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GUIDELINE

Clinical Practice Guidelines for the Use of Video Capsule Endoscopy

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BACKGROUND & AIMS: Video capsule endoscopy (CE) provides a noninvasive option to assess the small intestine, but its use with respect to endoscopic procedures and cross-sectional imaging varies widely. The aim of this consensus was to provide guidance on the appropriate use of CE in clinical practice. **METHODS:** A systematic literature search identified studies on the use of CE in patients with Crohn's disease, celiac disease, gastrointestinal bleeding, and anemia. The quality of evidence and strength of recommendations were rated using the Grading of Recommendation Assessment, Development, and Evaluation (GRADE) approach. **RESULTS:** The consensus includes 21 statements focused on the use of small-bowel CE and colon capsule endoscopy. CE was recommended for patients with suspected, known, or relapsed Crohn's disease when ileocolonoscopy and imaging studies were negative if it was imperative to know whether active Crohn's disease was present in the small bowel. It was not recommended in patients with chronic abdominal pain or diarrhea, in whom there was no evidence of abnormal biomarkers typically associated with Crohn's disease. CE was recommended to assess patients with celiac disease who have unexplained symptoms despite appropriate treatment, but not to make the diagnosis. In patients with overt gastrointestinal bleeding, and negative findings on esophagogastroduodenoscopy and colonoscopy, CE should be performed as soon as possible. CE was recommended only in selected patients with unexplained, mild, chronic iron-deficiency anemia. CE was suggested for surveillance in patients with polyposis syndromes or other small-bowel cancers, who required small-bowel studies. Colon capsule endoscopy should not be substituted routinely for colonoscopy. Patients should be made aware of the potential risks of CE including a failed procedure, capsule retention, or a missed lesion. Finally, standardized criteria for training and reporting in CE should be defined. **CONCLUSIONS:** CE generally should be considered a complementary test in patients with gastrointestinal bleeding, Crohn's disease, or celiac disease, who have had negative or inconclusive endoscopic or imaging studies.

Keywords: Capsule Endoscopy; Video Capsule; Colonoscopy; Endoscopy; Crohn's Disease; Celiac Disease; Gastrointestinal Bleeding.

Video capsule endoscopy (CE) provides a noninvasive method to visualize the small intestine in patients with a wide spectrum of disorders such as Crohn's disease (CD), obscure gastrointestinal (GI) bleeding, polyposis syndromes, celiac disease, and other inflammatory disorders. In patients under consideration for CE, initial assessment typically includes symptom evaluation, laboratory assessment, and endoscopic procedures, as well as cross-sectional imaging (eg, magnetic resonance enterography [MRE], or computed tomography enterography [CTE]) in selected patients.

Studies assessing CE generally use radiologic small-bowel studies or endoscopy as a historical standard for comparison, and assess the incremental diagnostic yield, not the diagnostic accuracy, of CE because a gold standard does not exist. There are a number of different procedures to assess the small intestine, with substantial diversity in investigative approaches evident internationally. Some of these issues recently were addressed through the European Society of Gastrointestinal Endoscopy guidelines, which focused on small-bowel investigative devices, including CE, and device-assisted enteroscopic techniques.[1] The present guideline is restricted to CE, and, more specifically, to relevant questions that are applicable in North America where there are somewhat different economic and clinical concerns. This guideline is focused on the use of CE in adults,

Abbreviations used in this paper: **CAG, Canadian Association of Gastroenterology; CCE, colon capsule endoscopy; CD, Crohn's disease; CE, capsule endoscopy; CI, confidence interval; CPG, clinical practice guideline; CRC, colorectal cancer; CRP, C-reactive protein; CTE, computed tomography enterography; DBE, double-balloon enteroscopy; EGD, esophagogastroduodenoscopy; FAP, familial adenomatous polyposis; FC, fecal calprotectin; GFD, gluten-free diet; GI, gastrointestinal; GRADE, Grading of Recommendation Assessment, Development, and Evaluation; IBD, inflammatory bowel disease; IDA, iron-deficiency anemia; MRE, magnetic resonance enterography; PEG, polyethylene glycol; PJS, Peutz–Jeghers Syndrome; RCT, randomized controlled trial.**

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primarily regarding small-bowel CE in patients with known or suspected CD, celiac disease, or gastrointestinal bleeding.

Materials and Methods

Scope and Purpose

This consensus was focused on specific questions regarding the use of CE as identified and discussed by the participants. Development of this clinical practice guideline was initiated in November 2014, with a meeting of the full consensus group held in November 2015. The entire process took approximately 20 months, with the final manuscript being submitted for publication in July 2016.

Sources and Searches

The Editorial Office of the Cochrane Upper Gastrointestinal and Pancreatic Diseases Group at McMaster University performed a systematic literature search of MEDLINE (1946 on), EMBASE (1980 on), and CENTRAL (Cochrane Central Register of Controlled Trials) for trials published through January 2014. Key search terms included the following: capsule endoscopy, video capsule, colonoscop*, esophag*, Pillcam, EndoCapsule, MiroCam, and CapsoCam. Human studies published in English were considered; additional details of search strategies used in the preparation of the initial consensus statements are provided online in Appendix 1. Additional focused (but nonsystematic) searches also were performed up until October 2015 before the consensus meeting.

Review and Grading of Evidence

The Grading of Recommendation Assessment, Development, and Evaluation (GRADE) approach[2] was used by 2 nonvoting methodologists (G.I.L. and F.T.) to assess the risk of bias (of individual studies and overall across studies), indirectness, inconsistency, imprecision, as well as other considerations (including publication bias) to determine the overall quality of evidence for each statement. The methodologists also used Quality Assessment of Diagnostic Accuracy Studies-2, a tool using 4 domains (patient selection, index test, reference standard, and flow and timing) to assess the quality of primary diagnostic accuracy studies.[3] The quality of evidence for each statement was graded as high, moderate, low, or very low, as described in GRADE[2,4] and prior Canadian Association of Gastroenterology (CAG) consensus documents.[5,6] GRADE assessments were reviewed and agreed upon by voting members of the consensus group at the meeting.

Three statements were determined to meet criteria for "good practice statements"[7] in that the consensus group believed the recommendation was clinically obvious, and the collection and GRADE analysis of supporting evidence was unnecessary. For these statements (statements 15, 20, and 21), although formal GRADE evaluation of the supporting evidence was not performed, details are provided in the accompanying sections explaining the group's rationale.

Because approved product labeling varies from country to country, recommendations—based on evidence from the literature and consensus discussion—may not fully reflect the product labeling for any given country.

Consensus Process

The consensus group included 6 voting participants and a nonvoting moderator (D.S.), all of whom were gastroenterologists practicing in Canada with expertise in the use of CE.

A web-based consensus platform (ECD Solutions, Atlanta, GA) administered by the CAG was used to facilitate the consensus process in advance of the 1-day face-to-face consensus meeting held in Toronto, Ontario, Canada, in November 2015. The meeting co-chairs (R.A.E. and L.H.) assisted by Dr Steve Heitman developed the initial statements. All participants then reviewed the results of the literature search through the web-based platform, and tagged (selected and linked) relevant references to each individual statement. Copies of the tagged references were made available to all members of the consensus group. The entire consensus group then voted anonymously on their level of agreement with the specific statements using a modified Delphi process.[8,9] The statements then were revised to incorporate suggestions from group members.

The consensus conference provided an opportunity for data to be presented, GRADE evaluations for the statements to be reviewed, as well as discussion and subsequent finalization of the phrasing for individual statements. Finally, participants were asked to vote as to their level of agreement for each specific statement. A statement was accepted if more than 75% of participants voted a 4 (agree) or 5 (strongly agree) on a scale of 1 to 5 (with 1, 2, and 3 being disagree strongly, disagree, and uncertain, respectively).

After acceptance of a statement, participants voted on the strength of the recommendation. A level of agreement of 75% of participants or more was needed to classify a statement as strong (we recommend); if this threshold was not met, the statement defaulted to conditional (we suggest). The strength of the recommendation considered risk-benefit balance, patients' values and preferences, cost and resource allocation, and the quality of the evidence. Therefore, it is possible for a recommendation to be classified as strong despite having low-quality evidence, or conditional despite the existence of high-quality evidence.[10] As per the GRADE method, a strong recommendation is indicative of a more broadly applicable statement, whereas a conditional recommendation suggests that clinicians should "recognize that different choices will be appropriate for different patients and that they must help each patient to arrive at a management decision consistent with her or his values and preferences."[10]

The manuscript initially was drafted by the co-chairs (R.A.E. and L.H.), after which it was revised based on input from all members of the consensus group. As per CAG policy for all clinical practice guidelines, the manuscript was made available to all CAG members for comments before submission for publication. Members were notified that the manuscript was available on the members-only section of the CAG website and open for comment for a 2-week period.

Written disclosures of any potential conflicts of interest for the 24 months before the consensus meeting were provided by all participants, and made available to all group members, as per CAG policy.

Role of the Funding Sources

Funding for the consensus meeting was provided by unrestricted, arms-length grants to the CAG by Allergan Canada,

Covidien Canada ULC, a Medtronic company, and Olympus Canada Inc. The CAG administered all aspects of the meeting, and the funding sources had no involvement in the process at any point, and they were not made aware of any part of the process from development of search strings and the statements, to drafting and approval of these guidelines.

Recommendation Statements

The individual recommendation statements are provided and include the GRADE of supporting evidence and the voting results, after which, a discussion of the evidence considered for the specific statement is presented. For the majority of statements the quality of evidence was determined to be very low, largely because of high risk of bias, indirectness, and imprecision. For some statements in which lower quality of evidence exists, a strong recommendation was made based on other factors such as increased costs of unnecessary procedures and lack of appropriate alternatives, or potential negative consequences of delayed diagnosis. A summary of the recommendation statements is provided in Table 1. Tables summarizing the most important evidence for each of the statements are provided in Appendix 2.

Crohn's Disease

Statement 1. In patients presenting with clinical features consistent with Crohn's disease, and negative ileocolonoscopy and imaging studies, we recommend capsule endoscopy of the small bowel. *GRADE: Strong recommendation, very low quality evidence (Appendix 2 and Supplementary Table 1). Vote: strongly agree, 83%; agree, 17%.*

CD is diagnosed based on clinical symptoms and a combination of endoscopic, histologic, radiologic, and biochemical investigations.[11] A history of diarrhea or abdominal pain for more than 6 weeks,[12] and changes in laboratory investigations such as C-reactive protein (CRP) level, erythrocyte sedimentation rate, or fecal calprotectin (FC) level,[11] as well as the finding of hypoalbuminemia[12] or anemia,[11] should suggest the possibility of CD. Typically, ileocolonoscopy, with biopsy, and imaging studies, are recommended to confirm the diagnosis.

CE has shown utility for the diagnosis of CD; however, studies generally assess diagnostic yield, not diagnostic accuracy, because there is no gold standard (reference standard) for diagnosis. In addition, few data are available specifically in patients who had negative alternative studies. A meta-analysis showed that CE has equivalent, or higher, diagnostic yield than other procedures in patients with suspected CD.[13] In this meta-analysis of 19 trials there was a significantly greater incremental diagnostic yield with small-bowel CE, compared with ileoscopy (22%; 95% confidence interval [CI], 5%–39%; $P < .00001$), radiography (32%; 95% CI, 16%–48%; $P < .00001$), and CTE (47%; 95% CI, 31%–63%; $P = .009$), but not MRE (10%; 95% CI, -14% to 34%; $P = .43$).[13] In patients with suspected CD, CE has shown good sensitivity (91%–100%) and specificity (91%–92%) when using ileocolonoscopy as the reference test.[14,15] In a prospective study, physicians reported that CE helped in diagnosing CD in 83% of cases, influenced decision making in 72%, and led to a change in management in 78% of patients.[16]

In patients who have negative or inconclusive evaluations (including ileoscopy, CTE/MRE, or radiography) for CD, CE led to an incremental diagnostic yield of 24% in 1 study,[17] and showed good sensitivity (93%) and specificity (84%) in another.[18] A trial in 20 pediatric patients with suspected CD that was obscure or difficult to diagnose by other imaging and endoscopic techniques showed multiple lesions that were detected by CE in 50% of patients.[19]

Based on the diagnostic yield of CE for the detection of small-bowel lesions, the consensus group concluded that in patients with inconclusive ileoscopy and imaging and no evidence of obstruction, CE is a recommended test. In particular, when there is a failure to visualize the ileum with ileoscopy, CE would be preferred to the more invasive options of double-balloon endoscopy (DBE) or diagnostic surgery. However, the physician performing and interpreting the CE must be sufficiently experienced to recognize that small mucosal breaks or small ulcers are not diagnostic of CD. Because a diagnosis of CD has implications for the patient's insurance and disability, as well as the likelihood that medications will be prescribed with potential adverse effects, it is imperative that small-bowel findings interpreted as CD are definitive, ideally supported by clinical presentation and histology. If there is any concern that small-bowel abnormalities identified on CE might represent a diagnosis other than CD then deep enteroscopy should be considered to facilitate tissue acquisition.

