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Capsule Endoscopy



Advances in
Esophageal
Imaging

Management of GERD

Current Primary Care Approaches

Capsule Endoscopy

New Applications

Capsule Endoscopy

What Can We Expect?

When Is Esophageal Capsule Endoscopy Appropriate?

A Panel Discussion

UNIVERSITY OF
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Capsule Endoscopy



Advances in Esophageal Imaging

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Learning Objectives

After completing this CME activity, participants should be better able to

- Discuss the role of endoscopy in establishing grade of esophagitis and detecting complications of gastroesophageal reflux disease, including Barrett's esophagus
- Explain the indications and contraindications for use of the esophageal video capsule
- Compare capsule endoscopy with conventional endoscopy

Audience

Family physicians

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- **Christina Li, MPH, Goutham Rao, MD**, and **Rick E. Ricer, MD**, indicated that they have nothing to disclose.

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The University of Cincinnati College of Medicine has not reviewed the content of the CME Web site that is listed on page 14 as an additional resource.

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Management of GERD

Current Primary Care Approaches

Goutham Rao, MD

As we begin to consider ways in which video capsule technology can enhance management of gastroesophageal reflux disease (GERD), it is critical that we review current primary care approaches to GERD. Therefore, this article will discuss 3 key questions:

- What is the scope of the problem of GERD?
- How do primary care physicians manage GERD in their own clinical settings?
- What is a rational approach to the management of GERD?

■ Scope of the Problem of GERD

The American College of Gastroenterology (ACG) guidelines for the diagnosis and treatment of GERD define the condition “as symptoms or mucosal damage produced by the abnormal reflux of gastric contents into the esophagus.”¹ To some patients, GERD is merely a nuisance. Other patients find GERD symptoms disabling.

In addition to its impact upon individual patients, it is important to consider the burden of suffering that GERD exerts on society as a whole. This burden encompasses not only the severity and chronicity of the disease but also its substantial impact upon health care costs and the overall quality of life (QOL) of millions of Americans.

Severity and Chronicity

Locke and colleagues conducted a population-based study in Olmsted County, a largely rural county in Minnesota with a population of approximately 100,000 people.² The study used a gastroesophageal reflux questionnaire, which defined heartburn as “a burning pain or discomfort behind the breast bone in the chest” and acid regurgitation as a “bitter- or sour-tasting fluid coming

into the throat or mouth.”² The questionnaire was completed and returned by 1511 of 2073 eligible patients aged 25 to 74 years. Approximately 42% of the respondents said they had experienced heartburn, the most common symptom of GERD, in the past year; almost 18% said they had heartburn at least weekly. Acid regurgitation, another symptom that is specific for the diagnosis of GERD, was reported to have occurred during the past year in 45% and to have been experienced at least weekly by just over 6%.

Locke’s group showed that GERD is not only highly prevalent but also chronic and, in many patients, severe. The more frequently a patient experiences reflux, the more likely he or she is to report severe symptoms. Severe or very severe symptoms were reported by 11.2% of those with symptoms occurring at least weekly but only 2.3% of those respondents whose symptoms were infrequent. Notably, the majority of those with GERD symptoms had had them for 5 to 10 years or even longer.

Financial Burden

When one considers both direct and indirect costs, GERD appears to be by far the most expensive gastrointestinal problem in the United States.³ Examples of direct costs include office visits, inpatient/outpatient hospital care, urgent-care visits, and pharmaceutical costs. Indirect costs include expenses associated with losses in productivity and the intangible costs of pain and suffering. Taken together, the direct and indirect costs of GERD add up to almost \$10 billion annually.³ Not surprisingly, spending on medications comprises 63% of the costs associated with GERD.³ Overall medication costs associated with GERD may decrease in the future as a result of the recent availability of over-the-counter proton pump inhibitors (PPIs).

TABLE 1

Domains of Health-Related QOL in Patients With GERD

Mobility and self-care	Job/education
Walking	Attendance
Running	Concentration
Climbing	Task completion
Eating	Achievement/promotion
Grooming	Satisfaction
Physical endurance	Financial reward
Emotions	Relationships
Anger	Friendships
Embarrassment	Intimacy and sexual function
Anxiety	Body image
Irritability	Understanding from others
Happiness	Coping and support
Worries or fears	Relations with children and extended family
Ability to relax	
Frustration	Well-being
Depression/sadness	Fatigue
Satisfaction	Sleep
Leisure and recreation	Self-control
Travel	Energy
Food/drink	Treatment
Visits to friends' homes	Side effects
Vacation	Efficacy
Hobbies and sports	
Pain and discomfort	
Chest pain	
Abdominal discomfort	
Abdominal pain	
Symptoms	
Heartburn	Chest pain
Regurgitation	Cough
Recumbency	Bloating
Nausea	Belching
Gurgling	Flatulence
Dysphagia	Early satiety
Globus	Bad breath

QOL = quality of life; GERD = gastroesophageal reflux disease
Irvine E.J. *Gut*. 2004;53(suppl):iv35-iv39.

Impact of GERD on QOL

Symptoms of GERD, especially those that occur at night, severely impact patients' QOL. Many patients complain of heartburn or regurgitation that occurs when they are sleeping or in a recumbent position. In a survey of 1000 adults who experienced heartburn at least once per week, 791 reported that they had nighttime heartburn. The majority (75%) of those respondents said that the symptom affected their sleep; 42% said they had accepted the fact that they could not sleep through the night. The prevalence of sleep disturbances (ie, being kept awake or woken up during the night) was directly correlated with the weekly frequency of nighttime heartburn episodes.⁴

Health-related QOL, rather than just the presence or absence of symptoms, is a more comprehensive measure of the impact of an illness. It is the functional effect of an illness and its therapy on an individual, as perceived by that individual.^{5,7} Health-related QOL is assessed using questionnaires or surveys that can be scored quantitatively. Measurement of health-related QOL of patients with GERD encompasses several different domains and items (TABLE 1), taking into consideration not only the symptoms and signs of a disease but also a patient's physical and occupational function, emotional state, social interactions, and somatic sensations.⁵ From that standpoint, GERD has a significant impact on patients' mobility, ability to care for themselves, job/education, emotions, relationships, leisure/recreation, and general well-being. For example, the frustration and anger associated with the pain and discomfort of GERD often affects relationships and detracts from enjoyment of meals or one's ability to perform optimally at work or in school. Describing the overall impact of GERD in this fashion underscores the seriousness of the condition.

Regardless of how QOL is measured, the overall conclusion is the same: Limitations imposed by GERD on one's food/drink intake, vitality, and emotions will significantly reduce QOL. In 1 study, QOL of patients with untreated GERD was found to be similar to that of patients who had experienced an acute coronary event and lower than that of patients with diabetes, cancer, or other severe diseases.⁸ Moreover, in that same study, QOL reached levels similar to those of the general population within a few weeks of beginning PPI therapy.

How Primary Care Physicians Manage GERD

Chey and colleagues recently published the results of a national survey that gathered information on primary care physicians' practices and perceptions regarding man-

agement of GERD.⁹ Among other topics, the survey asked questions about prescribing patterns and issues concerning Barrett's esophagus, in an effort to identify areas of controversy and confusion. Of the 1046 physicians who completed the questionnaire, 83% said that they are able to prescribe a PPI as initial therapy for GERD and that they are not required for insurance reasons to "step up" from an H₂-receptor antagonist (H₂RA) to a PPI (TABLE 2). Most (87%) of the respondents said that they are comfortable with prescribing long-term PPI therapy, but only 64% of the respondents correctly instruct patients to take their PPIs prior to a meal. The vast majority, 87%, agreed that patients with GERD symptoms of 5 or more years' duration should undergo an endoscopy to screen for Barrett's esophagus.

