Barrett's Esophagus: Evaluation and Management

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Program Audience

Primary care physicians.

Educational Needs Addressed

Barrett's esophagus (BE) is a precancerous condition of the distal esophagus associated with the development of esophageal adenocarcinoma. BE predominantly affects a Western population, especially older Caucasian men, although incidence rates are rising among women and minorities. While age (> 40 years), chronic gastroesophageal reflux, and male gender have been identified as risk factors for development of BE, studies are increasingly exploring the association between obesity and the molecular basis for pathogenesis of BE. The increasing incidence of esophageal adenocarcinoma in recent years has sparked great interest in developing novel diagnostic modalities and therapeutic interventions in the management of BE. Additionally, there is a growing body of literature evaluating the cost-effectiveness of such modalities.

Educational Objectives

After participating in this CME activity, primary care physicians should be able to

1. Describe the epidemiology of BE
2. Describe endoscopic and pathologic findings in BE
3. Review the role of antireflux therapy in BE
4. Discuss the relationship between BE and obesity
5. Review therapeutic interventions used in the management of BE

CASE STUDY
Initial Presentation

A 55-year-old attorney presents to his primary care physician with a 5-year history of heartburn symptoms, which have worsened over the past 6 months.

History

The patient has no significant past medical history other than being overweight. He drinks 1 glass of wine per day and does not smoke. Family medical history is unremarkable for any malignancies. He does not exercise because he "works all the time" and has gained approximately 22 lb over the last year. The patient describes his heartburn symptom as a substernal "burning" sensation, which occurs approximately 30 minutes after eating and lasts approximately 1 to 2 hours. He was taking omeprazole 20 mg daily with antacids as needed and his symptoms were well controlled on this regimen; however, recently his symptoms have persisted despite these medications, and his dose of omeprazole was increased from 20 mg daily to 40 mg twice daily. This has resulted in only minimal improvement of his symptoms.

- **What are the most common symptoms of gastroesophageal reflux disease?**

Gastroesophageal reflux disease (GERD) is a highly prevalent disorder that manifests with signs and symptoms (**Table 1**) of varying severity and expression [1–4]. An estimated 35% to 40% of adults in the Western world are affected by reflux-related symptoms [5], with an incidence of approximately 5 per 1000 person-years.

The most common symptoms of GERD include heartburn or pyrosis, regurgitation, and dysphagia. Heartburn, defined as a burning sensation in the retrosternal area, has a specificity of 89% and positive predictive value of 81% for GERD [6,7]. Regurgitation, defined as the sensation of gastric refluxate into the mouth or hypopharynx, has a

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specificity of 95% and positive predictive value of 57% for GERD [8]. Such classic symptoms of GERD rarely require a confirmatory test owing to their high positive predictive value and are sufficient to make a diagnosis in the vast majority of cases [9]. In fact, the combination of heartburn and regurgitation has an accuracy of greater than 90% for the diagnosis of GERD [6,7].

Extraesophageal or atypical manifestations occur commonly in patients with GERD. As many as 80% of patients with GERD may have at least 1 extraesophageal symptom [4].

Physical Examination

Physical examination reveals an obese Caucasian man in no apparent distress. Blood pressure is 124/70 mm Hg, heart rate is 84 bpm, and body mass index (BMI) is 31 kg/m^2. Heart and lung examination is unremarkable and the abdomen is soft, obese, and nontender with no organomegaly present.

- **When should patients with symptoms of GERD be referred for upper endoscopy to rule out Barrett's?**

The American College of Gastroenterology guidelines for the diagnosis and treatment of GERD [9] support an initial trial of empiric acid suppressive medication in addition to lifestyle modification if the patient's history is typical for uncomplicated GERD. Symptoms include heartburn and/or regurgitation that is aggravated by the ingestion of large or fatty meals, recumbency, or bending over and is relieved by antacids. An empiric trial may include high-dose acid suppression with proton pump inhibitors such as omeprazole 20 to 40 mg twice daily for 1 week [10,11]. One study reported that response to a 2-week course of 40 mg of omeprazole had the same diagnostic efficacy as pH testing [12].