Statement 2. In patients with Crohn's disease and clinical features unexplained by ileocolonoscopy or imaging studies, we recommend CE. *GRADE: Strong recommendation, very low-quality evidence (Appendix 2 and Supplementary Table 2). Vote: strongly agree, 100%.*

CE also has been shown to have equivalent or higher diagnostic yield than other procedures in patients with established CD.[13] In patients with established CD, a meta-analysis reported significantly greater incremental diagnostic yield with small-bowel CE compared with small-bowel barium radiography (small-bowel follow-through or enteroclysis) (38%; 95% CI, 22%–54%; $P < .00001$) and CTE (32%; 95% CI, 16%–47%; $P < .0001$), but not ileoscopy (13%; 95% CI, -1% to 26%; $P = .07$) or MRE (-6%; 95% CI, -30% to 19%; $P = .65$).[13] CE detected more lesions in the proximal small bowel compared with CTE or MRE.[15,20]

In small studies in patients with known CD, CE provided additional information in 50%–86% of patients, and these additional findings influenced disease management and clinical outcomes.[16,21]

Based on findings of improved diagnostic yield, and evidence that CE can alter patient management, the consensus group recommended that studies be performed if a patient with CD has symptoms that cannot be explained by endoscopy or cross-sectional imaging. In this circumstance, CE may help to determine whether pathology exists to account for ongoing symptoms that had been missed on other studies.

Table 1. Summary of Consensus Recommendations for the Use of Video Capsule Endoscopy

Crohn's disease

Statement 1. In patients presenting with clinical features consistent with Crohn's disease, and negative ileocolonoscopy and imaging studies, we recommend capsule endoscopy of the small bowel. GRADE: Strong recommendation, very low quality evidence. Vote: strongly agree, 83%; agree, 17%.

Statement 2. In patients with Crohn's disease and clinical features unexplained by ileocolonoscopy or imaging studies, we recommend CE. GRADE: Strong recommendation, very low quality evidence. Vote: strongly agree, 100%.

Statement 3. In patients with Crohn's disease, when assessment of small-bowel mucosal healing (beyond the reach of ileocolonoscopy) is needed, we suggest CE. GRADE: Conditional recommendation, very low quality evidence. Vote: strongly agree, 33%; agree, 67%.

Statement 4. In patients with a suspected small-bowel recurrence of Crohn's disease after colectomy, undiagnosed by ileocolonoscopy or imaging studies, we recommend CE. GRADE: Strong recommendation, very low quality evidence. Vote: strongly agree, 100%.

Statement 5. In patients with chronic abdominal pain or diarrhea as their only symptoms, and no evidence of biomarkers associated with Crohn's disease, we suggest against the use of CE for the diagnosis of Crohn's disease. GRADE: Conditional recommendation, low-quality evidence. Vote: strongly agree, 67%; agree, 33%.

Celiac disease

Statement 6. For patients with suspected celiac disease, we recommend against CE to make a diagnosis. GRADE: Strong recommendation, very low quality evidence for efficacy, low-quality evidence for safety. Vote: strongly agree, 100%.

Statement 7. In patients with celiac disease and unexplained symptoms despite treatment and appropriate investigations, we recommend CE. GRADE: Strong recommendation, very low quality evidence for efficacy, low-quality evidence for safety. Vote: strongly agree, 83%; agree, 17%.

Gastrointestinal bleeding

Statement 8. In patients who have documented overt GI bleeding (excluding hematemesis) and negative findings on high-quality EGD and colonoscopy, we recommend CE as the next diagnostic step. GRADE: Strong recommendation, very low quality evidence. Vote: strongly agree, 100%.

Statement 9. In patients with an overt, obscure bleeding episode, we recommend CE be performed as soon as possible. GRADE: Strong recommendation, very low quality evidence. Vote: strongly agree, 83%; agree, 17%.

Statement 10. In patients with prior negative CE who have repeated obscure bleeding, we recommend repeated studies (endoscopy, colonoscopy, and/or CE). GRADE: Strong recommendation, very low quality evidence. Vote: strongly agree, 100%.

Statement 11. In patients with suspected obscure GI bleeding and unexplained mild chronic iron-deficiency anemia, we recommend CE be used in selected cases. GRADE: Strong recommendation, low-quality evidence. Vote: strongly agree, 50%; agree, 50%.

Polyposis

Statement 12. In patients with polyposis syndromes who require small-bowel studies, we suggest CE for ongoing surveillance. GRADE: Conditional recommendation, very low quality evidence for efficacy, low-quality evidence for safety. Vote: strongly agree, 50%; agree, 50%.

Table 1. Continued

Colon capsule

Statement 13. We recommend against the routine substitution of colon CE for colonoscopy. GRADE: Strong recommendation, very low quality evidence. Vote: strongly agree, 83%; agree, 17%.

Statement 14. In patients with inflammatory bowel disease (IBD), we recommend against substituting colon capsule for colonoscopy to assess the extent and severity of disease. GRADE: Strong recommendation, very low quality evidence for efficacy, low-quality evidence for safety. Vote: strongly agree, 100%.

Contraindications, cautions, and consent

Statement 15. In patients undergoing CE, we recommend that the consent process include disclosure of the potential for a failed procedure, capsule retention, or a missed lesion. GRADE: Strong recommendation. Good practice statement, quality of evidence not assessed. Vote: strongly agree, 100%.

Statement 16. In patients with known or suspected strictures of the small bowel, we suggest a patency capsule before CE to minimize risk of retention. GRADE: Conditional recommendation, very low quality evidence for efficacy, low-quality evidence for safety. Vote: strongly agree, 67%; agree, 33%.

Statement 17. In patients with poor GI motility or chronic narcotic use, we recommend confirming that the capsule has reached the small bowel within 1 hour of capsule ingestion, and continuing the study to the full extent of the battery life of the capsule. GRADE: Strong recommendation, very low quality evidence. Vote: strongly agree, 83%; agree, 17%.

Statement 18. In patients with a pacemaker, we suggest that CE can be performed without special precautions. GRADE: Conditional recommendation, very low quality evidence. Vote: strongly agree, 50%; agree, 50%.

Bowel preparation

Statement 19. For patients undergoing CE, we recommend the use of a bowel preparation. GRADE: Strong recommendation, very low quality evidence for efficacy of prokinetics, low-quality evidence for efficacy of all other bowel preparations. Vote: strongly agree, 100%.

Reporting and training

Statement 20. In patients undergoing CE, we suggest that documentation have specific components noted on each report. GRADE: Conditional recommendation. Good practice statement, quality of evidence not assessed. Vote: strongly agree, 67%; agree, 33%.

Statement 21. We recommend CE be performed by endoscopists with documented competency in the cognitive and technical aspects of conducting, reporting, and interpreting CE examinations. GRADE: Strong recommendation. Good practice statement, quality of evidence not assessed. Vote: strongly agree, 83%; agree, 17%.

Statement 3. In patients with Crohn's disease, when assessment of small-bowel mucosal healing (beyond the reach of ileocolonoscopy) is needed, we suggest CE. *GRADE: Conditional recommendation, very low quality evidence (Appendix 2 and Supplementary Table 3). Vote: strongly agree, 33%; agree, 67%.*

As opposed to the clinical scenario covered in Statement 2 of pursuing diagnostic testing in symptomatic patents, this statement addresses the clinical scenario of when a patient has undergone treatment and it is deemed imperative to

determine if the active disease identified before treatment has resolved. Studies have suggested that symptomatic response to treatment may not correlate consistently with mucosal healing in patients with CD.[22–25] In a prospective case series, despite clinical remission, mucosal healing was detected on CE in no patients at week 12, and only in 42% at week 52.[23,24] Furthermore, in 1 prospective study of 58 patients, changes in CE scores and mucosal healing did not correlate with changes in either CRP level or symptoms associated with treatment.[25] However, absolute CE scores have been shown to correlate with symptoms and CRP levels.[25] Because mucosal healing has become a key goal of treatment in patients with CD,[26] it is imperative to not rely solely on self-reported symptoms to determine the extent to which an intervention has been fully successful. A recent report described the high rate of mucosal disease identified on CE in patients with CD who were in a symptomatic remission.[27]

Despite the poor correlation between treatment response and mucosal healing often seen in patients with CD, the consensus group suggested that CE was a valid option in select patients, such as those with multiple resections or with aggressive proximal or mid–small-bowel disease that would not be within reach of esophagogastroduodenoscopy (EGD) or ileocolonoscopy, where assessment of extent of ongoing disease activity may be warranted. Patients with multiple resections are at high risk for retention and appropriate small-bowel imaging (such as CTE or MRE) and consideration of patency capsule usually is performed before CE procedures to minimize the risk of retention caused by structural disease.

Statement 4. In patients with a suspected small-bowel recurrence of Crohn's disease after colectomy, undiagnosed by ileocolonoscopy or imaging studies, we recommend CE. *GRADE: Strong recommendation, very low-quality evidence (Appendix 2 and Supplementary Table 4). Vote: strongly agree, 100%.*

Studies have suggested that CE can provide additional information for the diagnosis of postoperative recurrence of CD in patients who have had ileocolonoscopy with or without other imaging studies.[28–30] In a prospective study, CE and ileocolonoscopy were performed within 6 months after surgery in 32 CD patients.[29] Among 21 patients with recurrence, sensitivity and specificity were 90% and 100% for ileocolonoscopy, respectively; whereas for CE, sensitivity was lower at 62%–76%, but specificity was excellent at 90%–100% when compared with ileocolonoscopy. In 2 patients, endoscopic recurrence in the neoterminal ileum was seen by CE but not by ileocolonoscopy. In addition, patients with endoscopic ileal recurrence frequently had concurrent jejunal lesions (10 of 21), whereas no proximal lesions were detected in patients with a normal ileum (0 of 10) at CE.[29]

The consensus group concluded that CE can provide additional diagnostic information, and is warranted in patients without strictures or other obstruction who are suspected of having recurrent active disease after surgery for CD. Typically, endoscopic or radiologic studies will define areas of recurrence in CD. However, for those who require postoperative monitoring where disease has been noted to be isolated to the small bowel (ie, radiologic and endoscopic studies are negative), surveillance of the small intestine with CE is appropriate.

Statement 5. In patients with chronic abdominal pain or diarrhea as their only symptoms, and no evidence of biomarkers associated with Crohn's disease, we suggest against the use of CE for the diagnosis of Crohn's disease. *GRADE: Conditional recommendation, low-quality evidence (Appendix 2 and Supplementary Table 5). Vote: strongly agree, 67%; agree, 33%.*

Studies have shown that the diagnostic yield in patients who only have symptoms is lower than in patients who are positive for biomarkers (eg, CRP, erythrocyte sedimentation rate).[31–35] In an analysis of 72 patients with chronic abdominal pain without diarrhea, the diagnostic yield of CE was 66.7% in patients who were positive for inflammatory markers compared with 21.4% in those who were negative.[32] In patients with both abdominal pain and diarrhea the impact of inflammatory markers was even more striking, with the diagnostic yield being 90.1% in patients who were positive compared with 0% in those who were negative. The diagnostic yield of CE was 3 times greater in patients with chronic abdominal pain who were positive for inflammatory markers compared with those who were not.[35] In a retrospective analysis of patients with symptoms suggestive of CD but negative endoscopies, FC greater than 100 μg/g predicted positive CE findings (43%), with FC greater than 200 μg/g providing an even higher diagnostic yield (65%); in contrast, CE was normal in all patients with an FC less than 100 μg/g.[33]

The consensus group concluded that CE is not warranted in most patients who present with chronic pain in the absence of positive tests for inflammatory markers or abnormal findings on endoscopy or imaging.