These same physicians were asked how they would manage a patient with typical GERD symptoms who experiences partial but incomplete relief with a once-daily PPI and still has heartburn late in the evening and at night. A wide variety of responses were offered (TABLE 3). Fifteen percent of those who completed the survey said they would either increase the PPI dose while maintaining the once-daily schedule or switch to another PPI. Forty percent said they would increase the PPI dose and switch to a twice-daily schedule, whereas 31% said they would add an H₂RA at bedtime, and 14% said they would refer the patient to a gastroenterologist.⁹

How the ACG Says GERD Should Be Managed

The wide range of responses given by those who completed the above-mentioned survey by Chey's group is not surprising in light of the updated ACG guidelines, which are somewhat general and accommodate a number of different management approaches.¹ Some highlights from the ACG guidelines are as follows:

- Empirical therapy is appropriate for uncomplicated GERD: if a patient has symptoms consistent with GERD and responds to an initial trial of acid-suppressive treatment, an assumed diagnosis of GERD is reasonable.¹
- Initial endoscopy should be considered for 2 categories of patients: those with alarm symptoms (eg, dysphagia, odynophagia, bleeding, weight loss, or anemia) and those at higher risk for Barrett's esophagus. Patients with alarm symptoms are more likely to have peptic strictures and esophagitis than are those without such symptoms. Moreover, approximately 6% to 12% of patients who undergo endoscopy for symptoms of GERD are found to have Barrett's esophagus.¹⁰ The risk for Barrett's

TABLE 2

GERD Management in Primary Care: Results of a Survey by Chey et al

83% prescribe a PPI as initial therapy and are not required for insurance reasons to "step up" from another treatment to a PPI.

64% of surveyed physicians correctly recommend that patients take their PPI before eating.

87% are "very comfortable" with prescribing long-term PPI therapy.

87% agree that patients with GERD symptoms for 5 years or longer should have endoscopy to screen for Barrett's esophagus.

GERD = gastroesophageal reflux disease; PPI = proton pump inhibitor
 Chey WD, et al. *Am J Gastroenterol.* 2005;100:1237-1242.

TABLE 3

Scenario Management: Results of a Survey by Chey et al

A patient with typical GERD symptoms experiences partial but incomplete relief with a PPI given once daily. He/she still has heartburn in the late evening and at night. What would be your preferred course of action?

Responses

- Increase PPI dose (still once daily) or switch to another PPI: 15%
- Increase the PPI dose but give it twice daily: 40%
- Add an H₂RA at bedtime: 31%
- Refer to a gastroenterologist: 14%

GERD = gastroesophageal reflux disease; PPI = proton pump inhibitor;
 H₂RA = H₂-receptor antagonist
 Adapted with permission from Chey WD, et al. *Am J Gastroenterol.*
 2005;100:1237-1242.

esophagus increases with chronicity and duration of symptoms. The odds ratios for Barrett's esophagus among patients who have had GERD symptoms for 1 to 5 years and 5 to 10 years are 3.0 and 5.0, respectively, compared with patients who have had such symptoms for less than a year. The odds ratio more than doubles (6.4) for those patients who have experienced GERD symptoms of more than 10 years' duration.^{1,11,12}

- Lifestyle modifications and patient-directed therapy are reasonable for some patients. Although there is little evidence supporting the efficacy of lifestyle modifications with respect to controlling GERD symptoms, most primary care providers agree that there is not much harm in recommending measures that benefit patients' overall health (eg, smoking cessation, decreasing fat intake) or

that do not impose an unreasonable burden on patients (eg, avoiding recumbency for 3 hours after meals).¹

- The PPIs are the best initial choice of acid suppression for GERD because they relieve symptoms and heal esophagitis more rapidly and frequently than do H₂RAs.¹ In a meta-analysis of 43 studies that included patients with endoscopically proven moderate-to-severe erosive or ulcerative esophagitis, Chiba and colleagues found that 3 PPIs (ie, omeprazole, lansoprazole, and pantoprazole) relieved heartburn and healed esophagitis at significantly faster rates than did H₂RAs (ie, cimetidine, nizatidine, ranitidine, and famotidine).¹³ Specifically, 2 weeks of treatment with a PPI relieved symptoms in the same number of patients as did 8 weeks of treatment with an H₂RA and healed esophagitis in the same number of patients as did 12 weeks of treatment with an H₂RA.

A more recent meta-analysis by Caro and colleagues identified 26 randomized controlled trials comparing lansoprazole, rabeprazole, pantoprazole, or omeprazole with ranitidine, 300 mg/d, for acute treatment of endoscopically confirmed GERD.¹⁴ (At that time, ranitidine was the H₂RA most often compared with PPIs.) Pooled data showed that the rate of heartburn resolution after 4 weeks of treatment was 1.53 times higher with PPIs (95% confidence interval [CI], 1.37-1.72) than with H₂RAs. The 4-week and 8-week healing-rate ratios for PPIs, compared with ranitidine, also were higher.

Some patients will find H₂RAs (given in divided doses) satisfactory for less severe GERD; however, lower costs have been the primary motivation for recommending this less effective treatment option. That economic advantage is now mitigated by the availability of generic and over-the-counter PPIs.¹

- Continuous therapy to control symptoms and prevent complications may be appropriate for some patients. Discontinuation of treatment with a PPI often is followed by a rapid return of symptoms.¹

The ACG guidelines provide some useful general recommendations. Their applicability to primary care settings, however, is somewhat questionable. A family physician, for example, may be less likely to see patients with alarm symptoms than a specialist. Primary care providers often encounter a large number of patients with mild symptoms, which can be self-treated or effectively suppressed with antacids and H₂RAs.

■ **A Rational Approach to GERD**

In February 2005, I had the privilege of leading a panel discussion in Washington, DC. The 4 of us—a gastroen-

terologist, a physician assistant, a nurse practitioner, and I—developed what we felt was a rational approach to GERD that would be appropriate for various practice settings.¹⁵ We began with the premise that the types of patients seen by primary care providers typically have heartburn or some other GERD symptoms at least twice per week, that is, frequently enough to be bothersome. We also acknowledged that many patients self-treat with an over-the-counter H₂RA or PPI. Furthermore, we agreed that 50% to 70% of patients who experience heartburn at least twice weekly will not have any endoscopic evidence of esophagitis.¹⁶

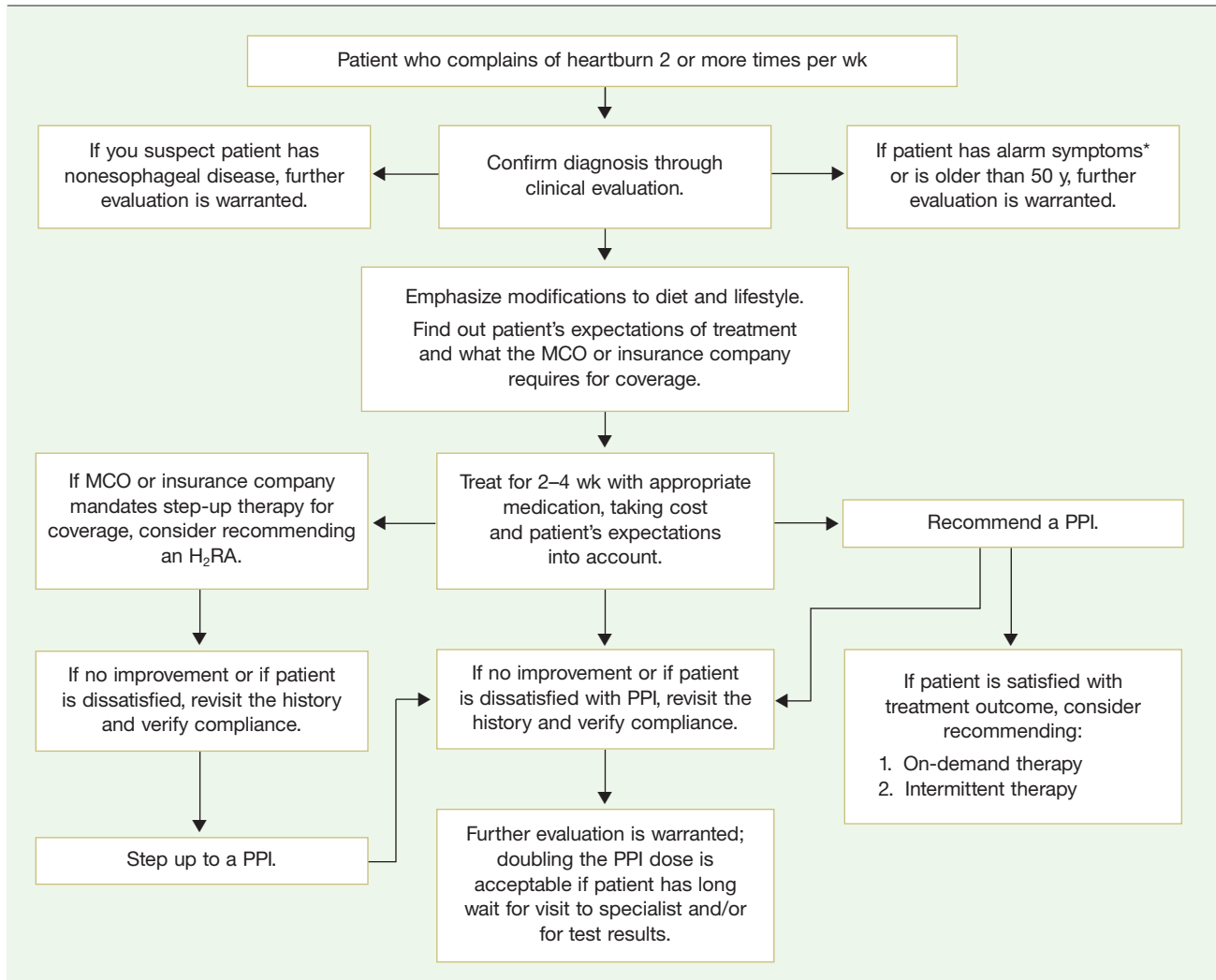
Our discussion yielded several major points (**FIGURE**).¹⁵ First of all, it is very important to actually confirm the diagnosis through a clinical evaluation. Many patients will complain of symptoms that are not typical of GERD. Some will have dyspepsia or abdominal pain; others may even have cardiac disease. Looking for the classic symptom of GERD—the burning sensation rising through the chest into the esophagus that may or may not be associated with regurgitation—is an extremely important prerequisite for further action.¹⁵ It is also important to ask how long the patient has experienced heartburn and to confirm the presence of alarm symptoms because endoscopy is recommended for patients who have had GERD symptoms for several years and for those who are currently experiencing alarm symptoms.^{17,18} Data from a study by Gopal's group regarding the prevalence of and risk for dysplasia also suggest that patients who are aged 40 and older should undergo endoscopic screening¹⁹; however, other investigators suggest that age 50 might be a more appropriate threshold.^{20,21}