Patients who require further diagnostic evaluation (ie, upper endoscopy) are those who fail to respond to high-dose acid suppression or who have alarm symptoms (ie, dysphagia, odynophagia, gastrointestinal bleeding, weight loss, or anemia). Additionally, patients with long-standing reflux symptoms are at risk for Barrett's esophagus (BE) and should undergo upper endoscopy to rule out BE. In a recent study by Giannini et al [13] conducted among patients presenting to gastroenterologists with typical reflux-related symptoms without alarm symptoms, empiric treatment with a proton pump inhibitor proved to be more cost-effective than endoscopy-oriented treatment, with no difference in health-related quality of life. Unfortunately, data are conflicting regarding the value of reflux symptom frequency and severity in predicting BE [14,15].

Evidence from nonrandomized and case-control studies

Table 1. Symptoms of Gastroesophageal Reflux Disease

Esophageal manifestations
Heartburn
Regurgitation
Dysphagia
Extraesophageal or atypical manifestations
Oral cavity
Water-brash
Burning in the mouth
Tongue sensitivity
Halitosis
Nonspecific itching and burning
ENT
Hoarseness
Dysphonia
Sore throat
Chronic cough
Pulmonary
Asthma
Bronchitis
Pneumonia
Idiopathic pulmonary fibrosis

ENT = ear, nose, and throat.

[9] support endoscopy as the technique of choice to identify BE and to diagnose complications of GERD (eg, stricture, esophagitis). Endoscopy offers direct visualization of the esophageal mucosal lining and the ability to obtain a biopsy, thus confirming the presence of BE and ruling out early neoplasia. To more accurately diagnose BE, the biopsy should be performed after a course of acid suppressive therapy, as reflux-related inflammatory changes in esophageal mucosa can be misinterpreted as dysplasia.

Endoscopic Examination

Due to his persistent symptoms on high-dose omeprazole, the patient is referred to a gastroenterologist for screening upper endoscopy. Esophagogastroduodenoscopy is performed that reveals a 2-cm segment of salmon-colored mucosa in the distal esophagus just proximal to the gastroesophageal junction. The patient is noted to have a small (2 cm) hiatal hernia. The remainder of the examination is unremarkable and there is no evidence of esophageal strictures, nodules, or ulcerations. The stomach and duodenum are unremarkable. Biopsies are taken in 4 quadrants within the 2-cm segment of BE.

- **What is the typical endoscopic appearance of BE?**

BE is characterized by replacement of the normal, squamous epithelial lining of the esophagus by a metaplastic columnar epithelium known as intestinal metaplasia. Endoscopically, this columnar-lined epithelium appears as a characteristic "salmon-colored" mucosa. In the distal esophagus the junction of normal columnar epithelium (pinkish-red with a velvet-like texture) and squamous epithelium (pale and glossy), which defines the normal squamocolumnar junction, is identified as a visible junction called the Z-line on endoscopy. The gastroesophageal junction is defined at the level of the proximal border of the gastric mucosal folds. Once the endoscopist has identified both the squamocolumnar and gastroesophageal junctions [16], any proximal displacement of the squamocolumnar junction relative to gastroesophageal junction defines BE. As mentioned previously, the endoscopic appearance of Barrett's epithelium is typically characterized by salmon-colored tongues or patches that represent the metaplastic epithelium. Standard endoscopic biopsy protocol for BE involves taking random biopsies every 1 to 2 cm in the metaplastic area. Areas of nodularity or irregularity should be biopsied separately.

Depending upon the length of specialized metaplasia, BE can be classified as long-segment BE (> 3 cm) and short-segment BE (< 3 cm) [17]. Intestinal metaplasia at the gastroesophageal junction is considered present if intestinal metaplasia is found in cases where the gastroesophageal junction and squamocolumnar junction/Z-line coincide [18].