Celiac Disease

Statement 6. For patients with suspected celiac disease, we recommend against CE to make a diagnosis. *GRADE: Strong recommendation, very low-quality evidence for efficacy, low-quality evidence for safety (Appendix 2 and Supplementary Table 6). Vote: strongly agree, 100%.*

Celiac disease is diagnosed by endoscopy with duodenal biopsies and small-bowel histology showing typical histologic features, with corroborating serologic evidence and a clinical response to a gluten-free diet (GFD).[1] Meta-analyses of prospective studies suggest that CE has good specificity (95%; 95% CI, 89%–98%), however, sensitivity (89%; 95% CI, 82%–94%) is lower.[36,37] Severe disease was detected more readily on CE than less severe disease, and most of the studies included patients with more severe symptoms and a high pretest probability of celiac disease. This may result in overestimation of the diagnostic accuracy of CE for celiac disease. In 2 studies, despite positive serology, no patients with negative endoscopy and histology showed mucosal changes compatible with celiac disease on CE.[38,39]

The consensus group concluded that even in patients with positive serology, CE performed after endoscopy is unlikely to detect any additional patients with celiac disease that had been missed on duodenal biopsy. In addition, if CE is performed instead of endoscopy and is positive for mucosal abnormalities, endoscopic biopsies still would be required to confirm the diagnosis. Therefore, CE would add little additional information, but could increase the cost of the diagnostic process.

Statement 7. In patients with celiac disease and unexplained symptoms despite treatment and appropriate investigations, we recommend CE. *GRADE: Strong recommendation, very low quality evidence for efficacy, low-quality evidence for safety (Appendix 2 and Supplementary Table 7). Vote: strongly agree, 83%; agree, 17%.*

Observational studies in patients with refractory celiac disease have shown that CE has a relatively low incremental diagnostic yield over endoscopy with histology, but there may be relevant findings requiring specific treatment in approximately 15%–30% of patients.[40–43] CE was shown to have a 74%–78% concordance with histology, with a 56%–67% sensitivity and an 85%–100% specificity for the detection of features of celiac disease.[42,43] Importantly, CE can help identify serious complications of celiac disease, including ulcerative jejunoileitis, lymphomas, enteropathy-associated T-cell lymphoma, fibroepithelial polyps, and adenocarcinoma.[40,41,43] Comparisons of CE with abdominal cross-sectional imaging in these settings have not been published, likely owing to their uncommon occurrence.

Despite at least 6 months on a GFD, positive serology—likely owing to inadvertent gluten use—was a frequent finding in patients with nonresponsive celiac disease (48%).[41,43] Therefore, before CE it is important to eliminate other common etiologies for ongoing symptoms, including inadvertent gluten ingestion or lactose intolerance.

Lower completion rates for small-bowel CE have been reported in patients with refractory celiac disease compared with a control group without celiac disease (62% vs 87%; $P = .008$), however, no cases of capsule retention were reported.[40]

The consensus group concluded that CE can be useful in patients with refractory celiac disease (defined as persistent or recurrent symptoms despite 6 months of a GFD), or patients who respond to treatment but have ongoing or new symptoms. Given that endoscopy with biopsy was superior, and positive serology was a frequent finding in patients with nonresponsive celiac disease,[41,43] CE is recommended only if these investigations are negative or fail to explain symptoms.

Gastrointestinal Bleeding

Statement 8. In patients who have documented overt gastrointestinal (GI) bleeding (excluding hematemesis) and negative findings on high-quality EGD and colonoscopy, we recommend CE as the next diagnostic step. *GRADE: Strong recommendation, very low quality evidence (Appendix 2 and Supplementary Table 8). Vote: strongly agree, 100%.*

Two randomized controlled trials (RCTs) supported the use of CE over other investigations in patients with overt obscure GI bleeding (ie, documented GI blood loss for which no cause had been identified) after negative EGD and colonoscopy.[44,45] Diagnostic yield was significantly higher with CE compared with small-bowel radiography (27% vs 4%; difference, 23%; 95% CI, 5%–42%)[44] and angiography (53% vs 20%; difference, 33%; 95% CI, 9%–53%; $P = .016$).[45] A subsequent RCT showed a significantly higher diagnostic yield with CE compared with push-enteroscopy (72.5% vs 48.7%; $P = .03$) in patients with obscure GI bleeding and negative findings on EGD and colonoscopy.[46]

CE can show additional findings in patients with prior negative endoscopic and imaging studies.[47–49] In retrospective and prospective case series, the diagnostic yield of CE was 50%–72% in patients with obscure overt bleeding.[48,50–60] One study, in patients with obscure bleeding and prior negative endoscopy with biopsy, found that CT enterography was significantly more sensitive than CE (88% vs 38%; $P = .008$).[61] Similarly, in patients with overt bleeding without a definitive source seen on CE, CT enterography was positive in 50% of patients,[62] showing the value of CT enterography, which may be considered complementary in some patients as opposed to mutually exclusive. The differences in the results with CE vs CTE at times may have to do with patient selection, which can be guided by local referral patterns, as well as ease of availability of these modalities for investigation. In terms of longer-term outcomes, some studies have reported a higher rebleeding rate in patients with positive CE than in those with negative CE,[53,63] whereas other studies reported no differences in outcomes (although specific treatments may be responsible for lowering the rebleeding rates after positive CE).[44,52,55]

A meta-analysis found a diagnostic yield of 62% (95% CI, 47.3%–76.1%) for CE and 56% (95% CI, 48.9%–62.1%) for DBE, with an odds ratio of 1.39 (95% CI, 0.88–2.20; $P = .16$) for CE in patients with obscure GI bleeding.[64] The diagnostic yield of DBE was significantly higher when performed after a positive CE than after a negative CE.

In a retrospective cost-effectiveness study, use of CE in patients with obscure bleeding had a higher diagnostic yield than other imaging procedures, and was associated with a lower cost per positive diagnosis.[65]

Based on evidence of a relatively high diagnostic yield with CE, the consensus group recommended CE be performed, rather than radiographic studies or angiography, after negative endoscopic studies in hemodynamically stable patients with overt bleeding. In those patients who are hemodynamically unstable, more urgent endoscopic (deep enteroscopy) or radiologic studies (angiography) may be more appropriate than CE. In addition, for patients with hematemesis, indicating an upper GI source of bleeding, repeat endoscopy rather than CE is preferred.

Statement 9. In patients with an overt, obscure bleeding episode, we recommend CE be performed as soon as possible. *GRADE: Strong recommendation, very low quality evidence (Appendix 2 and Supplementary Table 9). Vote: strongly agree, 83%; agree, 17%.*

As discussed in statement 8, CE has a diagnostic yield of 50%–72% in patients with overt obscure GI

bleeding.[45,48,50–60] In patients who have undergone emergency CE (immediately or within 48 hours), after negative endoscopy and colonoscopy, CE yielded diagnostic findings in 50%–67% of patients.[45,66] Evidence suggests that earlier CE (within 3 days) was associated with a higher diagnostic yield than after 3 days (44%–72% vs 28%–38%, respectively).[67,68] In a large retrospective cohort, the diagnostic yield of CE decreased for each day after admission, from 55% at day 1, 48% at day 2, 29% at day 3, 27% at day 4, and 18% at day 5.[68] In addition, studies have suggested that the diagnostic yield is higher in patients with ongoing overt bleeding compared with those with prior bleeding.[50,69–71]

Although the European Society of Gastrointestinal Endoscopy has recommended that CE be performed within 14 days (which is a reasonable goal), the selection of this precise time period could be argued based on the fact that all time periods have not been compared adequately.[1] As cited earlier, studies have shown only that earlier procedures have higher diagnostic yields, but true long-term outcomes in terms of patient morbidity and mortality have not been studied. Because diagnostic yield appears to decrease with each day of delay, but optimal timing has not been defined definitively, the consensus group recommended that CE be performed as soon as possible in patients with ongoing overt bleeding after prior negative studies.

Statement 10. In patients with prior negative CE who have repeated obscure bleeding, we recommend repeated studies (endoscopy, colonoscopy, and/or CE). *GRADE: Strong recommendation, very low quality evidence (Appendix 2 and Supplementary Table 10). Vote: strongly agree, 100%.*

In patients with negative CE who have ongoing or recurrence of obscure bleeding, repeat investigations can yield positive findings and result in a change in management.[72–75] In RCTs comparing different capsules in patients who underwent 2 consecutive CE examinations, discordant results between the 2 CE procedures were reported in approximately 16% of cases.[76,77] In a small cohort study, the diagnostic yield of the single CE was 37.5% for the first CE, 43.8% for the second CE, and 62.5% for the combined findings of the back-to-back CEs within a 24-hour interval.[73] Development of overt bleeding and a hemoglobin decrease of 4 g/dL or more have been found to be significant predictive factors for a positive second CE.[75] Patients with angiodysplasia on CE, duration of bleeding for more than 3 months, and ongoing anticoagulant use were associated with a higher risk of rebleeding after CE,[78] and may be more likely to benefit from a second procedure.

The consensus group recommended selective repetition of endoscopy, colonoscopy, or CE based on evidence of positive subsequent yield in some patients with negative CE who experience rebleeding. CT enterography, balloon enteroscopy, and angiography also may be options in very select cases; local resources and expertise may guide the use of these modalities. The choice of procedure should be based on patient risk factors, level of suspicion, presenting signs and symptoms, and anticipated yield (which is very low in the setting of repeated negative capsule study).

Statement 11. In patients with suspected obscure GI bleeding and unexplained mild chronic iron-deficiency anemia, we recommend CE be used in selected cases. *GRADE: Strong recommendation, low-quality evidence (Appendix 2 and Supplementary Table 11). Vote: strongly agree, 50%; agree, 50%.*

A meta-analysis of 24 studies (mainly retrospective) assessed the diagnostic yield of CE in patients with iron-deficiency anemia (IDA) who previously had undergone endoscopy and colonoscopy.[79] The pooled per-patient diagnostic yield was 47% (95% CI, 42%–52%) in 24 studies including patients with IDA, but also patients undergoing CE for other indications. A subgroup analysis of 4 studies (264 patients) that included only patients with IDA resulted in a higher diagnostic yield of 66% (95% CI, 58%–75%). Subsequent retrospective studies have reported relatively low rates of positive CE findings in 26%–44% of patients with IDA.[80–84] In addition, although 1 study suggested a higher rate of resolution of anemia in patients with positive vs negative CE (100% vs 68%; $P = .027$),[85] other studies have not shown an improvement in anemia and rebleeding rates, irrespective of CE findings or changes in management.[44,59,86]

Clinically relevant findings on CE were less likely in patients who had less severe anemia (no prior blood transfusions),[80] those with inadequate dietary iron intake, and menorrhagic females.[82]

The consensus group concluded that CE has a moderate diagnostic yield in unselected patients with chronic IDA, although this is unlikely to change management or long-term outcomes. It is appreciated that determining the exact etiology of iron deficiency (GI bleeding vs other causes) may be difficult. However, selected patients with IDA can be considered for CE, including males or non-menstruating females with more severe anemia (requiring blood transfusions, hemoglobin level <100 g/L), or those with persistent or recurrent IDA despite adequate iron-replacement therapy.

Polyposis

Statement 12. In patients with polyposis syndromes, who require small-bowel studies we suggest CE for ongoing surveillance. *GRADE: Conditional recommendation, very low quality evidence for efficacy, low-quality evidence for safety (Appendix 2 and Supplementary Table 12). Vote: strongly agree, 50%; agree, 50%.*

Intestinal polyposis syndromes are relatively rare, and can be divided, based on histology, into the broad categories of familial adenomatous polyposis (FAP), hamartomatous polyposis syndromes, and other rare polyposis syndromes. Hamartomatous polyposis syndromes include mainly Peutz–Jeghers Syndrome (PJS), *PTEN*-associated hamartomatous syndromes, familial juvenile polyposis, and Cronkhite–Canada syndrome. Small-bowel polyps occur in more than 75% of FAP and PJS patients, with a greater likelihood of jejunal and ileal polyps in patients who also have duodenal polyps.[87,88] Patients with hereditary polyposis syndromes are at high risk for colorectal cancers, thus surveillance is recommended every 1–3 years depending on the extent of disease.[89]

Diagnostic test and cohort studies in patients with FAP or PJS have shown that CE has a better diagnostic yield than endoscopy for the detection of small-bowel polyps, whereas endoscopy was superior for the detection of duodenal polyps.[87,90,91] CE has been shown to detect more and smaller jejunal–ileal polyps than other imaging modalities including radiography and MRE,[88,91–93] and had similar detection rates to device-assisted enteroscopy[94] in patients with FAP or PJS.

