Title: Wireless Capsule Endoscopy to Diagnose Disorders of the Small Bowel, Esophagus, and Colon

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<td>Relevant outcomes include: • Test accuracy • Test validity • Other test performance measures • Symptoms • Change in disease status</td>
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the Small Bowel, Esophagus, and Colon

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**DESCRIPTION**

The wireless capsule endoscopy uses a device to visualize portions of the bowel which are not accessible via upper or lower endoscopy, primarily the small bowel. Patients swallow a capsule that records images of the intestinal mucosa as it passes through the gastrointestinal (GI) tract. The capsule is collected after being excreted and the images interpreted.

**OBJECTIVE**

The objective of this policy is to evaluate whether the use of wireless capsule endoscopy is associated with improved diagnosis and health outcomes in patients with suspected or established gastrointestinal disorders.

**BACKGROUND**

Wireless Capsule Endoscopy

Wireless capsule endoscopy is performed using the PillCam™ Given® Diagnostic Imaging System (previously called M2A®, which is a disposable imaging capsule manufactured by Given Imaging Ltd. (Norcross, GA). The capsule measures 11 X 30 mm and contains video imaging, self-illumination, and image transmission modules, as well as a battery supply that lasts up to 8 hours. The indwelling camera takes images at a rate of 2 frames per second as peristalsis carries the capsule through the GI tract. The average transit time from ingestion to evacuation is 24 hours. The device uses wireless radio transmission to send the images to a receiving recorder device that the patient wears around the waist. This receiving device also contains some localizing...
antennae sensors that can roughly gauge where the image was taken over the abdomen. Images are then downloaded onto a workstation for viewing and processing.

**Applications**
In the small bowel, the capsule camera has been most frequently proposed as a technique to identify the source of obscure intestinal bleeding, although recently there has been interest in exploring its use in patients with inflammatory bowel disease. Alternative diagnostic techniques include barium studies or small intestinal endoscopy.

In the esophagus, the capsule camera has been proposed as a screening technique for Barrett esophagus associated with GERD. Evaluation of the esophagus requires limited transit time, and it is estimated that the test takes 20 minutes to perform. Alternative techniques include upper endoscopy.

**REGULATORY STATUS**
On August 1, 2001, the PillCam™ Given® Diagnostic Imaging System (Given Imaging) was cleared for marketing by the U.S. Food and Drug Administration (FDA) through the 510(k) process. FDA clearance provides for the capsule's use "along with - not as a replacement for - other endoscopic and radiologic evaluations of the small bowel." FDA clarified that the "capsule was not studied in the large intestine." On July 1, 2003, a supplemental 510(k) premarket notification was cleared, and the labeled indications were modified by removing the “adjunctive” use qualification: “the Given® Diagnostic System is intended for visualization of the small bowel mucosa. It may be used as a tool in the detection of abnormalities of the small bowel.”

In November 2004, the device received FDA clearance for the following labeled indication: “the Given® Diagnostic System with the PillCam™ ESO Capsule is intended for the visualization of esophageal mucosa.” A new model was cleared by FDA in June 2007, the PillCam ESO2 Capsule. In September 2007, the Olympus Capsule Endoscope System was cleared for marketing by FDA through the 510(k) process for “visualization of the small intestine mucosa.” More recent versions of both these systems also incorporate a blood indicator feature to assist with rapid screening of intestinal lesions with bleeding potential.

In 2006, the Given AGILE™ patency system was also cleared by FDA through the 510(k) process. This system is an accessory to the PillCam™ video capsule and, according to FDA material, is intended to verify adequate patency of the GI tract before administration of the PillCam™ into patients with known or suspected strictures. This capsule is of similar size to the endoscopy capsule but made of lactose and barium and dissolves within 30 to 100 hours of entering the GI tract. It carries a tracer material that can be detected by a scanning device. Excretion of the intact capsule without symptoms (abdominal pain or obstruction) is reported to predict the uncomplicated passage of the wireless capsule.
In 2014, PillCam™ COLON was cleared for marketing by FDA through a de novo 510(k) classification. The new classification applies to devices with low to moderate risk that have no predicate on the market. PillCam™ COLON is intended to visualize the colon in patients who have had an incomplete colonoscopy due to a technical impossibility and not incomplete evacuation.

In 2016, the PillCam™ COLON 2 Capsule Endoscopy System was cleared by FDA through the 510(k) process for the detection of colon polyps in patients after an incomplete colonoscopy with adequate preparation, and a complete evaluation of the colon was not technically possible, and for detection of colon polyps in patients with evidence of GI bleeding of lower GI origin in patients with major risks for colonoscopy or moderate sedation, but who could tolerate a colonoscopy and moderate sedation in the event that a clinically significant colon abnormality was identified on capsule endoscopy.

FDA Product Code: NEZ.

**POLICY**

A. Wireless capsule endoscopy of the small bowel may be considered *medically necessary* for the following indications:

1. Initial diagnosis in patients with suspected Crohn's disease without evidence of disease on conventional diagnostic tests such as small bowel follow-through and upper and lower endoscopy.

2. In patients with an established diagnosis of Crohn's disease, when there are unexpected change(s) in the course of disease or response to treatment, suggesting the initial diagnosis may be incorrect and reexamination may be indicated.

3. Obscure gastrointestinal bleeding suspected of being of small bowel origin, as evidenced by prior inconclusive upper and lower gastrointestinal (GI) endoscopic studies performed during the current episode of illness.

4. For surveillance of the small bowel in patients with hereditary GI polyposis syndromes, including familial adenomatous polyposis and Peutz-Jeghers syndrome.

B. Other indications of wireless capsule endoscopy are considered *experimental / investigational*, including, but not limited to:

1. Evaluation of the extent of involvement of known Crohn's disease or ulcerative colitis.
2. Evaluation of the esophagus, in patients with gastroesophageal reflux (GERD) or other esophageal pathologies.

3. Evaluation of other gastrointestinal diseases and conditions not presenting with GI bleeding, including, but not limited to, celiac sprue, irritable bowel syndrome, Lynch syndrome, portal hypertensive enteropathy, small bowel neoplasm, and unexplained chronic abdominal pain.

4. Evaluation of the colon, including, but not limited to, detection of colonic polyps or colon cancer.

5. Initial evaluation of patients with acute GI bleeding.

C. The patency capsule is considered experimental / investigational, including use to evaluate patency of the gastrointestinal tract before wireless capsule endoscopy.

Policy Guidelines
Obscure GI bleeding is defined as “recurrent or persistent iron-deficiency anemia, positive fecal occult blood test, or visible bleeding with no bleeding source found at original endoscopy.”

RATIONALE
The most recent literature review was conducted through September 11, 2017.

Assessment of diagnostic technology typically focuses on 3 categories of evidence: (1) technical reliability (test-retest reliability or interrater reliability); (2) clinical validity (sensitivity, specificity, positive and negative predictive values) in relevant populations of patients; and (3) clinical utility (ie, demonstration that the diagnostic information can be used to improve patient outcomes).

Patients with Suspected Gastrointestinal Conditions
Clinical Context and Test Purpose
The question addressed in this portion of the evidence review is whether there is sufficient evidence that wireless capsule endoscopy (CE) leads to improved diagnosis and better health outcomes in patients with suspected gastrointestinal (GI) conditions compared with standard approaches.

The following PICOTS were used to select literature to inform this review.

Patients
The relevant population of interest is patients with suspected GI conditions.

Interventions
The intervention of interest is wireless CE.
Comparators
The comparator of interest is a standard workup without wireless CE and, with or without direct endoscopic procedures or specialized gastrointestinal imaging.

Outcomes
The outcomes of interest for diagnostic accuracy include test accuracy and test validity (ie, sensitivity, specificity). The primary outcomes of interest for the clinical utility are symptoms and disease status that would change due to patient management decisions following wireless CE.

Timing
Wireless CE would be performed after an initial clinical examination.

Setting
The test would be performed in the outpatient specialty setting (gastroenterology).

Technical Reliability
For CE, in general, very little evidence exists for most indications regarding technical reliability, which in this case would evaluate concordance between different examinations in the same person and concordance between different examiners.