Another classification system, the Prague C & M criteria, is based on assessment of circumferential (C) and maximal (M) extent of endoscopically visualized BE [19]. This classification system identifies the landmarks of the squamocolumnar junction, gastroesophageal junction, extent of circumferential columnar lining, and the most proximal extension of columnar mucosa excluding islands to determine the length of BE.

Diagnosis

Histopathologic examination of the biopsy specimens reveal specialized intestinal metaplasia with goblet cells consistent with a diagnosis of BE. No evidence of dysplasia is noted.

- **What are the pathologic criteria for BE?**

Microscopically, Barrett's is characterized by replacement of the normal squamous epithelium of the esophagus with a specialized columnar epithelium, known as intestinal metaplasia. Like the intestinal epithelium, Barrett's epithelium contains mucin-producing goblet cells, which are easily identified as round blue structures on Alcian blue staining. In the United States, pathologic confirmation of intestinal metaplasia is required to make a diagnosis of BE. Interestingly, the British Society of Gastroenterology has excluded the requirement of intestinal metaplasia [20].

For the accurate diagnosis of BE, it is essential that the precise sites of biopsies in relation to the gastroesophageal junction and squamocolumnar junction are available to the pathologist [20]. A review by the British Society of Gastroenterology noted that histology alone is insufficient to definitively and independently identify patients with BE and only aids in corroborating this diagnosis. For Barrett's to be present, the columnar mucosa must be from the esophagus and not from the gastric cardia. Thus, when native esophageal structures including the esophageal gland duct or submucosal glands are noted with metaplastic columnar epithelium, biopsies are diagnostic for BE.

Treatment

The patient is continued on omeprazole 40 mg twice daily and instructed to take his medication 30 minutes before meals. He is instructed on diet and lifestyle modifications regarding his reflux disease and Barrett's, which includes refraining from alcohol, coffee, and carbonated beverages and refraining from lying recumbent after meals.

- **What is the role of antisecretory therapy in the treatment of BE? Is there a role for surgical antireflux therapy (eg, fundoplication)?**

The aim of antireflux therapy is to reduce or eliminate the symptoms of GERD and prevent complications related to long-standing GERD. While a dramatic symptomatic improvement (> 90%) has been demonstrated by both antisecretory therapy (histamine$_2$ blockers or proton pump inhibitors) and surgical fundoplication, such antireflux therapy has not demonstrated an actual reduction in progression of GERD to either BE or esophageal adenocarcinoma (EAC) [21].

Despite symptomatic improvement with antisecretory therapy, patients with BE continue to experience nocturnal gastric acid breakthrough that can be detected during pH studies [22]. Few retrospective studies have shed light on the benefits of chronic high-dose acid suppression therapy on the regression of specialized intestinal metaplasia [23,24]. Furthermore, studies have failed to show a decreased risk of esophageal cancer in treated patients.

A few nonrandomized studies have demonstrated an overall risk reduction in cancer progression in patients with BE undergoing surgical antireflux therapy [25,26]. Studies comparing risk of development of dysplasia or adenocarcinoma in BE undergoing antireflux therapy have

demonstrated superior effects with surgical fundoplication when compared with medical management [27–29]. Benefits of surgical gastric fundoplication in BE included regression of low-grade dysplasia to nondysplastic BE or even no BE and reduction or absence of progression to high-grade dysplasia or adenocarcinoma [30,31]. Despite these studies, an extensive meta-analysis demonstrated no significant change in risk of adenocarcinoma in subjects with BE undergoing surgical antireflux procedure when compared with those treated with medical management [32]. The authors concluded that antireflux surgery should not be recommended as an antineoplastic measure in the setting of BE.

The data are conflicting as to whether the medical or surgical management of GERD is more cost-effective. A discounted analysis from a study conducted by Arguedas et al [33] found that medical therapy was associated with lower costs and improved quality-adjusted life-years in comparison with surgical therapy. In contrast, Bojke et al [34] compared the cost-effectiveness of long-term medical management and laparoscopic fundoplication for GERD in patients from 5 major REFLUX study centers in the United Kingdom and concluded that while surgical means for treating GERD were more expensive, they were associated with more quality-adjusted life-years. A recent randomized clinical trial by Lundell et al [35] found the long-term outcome of patients with GERD undergoing antireflux surgery to be superior to acid inhibition therapy using proton pump inhibitors.