Because of the high risk of gastrointestinal polyp complications, and the demonstrated diagnostic yield of CE, the consensus group recommended CE as part of ongoing surveillance for patients with polyposis syndromes, especially those with PJS, who are also at highest risk for bleeding and intussusception related to small-bowel polyps.

Colon Capsule

Statement 13. We recommend against the routine substitution of colon CE for colonoscopy. *GRADE: Strong recommendation, very low quality evidence (Appendix 2 and Supplementary Table 13). Vote: strongly agree, 83%; agree, 17%.*

Meta-analyses[95,96] and additional subsequent diagnostic test studies[97–101] have suggested that although colon capsule endoscopy (CCE) has a high level of accuracy, it is less sensitive and specific than colonoscopy in patients undergoing colorectal cancer (CRC) screening/surveillance or those with known or suspected colonic diseases. In the meta-analyses, the per-patient sensitivities and specificities of CCE compared with conventional colonoscopy for detection of any polyp were 71%–73% and 75%–89%, and 68%–69% and 82%–86% for the detection of significant polyps (≥6 mm and/or ≥3 polyps), respectively.[95,96] However, substantial variability was noted among the included trials in terms of study design, patient populations, and CCE technical performance characteristics.[95,96]

All studies in the meta-analyses used first-generation colon capsules (CCE-1); current second-generation colon capsules (CCE-2) have improved image acquisition compared with CCE-1. In studies with CCE-2, reported sensitivities and specificities for detection of any polyp were 82% and 86%, and for the detection of significant polyps (≥6 mm) were 84%–89% and 64%–88%,[97,98,100,102] respectively, a significant improvement compared with CCE-1.

In addition to lower sensitivity and specificity than colonoscopy, CCE also is limited by an inability to insufflate the colon, aspirate liquids, control the transit of the CCE, and clean the mucosal surface. Patients with significant polyps on CCE also theoretically will require subsequent polypectomy, thereby requiring 2 procedures and increasing resource utilization.

In cases in which a previous colonoscopy was incomplete[103–105] or for patients who are unable/unwilling to undergo colonoscopy,[106,107] CCE has been shown to be a reasonable alternative. In this latter group, CCE may have a positive impact on CRC screening adherence rates.[107] On the other hand, incomplete colonoscopies are uncommon and can be completed in most patients through alternative endoscopic techniques (ie, different endoscopes) or referral to an expert center.

Two studies comparing CCE and CT colonography suggested that CCE was as good as,[102] or better than, CT colonography[108] for CRC screening. In patients with incomplete colonoscopy, CCE detected significant polyps in twice as many patients as CT colonography (relative sensitivity, 2.0; 95% CI, 1.34–2.98).[108]

In the meta-analysis, the rate of side effects with CCE was 4.1% (95% CI, 2.6%–5.6%), which generally were mild to moderate (ie, nausea, abdominal pain).[96]

A cost-effectiveness study suggested that colonoscopy was more cost effective than CCE if compliance with the 2 procedures was the same, however, CCE became more cost effective if compliance with CCE was higher (≥30%) than with colonoscopy for CRC screening in patients at average risk.[109]

Based on the higher polyp detection rate with colonoscopy and the added benefit of being able to perform polypectomy during the same procedure, the consensus group recommended that CCE not be substituted routinely for colonoscopy. However, in patients who are unwilling or unsuitable for colonoscopy, CCE is an appropriate alternative. The evidence for the value of CCE is very limited. Even in the setting of incomplete colonoscopy it is recognized that referral to an expert center or alternative methods (ie, DBE) will minimize incomplete rates.[110,111] For the small number of patients who are unwilling to undergo standard colonoscopy (or it is contraindicated), CCE-2 can be considered. The US Food and Drug Administration has approved a CCE for patients after an incomplete optical colonoscopy and, more recently, for patients with major risks for colonoscopy or moderate sedation.[112] In addition, Japan's Pharmaceuticals and Medical Devices Agency has approved a CCE for the diagnosis of colonic disease when colonoscopy is required but difficult to conduct, including patients unwilling or unable to undergo colonoscopy.[113]

A drawback of CCE is the preparation, which traditionally consisted of a large-volume, polyethylene glycol (PEG)-based initial laxative followed by a booster to accelerate the capsule through the colon. Though the booster was initially phosphate-based, a more promising magnesium-based booster with ascorbic acid, potentially combined with a motility agent, has been suggested. The extensive laxatives required may hinder patient and physician enthusiasm for this study.

Statement 14. In patients with inflammatory bowel disease (IBD), we recommend against substituting colon capsule for colonoscopy to assess the extent and severity of disease. *GRADE: Strong recommendation, very low quality evidence for efficacy, low-quality evidence for safety (Appendix 2 and Supplementary Table 14). Vote: strongly agree, 100%.*

CCE has been shown to underestimate the extent and severity of disease compared with colonoscopy in patients with ulcerative colitis[114,115] or CD.[116] In a prospective study in patients with known or suspected ulcerative colitis (N = 100), the sensitivity and specificity of CCE for the detection of active colonic inflammation were 89% (95% CI,

80%–95%) and 75% (95% CI, 51%–90%), respectively.[115] In patients with active CD of the colon (N = 40), CCE-2 underestimated the severity of disease compared with colonoscopy, and detected colonic ulcerations with 86% sensitivity and 40% specificity.[116]

No serious adverse events were reported with CCE-1[114,115] or CCE-2,[116] but are theoretically possible owing to the increased diameter of the CCE (eg, capsule retention in patients with unrecognized small-bowel strictures).

Based on evidence that CCE is likely to underestimate the extent and severity of IBD, the consensus group concluded that colonoscopy should remain the preferred procedure to assess active disease in patients with colitis or small-bowel disease.

Contraindications, Cautions, and Consent

Statement 15. In patients undergoing CE, we recommend that the consent process include disclosure of the potential for a failed procedure, capsule retention, or a missed lesion. *GRADE: Strong recommendation. Good practice statement, quality of evidence was not assessed (Appendix 2 and Supplementary Table 15). Vote: strongly agree, 100%.*

Informed consent is an essential component of good clinical practice and ethical physician conduct throughout medicine. Therefore, this statement warrants a "good practice" designation rather than rigorous application of the GRADE process for assessment of evidence.[7] In general, studies have shown that effective physician–patient communication can improve patient quality of life, medical decision making, and clinical outcomes.[117–119] The informed consent process is associated with minimal harms or costs, and the net benefit is large, thus minimizing medical–legal risk.

Information provided to patients undergoing CE should include a discussion of the potential risk, including a failed procedure (capsule fails to exit the stomach or otherwise fails to provide definitive visualization of the small bowel); retention (capsule becomes impacted); or missed small-bowel lesion (ie, false-negative result). In addition, it should be emphasized that the small-bowel capsule does not obtain ideal images of the esophagus, stomach, and colon.

A large case series of CE performed for various indications reported incomplete examinations in 20%.[120] In a systematic review, the pooled completion rate was 84% in patients with known or suspected CD.[121] Among 20 patients with known or suspected CD who underwent both CE and ileoscopy, incomplete examinations (defined as distal ileal evaluations not obtained) occurred in 12% of patients with CE, and in 24% with ileoscopy.[122] One patient had both an incomplete CE and an incomplete ileoscopy. Fortunately, newer-generation capsules have longer battery life (>12 vs 8 hours with first-generation capsules), which may increase the duration of the study and completion rates.[123,124]

Capsule retention has been reported in approximately 1.4% of CE procedures.[120,121,125–127] Retrospective studies have reported retention rates of 0% to 1.6% in patients with suspected IBD, and of 5.2% to 13% in patients with known IBD.[125,126] Patient factors associated with a higher risk of retention include known CD,[120,125,126,128] strictures or other obstruction,[126,129] pelvic or abdominal radiation,[128,130] or suspected tumor.[120,128] Capsule retention may require endoscopic or surgical retrieval of the capsule.[81,126,127]

The risk of missed lesions with CE also should be discussed with patients. In a retrospective review of 300 consecutive patients who underwent CE for obscure bleeding, small-bowel masses were found in 3% of patients, duodenal masses were missed in 3 patients (1%) on previous endoscopy, and in 1 patient (0.3%) on CE.[127] Cases have been reported in which, despite a negative CE, malignant small-bowel pathology was identified by DBE, which should be considered when there is a high index of suspicion.[131]

The consensus group unanimously agreed on the importance of informed consent and the need to provide patients with education regarding the benefits and risks of CE.

Statement 16. In patients with known or suspected strictures of the small bowel, we suggest a patency capsule before CE to minimize risk of retention. *GRADE: Conditional recommendation, very low quality evidence for efficacy, low-quality evidence for safety (Appendix 2 and Supplementary Table 16). Vote: strongly agree, 67%; agree, 33%.*

As discussed in statement 15, the risk of capsule retention in patients with CD can be up to 13%.[126] CD, strictures, pelvic or abdominal radiation, and suspected tumors increase the risk of capsule retention. Although strictures generally are considered a contraindication for CE, not all strictures cause enough obstruction to prevent the passage of the capsule.

Studies have suggested that passage of an intact patency capsule is predictive of successful passage of CE in most patients with known or suspected strictures or a history of obstructive disease.[132–136] However, in one retrospective study including 274 CE procedures, the risk of retention was similar in patients who underwent CE without patency capsule (2.3%) and those who underwent CE after a negative patency capsule (2.1%; $P = .9$).[137] Although CE generally is not administered after a retained patency capsule, in a small number of such patients (n = 18) the retention rate was 11.1%. It is important to note that not all patients in this study were selected based on history or risk of obstruction.

Although a patency capsule may identify patients at higher risk of retention, data also suggest that imaging studies,[136] or the combination of symptoms and imaging, can predict the patency of the small bowel for safe passage of the CE.[133] In a retrospective study, both patency capsule and imaging studies (such as CT and MRE) had a similar sensitivity (57% vs 71%; $P = 1.00$) and specificity (86% vs 97%; $P = .22$) to detect clinically significant small-bowel strictures.[136]

The main concern related to use of a patency capsule is that patients with false-positive results will be denied CE. False-positive patency capsule results can occur in patients with delayed transit without obstruction, resulting in retention of the patency capsule in the colon rather than small bowel.[136]

Patency capsules are not without risks. Cases of impaction requiring surgical removal and delays in dissolution of the patency capsule have been reported,[132,133] however, most reported cases are asymptomatic.[135] Abdominal pain was reported in 10% of patients in 1 study.[134]

Based on evidence of the high predictive value of a negative patency capsule, and the high retention rate in patients with a positive patency capsule, the consensus group recognized the utility of a patency capsule for some patients, typically those with obstructive symptomatology or imaging results suggesting narrowing. However, the retention rate in patients with a positive patency capsule who underwent CE was only 11%, raising concerns about unnecessarily denying patients a useful test. In addition, evidence that imaging studies, or symptoms plus imaging, may be as useful as a patency capsule in predicting the passage of CE, led the consensus group to suggest that this strategy may be a reasonable alternative to the use of a patency capsule in patients with evidence of known or suspected obstruction.