Clinical Validity and Clinical Utility
Suspected Small Bowel Bleeding
Suspected small bowel bleeding, previously referred to as obscure GI tract bleeding, is defined as bleeding from the GI tract that persists or recurs without an obvious etiology after imaging with upper and lower endoscopy and radiologic evaluation of the small bowel. Suspected small bowel bleeding is often detected by fecal occult blood testing performed for colon cancer screening, and the presence of anemia consistent with persistent blood loss. Causes of obscure bleeding in the small intestine include angiodysplasia (70%-80%), tumor (5%-10%), and other causes (10%-25%), including those related to medication, infections (tuberculosis), Crohn disease (CD), Meckel diverticulum, Zollinger-Ellison syndrome, vasculitis, radiation enteritis, jejunal diverticula, and chronic mesenteric ischemia. In patients older than age 60 years, angiodysplasia is the most likely cause, while in those younger than age 50 years, a small bowel tumor would be the most likely cause of bleeding.

A 2007 position statement by the American Gastroenterological Association indicated that CE should be the third test after upper and lower endoscopy in the evaluation of obscure GI bleeding. Evidence cited in the accompanying technical review caused the American Gastroenterological Association to revise prior position statements in which other tests (eg, bleeding scans, angiography, repeat endoscopy, enteroscopy, enteroclysis) were recommended, depending on the presence or absence of active bleeding. Arguments supporting the utility of CE are based on several lines of evidence. CE appears to have a higher sensitivity of locating bleeding lesions than other diagnostic techniques when diagnostic yields are compared. The technical review summarized 10 studies comparing CE with push enteroscopy in the same patients. CE located a source of bleeding in 25% to 55% more patients than push enteroscopy. One study by Hartmann et al (2005) compared the findings of CE with what might be considered the criterion standard for localizing bleeding, intraoperative endoscopy. CE was 95% sensitive in locating bleeding and was able to localize bleeding in a few cases in which
intraoperative endoscopy was not. In a study by Pennazio et al (2004) in which long-term follow-up was used as the reference standard, CE was 89% sensitive and 95% specific in 56 patients for whom a confirmed diagnosis was obtained. A “true” reference standard for obscure GI bleeding is, in fact, difficult or impossible to achieve, because the bleeding source may resolve and invasive techniques (eg, surgery) cannot be justifiably used.

A 2012 systematic review and meta-analysis by Koulaouzidis et al evaluated 24 studies on CE performed after negative findings from previous diagnostic evaluations including upper and lower endoscopy. Selected studies included 1960 patients, 1194 (60.9%) of whom had iron-deficiency anemia. The pooled per-patient diagnostic yield of all 24 studies, evaluated by a random-effects model, was 47% (95% confidence interval [CI], 42% to 52%). Almost 50% of the diagnostic yield was for small bowel angioectasia. In a subset of 4 studies focused on patients with iron-deficiency anemia (n=264 [13.47%]), the pooled diagnostic yield with CE was 66.6% (95% CI, 61.0% to 72.3%) and included more vascular, inflammatory, and mass/tumor lesions.

In 2012, Leung et al reported on 60 consecutive patients with acute melena or hematochezia who were randomized to immediate CE or mesenteric angiography in a 1:1 ratio after nondiagnostic endoscopy and colonoscopy. CE had a significantly higher diagnostic yield (53.3%) than angiography (20.0%; p=0.016). The cumulative risk of rebleeding in the angiography and CE group was 33.3% and 16.7%, respectively (p=0.10). After a mean follow-up of 48.5 months, further transfusion, hospitalization for rebleeding, and mortality did not differ significantly between the groups.

Section Summary: Suspected Small Bowel Bleeding

A large number of uncontrolled studies have evaluated the use of CE in the evaluation of patients with suspected small bowel bleeding. These studies have consistently reported that a substantial proportion of patients receive a definitive diagnosis following this test when there are few other diagnostic options. A meta-analysis of 24 studies estimated that the diagnostic yield in this patient population was approximately half of the included patients and was higher in patients with documented iron-deficiency anemia. CE appears to locate the source of bleeding at least as well as other diagnostic methods and direct treatment to the source of bleeding.

Suspected CD

CD is an inflammatory disease involving the small intestine that is usually diagnosed with small bowel imaging studies and ileocolonoscopy. When these studies are negative or equivocal, CE has been proposed as a method for identifying CD. There is no single criterion standard diagnostic test for CD; rather, diagnosis is based on a constellation of findings. Thus it is difficult to determine the diagnostic characteristics of various tests used to diagnose the condition and difficult to determine a single comparator diagnostic test to CE.

Despite difficulties in evaluating the clinical value of CE to assess suspected CD, findings tend to indicate that, compared with other diagnostic modalities, CE has an equivalent or higher yield of positive findings. A 2009 international consensus statement found 7 studies comparing CE with small bowel follow-through, a study comparing CE with magnetic resonance imaging, and 4 studies comparing CE with computed tomography (CT) scan. Conclusions reached indicated that CE may be superior to these alternative diagnostic tests.
In 2017, Choi et al reported on a meta-analysis of studies on the effectiveness of CE compared with other diagnostic modalities in patients with small bowel CD. Reviewers selected 24 studies, which included patients with both suspected and established CD, and compared CE with a range of alternative diagnostic modalities, including small bowel follow-through, enteroclysis (a conventional fluoroscopic technique not widely used due to invasiveness, time-intensiveness, and associated discomfort for the patient), CT enterography, and magnetic resonance enterography (MRE). For patients with suspected CD, the diagnostic yield of CE (66%) was higher than that of small bowel follow-through (21.3%; weighted incremental yield [\( I_{Yw} \), 0.44; 95% CI, 0.29 to 0.59, \( I^2=30\% \)). The diagnostic yield of CE was not significantly higher than that of CT enterography (72.5% for endoscopy vs 22.5% for CT enterography; \( I_{Yw}=0.36; 95\% \ CI, 0.18 \) to 0.90; \( I^2=68\% \)) or that of MRE (85.7% for endoscopy vs 100% for MRE; \( I_{Yw}=-0.16; 95\% \ CI, -0.63 \) to 0.32; \( I^2=44\% \)). The reference standards varied for the included studies, so quantitative data were not synthesized for diagnostic accuracy. In the pooled analysis, in patients with suspected CD, the sensitivity and specificity of CE ranged from 89.6% to 92.0% and 100%, respectively.

Section Summary: Suspected CD
For patients with suspected Crohn of the small bowel who cannot be diagnosed by other modalities, CE can confirm the diagnosis in a substantial number of patients. The diagnostic yield in the available studies varied but is likely superior to alternative tests such as CT or magnetic resonance imaging scanning.

Suspected Celiac Disease
Celiac disease, or gluten-sensitive enteropathy, is an immune-mediated condition of the small intestine. Serologic markers of the disease have good sensitivity and specificity, but the criterion standard for diagnosis of celiac disease is obtained through small bowel biopsies obtained during endoscopy. CE has been evaluated as an alternative method of diagnosing celiac disease, assessing the extent of disease, and in the evaluation of celiac disease unresponsive to treatment.

A meta-analysis by El-Matary et al (2009) compared the diagnostic performance of CE with a reference standard of duodenal biopsy. The pooled analysis of 3 studies showed a sensitivity of 83% and a specificity of 98%. Another meta-analysis by Rokkas and Niv (2012) also compared the diagnostic performance of CE with biopsy, summarizing 6 studies (total N=166 subjects). The overall pooled sensitivity was 89%, and the specificity was 95%. CE was able to detect involvement of intestines beyond the duodenum; however, the clinical significance of detecting the extent of celiac disease is uncertain. Given the less than 90% sensitivity of CE for celiac disease, it does not appear to be an adequate alternative method of making an initial diagnosis.

The role of CE in nonresponsive celiac disease has been evaluated in only a few studies. One case series by Culliford et al (2005) evaluated 47 patients with complicated celiac disease and found unexpected additional findings in 60% of patients, most of which were ulcers. However, the definition of “complicated” celiac disease included other factors such as evidence of blood loss, itself an indication for CE. The impact on patient management and outcomes is unclear.
In a 2013 study by Kurien et al, 62 patients with an equivocal diagnosis of celiac disease and 69 patients with the confirmed celiac disease who were unresponsive to standard treatment were evaluated with CE. Results were combined with human leukocyte antigen typing and response to gluten challenge, with the final diagnosis made by 3 expert physicians who received the information from all 3 sources. The main outcome was the increase in diagnostic yield after CE combined with the other tests. The diagnostic yield was greatest in cases with antibody negative villous atrophy where a diagnosis of celiac disease was made in 9 (28%) of 32 patients. In 8 (12%) of the 69 nonresponsive celiac disease patients, CE identified 2 cases of enteropathy-associated lymphoma, 4 type 1 refractory disease cases, 1 fibroepithelial polyp, and 1 case of ulcerative jejunitis. This study was limited by the small sample size and use of other tests in conjunction with CE to ascertain a final diagnosis.