- **What is the relationship between Barrett's and obesity?**

Traditionally, elevated BMI has been implicated as a major contributor to the development of GERD [36], which in turn is a known risk factor for BE [37]. However, there are conflicting data as to whether elevated BMI is directly associated with progression to BE. Recent studies have examined the association between elevated BMI and BE with conflicting results.

Several studies have investigated the mechanisms by which obesity might increase the risk of BE and EAC. A study by Lagergren et al [38] found that development of BE in patients with elevated BMI may not be related to the development of GERD; as many as 40% of patients with EAC did not report antecedent reflux symptoms. Elevated levels of serum proinflammatory cytokines (adipocytokines) including interleukin-6 and tumor necrosis factor–α, which have an association with visceral fat, have been shown to be overexpressed in patients with BE [39,40]. Various biologic mediators including leptins, insulin, and insulin-like growth factors, which are intricately associated with obesity, have been shown to stimulate cell proliferation and inhibit apoptosis [41–43]. It is possible that similar mechanisms may underlie the development of esophageal neoplasia.

However, in a recent meta-analysis, Cook et al [44] found that increasing BMI was not associated with BE when compared with GERD controls but was associated with BE when compared with population controls. The authors also concluded that increasing BMI increases the risk of BE indirectly through causation of GERD. Clearly further studies are needed to evaluate if the presence of reflux symptoms attenuates the strength of this relationship, and whether BMI itself is most strongly associated with BE.

It is important to explore the link between elevated BMI and risk of BE since, unlike other risk factors, obesity is potentially modifiable and there may be opportunities for behavioral and/or medical intervention in high-risk patients. To better risk stratify, it will also be important to determine whether a particular pattern of obesity plays a role in BE. Several studies have found that abdominal obesity is an independent risk factor for BE [45,46]. Additionally, Vaughan et al [47] have demonstrated an increased risk for cell cycle (aneuploidy) and genetic abnormalities (17p loss) in patients with BE and increased waist/hip ratio. Along these lines, it will also be important to determine whether weight loss decreases progression to EAC in patients with known BE.

- **What is the patient's risk of developing EAC?**

The risk of developing EAC in patients with BE is estimated at 0.5% to 1% per year [37,48]. In fact, patients with BE have a 50- to 100-fold increased risk of cancer compared with the general population [49]. The rising incidence of BE over the past few decades has paralleled that of EAC, especially in a white population [50–52]. Generally the sequence of progression of BE to EAC follows the metaplasia–dysplasia–carcinoma sequence. Many recent studies have focused on understanding the pathogenesis of BE to EAC at a molecular level [53,54]. Such transformation into neoplasia has been linked to alterations in the tumor suppression genes p53 and p16 and cyclin D1 protooncogene [55–57]. Together these contribute to inhibition of apoptosis, neoplastic progression, clonal selection, and expansion of neoplastic cells resulting in EAC.

- **How often should patients with BE undergo endoscopic surveillance?**

The 2008 guidelines from the American College of Gastroenterology on the management of BE [58] recommend that grade of dysplasia should determine the appropriate sur-

Table 2. Surveillance Intervals in Barrett's Esophagus

Grade of Dysplasia	Workup	Surveillance Recommendations
No dysplasia	Two endoscopies with biopsies within 1 year to confirm	No dysplasia: endoscopy every 3 years
Low-grade dysplasia	Confirmation by an expert GI pathologist: endoscopy with biopsy within 6 months	No high-grade dysplasia: annual endoscopy until no dysplasia in 2 consecutive endoscopies
High-grade dysplasia	Confirmation by an expert GI pathologist Mucosal irregularity: consider endoscopic mucosal resection for better sampling and to rule out cancer Flat mucosa: repeat EGD + biopsies within 3 months	Confirmed high-grade dysplasia: intensive 3-month surveillance, esophagectomy, endoscopic therapy

EGD = esophagogastroduodenoscopy; GI = gastrointestinal.