In addition, none of us on the panel had any objection to emphasizing modifications to diet and lifestyle, for example, not eating too close to bedtime, eating smaller meals. Most providers would agree that such measures by themselves are not enough to help the majority of patients who suffer from GERD. However, avoidance of recumbency for 3 hours after meals is a recommendation that remains consistent with physicians' understanding of the pathogenesis of GERD.^{22,23} In addition, a recent study by Emerenziani's group suggests that reduction of meal volumes may help decrease the severity of postprandial GERD symptoms.²⁴

The consensus of our panel regarding therapeutic recommendations was that a patient with typical symptoms of GERD should be treated for 2 to 4 weeks with appropriate medication. The treatment that works best would be the one that meets an individual patient's expectations. For example, a patient who has infrequent symp-

FIGURE

Rational Approach to Treating GERD Symptoms



MCO = managed care organization; PPI = proton pump inhibitor; H₂RA = H₂-receptor antagonist
 *Alarm symptoms include dysphagia, odynophagia, bleeding, weight loss, or anemia.
 Adapted with permission from Rao G, et al. *J Fam Pract.* 2005;54(suppl):S1-S6.

toms of GERD that are not terribly disabling visits her family physician's office for a flu shot and happens to mention 1 of those symptoms. If the patient is taking an H₂RA and feels that the medication improves her symptoms in such a way that meets her expectations, then the provider probably does not need to change the treatment regimen. On the other hand, some patients are looking for complete or nearly complete relief of symptoms and may be happier with a PPI. In other words, no one specific recommendation can be expected to apply to all patients. However, it is crucial that all primary care

providers find out about their patients' expectations because the lack of such knowledge could lead to frustration on the part of both patient and provider.

Van Pinxteren and colleagues conducted a systematic review and meta-analysis of the effect of acid-suppressant drugs in empirical treatment of GERD.²⁵ According to the pooled results, standard-dose PPIs were more effective than H₂RAs for short-term relief of heartburn (relative risk for symptom relief [sRR], 0.55; 95% CI, 0.44-0.68). Of note, in the single trial comparing omeprazole with placebo, the sRR was 0.35 (95% CI, 0.26-0.46); the

number needed to treat (NNT) was 2.2. For the 2 trials comparing ranitidine with placebo, the pooled sRR was 0.77 (95% CI, 0.60-0.99); the NNTs in these trials were 11.1 and 7.4.

If a provider were to recommend a PPI and the patient was satisfied after about 4 weeks or so, then the patient might be given 2 choices. She could opt for on-demand therapy, an option that allows her to decide when she needs that particular medication, or intermittent therapy, that is, taking a short course of a PPI and then stopping.²⁶

For cases in which a patient experiences no symptom improvement or is dissatisfied with the treatment, it is essential that the provider revisit the history and verify that the medication is being taken correctly. If it is determined that the patient has been taking a PPI correctly (ie, before a meal) once daily, then the provider might consider increasing the PPI dosing to twice daily (ie, once before breakfast and once before dinner)²⁷ and scheduling an endoscopy. There is evidence that double-dose PPI treatment is associated with a higher likelihood of short-term symptom relief than single-dose PPI treatment.²⁸ Although doubling the dose of a PPI does not guarantee better control of symptoms, it is a reasonable holdover measure among patients who still experience symptoms on single-dose PPI treatment and are awaiting endoscopic evaluation.

If the patient has been taking an H₂RA, then the provider should consider stepping treatment up to a PPI. Historically, cost has been the primary rationale for choosing step-up therapy and not recommending a PPI as initial therapy. In an effort to reduce spending, many managed care organizations and insurance companies have mandated step-up therapy for coverage. Now that an over-the-counter PPI is available, the cost of PPIs has become less of an issue in most health care environments. That is good news for providers, as the data simply have not shown step-up therapy—or for that matter, step-down therapy (ie, switching to an H₂RA once control has been achieved with a PPI)—to be effective.²⁹

Conclusion

As we learn more about video capsule technology, it will be helpful for us to think about how the technology might be useful with respect to diagnosis and treatment of GERD and prevention of complications. We must maintain a firm grasp of the currently acceptable strategies for managing GERD and explore our patients' expectations. Only then will we be able to determine when it is appropriate for our patients to undergo esophageal capsule endoscopy.

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Capsule Endoscopy

New Applications

Glenn M. Eisen, MD, MPH

The incidence among US white men of esophageal adenocarcinoma, a recognized complication of gastroesophageal reflux disease (GERD), continues to rise significantly.¹ According to a study evaluating Surveillance, Epidemiology and End Results program data through 1994, the annual incidence of esophageal adenocarcinoma had increased at the time of publication (1998) by more than 350% (from 0.7 to 3.2 per 100,000 population) since the mid-1970s.² This observation is supported by smaller epidemiologic studies conducted in Minnesota and Denmark,³⁻⁵ which showed that the incidence of esophageal adenocarcinoma had increased 5- to 6-fold and 8-fold, respectively, since the early 1970s.

Screening for Barrett's esophagus, a precursor to esophageal adenocarcinoma, requires endoscopy, a potentially uncomfortable and invasive procedure when conducted by traditional methods. Capsule endoscopy is currently an accepted method of visualizing the small bowel. The capsule recently was modified to permit a detailed evaluation of the esophagus. This article reviews the history of capsule endoscopy and the technology's importance vis-à-vis Barrett's esophagus and esophageal adenocarcinoma.