Section Summary: Suspected Celiac Disease
In cases where the diagnosis of celiac disease is equivocal, CE can sometimes reveal morphologic changes in the small bowel consistent with celiac disease. However, it is unlikely that the appearance of small bowel on CE is itself sufficient to make a definitive diagnosis of celiac disease. Small bowel biopsy, celiac serologies, and human leukocyte antigen typing remain the standard tests for confirming celiac disease and have a higher sensitivity and specificity for this purpose. Case series of patients with unresponsive celiac disease undergoing CE have shown some yield of actionable diagnoses that have the potential to improve patient outcomes. Larger studies are needed to better determine the diagnostic yield of CE in these patients.

Unexplained Chronic Abdominal Pain
CE has been proposed as a diagnostic tool for unexplained chronic abdominal pain. Xue et al (2015) reported on a systematic review of 21 studies (total N=1520 patients) evaluating CE for unexplained chronic abdominal pain. The pooled diagnostic yield was 20.9% (95% CI, 15.9% to 25.9%). The most commonly identified findings were inflammatory lesions (78.3%) and tumors (9.0%). Studies in the review were highly heterogeneous. Limitations in interpreting the findings included retrospective study designs, different durations of abdominal pain, and use of different tests before CE.

In a study not included in the systematic review, Yang et al (2014) reported on a case series evaluating 243 patients with CE for unexplained chronic abdominal pain. The diagnostic yield of CE was 23.0%. Identified findings included 19 (7.8%) patients with CD, 15 (6.2%) with enteritis, 11 (4.5%) with idiopathic intestinal lymphangiectasia, 5 (2.1%) with unciniarisis, 5 (2.1%) with abnormal transit time and other findings (eg, small bowel tumor, ascariasis, anaphylactoid purpura).

Section Summary: Unexplained Chronic Abdominal Pain
While CE may have yielded a diagnosis for unexplained chronic abdominal pain in a fair proportion of these patients, the sequence and chronology of testing and treatment recommended before CE needs to be defined to determine whether CE was necessary to diagnose the condition.
Patients with Established GI Conditions

Clinical Context and Test Purpose
The question addressed in this portion of the evidence review is whether there is sufficient evidence that wireless CE leads to improved diagnosis and better health outcomes in patients with established GI conditions compared with standard approaches to patient management. The following PICOTS were used to select literature to inform this review.

Patients
The relevant population of interest is patients with established GI conditions.

Interventions
The intervention of interest is wireless CE.

Comparators
The comparator of interest is a standard workup without wireless CE and, with or without direct endoscopic procedures or specialized gastrointestinal imaging.

Outcomes
The outcomes of interest for diagnostic accuracy include test accuracy and test validity (ie, sensitivity, specificity). The primary outcomes of interest for the clinical utility are symptoms and disease status that would change due to patient management decisions following wireless CE.

Timing
Wireless CE would be performed to further evaluate and/or monitor patients after a confirmed diagnosis.

Setting
The test would be performed in the outpatient specialty setting (gastroenterology).

Technical Reliability
For CE, in general, very little evidence exists for most indications regarding technical reliability, which in this case would evaluate concordance between different examinations in the same person and concordance between different examiners.

Clinical Validity and Clinical Utility
Established Diagnosis of CD
In 2017, Kopylov et al published a systematic review of studies on CE in the evaluation of CD.17 Reviewers included prospective studies comparing CE with MRE and/or small bowel contrast ultrasound in patients who had suspected and/or established CD. In pooled analyses of the 11 studies that included patients with established CD, the diagnostic yield of CE was similar to that of MRE (odds ratio [OR], 1.88; 95% CI, 0.53 to 1.48; I²=48%) and to ultrasound (OR=0.57; 95% CI, 0.27 to 1.20; I²=67%).

An international consensus statement indicated that radiographic imaging should take precedence over CE because of the capability to detect obstructive strictures as well as extraluminal and transmural disease.9 The consensus statement identified some studies in which CE had a higher percentage of positive findings than alternative tests in patients with
established CD, but it is not clear how these findings correlated with either symptoms or outcomes of the therapeutic intervention. A 2013 European consensus statement indicated MRE or CT enterography is usually preferred to CE in patients with known CD patients. The 2013 consensus also indicated CE should be limited in patients with CD to the evaluation of unexplained symptoms, unexplained iron-deficiency, or obscure GI bleeding after other investigations are inconclusive.

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**Section Summary: Established Diagnosis of CD**

A 2017 systematic review of 11 studies in patients with established CD found a similar diagnostic yield with CE compared with radiography. International consensus statements state that radiographic imaging has advantages (eg, ability to detect obstructive strictures) and that CE should be limited to certain situations (eg, unexplained symptoms or other inconclusive investigations).

**Ulcerative Colitis**

Ulcerative colitis is an inflammatory disease of the large intestine. It is usually diagnosed by colonoscopy and biopsy. CE has been proposed as an alternative method for assessing the extent and severity of disease activity in those with known ulcerative colitis.

Sung et al (2012) evaluated 100 patients with suspected or known ulcerative colitis using CE and colonoscopy performed on the same day. They reported CE sensitivity and specificity to detect active colonic inflammation were 89% (95% CI, 80% to 95%) and 75% (95% CI, 51% to 90%), respectively. The positive (PPV) and negative predictive values were 93% (95% CI, 84% to 97%) and 65% (95% CI, 43% to 83%), respectively.

San Juan-Acosta et al (2014) evaluated 42 patients with known ulcerative colitis using CE and colonoscopy to assess disease activity. Results were expressed with κ coefficients. There was a good correlation between colon CE and colonoscopy in disease severity (κ=0.79; 95% CI, 0.62 to 0.96) and extent of inflammation (κ=0.71; 95% CI, 0.52 to 0.90). In 3 patients, inflammation was seen in the terminal ileum, leading to a change in diagnosis to ileocolonic CD. Although the correspondence between the 2 methods was reasonably good, it is uncertain whether management changes based on one or the other test would result in similar or different patient outcomes.

Oliva et al (2014) evaluated 30 patients with known ulcerative colitis with both CE and colonoscopy to assess disease activity. The reference standard for disease activity was a Matts score greater than 6 as judged by colonoscopy. The sensitivity of CE was 96% (95% CI, 79%
to 99%) and specificity was 100% (95% CI, 61% to 100%). The PPV and negative predictive values of second-generation colon CE were 100% (95% CI, 85% to 100%) and 85% (95% CI, 49% to 97%), respectively. Although the 2 methods had a high concordance at this cutoff level of disease in this study, patient outcomes linked to these assessments of disease activity cannot be determined.

Section Summary: Ulcerative Colitis
Several diagnostic accuracy studies have compared CE and colonoscopy to assess disease activity in patients with ulcerative colitis. Two of 3 studies were small (ie, <50 patients) and thus data on diagnostic accuracy are limited. Because there are insufficient data on diagnostic accuracy, a chain of evidence on clinical utility cannot be constructed.

Esophageal Disorders
CE can visualize several types of esophageal conditions. It could substitute for traditional upper endoscopy for several indications and may have the advantage of comfort and convenience. However, interventional procedures and biopsies cannot be performed with CE. CE could triage patients for endoscopy if either the sensitivity or the specificity is high. Traditional endoscopy could then be performed on the appropriate group to determine false positives or false negatives, having spared the group with a high PPV an endoscopy procedure.

Most studies have shown that CE has inferior diagnostic characteristics compared with traditional upper endoscopy for a variety of esophageal conditions. A 2011 meta-analysis of 9 studies comparing CE with traditional endoscopy for detecting esophageal varices calculated a sensitivity of 83% and specificity of 85%.22 Another meta-analysis (2009) of 9 studies comparing CE with traditional endoscopy for detecting Barrett esophagus showed a sensitivity and specificity of 77% and 86%, respectively.23 Because neither the sensitivity nor the specificity of the test approached a high value, the test cannot substitute for traditional endoscopy nor can it be used to triage patients to endoscopy.

Section Summary: Esophageal Disorders
Other available modalities are superior to CE. The diagnostic characteristics of CE are inadequate to substitute for other modalities or to triage patients to other modalities.