Therefore, the consensus group suggested that in patients with obstructive symptomatology, imaging should be performed before CE. In patients with negative imaging, most investigators will not use a patency capsule. In patients with abnormalities, suggesting a high risk of capsule retention, patency capsules can be considered although some recent data have questioned their benefit.[137]

Statement 17. In patients with poor GI motility or chronic narcotic use, we recommend confirming that the capsule has reached the small bowel within 1 hour of capsule ingestion, and continuing the study to the full extent of the battery life of the capsule. *GRADE: Strong recommendation, very low quality evidence (Appendix 2 and Supplementary Table 17). Vote: strongly agree, 83%; agree, 17%.*

Poor GI motility, or delayed transit times related to chronic narcotic use,[138] raise concerns of a higher risk of failed procedures (eg, poor-quality images or incomplete studies) or capsule retention. However, retrospective cohort studies have failed to show an increased risk of incomplete CE or CE retention related to chronic narcotic use.[139,140] Incomplete small-bowel examinations have been reported in patients with delayed gastric emptying or dysmotility, which can lead to slow transit times, but this was not associated with an increased risk of retention.[140,141]

In a small observational study, despite low CE completion rates (failure to reach the cecum, or incomplete visualization of mucosa), mucosal breaks (ulcerations/erosions) were seen in 89% of patients with chronic dysmotility.[141]

Because there does not appear to be an increased risk of CE-related adverse events in these patients, and the fact that a significant proportion may have abnormal findings, the consensus group did not recommend against the use of CE in this population. However, because transit times can be longer they recommended that steps be taken to ensure transit to the small bowel. Real-time imaging, with interventions if transit is delayed (eg, water or prokinetic), has been shown to improve completion rates.[142] Other steps that may improve the likelihood of success include using a capsule with a longer battery life to compensate for longer transit times, use of bowel preparation/simethicone to improve visualization, or endoscopic placement of the capsule into the duodenum.

Statement 18. In patients with a pacemaker, we suggest that CE can be performed without special precautions. *GRADE: Conditional recommendation, very low quality evidence (Appendix 2 and Supplementary Table 18). Vote: strongly agree, 50%; agree, 50%.*

Observational data have suggested that CE does not interfere with the function of cardiac pacemakers and, conversely, that pacemakers do not interfere with the ability of CE to capture images.[143–146] An in vitro study found no interactions between 21 different pacemakers and CE, despite the close proximity of the 2 devices.[145] In a cohort study there was no loss of capsule images with pacemaker or implantable cardioverter defibrillator use, but interference with image acquisition with left ventricular assist device use was reported.[144]

The consensus group concluded that, although manufacturers of CE systems list the presence of a cardiac pacemaker or other implanted electromedical devices as a contraindication for the use of CE, there appears to be little clinical evidence supporting this. However, less information is available for implantable cardioverter defibrillators and left ventricular assist devices, and this statement was limited to the use of pacemakers.

Bowel Preparation

Statement 19. For patients undergoing CE, we recommend the use of a bowel preparation. *GRADE: Strong recommendation, very low quality evidence for efficacy of prokinetics, low-quality evidence for efficacy of all other bowel preparations (Appendix 2 and Supplementary Table 19). Vote: strongly agree, 100%.*

Systematic reviews and RCTs have shown that adequate bowel preparation can improve the quality of visualization when used before CE.[147–154] A systematic review of 15 RCTs comparing bowel cleansing with no preparation other than a clear fluid diet, found that PEG (1, 2, or 4 L) before CE significantly increased the odds of adequate visualization (odds ratio, 3.13; 95% CI, 1.70–5.75; $P = .0002$) and diagnostic yield (odds ratio, 1.68; 95% CI, 1.16–2.42; $P = .006$).[147] Sodium phosphate improved the diagnostic yield (odds ratio, 1.77; 95% CI, 1.18–2.64; $P = .005$), without affecting visualization quality. PEG plus an antifoaming agent (eg, simethicone) or simethicone alone showed significantly improved visualization, but no improvement in diagnostic yield. Neither bowel preparation nor the use of prokinetics was found to improve completion rates in patients undergoing CE.[147] Two RCTs published after the meta-analysis also reported improved visualization with the combination of PEG + simethicone, but again no improvements in completion rates.[152,153]

Two RCTs comparing low- and high-volume PEG cleansing strategies before CE found no significant differences in visualization, transit times, cleansing scores, or completion rates between the 2 regimens.[153,155] Two studies found that administration of low-dose PEG

(500 mL), with or without metoclopramide, within 1–2 hours of swallowing the capsule also could improve image quality.[156,157]

In a systematic review of studies in the setting of colonoscopy, bowel preparations generally were well tolerated and no clinically significant complications were reported.[158] In addition to minor electrolyte changes with both preparations, PEG tended to cause nausea and bloating, whereas sodium phosphate was associated with more dizziness and anal irritation.[158]

The consensus group concluded that the benefits of bowel preparation in terms of visualization were sufficient to recommend its use before CE, but there was insufficient evidence to recommend a specific type of preparation.

Reporting and Training

Statement 20. In patients undergoing CE, we suggest that documentation have specific components noted on each report. *GRADE: Conditional recommendation. Good practice statement, quality of evidence was not assessed (Appendix 2 and Supplementary Table 20). Vote: strongly agree, 67%; agree, 33%.*

Accurate and complete documentation in the medical record is considered standard clinical practice. Physicians have an ethical, professional, and legal obligation to ensure proper procedural documentation. Therefore, although there is no evidence that procedural documentation with specific elements can improve patient outcomes, this statement warrants a good practice designation rather than rigorous application of the GRADE process for assessment of evidence.[7]

The specific elements for documenting CE should mirror those recommended by the CAG consensus guidelines on safety and quality indicators in endoscopy (Table 2).[159] Standardized reporting allows for the future evaluation of aggregate data for the purpose of process quality improvement. Appropriate documentation of the procedure and subsequent findings in patients undergoing CE should include standardized elements.

Ideally, relevant findings on CE would be described using an appropriate grading scale. However, there is not a widely accepted, well-validated rating scale for CE. Most of the scales have been developed for the assessment of CD, the most common of which are the Lewis score[160–162] and the Capsule Endoscopy Crohn's Disease Activity Index.[163,164]

The Capsule Endoscopy Structured Terminology can be used to report the indications for performing CE and to describe the findings.[165–167] Although the Smooth, Protruding lesion Index on Capsule Endoscopy score may have clinically useful applications,[168] it does not appear to be adequately validated and was not recommended.

The consensus group suggested that appropriate and consistent documentation of CE procedures include the elements shown in Table 2, and encouraged more frequent use of a standardized rating scale, such as the Lewis score for CD, to describe findings on CE.

Statement 21. We recommend CE be performed by endoscopists with documented competency in the cognitive and technical aspects of conducting, reporting, and interpreting CE examinations. *GRADE: Strong recommendation. Good practice statement, quality of evidence was not assessed (Appendix 2 and Supplementary Table 21). Vote: strongly agree, 83%; agree, 17%.*

Credentialing and privileging serve to ensure that patients receive safe high-quality care from providers with appropriate skills, training, and experience. The net benefit of the procedure being performed by appropriately trained endoscopists possessing documented competence in CE is likely large and unequivocal, and, thus, this statement warrants a "good practice" designation.[7]

An important aspect of competency is supervised performance of the specific gastroenterology procedure. This has been shown for other procedures such as endoscopic retrograde cholangiopancreatography,[169,170] and likely is generalizable to CE. In CE, greater interobserver agreement in describing CE findings was seen among more experienced endoscopists who perform a greater number of CE procedures per year.[167]

Specific measures for competency in CE have not yet been developed. A study to determine minimum training requirements, including a structured CE training program with supervised CE interpretation, determined that trainees

Table 2. Suggested Elements of Capsule Endoscopy Reports

Preprocedure	Postprocedure
Capsule system used	Quality of bowel preparation
Date and time of procedure	Extent and completeness of examination
Name of reader of capsule output	Key times of entry into various portions of GI tract
Patient demographics	Relevant findings
Indication for CE	Pertinent negatives
Previous investigations	Adverse events and resulting interventions
Comorbidities	Diagnoses
Type of bowel preparation	Management recommendations
Other medication and related information (eg, administration route, antispasmodics, allergies)	
Information provided to patient and/or family	

Adapted from Armstrong et al with permission.[159]

should perform a minimum of 20 supervised procedures to achieve competence in CE.[171] Previous endoscopy experience did not impact this finding. The use of a computer-based CE training module with video clips and multiple-choice questions has been shown to improve lesion recognition on CE.[172]

American Society for Gastrointestinal Endoscopy guidelines for credentialing and the granting of privileges to perform CE recommend specific CE training as part of a GI fellowship, or an 8-hour interactive continuing medical education course, followed by performance of 10 CEs that are reviewed by a credentialed CE endoscopist.[173] However, those guidelines are based on expert opinion. Expert management (as opposed to interpretation of the studies) likely requires more experience with specific patient subgroups undergoing CE.

The consensus group agreed that endoscopists performing procedures should be competent in all aspects of CE, and should provide an interpretation of the findings with a consultant opinion, rather than just a technical report. Documentation of continued competence should be required for the renewal of CE privileges. However, this cannot be adopted as a requirement until the minimum number of CE procedures and other objective criteria to define competency in CE are developed.

Future Directions

Although CE has advanced substantially as an important procedure to visualize the small-bowel mucosa, certain knowledge gaps have an important impact on the use of CE. Standardized criteria should be developed for documenting CE findings, as well as for training and credentialing. More information is needed on the extent of bowel preparation that should be recommended for CE, and on the role of CE in patients with CD recurrence after surgery, those with polyposis syndromes, and patients with issues of limited mobility or narcotics use.

Summary

These guidelines present recommendations for the use of small-bowel CE and CCE in the context of CD, celiac disease, and gastrointestinal bleeding. These 21 statements on the use of small-bowel CE and CCE also include recommendations pertaining to training, reporting, and informed consent.

The quality of evidence supporting these consensus statements was often very low owing to high risk of bias, indirectness, and imprecision. However, in many cases strong recommendations were made based on other factors such as cost and lack of appropriate alternatives.

These guidelines should help to optimize the use of CE and thus help improve patient outcomes. In general, CE is recommended in patients with negative or inconclusive endoscopic and imaging studies. CE has been shown to provide additional information and influence disease management.

CE was recommended for patients with suspected, known, or relapsed CD when ileocolonoscopy and imaging studies were negative. However, it was not recommended in patients with only chronic abdominal pain or diarrhea, and no evidence of biomarkers associated with CD. CE was not recommended for the diagnosis of celiac disease, but may be useful in patients with unexplained symptoms despite treatment and appropriate investigations. In patients with overt gastrointestinal bleeding and negative findings on EGD and colonoscopy, CE should be performed as soon as possible. CE may be used in selected patients with chronic iron-deficiency anemia. CE is recommended for surveillance in patients with polyposis syndromes who require small-bowel studies. CCE should not be substituted routinely for colonoscopy, especially in patients with IBD.

Canadian Association of Gastroenterology Statement

This clinical practice guideline (CPG) on the use of video capsule endoscopy was developed under the direction of Drs Robert A. Enns and Lawrence Hookey, in accordance with the policies and procedures of the CAG and under the direction of CAG Clinical Affairs. It has been reviewed by the CAG Practice Affairs and Clinical Affairs Committees and the CAG Board of Directors. The CPG was developed after a thorough consideration of the medical literature and the best available evidence and clinical experience. It represents the consensus of a Canadian panel comprised of experts on this topic. The CPG aims to provide a reasonable and practical approach to care for specialists and allied health professionals charged with the duty of providing optimal care to patients and families, and can be subject to change as scientific knowledge and technology advance and as practice patterns evolve. The CPG is not intended to be a substitute for physicians using their individual judgment in managing clinical care in consultation with the patient, with appropriate regard to all the individual circumstances of the patient, diagnostic and treatment options available, and available resources. Adherence to these recommendations will not necessarily produce successful outcomes in every case.

Supplementary Material

Note: To access the supplementary material accompanying this article, visit the online version of *Gastroenterology* at www.gastrojournal.org, and at http://dx.doi.org/10.1053/j.gastro.2016.12.032.

References

1. Pennazio M, Spada C, Eliakim R, et al. Small-bowel capsule endoscopy and device-assisted enteroscopy for diagnosis and treatment of small-bowel disorders: European Society of Gastrointestinal Endoscopy (ESGE) Clinical Guideline. Endoscopy 2015;47:352–376.
2. Guyatt GH, Oxman AD, Vist GE, et al. GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. BMJ 2008;336:924–926.
3. Whiting PF, Rutjes AW, Westwood ME, et al. QUADAS-2: a revised tool for the quality assessment of diagnostic accuracy studies. Ann Intern Med 2011;155:529–536.