History of Capsule Endoscopy

Prior to any discussion of the utility of esophageal capsule endoscopy, it is necessary to understand the development of capsule endoscopy and the components of the capsule itself. During the early 1990s, two independent research groups evaluated the use of miniature video cameras and wireless transmitters as a method of conducting wireless capsule endoscopy. In 1994, the first patent application was filed for a complementary metal oxide semiconductor imaging device, which allowed acquisition of good quality images with lower power requirements.⁶ A major conceptual break-

through in the development of capsule-endoscopy systems was separation of the device into 3 subsystems: an imager/transmitter, a receiver/recorder, and a workstation.⁶ Following several years of animal testing, the first human volunteer study was conducted in 1999, when researcher C. Paul Swain, MD, swallowed the first endoscopic capsules.⁶ After subsequent patient trials, the US Food and Drug Administration approved capsule endoscopy for small bowel examination in adults (2001) and children (2003) and most recently, for visualization of the esophagus (2004).^{7,8}

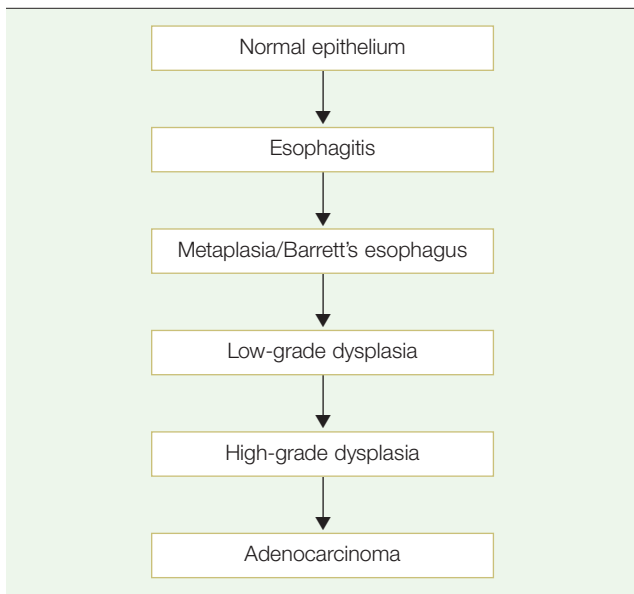
Barrett's Esophagus

The American College of Gastroenterology (ACG) defines Barrett's esophagus as a change in the esophageal epithelium of any length that can be recognized at endoscopy and is confirmed by biopsy to have intestinal metaplasia of the tubular esophagus. The definition, which excludes intestinal metaplasia of the cardia, has evolved over the last 2 decades to the current requirement for metaplasia in the esophagus without referral to length of the columnar lining.¹ An acquired condition that results from injury of the esophageal epithelium by repetitive exposure to gastric contents, Barrett's esophagus is 1 of several complications of GERD along with erosive esophagitis, stricture formation, and adenocarcinoma of the esophagus. Many patients with Barrett's esophagus deny symptoms of reflux; therefore, the prevalence within the general population may be higher than that which can be detected by symptomatology.¹

The progression from GERD to adenocarcinoma of the esophagus generally follows a stepwise pattern with the initial presentation of esophagitis and healing of the damage in a metaplastic process that results in abnormal columnar cells replacing squamous cells in the characteristic pattern of Barrett's esophagus (FIGURE 1).⁹ A popula-

FIGURE 1

Typical Progression of GERD to Esophageal Adenocarcinoma



GERD = gastroesophageal reflux disease
 Reproduced with permission from Shalauta MD, Saad R. *Am Fam Physician.* 2004;69:2113-2118, 2120.

TABLE 1

Risk Factors Associated With Barrett's Esophagus and Adenocarcinoma

GERD, especially of long-standing duration
White or Hispanic race
Male sex
Advancing age (reaching a plateau in one's 60s)
Smoking
Obesity

GERD = gastroesophageal reflux disease
 Adapted with permission from Shalauta MD, Saad R. *Am Fam Physician.* 2004;69:2113-2118, 2120.

tory of Barrett's esophagus. The causal relation was even stronger (OR, 43.5; 95% CI, 18.3-103.5) among those with long-standing and severe symptoms (≥ 20 years and ≥ 3 times/week).¹⁰

Why Screen for Barrett's Esophagus?

It is estimated that one in 200 patients with Barrett's esophagus develops esophageal adenocarcinoma each year.¹¹ The median duration of survival for patients diagnosed with esophageal adenocarcinoma is approximately 9 months; the 5-year survival rate is only 12%.¹² Such high mortality is largely attributable to the fact that many patients are not diagnosed until the cancer has become locally advanced or metastatic. Often esophageal cancer is not detected until a patient notices symptoms indicating incurable disease (ie, dysphagia and weight loss).¹³ Less than 5% of patients with esophageal adenocarcinoma are known to have Barrett's esophagus before developing cancer symptoms.¹⁴ Therefore, it is hoped that screening for Barrett's esophagus will improve patient outcomes by allowing for earlier detection of esophageal adenocarcinoma.

Risk factors for the development of Barrett's esophagus are the same as those associated with esophageal adenocarcinoma (TABLE 1).⁹ Although the stereotypical patient with Barrett's esophagus would be a 50-year-old obese white man who has a history of long-standing GERD symptoms, it should be noted that any patient with long-standing GERD is at risk regardless of sex, race, or weight. While these risk factors could be used as the determining factors for screening for Barrett's esophagus, the ACG recommends the use of upper endoscopy to screen all patients with chronic GERD symptoms.¹ (The chronicity of GERD symptoms is not spelled out in the guidelines, but it is generally accepted that individuals with 5 or more years of GERD symptoms should undergo screening.) A reasonable interpretation of the guidelines may be to perform endoscopic screening in patients with a combination of risk factors as well as those with recurring symptoms on most days of the week for several years. The guidelines acknowledge that the specific criteria for selecting patients to screen for Barrett's esophagus are not defined, and the substantive presence of asymptomatic Barrett's esophagus highlights the need to assess the distal esophagus in all patients undergoing upper endoscopy.¹ Regardless of the method used to visualize the esophagus, providers are advised to treat patients for GERD prior to endoscopy. Such treat-

tion-based, case-control study conducted in Sweden¹⁰ reported a strong and probably causal association between chronic gastroesophageal reflux and esophageal adenocarcinoma (odds ratio [OR], 7.7; 95% confidence interval [CI], 5.3-11.4) (STATISTICAL DEFINITIONS). In this study, the strength of the association with symptoms of reflux was the same for patients with esophageal adenocarcinoma, regardless of whether they had a prior his-

ment decreases the chances that inflammation will be misinterpreted as dysplasia or that Barrett's esophagus will be obscured by esophagitis.¹⁵

The esophageal endoscopy capsule appears to provide reliable initial screening for Barrett's esophagus; however, final diagnosis requires systematic biopsy of abnormal-appearing esophageal mucosa to document intestinal metaplasia and to detect dysplasia.¹

■ Surveillance in Patients With Barrett's Esophagus

Survival of patients diagnosed with esophageal adenocarcinoma is dependent on stage at diagnosis. Even with improved diagnostic techniques, most patients continue to present with advanced or metastatic disease. Preliminary data suggest that cases diagnosed via surveillance may have improved outcomes.^{1,16-18} A study by van Sandick and co-workers of patients with esophageal adenocarcinoma demonstrated that patients whose cancer had been detected during surveillance for Barrett's esophagus had significantly better 2-year survival rates than did patients who had never undergone surveillance (85.9% vs 43.3%, $P = .0029$).¹⁶ Whereas none of the patients in the surveillance group had advanced stages of cancer, 56% of the patients in the nonsurveillance group were diagnosed with stage III or IV tumors. These results confirmed the conclusions of earlier studies comparing surveillance and nonsurveillance groups with respect to survival rates and stage at diagnosis.^{17,18}

The goal of surveillance is the early detection of dysplasia and cancer. The ACG guidelines state that the grade of dysplasia present on biopsy should determine the endoscopy interval with abnormal epithelial surfaces such as nodules or ulcers requiring special sampling attention.¹ Patients with Barrett's esophagus may be candidates for life-long surveillance if there is the potential to prolong life expectancy.

■ Esophageal Video Capsule

The esophageal video capsule is a single-use, wireless 11 x 26-mm capsule made of biocompatible plastic. It contains miniature video cameras with a flash, batteries, a transmitter, and an antenna to transmit acquired images (**FIGURE 2**). Other components of the imaging system include a data recorder worn by the patient on a belt, external sensor arrays, and a workstation with proprietary software that receives downloaded images. The capsule endoscope is intended for visualization of the esoph-

Statistical Definitions

Odds Ratio (OR): the ratio of the odds in favor of being exposed in subjects with the target disorder divided by the odds in favor of being exposed in subjects without the target disorder.

95% Confidence Interval (CI): the range of values within which we can be 95% sure that the true value falls. If the test is repeated 100 times, the results will fall within that range of values 95 times.

Sensitivity (Sn): the probability that the test is positive when given to a group of patients with the disease. Sensitivity may be thought of as the false-negative rate. A high sensitivity means that a negative test can rule out the disease. The formula for sensitivity is: $Sn = TP / (TP + FN)$ where TP = true positive and FN = false negative.