Hereditary GI Polyposis Syndromes
Persons with familial adenomatous polyposis and Peutz-Jeghers syndrome are genetically at high risk of small bowel polyps and tumors. Mata et al (2005) studied the role of CE in 24 patients with hereditary GI polyposis syndromes, including familial adenomatous polyposis (n=20) or Peutz-Jeghers syndrome (n=4).24 Compared with barium studies using small bowel enteroclysis, CE identified 4 additional patients with small bowel polyps, which were subsequently removed with endoscopic polypectomy. A study by Brown et al (2006) in 19 patients showed a greater number of polyps identified with CE than with barium follow-through examinations.25 Urquhart et al (2014) compared CE with MRE in 20 patients with Peutz-Jeghers syndrome.26 CE identified more polyps 10 mm or larger (47 polyps) than MRE (14 polyps; p=0.02). However, subsequent balloon enteroscopy in 12 patients showed a poor correlation of findings between techniques, with a 100% PPV of finding a polyp on balloon enteroscopy with MRE vs 60% for CE. Although these studies were small, they demonstrated that CE can identify additional lesions compared with other diagnostic methods in persons with disease syndromes at high risk for such lesions.
The lifetime risk of small bowel cancer in Lynch syndrome has been estimated at 5%. Although not extremely high, this risk is greatly increased compared with the general population. There are a few case series of the prevalence of neoplastic lesions in asymptomatic patients in patients with Lynch syndrome. In the study by Saurin et al (2010), 35 asymptomatic patients with Lynch syndrome underwent colon CE. Small bowel neoplasms were diagnosed in 3 (8.6%) patients (1 adenocarcinoma, 2 adenomas with low-grade dysplasia). In a larger study by Haanstra et al (2015), 200 patients with Lynch syndrome underwent CE. Small bowel neoplasia was detected in the duodenum in 2 patients (1 adenocarcinoma, 1 adenoma). These lesions would have been in the reach of a gastroduodenoscope.

Section Summary: Hereditary GI Polyposis Syndromes
Although these studies showed at least a low prevalence of small bowel neoplasms, these data are insufficient to determine whether evaluation with CE would improve patient outcomes. Further information on the prevalence and natural history of small bowel polyps in Lynch syndrome patients is necessary. At this time, surveillance of the small bowel is not generally recommended as a routine intervention for patients with Lynch syndrome.

Portal Hypertensive Enteropathy
Patients with liver cirrhosis and portal hypertension can develop portal hypertensive enteropathy, which may lead to GI bleeding. CE has been considered as a diagnostic tool for portal hypertensive enteropathy. Several systematic reviews have been published.

A Cochrane systematic review on the use of CE for the diagnosis of esophageal varices was published in 2014. This analysis included 16 studies of adults with cirrhosis. All patients underwent CE followed by esophagogastroduodenoscopy. Most studies were judged at high risk for bias. On pooled analysis, the sensitivity of CE was 84.8% (95% CI, 77.3% to 90.2%) and the specificity was 84.3% (95% CI, 73.1% to 91.4%). A subset analysis of studies that were at low risk for bias reported a sensitivity of 79.7% (95% CI, 73.1% to 85.0%) and a specificity of 86.1% (95% CI, 64.5% to 95.5%).

In 2017, McCarty et al included 17 studies on wireless CE for identifying esophageal varices in patients with portal hypertension and had findings similar to the Cochrane review. Studies used either the first- or second-generation PillCam capsule. The investigators assessed the quality of individual studies and found that 8 studies were at high risk of bias. However, there was a low risk of bias in most studies in terms of whether an appropriate reference standard had been used. In a pooled analysis, the sensitivity and specificity of CE for diagnosing esophageal varices were 83% (95% CI, 76% to 89%) and 85% (95% CI, 75% to 91%), respectively.

Section Summary: Portal Hypertensive Enteropathy
CE has been used to diagnose portal hypertensive enteropathy. Systematic reviews of studies of its diagnostic performance for this purpose reported limited sensitivity and specificity. Because neither the sensitivity nor the specificity was high for identifying esophageal varices, CE could not be used instead of esophagogastroduodenoscopy nor could it be used to triage patients to esophagogastroduodenoscopy. Based on these diagnostic characteristics, the test does not appear to have clinical utility.
Acute Upper GI Tract Bleeding
Clinical Context and Test Purpose
The question addressed in this portion of the evidence review is whether there is sufficient evidence that wireless CE leads to improved diagnosis and better health outcomes in patients with acute upper GI tract bleeding compared with standard approaches.

The following PICOTS were used to select literature to inform this review.

Patients
The relevant population of interest is patients with acute GI tract bleeding.

Interventions
The intervention of interest is wireless CE.

Comparators
The comparator of interest is a standard workup of acute bleeding without wireless CE and, with or without direct endoscopic procedures or specialized gastrointestinal imaging.

Outcomes
The outcomes of interest for diagnostic accuracy include test accuracy and test validity (ie, sensitivity, specificity). The primary outcomes of interest for clinical utility are symptoms and disease status that would change due to patient management decisions following wireless CE. Other outcomes of interest for clinical utility are avoidance of hospitalizations and resource utilization (eg, need for additional testing or procedures).

Timing
Wireless CE would be performed as soon as possible after acute bleeding is identified.

Setting
The test would be performed in in an urgent care or emergency setting.

Technical Reliability
For CE, in general, very little evidence exists for most indications regarding technical reliability, which in this case would evaluate concordance between different examinations in the same person and concordance between different examiners.

Clinical Validity and Clinical Utility
In 2016, Sung et al reported on a prospective randomized controlled trial to evaluate the use of CE in the emergency department for patients with suspected upper GI bleeding. CE was used to determine whether patients would be admitted to the hospital or sent home, vs an alternative strategy of admitting all patients. Eligible patients presented with signs and/or symptoms of acute upper GI bleeding but were without hemodynamic shock or conditions likely to preclude the use of the capsule endoscope. Seventy-one patients were randomized to CE in the emergency department (n=37), followed by monitoring for upper GI bleeding, or standard care (n=34), which included mandatory hospital admission. Seven CE patients with active bleeding or endoscopic findings were admitted, with the remainder discharged home. There were no deaths or morbid outcomes in either group, indicating that CE could result in equivalent patient outcomes with many patients safely avoiding emergency hospitalization.
Three 2013 studies with small cohorts of patients (range, 25-83 patients) have reported on the use of CE before upper endoscopy for acute GI bleeding, to triage and/or risk-stratify patients in the emergency department or hospital.32-34 These studies reported that CE provides useful information, such as identifying gross bleeding and inflammatory lesions in a substantial proportion of patients and in stratifying patients into high- or low-risk categories. However, the yield of CE in localizing the bleeding source was lower than for esophagogastroduodenoscopy, which is the standard initial evaluation for acute upper GI bleeding.

*Section Summary: Acute Upper GI Tract Bleeding*
Use of CE in the emergency department setting for suspected upper GI bleeding is based on efficiency (avoiding hospitalization, avoiding immediate endoscopy). Further controlled studies are needed to assess further the impact of CE on health outcomes compared with standard management. Patients should be followed to their ultimate diagnosis to determine whether the use of CE vs other triage strategies or immediate endoscopy results in lower health care resource utilization.

**Colon Cancer Screening**
**Clinical Context and Test Purpose**
The question addressed in this portion of the evidence review is whether there is sufficient evidence that wireless CE leads to improved diagnosis and better health outcomes in patients who are being screened for colon cancer compared with other screening modalities. The following PICOTS were used to select literature to inform this review.

**Patients**
The relevant population of interest is patients who are undergoing colon cancer screening.

**Interventions**
The intervention of interest is wireless CE.

**Comparators**
The comparator of interest is a standard workup without wireless CE.

**Outcomes**
The outcomes of interest for diagnostic accuracy include test accuracy and test validity (ie, sensitivity, specificity). The primary outcomes of interest for clinical utility are overall mortality and disease-specific mortality from colon cancer.

**Timing**
Wireless CE would be performed after an initial clinical examination.

**Setting**
The test would be performed in the outpatient specialty setting (gastroenterology).

**Technical Reliability**
For CE, in general, very little evidence exists for most indications regarding technical reliability, which in this case would evaluate concordance between different examinations in the same person and concordance between different examiners.
Clinical Validity and Clinical Utility
Several studies have assessed the accuracy of CE for detection of colonic lesions. In 2016, Spada et al reported on a systematic review and meta-analysis of the diagnostic accuracy of CE for detecting colorectal polyps with stratified results for first- and second-generation capsules.35 Across the 14 eligible studies, the indications for endoscopy included colorectal cancer screening (n=1261 [47%]), postpolypectomy surveillance or family history of colorectal cancer (n=636 [24%]), symptoms suggestive of cancer and/or fecal occult blood test positivity (n=619 [23%]), positive imaging tests (n=136 [5%]), or other indication (24 [1%]). Characteristics of the systematic review and its main findings are summarized in Tables 1 and 2, respectively.