4. Sultan S, Falck-Ytter Y, Inadomi JM. The AGA institute process for developing clinical practice guidelines part one: grading the evidence. Clin Gastroenterol Hepatol 2013;11:329–332.
5. Bressler B, Marshall JK, Bernstein CN, et al. Clinical practice guidelines for the medical management of nonhospitalized ulcerative colitis: the Toronto consensus. Gastroenterology 2015;148:1035–1058 e3.
6. Nguyen GC, Bernstein CN, Bitton A, et al. Consensus statements on the risk, prevention, and treatment of venous thromboembolism in inflammatory bowel disease: Canadian Association of Gastroenterology. Gastroenterology 2014;146:835–848 e6.
7. Guyatt GH, Schunemann HJ, Djulbegovic B, et al. Guideline panels should not GRADE good practice statements. J Clin Epidemiol 2015;68:597–600.
8. Dalkey N. An experimental study of group opinion: the Delphi method. Futures 1969;1:408–426.
9. Cook DJ, Greengold NL, Ellrodt AG, et al. The relation between systematic reviews and practice guidelines. Ann Intern Med 1997;127:210–216.
10. Guyatt GH, Oxman AD, Kunz R, et al. Going from evidence to recommendations. BMJ 2008;336:1049–1051.
11. Van Assche G, Dignass A, Panes J, et al. The second European evidence-based consensus on the diagnosis and management of Crohn's disease: definitions and diagnosis. J Crohns Colitis 2010;4:7–27.
12. Sands BE. From symptom to diagnosis: clinical distinctions among various forms of intestinal inflammation. Gastroenterology 2004;126:1518–1532.
13. Dionisio PM, Gurudu SR, Leighton JA, et al. Capsule endoscopy has a significantly higher diagnostic yield in patients with suspected and established small-bowel Crohn's disease: a meta-analysis. Am J Gastroenterol 2010;105:1240–1248; quiz 1249.
14. Casciani E, Masselli G, Di Nardo G, et al. MR enterography versus capsule endoscopy in paediatric patients with suspected Crohn's disease. Eur Radiol 2011; 21:823–831.
15. Jensen MD, Nathan T, Rafaelsen SR, et al. Diagnostic accuracy of capsule endoscopy for small bowel Crohn's disease is superior to that of MR enterography or CT enterography. Clin Gastroenterol Hepatol 2011; 9:124–129.
16. Gralnek IM, Cohen SA, Ephrath H, et al. Small bowel capsule endoscopy impacts diagnosis and management of pediatric inflammatory bowel disease: a prospective study. Dig Dis Sci 2012;57:465–471.
17. Adler SN, Yoav M, Eitan S, et al. Does capsule endoscopy have an added value in patients with perianal disease and a negative work up for Crohn's disease? World J Gastrointest Endosc 2012;4:185–188.
18. Girelli CM, Porta P, Malacrida V, et al. Clinical outcome of patients examined by capsule endoscopy for suspected small bowel Crohn's disease. Dig Liver Dis 2007; 39:148–154.
19. Guilhon de Araujo Sant'Anna AM, Dubois J, Miron MC, et al. Wireless capsule endoscopy for obscure small-bowel disorders: final results of the first pediatric controlled trial. Clin Gastroenterol Hepatol 2005;3:264–270.
20. Voderholzer WA, Beinhoelzl J, Rogalla P, et al. Small bowel involvement in Crohn's disease: a prospective comparison of wireless capsule endoscopy and computed tomography enteroclysis. Gut 2005; 54:369–373.
21. Lorenzo-Zuniga V, de Vega VM, Domenech E, et al. Impact of capsule endoscopy findings in the management of Crohn's disease. Dig Dis Sci 2010;55:411–414.
22. Efthymiou A, Viazis N, Mantzaris G, et al. Does clinical response correlate with mucosal healing in patients with Crohn's disease of the small bowel? A prospective, case-series study using wireless capsule endoscopy. Inflamm Bowel Dis 2008;14:1542–1547.
23. Hall B, Holleran G, Chin JL, et al. A prospective 52 week mucosal healing assessment of small bowel Crohn's disease as detected by capsule endoscopy. J Crohns Colitis 2014;8:1601–1609.
24. Hall BJ, Holleran GE, Smith SM, et al. A prospective 12-week mucosal healing assessment of small bowel Crohn's disease as detected by capsule endoscopy. Eur J Gastroenterol Hepatol 2014;26:1253–1259.
25. Yang L, Ge ZZ, Gao YJ, et al. Assessment of capsule endoscopy scoring index, clinical disease activity, and C-reactive protein in small bowel Crohn's disease. J Gastroenterol Hepatol 2013;28:829–833.
26. Lichtenstein GR, Hanauer SB, Sandborn WJ, et al. Management of Crohn's disease in adults. Am J Gastroenterol 2009;104:465–483; quiz 464, 484.
27. Kopylov U, Yablecovitch D, Lahat A, et al. Detection of small bowel mucosal healing and deep remission in patients with known small bowel Crohn's disease using biomarkers, capsule endoscopy, and imaging. Am J Gastroenterol 2015;110:1316–1323.
28. Albert JG, Martiny F, Krummenerl A, et al. Diagnosis of small bowel Crohn's disease: a prospective comparison of capsule endoscopy with magnetic resonance imaging and fluoroscopic enteroclysis. Gut 2005;54:1721–1727.
29. Bourreille A, Jarry M, D'Halluin PN, et al. Wireless capsule endoscopy versus ileocolonoscopy for the diagnosis of postoperative recurrence of Crohn's disease: a prospective study. Gut 2006;55:978–983.
30. Biancone L, Calabrese E, Petruzziello C, et al. Wireless capsule endoscopy and small intestine contrast ultrasonography in recurrence of Crohn's disease. Inflamm Bowel Dis 2007;13:1256–1265.
31. Bardan E, Nadler M, Chowers Y, et al. Capsule endoscopy for the evaluation of patients with chronic abdominal pain. Endoscopy 2003;35:688–689.
32. Katsinelos P, Fasoulas K, Beltsis A, et al. Diagnostic yield and clinical impact of wireless capsule endoscopy in patients with chronic abdominal pain with or without diarrhea: a Greek multicenter study. Eur J Intern Med 2011;22:e63–e66.
33. Koulaouzidis A, Douglas S, Rogers MA, et al. Fecal calprotectin: a selection tool for small bowel capsule endoscopy in suspected IBD with prior negative bidirectional endoscopy. Scand J Gastroenterol 2011; 46:561–566.
34. Koulaouzidis A, Douglas S, Plevris JN. Lewis score correlates more closely with fecal calprotectin than Capsule

Endoscopy Crohn's Disease Activity Index. Dig Dis Sci 2012;57:987–993.
35. May A, Manner H, Schneider M, et al. Prospective multicenter trial of capsule endoscopy in patients with chronic abdominal pain, diarrhea and other signs and symptoms (CEDAP-Plus Study). Endoscopy 2007; 39:606–612.
36. El-Matary W, Huynh H, Vandermeer B. Diagnostic characteristics of given video capsule endoscopy in diagnosis of celiac disease: a meta-analysis. J Laparoendosc Adv Surg Tech A 2009;19:815–820.
37. Rokkas T, Niv Y. The role of video capsule endoscopy in the diagnosis of celiac disease: a meta-analysis. Eur J Gastroenterol Hepatol 2012;24:303–308.
38. Lidums I, Cummins AG, Teo E. The role of capsule endoscopy in suspected celiac disease patients with positive celiac serology. Dig Dis Sci 2011;56:499–505.
39. Rondonotti E, Spada C, Cave D, et al. Video capsule enteroscopy in the diagnosis of celiac disease: a multicenter study. Am J Gastroenterol 2007;102:1624–1631.
40. Barret M, Malamut G, Rahmi G, et al. Diagnostic yield of capsule endoscopy in refractory celiac disease. Am J Gastroenterol 2012;107:1546–1553.
41. Kurien M, Evans KE, Aziz I, et al. Capsule endoscopy in adult celiac disease: a potential role in equivocal cases of celiac disease? Gastrointest Endosc 2013;77:227–232.
42. Maiden L, Elliott T, McLaughlin SD, et al. A blinded pilot comparison of capsule endoscopy and small bowel histology in unresponsive celiac disease. Dig Dis Sci 2009;54:1280–1283.
43. Atlas DS, Rubio-Tapia A, Van Dyke CT, et al. Capsule endoscopy in nonresponsive celiac disease. Gastrointest Endosc 2011;74:1315–1322.
44. Laine L, Sahota A, Shah A. Does capsule endoscopy improve outcomes in obscure gastrointestinal bleeding? Randomized trial versus dedicated small bowel radiography. Gastroenterology 2010;138:1673–1680 e1; quiz e11–e12.
45. Leung WK, Ho SS, Suen BY, et al. Capsule endoscopy or angiography in patients with acute overt obscure gastrointestinal bleeding: a prospective randomized study with long-term follow-up. Am J Gastroenterol 2012;107:1370–1376.
46. Segarajasingam DS, Hanley SC, Barkun AN, et al. Randomized controlled trial comparing outcomes of video capsule endoscopy with push enteroscopy in obscure gastrointestinal bleeding. Can J Gastroenterol Hepatol 2015;29:85–90.
47. Hartmann D, Schmidt H, Bolz G, et al. A prospective two-center study comparing wireless capsule endoscopy with intraoperative enteroscopy in patients with obscure GI bleeding. Gastrointest Endosc 2005;61:826–832.
48. Heo HM, Park CH, Lim JS, et al. The role of capsule endoscopy after negative CT enterography in patients with obscure gastrointestinal bleeding. Eur Radiol 2012; 22:1159–1166.
49. Tacheci I, Deviere J, Kopacova M, et al. The importance of upper gastrointestinal lesions detected with capsule endoscopy in patients with obscure digestive bleeding. Acta Gastroenterol Belg 2011;74:395–399.
50. Carey EJ, Leighton JA, Heigh RI, et al. A single-center experience of 260 consecutive patients undergoing capsule endoscopy for obscure gastrointestinal bleeding. Am J Gastroenterol 2007;102:89–95.
51. Chami G, Raza M, Bernstein CN. Usefulness and impact on management of positive and negative capsule endoscopy. Can J Gastroenterol 2007;21:577–581.
52. Hindryckx P, Botelberge T, De Vos M, et al. Clinical impact of capsule endoscopy on further strategy and long-term clinical outcome in patients with obscure bleeding. Gastrointest Endosc 2008;68:98–104.
53. Lai LH, Wong GL, Chow DK, et al. Long-term follow-up of patients with obscure gastrointestinal bleeding after negative capsule endoscopy. Am J Gastroenterol 2006; 101:1224–1228.
54. Matsumura T, Arai M, Sazuka S, et al. Negative capsule endoscopy for obscure gastrointestinal bleeding is closely associated with the use of low-dose aspirin. Scand J Gastroenterol 2011;46:621–626.
55. Park JJ, Cheon JH, Kim HM, et al. Negative capsule endoscopy without subsequent enteroscopy does not predict lower long-term rebleeding rates in patients with obscure GI bleeding. Gastrointest Endosc 2010; 71:990–997.
56. Redondo-Cerezo E, Perez-Vigara G, Perez-Sola A, et al. Diagnostic yield and impact of capsule endoscopy on management of patients with gastrointestinal bleeding of obscure origin. Dig Dis Sci 2007;52:1376–1381.
57. Sakai E, Endo H, Taniguchi L, et al. Factors predicting the presence of small bowel lesions in patients with obscure gastrointestinal bleeding. Dig Endosc 2013; 25:412–420.
58. Saperas E, Dot J, Videla S, et al. Capsule endoscopy versus computed tomographic or standard angiography for the diagnosis of obscure gastrointestinal bleeding. Am J Gastroenterol 2007;102:731–737.
59. Sheibani S, Levesque BG, Friedland S, et al. Long-term impact of capsule endoscopy in patients referred for iron-deficiency anemia. Dig Dis Sci 2010;55:703–708.
60. Toy E, Rojany M, Sheikh R, et al. Capsule endoscopy's impact on clinical management and outcomes: a single-center experience with 145 patients. Am J Gastroenterol 2008;103:3022–3028.
61. Huprich JE, Fletcher JG, Fidler JL, et al. Prospective blinded comparison of wireless capsule endoscopy and multiphase CT enterography in obscure gastrointestinal bleeding. Radiology 2011;260:744–751.
62. Agrawal JR, Travis AC, Mortele KJ, et al. Diagnostic yield of dual-phase computed tomography enterography in patients with obscure gastrointestinal bleeding and a non-diagnostic capsule endoscopy. J Gastroenterol Hepatol 2012;27:751–759.
63. Riccioni ME, Urgesi R, Cianci R, et al. Negative capsule endoscopy in patients with obscure gastrointestinal bleeding reliable: recurrence of bleeding on long-term follow-up. World J Gastroenterol 2013;19:4520–4525.
64. Teshima CW, Kuipers EJ, van Zanten SV, et al. Double balloon enteroscopy and capsule endoscopy for obscure gastrointestinal bleeding: an updated meta-analysis. J Gastroenterol Hepatol 2011;26:796–801.

