/vomiting.21

**Mistake 8** Not ensuring capsule excretion if the cecum hasn’t been reached

There is no need to check for small-bowel capsule excretion if the capsule record shows the cecum, as the risk of capsule retention in the colon is very low (0.9%).24 Considering the definition of capsule retention, the ESGE suggests confirmation of the capsule location if the cecum has not been reached and the capsule has not been excreted within 15 days.23

**Mistake 9** Avoiding capsule endoscopy in patients who have implanted devices

At the beginning of the capsule endoscopy era, implanted devices such as pacemakers were considered a contraindication for the procedure. Several studies have since shown that there is no risk of dysfunction for either the capsule or cardiac devices.24–25 The ESGE recommends that patients who have pacemakers or implantable cardioverter defibrillators (ICDs) and left ventricular assist devices (LVADs) can safely undergo small-bowel capsule endoscopy without the need for special precautions.25

**Mistake 10** Not taking enough time and care with the capsule reading and reporting

Capsule reading is time consuming, with a mean reading time of 45–60 min.26–27 Based on experience, it is highly recommended to read the video in a single nonstop session. Indeed, we suggest using the preview–review–report
method to minimize misreading, both for small-bowel and colon capsule readings.

During the preview phase, anatomical landmarks should be determined, while all abnormalities should be selected in the review phase. For the colon capsule keep in mind to select two or more images of any polyp and measure them at least two times in the same frame, and in different frames as well. The ESGE recommends a maximum reading speed of 10 (less in the proximal small bowel) for small-bowel capsules.19

Multiframe reading may be acceptable for small-bowel capsules in conditions affecting the small-bowel mucosa diffusely, while colon capsule readings should be performed with one camera (green or yellow) in single view mode, followed by the other camera, as polyps may appear in only one of the cameras. This recommendation is based on accumulated experience.

Data on reporting is scarce, however the ESGE recommends including information on the bowel preparation used and the quality of the bowel preparation, the completion/extent of examination, clinical findings and the use of validated indexes (such as the Lewis score for inflammatory activity), and a final recommendation for the referring physician as well.19

References

UGE online courses
• A Primer in Capsule Endoscopy [https://www.ueg.eu/education/online-courses/a-primer-in-capsule-endoscopy/].

UGE Week
• "The role of capsule endoscopy" presentation in the "Visualising small bowel diseases" session at UEG week 2016. [https://www.ueg.eu/education/document/the-role-of-capsule-endoscopy/131337/].
• "Case presentation – Evidence based approach to capsule endoscopy" presentation in the "Small bowel tumours: Rare entities and how to find them" session at UEG Week 2016. [https://www.ueg.eu/education/document/case-presentation-evidence-based-approach-to-capsule-endoscopy/128963/].

Standards & Guidelines