Specificity (Sp): the probability that the test will be negative among patients who do not have the disease. Specificity may be thought of as the false-positive rate. A high specificity means that a positive test can rule in the disease. The formula for specificity is: $Sp = TN / (TN + FP)$ where TN = true negative and FP = false positive.

Positive Predictive Value (PPV): the probability that the patient has the disease when restricted to those patients who test positive. The formula for positive predictive value is: $PPV = TP / (TP + FP)$. The PPV is meaningless in a study where healthy and diseased patients are artificially recruited in a one-to-one sample.

Negative Predictive Value (NPV): the probability that the patient will not have the disease when restricted to all patients who test negative. The formula for negative predictive value is: $NPV = TN / (TN + FN)$. As with PPV, the NPV is meaningless in a study where healthy and diseased patients are artificially recruited in a one-to-one sample.

agus in adults.¹⁹ The esophageal capsule differs from the small-bowel capsule in that it is a 2-headed capsule with cameras at both ends (as opposed to having a camera at 1 end) and has a battery life of about 20 minutes (as opposed to 8 hours). Together, the cameras in the esophageal capsule are able to capture 14 images per second, whereas the small-bowel capsule captures 2 images per second.

Patients undergo esophageal capsule endoscopy in accordance with an ingestion protocol (**FIGURE 3**) that may be conducted without sedation. Because the normal esophageal transit time of a patient who is sitting or

FIGURE 2

Components of Esophageal Video Capsule

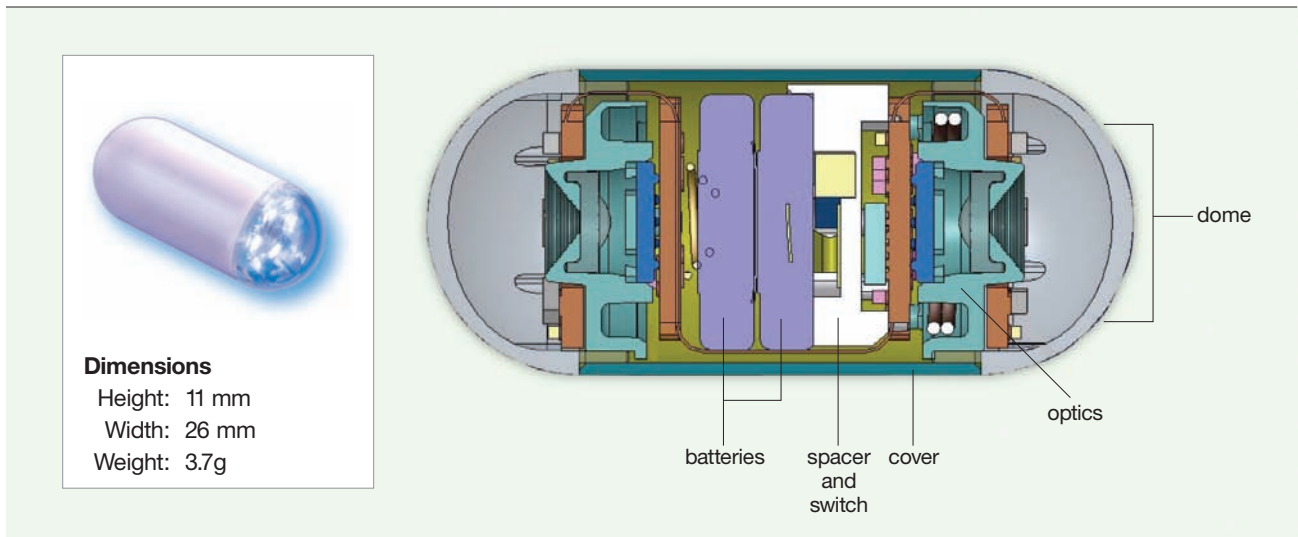
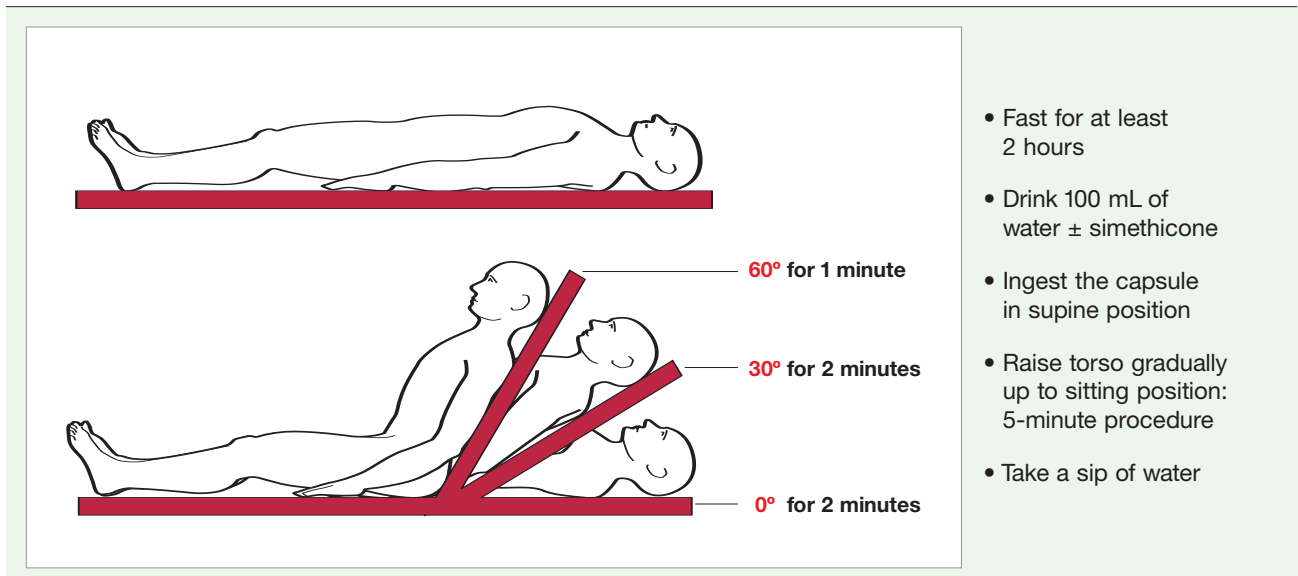


FIGURE 3

Esophageal Video Capsule: Ingestion Protocol Designed to Slow Capsule Passage Through Esophagus



standing may be measured in seconds, patients should ingest the capsule while in a supine position, with slow passive rising to an upright position after about 5 minutes in order to obtain more complete imaging of the esophagus. Typically, esophageal capsule endoscopy lasts about 20 minutes. Following the procedure,

patients are instructed to drink water to ensure the capsule enters the stomach.

The preparation for esophageal capsule endoscopy consists of fasting for 2 hours prior to the procedure. There is no need for sedation with the procedure. Medications may be taken up to 2 hours before the

TABLE 2

**Results of Endoscopic Findings:
 Suspected Barrett's Esophagus**

		Conventional Endoscopy		
		+	-	
Capsule	+	32	1	33
Endoscopy	-	1	72	73
		33	73	106
Accuracy of Capsule Endoscopy				
Sensitivity	=	$\frac{32}{33}$	=	97%
Specificity	=	$\frac{72}{73}$	=	99%
PPV	=	$\frac{32}{33}$	=	97%
NPV	=	$\frac{72}{73}$	=	99%

PPV = positive predictive value; NPV = negative predictive value
 Eliakim R, et al. *J Clin Gastroenterol.* 2005;39:572-578.