Table 3. Treatment Options for Barrett's Esophagus with High-Grade Dysplasia

Esophagectomy
Endoscopic ablation
Radiofrequency ablation
Photodynamic therapy
Other: argon plasma coagulation, cryotherapy, etc.
Endoscopic mucosal resection
Endoscopic surveillance

veillance interval (**Table 2**). Surveillance endoscopy should be performed in patients with chronic reflux symptoms ideally when symptoms are controlled with acid suppressive therapy. This is important since the inflammatory process associated with reflux esophagitis and its resultant cellular changes can interfere with the diagnosis and grading of BE and may even mimic dysplasia [59]. As mentioned previously, endoscopic surveillance of BE involves 4-quadrant biopsies taken every 1 to 2 cm throughout the Barrett's segment. Ideally, the biopsies from a given "level" of BE should be placed in separate container. Additionally, all cases diagnosed with low-grade or high-grade dysplasia should be confirmed by an expert gastrointestinal pathologist.

For patients with intestinal metaplasia (no dysplasia), surveillance endoscopy should be performed twice within the first year to rule out dysplastic changes. In the absence of dysplasia, endoscopies can then be performed at 3-year intervals. Patients with low-grade dysplasia should undergo follow-up endoscopy at 6 months from the initial examination to exclude progression to high-grade dysplasia. Patients with high-grade dysplasia in flat mucosa should be referred to a specialized center to undergo further diagnostic evaluation and confirmation of their diagnosis by an expert gastrointestinal pathologist along with subsequent endoscopy within 3 months.

- **When should BE be removed?**

While all patients with BE can progress to EAC, the 5-year risk of EAC with high-grade dysplasia exceeds 30%. Indeed, the time for progression of high-grade dysplasia to cancer is about 24 months (range, 6–43 months) [60–63]. Thus, as mentioned previously, all patients with high-grade dysplasia should be referred to a specialized center for further evaluation.

However, it is important to note that not all patients with high-grade dysplasia progress to EAC. Schnell et al [64] reported that 11 of 75 cases of high-grade dysplasia developed EAC during a mean surveillance period of 7.5 years. Several options are available for patients with high-grade dysplasia, including esophagectomy, endoscopic therapy, and close endoscopic surveillance at 3-month intervals (**Table 3**). Patients with high-grade dysplasia and mucosal irregularity are at high risk for concomitant adenocarcinoma. These individuals should be seen by a gastroenterologist with expertise in the management of BE and consideration should be made for an endoscopic mucosal resection of the nodular area, as this provides a better histologic assessment of the affected area and can more accurately exclude the presence of cancer. For patients with high-grade dysplasia in flat mucosa, several options exist including: (1) esophagectomy, (2) endoscopic therapy (endoscopic mucosal resection or ablative therapy), and (3) close surveillance at 3-month intervals. Patients who undergo ablation of their Barrett's mucosa for high-grade dysplasia should be followed and biopsied in the entire area of prior Barrett's mucosa at intervals appropriate for their prior grade of dysplasia until complete ablation is documented on at least 3 consecutive endoscopies.

Traditionally, esophagectomy has been the standard of care for BE; however, increasingly more patients are opting for endoscopic therapy given its lower morbidity and mortality. Historically esophagectomies have been associated with higher rates of postoperative mortality [65]. One study reports that esophagectomy preformed even in high-volume and expert centers is associated with mortality and morbidity rates of 3% to 5% and 20% to 50%, respectively [66].

Despite this, there is considerable controversy as to what is the ideal treatment of choice for high-grade dysplasia.