### Table 1. Colon Cancer Screening Systematic Review Characteristics

<table>
<thead>
<tr>
<th>Study (Year)</th>
<th>Dates</th>
<th>Trials</th>
<th>N (Range)</th>
<th>Design</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spada et al</td>
<td>2006-2015</td>
<td>14</td>
<td>2681 (40-884)</td>
<td>Diagnostic accuracy studies</td>
<td>Per-patient sensitivity of CCE for different categories of polyp size and for cancer</td>
</tr>
</tbody>
</table>

CCE: colon capsule endoscopy.

### Table 2. Summary of Colon Cancer Screening Results for Capsule Endoscopy (Spada et al)

<table>
<thead>
<tr>
<th>Analysis</th>
<th>Trials</th>
<th>N</th>
<th>Outcomes</th>
<th>Effect Size</th>
<th>95% CI</th>
<th>I², %</th>
</tr>
</thead>
</table>
| Random-effects model for ≥10 mm polyps | 10     | NR | Diagnostic accuracy for ≥10 mm polyps | Sens=80.0%  
Spec=96.2%   
PLR=18.6  
NLR=0.22  
DOR=90.4  
AUC=0.94 | 66% to 90.3%  
94.0% to 97.6%  
12.0 to 28.2  
0.13 to 0.34  
44 to 163  
0.88 to 1.00 | 53.4  
31.3 |
| Random-effects model for ≥6 mm polyps using 1st-generation CCE | 7     | NR | Diagnostic accuracy for ≥6 mm polyps using 1st-generation CCE | Sens=58%  
Spec=85.7%  
PLR=3.7  
NLR=0.51  
DOR=7.4 | 44% to 70%  
80.2% to 90.0% | 65 |
| Random-effects model for ≥6 mm polyps using 2nd-generation CCE | 6     | NR | Diagnostic accuracy for ≥6 mm polyps using 2nd-generation CCE | Sens=86%  
Spec=88.1%  
PLR=7.9  
NLR=0.16  
DOR=50.5 | 82% to 89%  
74.2% to 95.0%  
3.7 to 16.1  
0.12 to 0.21  
20.3 to 107.0 | 0 |
| Random-effects model for ≥10 mm polyps using 1st-generation CCE | 3     | NR | Diagnostic accuracy for ≥6 mm polyps using 1st-generation CCE | Sens=54%  
Spec=97.4%  
PLR=NR  
NLR=NR  
DOR=NR | 29% to 77%  
96.0% to 98.3% | 76.2  
0 |
| Random-effects model for ≥10 mm polyps using 2nd-generation CCE | 6     | NR | Diagnostic accuracy for ≥6 mm polyps using 2nd-generation CCE | Sens=8876%  
Spec=95.3%  
PLR=NR  
NLR=NR  
DOR=NR | 81% to 91%  
91.5% to 97.5% | 0  
67 |

AUC: area under the curve; CCE: colon capsule endoscopy; CI: confidence interval; DOR: diagnostic odds ratio; NLR: negative likelihood ratio; NR: not reported; PLR: positive likelihood ratio; Sens: sensitivity; Spec: specificity.

There were no missed cancers (n=11) in the series using second-generation CE (per-patient sensitivity, 100%). In series using first-generation CE, 6 of 26 proven cancers were missed on CE (per-patient sensitivity, 77%).

Other recent studies by Saito et al (2015), Morgan et al (2016), and Parodi (2017) have evaluated the diagnostic characteristics of CE, using subsequently performed colonoscopy as the reference standard.36-38 In the study by Saito et al, of 66 evaluable patients, per-patient
Wireless Capsule Endoscopy to Diagnose Disorders of
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sensitivity for detection of polyps was 94% (95% CI, 88.2% to 99.7%). In the study by Morgan et al, for lesions 10 mm or larger, sensitivity of CE was 100% (95% CI, 56.1% to 100%), with a specificity of 93.0% (95% CI, 79.9% to 98.2%). For lesions 6 mm or larger, sensitivity was 93.3% (95% CI, 66.0% to 99.7%) and the specificity was 80.0% (95% CI, 62.5% to 90.9%). Parodi et al included 177 first-degree relatives of individuals with colorectal cancer and found, for lesions 6 mm or larger, a sensitivity of 91% (95% CI, 81% to 96%) and a specificity of 88% (95% CI, 81% to 93%).

Section Summary: Colon Cancer Screening
Studies of diagnostic characteristics alone are insufficient evidence to determine the efficacy of CE for colon cancer screening. Because diagnostic performance is worse than standard colonoscopy, CE would need to be performed more frequently than standard colonoscopy to have comparable efficacy potentially. Without direct evidence of efficacy in a clinical trial of colon cancer screening using CE, modeling studies using established mathematical models of colon precursor incidence and progression to cancer could provide estimates of efficacy in preventing colon cancer mortality. Studies of CE in screening populations are necessary to determine the diagnostic characteristics of the test in this setting.

Bowel Stricture
Contraindications to the use of CE include known or suspected obstruction or stricture, Zenker diverticulum, intestinal pseudo-obstruction, and motility disorders. Certain patients with known or suspected strictures of the small bowel may be at risk of retaining the capsule. Surgical removal may be necessary. The patency capsule is proposed as a technique to evaluate patients with known or suspected strictures before using the wireless CE system. The capsule could be to select patients for CE instead of assessing clinical risk factors. It needs to be determined whether the change in diagnostic strategy and ultimate treatment improved as a consequence of either being selected or deselected to have a CE.

Clinical Context and Test Purpose
The question addressed in this portion of the evidence review is whether there is sufficient evidence that a patency capsule before wireless CE leads to improved diagnosis and better health outcomes in patients with suspected GI conditions compared with no patency capsule.

The following PICOTS were used to select literature to inform this review.

Patients
The relevant population of interest is patients who are scheduled to undergo CE for known or suspected small bowel stricture.

Interventions
The intervention of interest is a patency capsule before wireless CE.

Comparators
The comparators of interest are CE without patency capsule or a standard workup without CE.

Outcomes
The outcomes of interest for diagnostic accuracy include test accuracy and test validity (ie, sensitivity, specificity). The primary outcomes of interest for clinical utility are symptoms and
disease status that would change due to patient management decisions following patency capsule use. Another outcome of interest is treatment-related morbidity because there is risk associated with the use of the patency capsule.

**Timing**
Patency capsules would be performed before wireless CE; exact timing depends on the specific indication being evaluated.

**Setting**
The test would be performed in the outpatient specialty setting (gastroenterology).

**Technical Reliability**
For patency capsules, there is a lack of evidence regarding technical reliability, which in this case would evaluate concordance between different examinations in the same person and concordance between different examiners.

**Clinical Validity and Clinical Utility**
The use of the patency capsule has some risk itself. Published studies are small and do not provide comparative data on the incremental value of this capsule over standard clinical evaluation. In some series, administration of the patency capsule has produced symptoms requiring hospitalization and even surgery. In a series from Europe, Delvaux et al (2005) reported on findings in 22 patients with suspected intestinal stricture, 15 of whom had CD. In this study, at 30 hours after ingestion, the patency capsule was detected in 17 (72.3%) patients. In all patients in whom the capsule was blocked in the small intestine, the stenosis had been suspected on CT scan or small bowel follow-through. In 3 patients, the delay in progression of the patency capsule led to cancellation of capsule endoscopy. In 3 patients, the patency capsule induced a symptomatic intestinal occlusion, which resolved spontaneously in one and required emergency surgery in two. The authors commented that the current technical development of the patency capsule limits its use in clinical practice, because it did not detect stenoses undiagnosed by CT or small bowel follow-through, and the start of dissolution at 40 hours after ingestion is too slow to prevent episodes of intestinal occlusion. They also commented that a careful interview eliciting the patient's history and symptoms remains the most useful indicator for suspicion of an intestinal stenosis. In another European study, Spada et al (2007) reported on findings for 27 patients, 24 with CD. In this study, 25 (92.6%) patients retrieved the patency capsule in their stools. Six patients complained of abdominal pain, four of whom excreted a nonintact capsule, and hospitalization was required in 1 patient due to the occlusive syndrome.