TABLE 3

**Results of Endoscopic Findings:
 Esophagitis**

		Conventional Endoscopy		
		+	-	
Capsule	+	33	1	34
Endoscopy	-	4	68	72
		37	69	106
Accuracy of Capsule Endoscopy				
Sensitivity	=	$\frac{33}{37}$	=	89%
Specificity	=	$\frac{68}{69}$	=	99%
PPV	=	$\frac{33}{34}$	=	97%
NPV	=	$\frac{68}{72}$	=	94%

PPV = positive predictive value; NPV = negative predictive value
 Eliakim R, et al. *J Clin Gastroenterol.* 2005;39:572-578.

procedure; however, medications that delay gastric emptying, such as calcium channel blockers, should be withheld. Similarly, medications that may coat the esophagus, such as iron or sucralfate, should be withheld beginning 5 days prior to the procedure if medically acceptable. Esophageal capsule endoscopy should not be performed on a patient with known or suspected gastrointestinal obstruction, strictures or fistulas, patients with cardiac pacemakers or other implanted electromagnetic devices, or those with swallowing disorders.¹⁹

Clinical Trials Involving Esophageal Capsule Endoscopy

Data regarding esophageal capsule endoscopy are promising; however, they are limited to results from a small pilot trial¹¹ and a larger multicenter prospective trial.²⁰ Both studies were conducted at tertiary referral centers and were designed to assess the accuracy of the esophageal video capsule with respect to diagnosing reflux esophagitis and screening for Barrett's esophagus.

In the pilot trial, 17 adults (11 male, 6 female) who complained of heartburn and/or epigastric pain underwent esophageal capsule endoscopy that was followed by esophagogastroduodenoscopy (EGD) with conscious sedation.¹¹ The study excluded patients with a history of dysphagia, known Zenker's diverticulum, known or suspected intestinal obstruction, cardiac pacemaker or other

implanted electromagnetic device, pregnancy, expectation of undergoing magnetic resonance imaging within 7 days, or a history of abdominal surgery other than uncomplicated appendectomy or cholecystectomy within the prior 6 months.

Before discharge, all patients were asked to complete a satisfaction questionnaire and were contacted 1 week later to confirm excretion of the capsule and to record adverse events. The investigators interpreting the findings of each type of test were blinded to the findings of the other test. The EGD was considered the gold standard. A true positive was defined as esophageal findings on both capsule and traditional endoscopy. A true negative was defined as findings on neither test (**STATISTICAL DEFINITIONS**).

For capsule endoscopy, mean esophageal passage time was 189 seconds; median passage time was 88 seconds (range, 3-1051 s). Positive esophageal findings (reflux esophagitis and Barrett's esophagus) were identified in 12 of 17 patients, using both capsule endoscopy and EGD. The capsule also identified pathology in 1 other patient, but the EGD proved that result to be a false positive. No adverse events related to capsule endoscopy were reported at the time of the procedure or at the 1-week follow-up. Of the 15 patients queried, 11 preferred capsule endoscopy, 1 preferred traditional endoscopy, and 3 were undecided.

A larger, multicenter trial compared the accuracy (ie, specificity, sensitivity, positive predictive value, and

negative predictive value) of esophageal capsule endoscopy and EGD in 109 patients (**STATISTICAL DEFINITIONS**).²⁰ Of those patients, 1 was unable to swallow the capsule and 2 others were not included in the statistical analysis because of technical difficulties (ie, trouble capturing the images on the monitor). The final analysis included 93 patients who had chronic GERD symptoms and had never undergone EGD and 13 patients who were undergoing surveillance for Barrett's esophagus.²⁰ Study methodology was similar to that used in the pilot study.¹¹ For analytical purposes, EGD was considered the gold standard.²⁰

In patients diagnosed with Barrett's esophagus, capsule endoscopy demonstrated a sensitivity of 97% and a negative predictive value of 99% (**TABLE 2**). In patients diagnosed with erosive esophagitis, it demonstrated a sensitivity of 89% in detecting esophagitis and a negative predictive value of 94% for ruling out esophagitis (**TABLE 3**). Capsule endoscopy also was able to identify a small esophageal nodule in 1 patient and varices in another. Significantly more patients rated the esophageal capsule higher than EGD in all 8 parameters of patient satisfaction, including pain and discomfort during and after the procedure, overall convenience, and missed time from work. No adverse events were reported with either procedure.²⁰

Conclusion

According to clinical trial data and consensus statements from the Fourth International Conference on Capsule Endoscopy, esophageal capsule endoscopy can be used to evaluate the esophagogastric junction and rule out Barrett's esophagus in patients with chronic reflux.^{11,20,21} Given the rising incidence of esophageal adenocarcinoma and its potentially devastating outcomes, increased screening for Barrett's esophagus is warranted in patients with long-standing GERD. Esophageal capsule endoscopy is a patient-friendly alternative method of screening for dysplasia and Barrett's esophagus.

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Additional Resource

Eisen G, Sharma P. Applying innovations in capsule endoscopy to clinical practice. Available at: <http://www.cmesci.com/endoscopy>. Accessed November 7, 2005.

Capsule Endoscopy

What Can We Expect?

Rick E. Ricer, MD ■ Christina Li, MPH

For years, esophagogastroduodenoscopy (EGD) has been the technique of choice for documenting the type and extent of mucosal injury due to gastroesophageal reflux disease (GERD) and for identifying Barrett's esophagus, a GERD-related condition. Also known as upper endoscopy, traditional endoscopy, or conventional endoscopy, the procedure has been a key component of strategies for managing patients with complicated GERD.^{1,2}

Technology now allows for endoscopy to be conducted by way of an esophageal video capsule, which transmits images via digital radio to a data recorder. The new noninvasive imaging technique can be an office-based procedure and offers an alternative to EGD, as it requires no sedation and allows for patients' immediate return to full activity. This article compares esophageal capsule endoscopy with EGD (TABLE)^{3,4} and discusses possible implications of the new technology with respect to how GERD complications are diagnosed and treated.

■ Why Opt for Esophageal Capsule Endoscopy?

Esophageal capsule endoscopy has several important advantages. To begin with, as Dr Eisen explains in *Capsule Endoscopy: New Applications* (on pages 13 and 14), the accuracy of capsule endoscopy appears to be comparable with that of EGD for the diagnosis of esophageal pathology in patients with GERD symptoms.^{3,5} Also, esophageal capsule endoscopy is an easy procedure for providers to perform. Reviewing the results of capsule endoscopy requires a relatively brief period of time; the capsule's median passage time is only 88 seconds.³ The training that is required to learn how to perform esophageal capsule endoscopy takes anywhere from a few hours to a few days. In contrast,

proper manipulation of the traditional endoscope and interpretation of EGD findings often is taught in the context of a fellowship, the length of which typically ranges anywhere from 3 months to 2 years.

The esophageal video capsule is smaller than many vitamin tablets and herbal supplements. Most patients will be able to swallow it without much difficulty, provided that they do not have dysphagia or odynophagia. Patient discomfort is minimal during capsule endoscopy because it is not invasive, whereas EGD requires insertion of a long tube down the patient's esophagus.

The lack of necessity for sedation is a significant advantage. Patients can drive home or return to work immediately after the procedure. Not surprisingly, patients in studies by Eliakim and colleagues tended to prefer capsule endoscopy over EGD.^{3,5} (For further details of these studies, see pages 13 and 14.)

■ When Should Capsule Endoscopy Not Be Used?

Like any procedure, esophageal capsule endoscopy is not meant for everyone. Safety of the capsule has not been established in patients who are pregnant or younger than 18 years, and it is unknown in patients who have significant gastrointestinal (GI) diverticular disease.⁴ Contraindications for the procedure include known or suspected GI obstruction, fistulas, or strictures. Unless screening is deemed urgent, it is generally advisable to delay capsule endoscopy until patients have received a full course of appropriately administered therapy to help decrease the likelihood that underlying disease will be obscured by inflammation. In addition, capsule endoscopy should be avoided in any patient who has a swallowing disorder, nonesophageal abdominal symptoms, or implanted electromagnetic devices

TABLE

Comparison of EGD and Esophageal Capsule Endoscopy

Characteristic	EGD	Esophageal Capsule Endoscopy
Type of endoscopic device	Reusable tube	Disposable video capsule
Length of training required to perform procedure	3 months to 2 years	A few hours to a few days
Total physician time (min)	25*	18†
Sedation required	Yes	No
Potential for patient discomfort	Considerable	Minimal
Average recovery time (min)	60	0
Ability to visualize the stomach and duodenum	Yes	No
Ability to provide tissue biopsy	Yes	No

EGD = esophagogastroduodenoscopy

*Includes consult and procedure.

†Includes consult, procedure, and video review time.

Eliakim R, et al. *Aliment Pharmacol Ther*. 2004;20:1083-1089; PillCam™ ESO Capsule package insert.

(eg, pacemakers).^{4,6} Two recent studies have found capsule endoscopy to be safe in patients with implanted cardiac devices^{7,8}; however, the small number of patients in each study precludes any firm recommendations.