65. Marmo R, Rotondano G, Rondonotti E, et al. Capsule enteroscopy vs. other diagnostic procedures in diagnosing obscure gastrointestinal bleeding: a cost-effectiveness study. Eur J Gastroenterol Hepatol 2007; 19:535–542.
66. Lecleire S, Iwanicki-Caron I, Di-Fiore A, et al. Yield and impact of emergency capsule enteroscopy in severe obscure-overt gastrointestinal bleeding. Endoscopy 2012;44:337–342.
67. Esaki M, Matsumoto T, Yada S, et al. Factors associated with the clinical impact of capsule endoscopy in patients with overt obscure gastrointestinal bleeding. Dig Dis Sci 2010;55:2294–2301.
68. Singh A, Marshall C, Chaudhuri B, et al. Timing of video capsule endoscopy relative to overt obscure GI bleeding: implications from a retrospective study. Gastrointest Endosc 2013;77:761–766.
69. Ge ZZ, Chen HY, Gao YJ, et al. Best candidates for capsule endoscopy for obscure gastrointestinal bleeding. J Gastroenterol Hepatol 2007;22:2076–2080.
70. Pennazio M, Santucci R, Rondonotti E, et al. Outcome of patients with obscure gastrointestinal bleeding after capsule endoscopy: report of 100 consecutive cases. Gastroenterology 2004;126:643–653.
71. Yamada A, Watabe H, Kobayashi Y, et al. Timing of capsule endoscopy influences the diagnosis and outcome in obscure-overt gastrointestinal bleeding. Hepatogastroenterology 2012;59:676–679.
72. Lorenceau-Savale C, Ben-Soussan E, Ramirez S, et al. Outcome of patients with obscure gastrointestinal bleeding after negative capsule endoscopy: results of a one-year follow-up study. Gastroenterol Clin Biol 2010; 34:606–611.
73. Min BH, Chang DK, Kim BJ, et al. Does back-to-back capsule endoscopy increase the diagnostic yield over a single examination in patients with obscure gastrointestinal bleeding? Gut Liver 2010;4:54–59.
74. Svarta S, Segal B, Law J, et al. Diagnostic yield of repeat capsule endoscopy and the effect on subsequent patient management. Can J Gastroenterol 2010; 24:441–444.
75. Viazis N, Papaxoinis K, Vlachogiannakos J, et al. Is there a role for second-look capsule endoscopy in patients with obscure GI bleeding after a nondiagnostic first test? Gastrointest Endosc 2009;69:850–856.
76. Hartmann D, Eickhoff A, Damian U, et al. Diagnosis of small-bowel pathology using paired capsule endoscopy with two different devices: a randomized study. Endoscopy 2007;39:1041–1045.
77. Pioche M, Gaudin JL, Filoche B, et al. Prospective, randomized comparison of two small-bowel capsule endoscopy systems in patients with obscure GI bleeding. Gastrointest Endosc 2011;73:1181–1188.
78. Min YW, Kim JS, Jeon SW, et al. Long-term outcome of capsule endoscopy in obscure gastrointestinal bleeding: a nationwide analysis. Endoscopy 2014;46:59–65.
79. Koulaouzidis A, Rondonotti E, Giannakou A, et al. Diagnostic yield of small-bowel capsule endoscopy in patients with iron-deficiency anemia: a systematic review. Gastrointest Endosc 2012;76:983–992.
80. Koulaouzidis A, Yung DE, Lam JH, et al. The use of small-bowel capsule endoscopy in iron-deficiency anemia alone; be aware of the young anemic patient. Scand J Gastroenterol 2012;47:1094–1100.
81. Rondonotti E, Soncini M, Girelli C, et al. Small bowel capsule endoscopy in clinical practice: a multicenter 7-year survey. Eur J Gastroenterol Hepatol 2010; 22:1380–1386.
82. Tong J, Svarta S, Ou G, et al. Diagnostic yield of capsule endoscopy in the setting of iron deficiency anemia without evidence of gastrointestinal bleeding. Can J Gastroenterol 2012;26:687–690.
83. van Turenhout ST, Jacobs MA, van Weyenberg SJ, et al. Diagnostic yield of capsule endoscopy in a tertiary hospital in patients with obscure gastrointestinal bleeding. J Gastrointest Liver Dis 2010;19:141–145.
84. Sidhu R, McAlindon ME, Kapur K, et al. Push enteroscopy in the era of capsule endoscopy. J Clin Gastroenterol 2008;42:54–58.
85. Apostolopoulos P, Liatsos C, Gralnek IM, et al. The role of wireless capsule endoscopy in investigating unexplained iron deficiency anemia after negative endoscopic evaluation of the upper and lower gastrointestinal tract. Endoscopy 2006;38:1127–1132.
86. Holleran GE, Barry SA, Thornton OJ, et al. The use of small bowel capsule endoscopy in iron deficiency anaemia: low impact on outcome in the medium term despite high diagnostic yield. Eur J Gastroenterol Hepatol 2013;25:327–332.
87. Schulmann K, Hollerbach S, Kraus K, et al. Feasibility and diagnostic utility of video capsule endoscopy for the detection of small bowel polyps in patients with hereditary polyposis syndromes. Am J Gastroenterol 2005; 100:27–37.
88. Burke CA, Santisi J, Church J, et al. The utility of capsule endoscopy small bowel surveillance in patients with polyposis. Am J Gastroenterol 2005;100:1498–1502.
89. Cairns SR, Scholefield JH, Steele RJ, et al. Guidelines for colorectal cancer screening and surveillance in moderate and high risk groups (update from 2002). Gut 2010; 59:666–689.
90. Iaquinto G, Fornasarig M, Quaia M, et al. Capsule endoscopy is useful and safe for small-bowel surveillance in familial adenomatous polyposis. Gastrointest Endosc 2008;67:61–67.
91. Tescher P, Macrae FA, Speer T, et al. Surveillance of FAP: a prospective blinded comparison of capsule endoscopy and other GI imaging to detect small bowel polyps. Hered Cancer Clin Pract 2010;8:3.
92. Gupta A, Postgate AJ, Burling D, et al. A prospective study of MR enterography versus capsule endoscopy for the surveillance of adult patients with Peutz-Jeghers syndrome. AJR Am J Roentgenol 2010;195:108–116.
93. Mata A, Llach J, Castells A, et al. A prospective trial comparing wireless capsule endoscopy and barium contrast series for small-bowel surveillance in hereditary GI polyposis syndromes. Gastrointest Endosc 2005; 61:721–725.
94. Ohmiya N, Nakamura M, Takenaka H, et al. Management of small-bowel polyps in Peutz-Jeghers syndrome by

using enteroclysis, double-balloon enteroscopy, and videocapsule endoscopy. Gastrointest Endosc 2010; 72:1209–1216.
95. Rokkas T, Papaxoinis K, Triantafyllou K, et al. A meta-analysis evaluating the accuracy of colon capsule endoscopy in detecting colon polyps. Gastrointest Endosc 2010;71:792–798.
96. Spada C, Hassan C, Marmo R, et al. Meta-analysis shows colon capsule endoscopy is effective in detecting colorectal polyps. Clin Gastroenterol Hepatol 2010; 8:516–522.
97. Eliakim R, Yassin K, Niv Y, et al. Prospective multicenter performance evaluation of the second-generation colon capsule compared with colonoscopy. Endoscopy 2009; 41:1026–1031.
98. Spada C, Hassan C, Munoz-Navas M, et al. Second-generation colon capsule endoscopy compared with colonoscopy. Gastrointest Endosc 2011;74:581–589 e1.
99. Gay G, Delvaux M, Frederic M, et al. Could the colonic capsule PillCam Colon be clinically useful for selecting patients who deserve a complete colonoscopy?: results of clinical comparison with colonoscopy in the perspective of colorectal cancer screening. Am J Gastroenterol 2010;105:1076–1086.
100. Hagel AF, Gabele E, Raithel M, et al. Colon capsule endoscopy: detection of colonic polyps compared with conventional colonoscopy and visualization of extracolonic pathologies. Can J Gastroenterol Hepatol 2014; 28:77–82.
101. Pilz JB, Portmann S, Peter S, et al. Colon capsule endoscopy compared to conventional colonoscopy under routine screening conditions. BMC Gastroenterol 2010;10:66.
102. Rondonotti E, Borghi C, Mandelli G, et al. Accuracy of capsule colonoscopy and computed tomographic colonography in individuals with positive results from the fecal occult blood test. Clin Gastroenterol Hepatol 2014; 12:1303–1310.
103. Alarcon-Fernandez O, Ramos L, Adrian-de-Ganzo Z, et al. Effects of colon capsule endoscopy on medical decision making in patients with incomplete colonoscopies. Clin Gastroenterol Hepatol 2013;11: 534–540 e1.
104. Pioche M, de Leusse A, Filoche B, et al. Prospective multicenter evaluation of colon capsule examination indicated by colonoscopy failure or anesthesia contraindication. Endoscopy 2012;44:911–916.
105. Triantafyllou K, Viazis N, Tsibouris P, et al. Colon capsule endoscopy is feasible to perform after incomplete colonoscopy and guides further workup in clinical practice. Gastrointest Endosc 2014;79:307–316.
106. Negreanu L, Babiuc R, Bengus A, et al. PillCam Colon 2 capsule in patients unable or unwilling to undergo colonoscopy. World J Gastrointest Endosc 2013;5:559–567.
107. Rex DK, Lieberman DA. A survey of potential adherence to capsule colonoscopy in patients who have accepted or declined conventional colonoscopy. J Clin Gastroenterol 2012;46:691–695.
108. Spada C, Hassan C, Barbaro B, et al. Colon capsule versus CT colonography in patients with incomplete colonoscopy: a prospective, comparative trial. Gut 2015; 64:272–281.
109. Hassan C, Zullo A, Winn S, et al. Cost-effectiveness of capsule endoscopy in screening for colorectal cancer. Endoscopy 2008;40:414–421.
110. Gawron AJ, Veerappan A, Keswani RN. High success rate of repeat colonoscopy with standard endoscopes in patients referred for prior incomplete colonoscopy. BMC Gastroenterol 2014;14:56.
111. Brahmania M, Park J, Svarta S, et al. Incomplete colonoscopy: maximizing completion rates of gastroenterologists. Can J Gastroenterol 2012;26:589–592.
112. Food and Drug Administration. PillCam® COLON 2 capsule endoscopy system last update 2014. Available at: http://www.accessdata.fda.gov/cdrh_docs/pdf12/K123666.pdf. Accessed: August 22, 2016.
113. Given imaging receives reimbursement approval for PillCam COLON® in Japan effective January 1, 2014. GlobeNewswire. Last update 2013. Available at: http://www.globenewswire.com/news-release/2013/11/11/588474/10057254/en/Photo-Release-Given-Imaging-Receives-Reimbursement-Approval-for-PillCam:R-in-Japan-Effective-January-1-2014.html. Accessed: August 22, 2016.
114. Meister T, Heinzow HS, Domagk D, et al. Colon capsule endoscopy versus standard colonoscopy in assessing disease activity of ulcerative colitis: a prospective trial. Tech Coloproctol 2013;17:641–646.
115. Sung J, Ho KY, Chiu HM, et al. The use of Pillcam Colon in assessing mucosal inflammation in ulcerative colitis: a multicenter study. Endoscopy 2012;44:754–758.
116. D'Haens G, Lowenberg M, Samaan MA, et al. Safety and feasibility of using the second-generation pillcam colon capsule to assess active colonic Crohn's disease. Clin Gastroenterol Hepatol 2015;13:1480–1486 e3.
117. Greenfield S, Kaplan S, Ware JE Jr. Expanding patient involvement in care. Effects on patient outcomes. Ann Intern Med 1985;102:520–528.
118. Stewart MA. Effective physician-patient communication and health outcomes: a review. CMAJ 1995; 152:1423–1433.
119. Davis RE, Jacklin R, Sevdalis N, et al. Patient involvement in patient safety: what factors influence patient participation and engagement? Health Expect 2007; 10:259–267.
120. Hoog CM, Bark LA, Arkani J, et al. Capsule retentions and incomplete capsule endoscopy examinations: an analysis of 2300 examinations. Gastroenterol Res Pract 2012;2012:518718.
121. Liao Z, Gao R, Xu C, et al. Indications and detection, completion, and retention rates of small-bowel capsule endoscopy: a systematic review. Gastrointest Endosc 2010;71:280–286.
122. Hara AK, Leighton JA, Heigh RI, et al. Crohn disease of the small bowel: preliminary comparison among CT enterography, capsule endoscopy, small-bowel follow-through, and ileoscopy. Radiology 2006; 238:128–134.
123. Ou G, Shahidi N, Galorport C, et al. Effect of longer battery life on small bowel capsule endoscopy. World J Gastroenterol 2015;21:2677–2682.