Several studies have shown that patients who had uncomplicated passage of the patency capsule subsequently underwent uncomplicated CE. These patients often had significant findings on CE. However, it is difficult to determine whether the findings of CE in these patients improved their outcomes beyond any alternative testing regimen that could have been done. In one of these studies, 3 of 106 patients had severe adverse events, including 1 patient who required surgery.

**Section Summary: Bowel Stricture**
The overall balance of harm and benefit of using the patency capsule cannot be determined from the existing studies.
SUMMARY OF EVIDENCE

Patients with Suspected GI Disorders
For individuals who have suspected small bowel bleeding (previously referred to as obscure GI bleeding) who receive wireless CE, the evidence includes numerous case series evaluating patients with a nondiagnostic standard workup. Relevant outcomes are test accuracy and validity, other test performance measures, symptoms, and change in disease status. The evidence has demonstrated that CE can identify a bleeding source in a substantial number of patients who cannot be diagnosed by other methods, with a low incidence of adverse events. Because there are few other options for diagnosing obscure small bowel bleeding in patients with negative upper and lower endoscopy, this technique will likely improve health outcomes by directing specific treatment when a bleeding source is identified. The evidence is sufficient to determine that the technology results in a meaningful improvement in the net health outcome. For individuals who suspected small bowel CD who receive wireless CE, the evidence includes case series. Relevant outcomes are test accuracy and validity, other test performance measures, symptoms, and change in disease status. Although the test performance characteristics and diagnostic yields of the capsule for these indications are uncertain, the diagnostic yields are as good as or better than other diagnostic options, and these data are likely to improve health outcomes by identifying some cases of CD and directing specific treatment. The evidence is sufficient to determine that the technology results in a meaningful improvement in the net health outcome.

For individuals who have suspected celiac disease who receive wireless CE, the evidence includes case series and diagnostic accuracy studies. Relevant outcomes are test accuracy and validity, other test performance measures, symptoms, and change in disease status. The diagnostic characteristics of CE are inadequate enough to substitute for other modalities or to triage patients to other modalities. For other conditions (eg, determining the extent of CD), direct evidence of improved outcomes or a strong indirect chain of evidence to improved outcomes is lacking. The evidence is insufficient to determine the effects of the technology on health outcomes.

For individuals who have unexplained chronic abdominal pain who receive wireless CE, the evidence includes case series and diagnostic accuracy studies. Relevant outcomes are test accuracy and validity, other test performance measures, symptoms, and change in disease status. The diagnostic characteristics of CE are inadequate to substitute for other modalities or to triage patients to other modalities. For other conditions (eg, determining the extent of CD), direct evidence of improved outcomes or a strong chain of evidence to improved outcomes is lacking. The evidence is insufficient to determine the effects of the technology on health outcomes.

Patients with Confirmed GI Disorders
For individuals who have an established diagnosis of CD who receive wireless CE, the evidence includes diagnostic accuracy studies and a systematic review. Relevant outcomes are test accuracy and validity, other test performance measures, symptoms, and change in disease status. A 2017 systematic review of 11 studies in patients with established CD found a similar diagnostic yield with CE compared with radiography. Because there is evidence that the diagnostic yields are as good as or better than other diagnostic options, there is indirect evidence that CE is likely to improve health outcomes by identifying some cases of CD and
directing specific treatment. The evidence is sufficient to determine that the technology results in a meaningful improvement in the net health outcome.

For individuals who have ulcerative colitis who receive wireless CE, the evidence includes case series and diagnostic accuracy studies. Relevant outcomes are test accuracy and validity, other test performance measures, symptoms, and change in disease status. Several diagnostic accuracy studies have compared CE with colonoscopy to assess disease activity in patients with ulcerative colitis. Two of 3 studies were small (ie, <50 patients) and thus data on diagnostic accuracy are limited. Direct evidence of improved outcomes or a strong chain of evidence to improved outcomes is lacking. The evidence is insufficient to determine the effects of the technology on health outcomes.

For individuals who have esophageal disorders who receive wireless CE, the evidence includes case series and diagnostic accuracy studies. Relevant outcomes are test accuracy and validity, other test performance measures, symptoms, and change in disease status. Other available modalities are superior to CE. The diagnostic characteristics of CE are inadequate to substitute for other modalities or to triage patients to other modalities. The evidence is insufficient to determine the effects of the technology on health outcomes.

For individuals who have hereditary polyposis syndromes who receive wireless CE, the evidence includes case series and diagnostic accuracy studies. Relevant outcomes are test accuracy and validity, other test performance measures, symptoms, and change in disease status. The data are insufficient to determine whether evaluation with CE would improve patient outcomes. Further information on the prevalence and natural history of small bowel polyps in Lynch syndrome patients is necessary. At present, surveillance of the small bowel is not generally recommended as a routine intervention for patients with Lynch syndrome. The evidence is insufficient to determine the effects of the technology on health outcomes.

For individuals who have portal hypertensive enteropathy who receive wireless CE, the evidence includes case series and diagnostic accuracy studies. Relevant outcomes are test accuracy and validity, other test performance measures, symptoms, and change in disease status. Systematic reviews of studies of its diagnostic performance for this purpose reported limited sensitivity and specificity. Due to insufficient data on diagnostic accuracy, a chain of evidence on clinical utility cannot be constructed. The evidence is insufficient to determine the effects of the technology on health outcomes.

**Acute Upper GI Bleeding**

For individuals who have acute upper GI tract bleeding who receive wireless CE, the evidence includes a randomized controlled trial and several cohort studies. Relevant outcomes are test accuracy and validity, and other test performance measures, symptoms, change in disease status, and resource utilization. The use of CE in the emergency department setting for suspected upper GI bleeding is based on efficiency (avoiding hospitalization, avoiding immediate endoscopy). Further controlled studies are needed to assess further the impact of CE on health outcomes compared with standard management. The evidence is insufficient to determine the effects of the technology on health outcomes.
Colon Cancer Screening
For individuals who are screened for colon cancer who receive wireless CE, the evidence includes diagnostic accuracy studies and systematic reviews. Relevant outcomes are overall survival, disease-specific survival, test accuracy and validity, and other test performance measures. Studies of CE in screening populations are necessary to determine the diagnostic characteristics of the test in this setting. Studies of diagnostic characteristics alone are insufficient evidence to determine the efficacy of CE for colon cancer screening. Because diagnostic performance is worse than standard colonoscopy, CE would need to be performed more frequently than standard colonoscopy to have comparable efficacy potentially. Without direct evidence of efficacy in a clinical trial of colon cancer screening using CE, modeling studies using established mathematical models of colon precursor incidence and progression to cancer could provide estimates of efficacy in preventing colon cancer mortality. The evidence is insufficient to determine the effects of the technology on health outcomes.

Patency Capsule for Patients with Bowel Stricture
For individuals who are scheduled to undergo CE for known or suspected small bowel stricture who receive a patency capsule, the evidence includes case series. Relevant outcomes are test accuracy and validity, symptoms, change in disease status, and treatment-related morbidity. The available studies have reported that CE following a successful patency capsule test results in high rates of success with low rates of adverse events. The capsule is also associated with adverse events. Because of the lack of comparative data to other diagnostic strategies, it is not possible to determine whether the use of the patency capsule improves the net health outcome. The evidence is insufficient to determine the effects of the technology on health outcomes.

PRACTICE GUIDELINES AND POSITION STATEMENTS
Canadian Association of Gastroenterology
In 2017, the Canadian Association of Gastroenterology published guidelines on the use of video capsule endoscopy (CE), which included the following consensus recommendations (majority voting for recommendation) (see Table 3).44

Table 3. Recommendations on Use of Video CE

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>QOE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crohn disease</td>
<td></td>
</tr>
<tr>
<td>Patients presenting with clinical features consistent with Crohn disease and negative ileocolonoscopy and imaging studies</td>
<td>Very low or low</td>
</tr>
<tr>
<td>Patients with Crohn disease and clinical features not explained by negative ileocolonoscopy and imaging studies</td>
<td>Very low or low</td>
</tr>
<tr>
<td>Patients with Crohn disease, when assessment of small-bowel mucosal healing is needed, and the area is beyond the reach of ileocolonoscopy</td>
<td>Very low or low</td>
</tr>
<tr>
<td>Patients with suspected small bowel recurrence of Crohn disease after colectomy, undiagnosed by ileocolonoscopy and imaging studies</td>
<td>Very low or low</td>
</tr>
<tr>
<td>Celiac disease</td>
<td></td>
</tr>
<tr>
<td>Recommend against CE in patients with suspected celiac disease</td>
<td>Very low or low</td>
</tr>
<tr>
<td>Recommend for CE in patients with celiac disease and unexplained symptoms despite treatment and appropriate investigations</td>
<td>Very low or low</td>
</tr>
<tr>
<td>Gastrointestinal bleeding</td>
<td></td>
</tr>
<tr>
<td>Recommend for CE in patients with documented overt gastrointestinal bleeding (excluding hematemesis) and negative colonoscopy and high-quality esophagogastroduodenoscopy</td>
<td>Very low or low</td>
</tr>
<tr>
<td>Recommend for CE in patients with an overt, obscure bleeding episode</td>
<td>Very low or low</td>
</tr>
</tbody>
</table>
Recommendation | QOE
--- | ---
Recommend for endoscopy, colonoscopy and/or CE in patients with prior negative CE who have repeated obscure bleeding | Very low or low

CE: capsule endoscopy; QOE: quality of evidence (all consensus based).