Although not an issue in the clinical trials reported to date, based on what is known of the anatomy, the capsule may have a propensity to become lodged at 3 different sites: the upper esophageal sphincter, the lower esophageal sphincter, or the small intestine.⁶ Theoretically, the capsule also could lodge itself in a Zenker's diverticulum, a stricture at the pyloric outlet, along the small intestine in a patient with Crohn's disease, or in an intestinal diverticulum. The probability of these types of adverse events can be minimized by taking a careful preprocedural history (with special attention to dysphagia, nonesophageal abdominal symptoms, and current or past use of nonsteroidal anti-inflammatory drugs on a daily basis) and/or performing a small-bowel series.^{4,6,9}

Fortunately, the capsule does contain some metal, so it is very easy to find out if it remains in the body by performing an x-ray examination. However, to avoid damage to a patient's GI tract or abdominal cavity, magnetic resonance imaging definitely should not be performed until the capsule has passed.⁴ On the rare occasions when capsule retention is diagnosed, either EGD or surgery may be required. Surgical intervention may be preferable in certain cases because it can be the means for removing not only the video capsule but also the abnormal pathology that caused the capsule retention and that likely was the original reason for the capsule study.⁹

It is important to note that some patients who undergo capsule endoscopy will return to the provider's office after the procedure and insist that the capsule has not been passed. According to anecdotal reports, in at least half of such cases, the capsule has been eliminated, and the patient simply has not seen it.

Unlike EGD, the esophageal video capsule does not allow for visualization of the stomach or duodenum.³ Notably, neither biopsy nor insufflation can be performed during capsule endoscopy. The capsule can be used to help screen for Barrett's esophagus. However, if Barrett's esophagus is suspected, an EGD is necessary to confirm the presence of intestinal metaplasia in the esophagus. If a positive biopsy is obtained, an EGD also would be needed for subsequent surveillance.

Providers should be aware that the video capsule remains in the same position—1 camera in front, another in the back—all the way down the esophagus, without tumbling. Passage of the capsule cannot be halted, whereas with EGD, the provider can adjust the flexible tube in order to change direction or obtain multiple views from different directions.

Will Capsule Endoscopy Be Cost-Effective?

Because the esophageal video capsule is so new, the reimbursement issues have yet to be resolved. In fact, the Center for Medicare and Medicaid Services, which is an agency within the US Department of Health and Human Services, has not issued an official reimbursement code for capsule endoscopy. Until that happens, it will be difficult for providers to know exactly how much they can expect to be reimbursed for the procedure. In contrast, EGD is almost always covered by Medicare, managed care organizations, and the different insurance companies, provided that it is performed in accordance with an accepted indication.

Eliakim and colleagues suggest that the direct costs related to periprocedural and postprocedural monitoring, medication costs, and complications/risks are lower for esophageal capsule endoscopy than for EGD because capsule endoscopy does not require sedation. Indirect costs, such as time taken off from work and the need for a driver or separate transportation, also are saved by opting for the noninvasive procedure.⁵

Physicians have yet to agree as to how cost-effective screening and surveillance of patients for Barrett's esophagus can be.¹⁰⁻¹⁴ Much of the debate is fueled by modeling approaches that utilize different assumptions, probabilities, and methodologies.^{15,16} For example, some authors calculate cost per quality-adjusted life-year (QALY), whereas other authors' analyses include no quality-of-life adjustments.¹⁵⁻¹⁷ Also, whereas some assume that nonsurgical candidates would be offered only palliative care, others assume that endoscopic therapies would be an option for such patients.^{16,17}

For the most part, arguments regarding the practicality of screening and surveillance for Barrett's esophagus have been based on the costs associated with EGD. One exception is the modification by Eliakim and colleagues of a decision-analysis model previously developed by Inadomi's group.^{3,16} According to the original model, the use of traditional endoscopy to perform a single screening amongst 50-year-old white men with chronic GERD symptoms would cost \$10,440 for each additional QALY gained and would probably be cost-effective (compared with no screening).¹⁶

In connection with a manufacturer-sponsored pilot study of esophageal capsule endoscopy, Eliakim and colleagues modified the model that Inadomi's group developed by assuming that the same cohort of patients could undergo capsule endoscopy first and an EGD (if Barrett's esophagus was suspected) second.³ According to this model, such a screening strategy also would be cost-effective; each additional QALY gained would cost \$9800.

An editorial by Eisen and colleagues asks that the medical community consider the merits of (1) screening white men who are older than 50 years and have chronic GERD symptoms for Barrett's esophagus and (2) surveillance for patients with dysplasia.¹⁸ Obviously, formal studies examining the cost-effectiveness of esophageal capsule endoscopy are needed. In addition, prospective cohort studies should be conducted to enhance our knowledge regarding the risks for esophageal adenocarcinoma in patients with chronic GERD.^{11,12} Such studies will help the medical community determine the necessary

reach of screening for Barrett's esophagus and the appropriate intervals at which endoscopic surveillance should be conducted.

Conclusion

Many patients are reluctant to undergo EGD because of the procedure's invasiveness and the sedation requirement. However, patient satisfaction with esophageal capsule endoscopy has been quite high in the small number of studies conducted thus far.^{3,5}

According to American College of Gastroenterology guidelines issued prior to the advent of esophageal capsule endoscopy, patients with chronic GERD symptoms should undergo endoscopic screening for Barrett's esophagus.¹⁹ An International Conference on Capsule Endoscopy (ICCE) 2005 consensus paper goes a step further by recommending the use of esophageal capsule endoscopy to screen for Barrett's esophagus and the use of EGD for histological confirmation in patients whose capsule-endoscopy results cannot rule out the condition.⁶ The ICCE also advocates the use of esophageal capsule endoscopy for primary diagnosis of erosive esophagitis in patients with chronic heartburn.⁶ Currently, it is too soon to determine the cost-effectiveness of using capsule endoscopy to screen for Barrett's esophagus. Nonetheless, it is hoped that the availability of video capsule technology will improve diagnosis and treatment of Barrett's esophagus and other GERD complications.

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► Capsule Endoscopy What Can We Expect?

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When Is Esophageal Capsule Endoscopy Appropriate?

A Panel Discussion

Rick E. Ricer, MD ■ Glenn M. Eisen, MD, MPH ■ Goutham Rao, MD

Ricer: The patients in the following 3 clinical scenarios have gastroesophageal reflux disease (GERD) symptoms of varying durations. Dr Rao and Dr Eisen, your job is to comment on whether esophageal capsule endoscopy would be an appropriate next step for each patient.

■ Clinical Scenario 1

Ricer: A 63-year-old white man has been taking proton pump inhibitors (PPIs) and/or H₂-blockers on an as-needed basis for the past 7 years to control chronic symptoms of GERD. He experiences no symptoms so long as he continues taking his medications. However, he is tired of being on maintenance therapy. The patient feels well otherwise. What would you recommend as a next step?

Rao: Assuming that our patient has no swallowing disorders or nonesophageal symptoms,^{1,2} I would recommend that he undergo esophageal capsule endoscopy to rule out Barrett's esophagus. You said that GERD is the patient's only complaint; he feels well otherwise. Under those circumstances, he probably would not be willing to undergo a traditional endoscopy, which is invasive and requires sedation. Therefore, capsule endoscopy might be a simpler alternative to offer him.

Eisen: I agree that we should rule out Barrett's esophagus. This patient is in the highest risk category. He has had GERD for more than 5 years, is over the age of 50, and is a white male.^{3,4} Therefore, esophageal capsule endoscopy would be an appropriate option. However, I would also remind our patient that anyone older than 50 should be screened for colon cancer. If he is due for a

colonoscopy anyway, then I would recommend that he undergo a traditional endoscopy on the same day. Let me explain why. A big advantage of capsule endoscopy is that patients do not need to be sedated for the procedure. However, that advantage is negated if the patient is already going to be sedated for his colonoscopy.

■ Clinical Scenario 2

Ricer: A 41-year-old African American woman has had reflux for 6 months. Previously, the reflux was well-controlled with a once-daily PPI. Lately, however, she has been experiencing some breakthrough symptoms. What would be your next step?