124. Dolak W, Kulnigg-Dabsch S, Evstatiev R, et al. A randomized head-to-head study of small-bowel imaging comparing MiroCam and EndoCapsule. Endoscopy 2012;44:1012–1020.
125. Atay O, Mahajan L, Kay M, et al. Risk of capsule endoscope retention in pediatric patients: a large single-center experience and review of the literature. J Pediatr Gastroenterol Nutr 2009;49:196–201.
126. Cheifetz AS, Kornbluth AA, Legnani P, et al. The risk of retention of the capsule endoscope in patients with known or suspected Crohn's disease. Am J Gastroenterol 2006;101:2218–2222.
127. Baichi MM, Arifuddin RM, Mantry PS. Small-bowel masses found and missed on capsule endoscopy for obscure bleeding. Scand J Gastroenterol 2007; 42:1127–1132.
128. Singeap AM, Trifan A, Cojocariu C, et al. Outcomes after symptomatic capsule retention in suspected small bowel obstruction. Eur J Gastroenterol Hepatol 2011;23:886–890.
129. Al-Bawardy B, Locke G, Huprich JE, et al. Retained capsule endoscopy in a large tertiary care academic practice and radiologic predictors of retention. Inflamm Bowel Dis 2015;21:2158–2164.
130. Rogers AM, Kuperman E, Puleo FJ, et al. Intestinal obstruction by capsule endoscopy in a patient with radiation enteritis. JSLS 2008;12:85–87.
131. Chong AK, Chin BW, Meredith CG. Clinically significant small-bowel pathology identified by double-balloon enteroscopy but missed by capsule endoscopy. Gastrointest Endosc 2006;64:445–449.
132. Banerjee R, Bhargav P, Reddy P, et al. Safety and efficacy of the M2A patency capsule for diagnosis of critical intestinal patency: results of a prospective clinical trial. J Gastroenterol Hepatol 2007;22:2060–2063.
133. Boivin ML, Lochs H, Voderholzer WA. Does passage of a patency capsule indicate small-bowel patency? A prospective clinical trial? Endoscopy 2005;37:808–815.
134. Herrerias JM, Leighton JA, Costamagna G, et al. Agile patency system eliminates risk of capsule retention in patients with known intestinal strictures who undergo capsule endoscopy. Gastrointest Endosc 2008; 67:902–909.
135. Postgate AJ, Burling D, Gupta A, et al. Safety, reliability and limitations of the given patency capsule in patients at risk of capsule retention: a 3-year technical review. Dig Dis Sci 2008;53:2732–2738.
136. Yadav A, Heigh RI, Hara AK, et al. Performance of the patency capsule compared with nonenteroclysis radiologic examinations in patients with known or suspected intestinal strictures. Gastrointest Endosc 2011;74:834–839.
137. Nemeth A, Kopylov U, Koulaouzidis A, et al. Patency capsule in patients with established Crohn's disease undergoing videocapsule endoscopy of the small bowel (abstr P177). J Crohns Colitis 2015;9:S165.
138. Rozov-Ung I, Mreyoud A, Moore J, et al. Detection of drug effects on gastric emptying and contractility using a wireless motility capsule. BMC Gastroenterol 2014;14:2.
139. Lee MM, Jacques A, Lam E, et al. Factors associated with incomplete small bowel capsule endoscopy studies. World J Gastroenterol 2010;16:5329–5333.
140. Yazici C, Losurdo J, Brown MD, et al. Inpatient capsule endoscopy leads to frequent incomplete small bowel examinations. World J Gastroenterol 2012; 18:5051–5057.
141. Hoog CM, Lindberg G, Sjoqvist U. Findings in patients with chronic intestinal dysmotility investigated by capsule endoscopy. BMC Gastroenterol 2007;7:29.
142. Shiotani A, Honda K, Kawakami M, et al. Use of an external real-time image viewer coupled with prespecified actions enhanced the complete examinations for capsule endoscopy. J Gastroenterol Hepatol 2011; 26:1270–1274.
143. Cuschieri JR, Osman MN, Wong RC, et al. Small bowel capsule endoscopy in patients with cardiac pacemakers and implantable cardioverter defibrillators: outcome analysis using telemetry review. World J Gastrointest Endosc 2012;4:87–93.
144. Harris LA, Hansel SL, Rajan E, et al. Capsule endoscopy in patients with implantable electromedical devices is safe. Gastroenterol Res Pract 2013;2013:959234.
145. Bandorski D, Irnich W, Bruck M, et al. Capsule endoscopy and cardiac pacemakers: investigation for possible interference. Endoscopy 2008;40:36–39.
146. Bandorski D, Jakobs R, Bruck M, et al. Capsule endoscopy in patients with cardiac pacemakers and implantable cardioverter defibrillators: (re)evaluation of the current state in Germany, Austria, and Switzerland 2010. Gastroenterol Res Pract 2012;2012:717408.
147. Kotwal VS, Attar BM, Gupta S, et al. Should bowel preparation, antifoaming agents, or prokinetics be used before video capsule endoscopy? A systematic review and meta-analysis. Eur J Gastroenterol Hepatol 2014; 26:137–145.
148. Belsey J, Crosta C, Epstein O, et al. Meta-analysis: efficacy of small bowel preparation for small bowel video capsule endoscopy. Curr Med Res Opin 2012; 28:1883–1890.
149. Koulaouzidis A, Giannakou A, Yung DE, et al. Do prokinetics influence the completion rate in small-bowel capsule endoscopy? A systematic review and meta-analysis. Curr Med Res Opin 2013;29:1171–1185.
150. Rokkas T, Papaxoinis K, Triantafyllou K, et al. Does purgative preparation influence the diagnostic yield of small bowel video capsule endoscopy?: a meta-analysis. Am J Gastroenterol 2009;104:219–227.
151. Wu L, Cao Y, Liao C, et al. Systematic review and meta-analysis of randomized controlled trials of simethicone for gastrointestinal endoscopic visibility. Scand J Gastroenterol 2011;46:227–235.
152. Rosa BJ, Barbosa M, Magalhaes J, et al. Oral purgative and simethicone before small bowel capsule endoscopy. World J Gastrointest Endosc 2013;5:67–73.
153. Oliva S, Cucchiara S, Spada C, et al. Small bowel cleansing for capsule endoscopy in paediatric patients: a prospective randomized single-blind study. Dig Liver Dis 2014;46:51–55.
154. Franke A, Hummel F, Knebel P, et al. Prospective evaluation of small bowel preparation with bisacodyl and sodium phosphate for capsule endoscopy. World J Gastroenterol 2008;14:2061–2064.

155. Kantianis A, Karagiannis S, Liatsos C, et al. Comparison of two schemes of small bowel preparation for capsule endoscopy with polyethylene glycol: a prospective, randomized single-blind study. Eur J Gastroenterol Hepatol 2009;21:1140–1144.
156. Hosono K, Endo H, Sakai E, et al. Optimal approach for small bowel capsule endoscopy using polyethylene glycol and metoclopramide with the assistance of a real-time viewer. Digestion 2011;84:119–125.
157. Ito T, Ohata K, Ono A, et al. Prospective controlled study on the effects of polyethylene glycol in capsule endoscopy. World J Gastroenterol 2012;18:1789–1792.
158. Belsey J, Epstein O, Heresbach D. Systematic review: oral bowel preparation for colonoscopy. Aliment Pharmacol Ther 2007;25:373–384.
159. Armstrong D, Barkun A, Bridges R, et al. Canadian Association of Gastroenterology consensus guidelines on safety and quality indicators in endoscopy. Can J Gastroenterol 2012;26:17–31.
160. Gralnek IM, Defranchis R, Seidman E, et al. Development of a capsule endoscopy scoring index for small bowel mucosal inflammatory change. Aliment Pharmacol Ther 2008;27:146–154.
161. Cotter J, Dias de Castro F, Magalhaes J, et al. Validation of the Lewis score for the evaluation of small-bowel Crohn's disease activity. Endoscopy 2015;47:330–335.
162. Monteiro S, Boal Carvalho P, Dias de Castro F, et al. Capsule endoscopy: diagnostic accuracy of Lewis score in patients with suspected Crohn's disease. Inflamm Bowel Dis 2015;21:2241–2246.
163. Gal E, Geller A, Fraser G, et al. Assessment and validation of the new capsule endoscopy Crohn's disease activity index (CECDAI). Dig Dis Sci 2008;53:1933–1937.
164. Niv Y, Ilani S, Levi Z, et al. Validation of the Capsule Endoscopy Crohn's Disease Activity Index (CECDAI or Niv score): a multicenter prospective study. Endoscopy 2012;44:21–26.
165. Delvaux M, Friedman S, Keuchel M, et al. Structured terminology for capsule endoscopy: results of retrospective testing and validation in 766 small-bowel investigations. Endoscopy 2005;37:945–950.
166. Korman LY, Delvaux M, Gay G, et al. Capsule endoscopy structured terminology (CEST): proposal of a standardized and structured terminology for reporting capsule endoscopy procedures. Endoscopy 2005;37:951–959.
167. Pezzoli A, Cannizzaro R, Pennazio M, et al. Interobserver agreement in describing video capsule endoscopy findings: a multicentre prospective study. Dig Liver Dis 2011;43:126–131.
168. Girelli CM, Porta P, Colombo E, et al. Development of a novel index to discriminate bulge from mass on small-bowel capsule endoscopy. Gastrointest Endosc 2011;74:1067–1074; quiz 1115 e1–e5.
169. Jowell PS, Baillie J, Branch MS, et al. Quantitative assessment of procedural competence. A prospective study of training in endoscopic retrograde cholangiopancreatography. Ann Intern Med 1996;125:983–989.
170. Watkins JL, Etzkorn KP, Wiley TE, et al. Assessment of technical competence during ERCP training. Gastrointest Endosc 1996;44:411–415.
171. Rajan E, Iyer PG, Oxentenko AS, et al. Training in small-bowel capsule endoscopy: assessing and defining competency. Gastrointest Endosc 2013;78:617–622.
172. Postgate A, Haycock A, Thomas-Gibson S, et al. Computer-aided learning in capsule endoscopy leads to improvement in lesion recognition ability. Gastrointest Endosc 2009;70:310–316.
173. Faigel DO, Baron TH, Adler DG, et al. ASGE guideline: guidelines for credentialing and granting privileges for capsule endoscopy. Gastrointest Endosc 2005;61:503–505.

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Conflicts of interest
These authors disclose the following: Charles Bernstein has performed consulting for Mylan Pharmaceuticals, has served on the advisory board for AbbVie, Janssen, Pfizer, and Takeda, has received research or educational grants/clinical trial funding from AbbVie, Janssen, Shire, and Takeda, and has served on the speaker's bureau for AbbVie and Shire; David Armstrong has served on the advisory board for AbbVie, Allergan, Janssen, Pfizer, and Lupin, has received research or educational grants/clinical trial funding from AbbVie, and has served on the speaker's bureau for AbbVie, Allergan, Mylan, Pendopharm, Pentax, Pfizer, Shire, and Takeda; Robert A. Enns has served on the speaker's bureau for AbbVie, Actavis, Boston Medical, Conmed, Cook, Covidien, Ferring, Gilead, Janssen, Merck, Olympus, Pendopharm, Pentax, Roche, Shire, Takeda, and Vantage; and Lawrence Hookey has received research or educational grants/clinical trial funding from Given Imaging, and served on the speaker's bureau for Ferring. The remaining authors disclose no conflicts.

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