**American College of Gastroenterology**

In 2013, the American College of Gastroenterology (ACG) issued guidelines on the diagnosis and management of celiac disease. The guidelines recommended that CE not be used for initial diagnosis, except for patients with positive celiac–specific serology who are unwilling or unable to undergo upper endoscopy with biopsy (strong recommendation, moderate level of evidence).

CE should be considered for the evaluation of small bowel mucosa in patients with complicated Crohn disease (CD; strong recommendation, moderate level of evidence).

ACG issued guidelines in 2009 on the management of CD in adults. The guidelines indicated that use of video CE had been assessed in a prospective blinded evaluation and was shown to be superior in its ability to detect small bowel pathology missed on small bowel radiographic studies and computed tomography radiographic examinations. However, because there is a risk of capsule retention in up to 13% of patients with CD, which could require surgical intervention, CE is considered to be a contraindication in patients with known small bowel strictures. It was recommended that radiographic studies such as computed tomography enterography, small bowel follow-through, or magnetic resonance imaging be done to assess for the presence of unsuspected bowel strictures before CE. A patency capsule may also be considered.

In 2015, ACG issued guidelines on the diagnosis and management of small bowel bleeding (including using “small bowel bleeding” to replace “obscure GI [gastrointestinal] bleeding,” which should be reserved for patients in whom a source of bleeding cannot be identified anywhere in the GI tract). These guidelines made the following statements related to video CE (see Table 4).

**American Society of Gastrointestinal Endoscopy**

In 2016, the American Society of Gastrointestinal Endoscopy published guidelines for the use of endoscopy in the management of suspected small bowel bleeding. These guidelines made the following recommendations on capsule endoscopy (VCE) (see Table 5).

---

**Table 4. Recommendations on Diagnosis and Management of Small Bowel Bleeding**

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>SOR</th>
<th>LOE</th>
</tr>
</thead>
<tbody>
<tr>
<td>“… VCE should be considered as a first-line procedure for SB evaluation after upper and lower GI sources have been excluded, including second-look endoscopy when indicated”</td>
<td>Strong</td>
<td>Moderate</td>
</tr>
<tr>
<td>“VCE should be performed before deep enteroscopy to increase diagnostic yield. Initial deep enteroscopy can be considered in cases of massive hemorrhage or when VCE is contraindicated”</td>
<td>Strong</td>
<td>High</td>
</tr>
</tbody>
</table>

LOE: level of evidence; SB: small bowel; SOR: strength of recommendation; VCE: video capsule endoscopy.

**Table 5. Recommendations on Use of Endoscopy to Manage Suspected Small Bowel Bleeding**

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>QOE</th>
</tr>
</thead>
<tbody>
<tr>
<td>We suggest VCE as the initial test for patients with overt or occult small-bowel bleeding. Positive VCE results should be followed with push enteroscopy if within reach or DAE.”</td>
<td>Moderate</td>
</tr>
<tr>
<td>“We suggest DAE or push enteroscopy if VCE is unavailable or nondiagnostic in patients with overt small bowel bleeding.”</td>
<td>Moderate</td>
</tr>
</tbody>
</table>
American Gastroenterological Association
A 2007 position statement by AGA\(^1\) states the following concerning obscure GI bleeding and capsule endoscopy:
- Evaluation of the patient with obscure GI bleeding is dependent on the extent of the bleeding and the age of the patient.
- Patients with occult GI blood loss and no anemia most likely do not require evaluation beyond colonoscopy unless upper tract symptoms are present.
- Patients with occult GI blood loss and iron-deficiency anemia and negative workup on esophagogastroduodenoscopy (EGD) and colonoscopy need comprehensive evaluation, including capsule endoscopy to identify an intestinal bleeding lesion.

European Crohn's and Colitis Organisation and Organisation Mondiale d'Endoscopie Digestive
An international consensus panel from 2009 published guidelines on the use of wireless capsule endoscopy for inflammatory bowel disease.\(^9\)

European Society of Gastrointestinal Endoscopy
In 2012, the European Society of Gastrointestinal Endoscopy published guidelines on colon CE, which made the following statements on indications for colon CE\(^49\):
- “CCE [colon capsule endoscopy] is feasible and safe and appears to be accurate when used in average-risk individuals (Evidence level 2++, Recommendation grade C).”
- “CCE screening may be cost-effective if it increases screening uptake compared with colonoscopy (Evidence level 4, Recommendation grade D).”

European Commission
European guidelines for quality assurance in colorectal cancer screening and diagnosis, published in 2012, indicate capsule endoscopy is not recommended for screening for colorectal cancer.\(^50\) These guidelines indicate studies have shown capsule endoscopy to be inferior to colonoscopy in diagnostic performance.

U.S. PREVENTIVE SERVICES TASK FORCE RECOMMENDATIONS
The U.S. Preventive Services Task Force published its most recent recommendations for colorectal cancer (CRC) screening in June 2016. CRC screening is recommended starting at age 50 years and continuing until age 75 years (A recommendation).\(^51\) Studies evaluating capsule endoscopy were not included in the evidence reviews in this report.

ONGOING AND UNPUBLISHED CLINICAL TRIALS
Some currently unpublished trials that might influence this review are listed in Table 6.

Table 6. Summary of Key Trials

<table>
<thead>
<tr>
<th>NCT No.</th>
<th>Trial Name</th>
<th>Planned Enrollment</th>
<th>Completion Date</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ongoing</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NCT02754661(^a)</td>
<td>Evaluation the Efficacy of Colon Capsule Endoscopy (CCE) Versus Computed Tomographic Colonography (CTC) in the Identification of Colonic Polyps in a Screening Population. (TOPAZ)</td>
<td>320</td>
<td>Dec 2017</td>
</tr>
<tr>
<td>NCT01371591(^a)</td>
<td>Capsule Endoscopy for Hemorrhage in the Emergency Room (CHEER)</td>
<td>100</td>
<td>Aug 2018</td>
</tr>
</tbody>
</table>

\(^a\) Indicates ongoing clinical trials.
Wireless Capsule Endoscopy to Diagnose Disorders of the Small Bowel, Esophagus, and Colon

<table>
<thead>
<tr>
<th>NCT No.</th>
<th>Trial Name</th>
<th>Planned Enrollment</th>
<th>Completion Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCT03241368a</td>
<td>Clinical Study Comparing PillCam® Crohn's Capsule Endoscopy to Ileocolonoscopy (IC) Plus MRE for Detection of Active CD in the Small Bowel and Colon in Subjects With Known CD and Mucosal Disease (BLINK)</td>
<td>352</td>
<td>Aug 2020</td>
</tr>
</tbody>
</table>

NCT: national clinical trial.
a Denotes industry-sponsored or cosponsored trial.

**CODING**

The following codes for treatment and procedures applicable to this policy are included below for informational purposes. Inclusion or exclusion of a procedure, diagnosis or device code(s) does not constitute or imply member coverage or provider reimbursement. Please refer to the member's contract benefits in effect at the time of service to determine coverage or non-coverage of these services as it applies to an individual member.