Rao: As we've already mentioned, the esophageal video capsule is particularly useful for ruling out Barrett's esophagus. However, African American women are considered to be at low risk for that condition, and this patient has not had reflux for very long. Therefore, I wouldn't recommend esophageal capsule endoscopy at this point.^{3,4} In light of her breakthrough symptoms, I would revisit the history to determine whether she really has GERD or if something else is going on. If it turns out that she really does have GERD, then I would recommend that she try taking a PPI twice daily—once in the morning, once in the evening—before meals.⁵ I might consider recommending an endoscopy to her down the road.

Eisen: As Dr Rao pointed out, this patient appears to be at low risk for Barrett's esophagus, so I would not immediately recommend that she undergo screening for Barrett's esophagus. Instead, I would first see if the

patient's symptoms are consistent with reflux. Next I would make sure that she is taking the PPI appropriately (ie, before a meal).⁶ It's really astonishing, but I would say that at least 50% of the patients that I see—some of whom are referred to me by other gastroenterologists—are not taking their PPI correctly. If she is taking it correctly, then most likely I'd just put her on a twice-daily-PPI regimen, ie, once before breakfast and once before dinner.⁵ If she didn't respond to the new regimen, then I would consider either upper endoscopy or capsule endoscopy. Because the patient is already taking a PPI, it is more than likely that she doesn't have erosive esophagitis.⁷ Therefore, I would not be inclined to perform either type of endoscopy right off the bat because I'm not sure that the results of either procedure would actually help my decision-making process. Rather, I would just go with medical therapy for now.

■ Clinical Scenario 3

Ricer: A 74-year-old Hispanic man has had intermittent GERD symptoms for about a year. About 2 weeks ago, he began having occasional difficulty swallowing. What are your options?

Rao: In light of the patient's difficulty swallowing, capsule endoscopy obviously is not an option here.¹

Eisen: Assuming that the patient is on medication, I might consider increasing his dosage, but I certainly

would perform an upper endoscopy. Some physicians would argue that performing a barium esophagram first would help us decide what to do next. However, traditional endoscopy is preferable because a barium esophagram often fails to identify esophagitis or Barrett's esophagus.⁸ In fact, the American College of Gastroenterology guidelines state that endoscopy is the only reliable method of diagnosing Barrett's esophagus and that barium radiography is of limited usefulness in the routine diagnosis of GERD.⁹

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*For each of the following questions,
please circle the best response.*

- The most expensive gastrointestinal problem in the United States is:
 - Peptic ulcer disease
 - Gastroesophageal reflux disease (GERD)
 - Gallbladder disease
 - Colorectal cancer
- When a patient comes to a family physician's office complaining of heartburn, it is important for the physician to:
 - Ask how long the patient has experienced heartburn
 - Confirm the presence of alarm symptoms
 - Find out about the patient's expectations regarding symptom relief
 - All of the above
- Endoscopy should be considered for patients who:
 - Have had GERD symptoms for several years
 - Are currently experiencing alarm symptoms
 - Have been taking a proton pump inhibitor correctly and experienced no symptom improvement
 - All of the above
- Which of the following is *not* a complication of GERD?
 - Adenocarcinoma of the gastric cardia
 - Adenocarcinoma of the esophagus
 - Barrett's esophagus
 - Stricture formation
- Which of the following is *not* considered a risk factor associated with Barrett's esophagus and esophageal adenocarcinoma?
 - Recurring GERD symptoms of long-standing duration
 - African ancestry
 - Male sex
 - Smoking
- The goal of surveillance among patients with Barrett's esophagus is:
 - Early detection of dysplasia
 - Early detection of cancer
 - Both A and B
 - Neither A nor B
- The esophageal video capsule can be used to:
 - Conduct surveillance among patients with Barrett's esophagus
 - Screen for Barrett's esophagus
 - Determine the grade of dysplasia
 - None of the above
- Which of the following statements about esophageal capsule endoscopy is false?
 - It does not require sedation
 - It provides tissue biopsy
 - It should be avoided in patients with swallowing disorders
 - It may incur lower costs with respect to peri-procedural and post-procedural monitoring
- Which of the following statements about esophagogastroduodenoscopy is false?
 - It can be used to obtain multiple views of the esophagus, stomach, and duodenum
 - It is necessary to confirm the presence of intestinal metaplasia in the esophagus
 - It is not associated with any risk for complications
 - None of the above
- If capsule retention is suspected, what is the appropriate method of confirming that suspicion?
 - Magnetic resonance imaging
 - X-ray examination
 - Both A and B
 - Neither A nor B

Capsule Endoscopy

Advances in Esophageal Imaging

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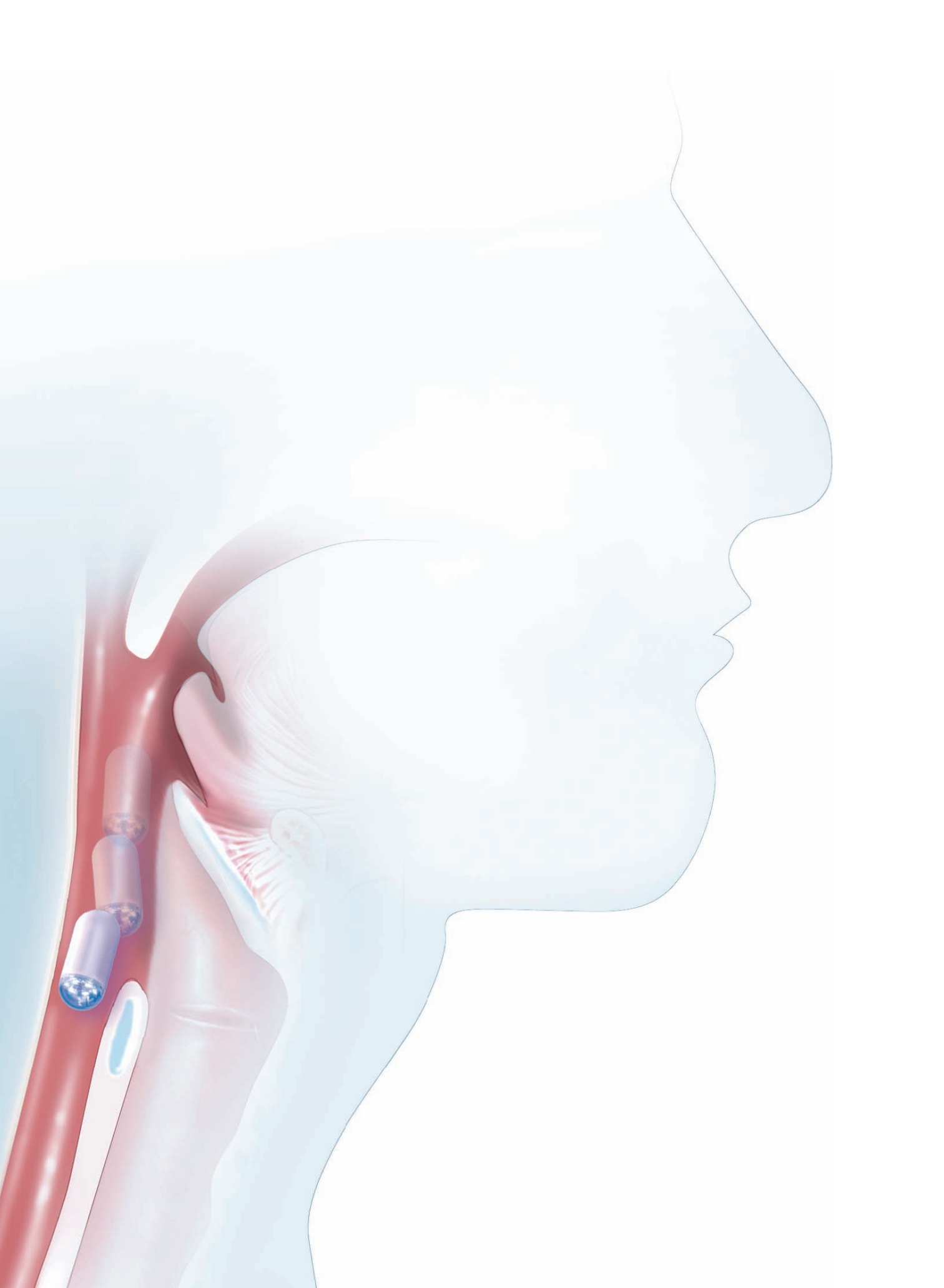
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