**CPT/HCPCS**

- **91110** Gastrointestinal tract imaging, intraluminal (eg, capsule endoscopy), esophagus through ileum, with physician interpretation and report
- **91111** Gastrointestinal tract imaging, intraluminal (eg, capsule endoscopy), esophagus, with physician interpretation and report
- **0355T** Gastrointestinal tract imaging, intraluminal (eg, capsule endoscopy), colon, with interpretation and report

**ICD-10 Diagnoses**

- **D13.2** Benign neoplasm of duodenum
- **D13.39** Benign neoplasm of other parts of small intestine
- **K50.00** Crohn's disease of small intestine without complications
- **K50.011** Crohn's disease of small intestine with rectal bleeding
- **K50.012** Crohn's disease of small intestine with intestinal obstruction
- **K50.013** Crohn's disease of small intestine with fistula
- **K50.014** Crohn's disease of small intestine with abscess
- **K50.018** Crohn's disease of small intestine with other complication
- **K50.10** Crohn's disease of large intestine without complications
- **K50.111** Crohn's disease of large intestine with rectal bleeding
- **K50.112** Crohn's disease of large intestine with intestinal obstruction
- **K50.113** Crohn's disease of large intestine with fistula
- **K50.114** Crohn's disease of large intestine with abscess
- **K50.118** Crohn's disease of large intestine with other complication
- **K50.80** Crohn's disease of both small and large intestine without complications
- **K50.811** Crohn's disease of both small and large intestine with rectal bleeding
- **K50.812** Crohn's disease of both small and large intestine with intestinal obstruction
- **K50.813** Crohn's disease of both small and large intestine with fistula
- **K50.814** Crohn's disease of both small and large intestine with abscess
- **K50.818** Crohn's disease of both small and large intestine with other complication
- **K50.90** Crohn's disease, unspecified, without complications
- **K50.911** Crohn's disease, unspecified, with rectal bleeding
- **K50.912** Crohn's disease, unspecified, with intestinal obstruction
- **K50.913** Crohn's disease, unspecified, with fistula

K50.918 Crohn's disease, unspecified, with other complication
K52.0 Gastroenteritis and colitis due to radiation
K52.1 Toxic gastroenteritis and colitis
K52.21 Food protein-induced enterocolitis syndrome
K52.22 Food protein-induced enteropathy
K52.29 Other allergic and dietetic gastroenteritis and colitis
K52.3 Indeterminate colitis
K52.831 Collagenous colitis
K52.832 Lymphocytic colitis
K52.838 Other microscopic colitis
K52.839 Microscopic colitis, unspecified
K52.89 Other specified noninfective gastroenteritis and colitis
K52.9 Noninfective gastroenteritis and colitis, unspecified
K92.0 Hematemesis
K92.1 Melena
K92.2 Gastrointestinal hemorrhage, unspecified
Q85.8 Other phakomatoses, not elsewhere classified
R10.0 Acute abdomen
R10.11 Right upper quadrant pain
R10.12 Left upper quadrant pain
R10.13 Epigastric pain
R10.2 Pelvic and perineal pain
R10.31 Right lower quadrant pain
R10.32 Left lower quadrant pain
R10.33 Periumbilical pain
R10.84 Generalized abdominal pain
R19.7 Diarrhea, unspecified
R50.2 Drug induced fever
R50.9 Fever, unspecified
R63.4 Abnormal weight loss

**REVISED**

| 06-29-2010 | Title was changed From: "Wireless Capsule Endoscopy"
              To: "Wireless Capsule Endoscopy as a Diagnostic Technique in Disorders of the Small Bowel, Esophagus, and Colon"

Description Section was updated.

In Policy Section:
- Updated policy From:
  "1. Wireless capsular endoscopy is considered medically necessary as an adjunctive diagnostic imaging tool when all other modalities have failed to identify the source of bleeding (e.g., colonoscopy, and upper endoscopy, or panendoscopy) and the patient continues to require active medical or surgical treatment for:
     a. Clinically significant bleeding (i.e., drop in hemoglobin or progressive anemia) in chronic or acute obscure small intestinal bleeding.
     b. Abdominal pain, diarrhea, fever, elevated white blood cell count, elevated erythrocyte sedimentation rate, weight loss, or bleeding in the initial diagnosis with suspected Crohn's disease or Crohn's disease."
2. Wireless capsular endoscopy is considered investigational for all other indications, including but not limited to the study of the colon or stomach and investigating suspected diseases in the absence of bleeding.

To:

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A. Wireless capsule endoscopy of the small bowel may be considered medically necessary for the following indications:
1. Initial diagnosis in patients with suspected Crohn's disease without evidence of disease on conventional diagnostic tests such as small-bowel follow-through (SBFT), and upper and lower endoscopy.
2. Obscure gastrointestinal (GI) bleeding suspected of being of small bowel origin, as evidenced by prior inconclusive upper and lower gastrointestinal endoscopic studies.
3. For surveillance of the small bowel in patients with hereditary GI polyposis syndromes, including familial adenomatous polyposis and Peutz-Jeghers syndrome.

B. Other indications of wireless capsule endoscopy are considered experimental / investigational, including but not limited to:
1. Evaluation of the extent of involvement of known Crohn's disease or ulcerative colitis.
2. Evaluation of the esophagus, in patients with gastroesophageal reflux (GERD) or other esophageal pathologies
3. Evaluation of other gastrointestinal diseases not presenting with GI bleeding including, but not limited to celiac sprue, irritable bowel syndrome, small bowel neoplasm
4. Evaluation of the colon including, but not limited to, detection of colonic polyps or colon cancer.

C. The patency capsule is considered experimental / investigational, including use to evaluate patency of the gastrointestinal tract before wireless capsule endoscopy.
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Added Rationale Section

In Coding Section:
- Added Diagnosis Codes: 211.2, 759.6

Updated References

08-19-2011 Updated Rational section.
Updated Reference section.

01-15-2013 In the Coding section:
- Added new CPT code: 91112 (Effective 01-01-2013)

Added Medical Policy and Coding Disclaimers

01-10-2014 Updated Description section.

In Policy section:
- In Item B, added "Initial evaluation of patients with acute GI bleeding."

Updated Rationale section.

In Coding section:
- Removed CPT code 91112
- Added ICD-10 Diagnosis (Effective October 1, 2014)

Updated Reference section.

12-11-2014 Updated Description section.

In Policy section:
- In Item A, added "2. In patients with an established diagnosis of Crohn's disease, when there are unexpected change(s) in the course of disease or response to treatment, suggesting the initial diagnosis may be incorrect and re-examination may be indicated.
- In Item B, #1, added "or ulcerative colitis", to read, "Evaluation of the extent of involvement of known Crohn's disease or ulcerative colitis."
In Item B, #3, added "Lynch syndrome, portal hypertensive enteropathy," and "unexplained chronic abdominal pain." to read, "Evaluation of other gastrointestinal diseases not presenting with GI bleeding including, but not limited, celiac sprue, irritable bowel syndrome, Lynch syndrome, portal hypertensive enteropathy, small bowel neoplasm, and unexplained chronic abdominal pain."

<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-24-2015</td>
<td>Updated Description section. In Policy section: In Item A 3, added &quot;performed during the current episode of illness&quot; to read, &quot;Obscure gastrointestinal (GI) bleeding suspected of being of small bowel origin, as evidence by prior inconclusive upper and lower gastrointestinal endoscopic studies performed during the current episode of illness.&quot; In Item B 3, added &quot;and conditions&quot; to read, &quot;Evaluation of other gastrointestinal diseases and conditions not presenting with GI bleeding, including, but not limited to, celiac sprue, irritable bowel syndrome, Lynch syndrome, portal hypertensive enteropathy, small bowel neoplasm, and unexplained chronic abdominal pain.&quot;</td>
</tr>
<tr>
<td>10-01-2016</td>
<td>In Coding section: Added ICD-10 code Q85.8. Updated References section.</td>
</tr>
<tr>
<td>01-18-2017</td>
<td>Updated Description section. Updated Rationale section. Updated References section.</td>
</tr>
<tr>
<td>01-30-2018</td>
<td>Updated Description section. In Policy section: In Item A 1, removed &quot;(SBFT)&quot; to read, &quot;Initial diagnosis in patients with suspected Crohn's disease without evidence of disease on conventional diagnostic tests such as small bowel follow-through and upper and lower endoscopy.&quot; Updated Policy Guidelines. Updated Rationale section. In Coding section: Removed ICD-9 codes. Updated References section.</td>
</tr>
</tbody>
</table>

REFERENCES


Other References
1. Blue Cross and Blue Shield of Kansas Surgery Liaison Committee meeting, August 18, 2004, (see Blue Cross and Blue Shield of Kansas Newsletter, Blue Shield Report. MAC–03-04); August 2014.
2. Blue Cross and Blue Shield of Kansas Medical Advisory Committee meeting, November 4, 2004 (see Blue Cross and Blue Shield of Kansas Newsletter, Blue Shield Report. MAC–03-04).
3. Blue Cross and Blue Shield of Kansas Surgery Liaison Committee CB, May 2010.