Researchers in favor of esophagectomy for high-grade dysplasia believe that poor outcomes reported by studies may be in part a result of extrapolation of data derived from patients with invasive esophageal cancer. This was confirmed by Williams et al [67], where the postesophagectomy cumulative mortality rates in high-grade dysplasia population were found to be approximately 1%. A recent study found similar long-term mortality rates among 199 patients with high-grade dysplasia treated with photodynamic therapy and endoscopic mucosal resection versus surgical resection (9% vs. 8.5%) with no patient from either group having an esophageal cancer–related death [68].

An important factor influencing postesophagectomy mortality rates is the institutional volume of procedures. A report derived from the Medicare database found that postoperative mortality from esophagectomy during 1994–1997 was 20.3% in hospitals performing fewer than 2 esophagectomies per year versus 8.4% in hospitals performing greater than 19 per year [69]. Maish and DeMeester [70] estimated that in order to decrease the operative mortality rates to less than 5%, an institution would need perform at least 20 esophagectomies annually.

Shaheen et al [71] studied the cost-effectiveness of competing management strategies that included elective esophagectomy, surveillance endoscopy, and endoscopic ablation among 50-year-old white males diagnosed with high-grade dysplasia. It was observed that endoscopic surveillance was less expensive and more effective than esophagectomy. Although esophageal ablation was found to be a more expensive option as compared with surveillance endoscopy, it was still the most cost-effective and preferred option since it had the highest return in life-years per dollar spent. Sensitivity analysis from the study also demonstrated that when yearly rates of progression to cancer from high-grade dysplasia exceeded 30%, esophagectomy became a more cost-effective option. Another study by Comay et al [72] in a hypothetical cohort of 50-year-old male patients with BE and high-grade dysplasia concluded that both photodynamic therapy and esophagectomy are cost-effective alternatives to endoscopic surveillance.

Endoscopic mucosal resection is increasingly being looked at as a preferred modality in patients with nodular or focal high-grade dysplasia. The procedure involves raising the mucosal/submucosal target area by using various techniques including submucosal saline and epinephrine injections and/or suction followed by subsequent resection. One potential drawback of incomplete mucosal resection is that some dysplastic foci may persist in the residual Barrett's segment, which has the potential to develop into EAC. Also, the subsquamous Barrett's epithelium continues to be at risk for progression to EAC. Therefore, it is important that patients treated with incomplete EMR undergo close endoscopic follow-up. Researchers, however, have found encouraging results in patients that underwent stepwise radical resection of BE using endoscopic techniques. A study conducted by Peters et al [23] in 56 patients with high-grade dysplasia that underwent stepwise radical endoscopic mucosal resection with regular endoscopic follow-up demonstrated complete eradication of neoplasia in all patients over a median of 3 sessions and reported no recurrence of dysplasia/intestinal metaplasia or deaths in this group.

SUMMARY

BE is an increasingly prevalent condition of the distal esophagus that is thought to be a complication of long-standing GERD. Patients with long-standing or refractory symptoms of GERD should therefore be referred to a gastroenterologist for endoscopic evaluation to rule out BE, the predominant precursor to EAC. Esophagogastroduodenoscopy allows direct visualization of the Barrett's mucosa and is able to obtain biopsies for histopathologic confirmation of BE. Further guidelines for endoscopic surveillance in patients diagnosed with BE are guided by the presence and grade of dysplasia. The risk of progression to EAC is highest in patients with high-grade dysplasia. Several management strategies including endoscopic surveillance, endoscopic therapy, and esophagectomy are available for subjects with high-grade dysplasia; however, the cost-effectiveness of these modalities depends upon patient characteristics and the risk for progression from high-grade dysplasia to EAC.

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JCOM CME

WAYNE STATE UNIVERSITY

CME EVALUATION: Barrett's Esophagus: Evaluation and Management

DIRECTIONS: Each of the questions below is followed by 4 possible answers. Select the ONE lettered answer that is BEST in each case and circle the corresponding letter on the answer sheet.

1. All of the following have been identified as risk factors for the development of Barrett's esophagus EXCEPT
   A. Gastroesophageal reflux disease
   B. Male gender
   C. *Helicobacter pylori*
   D. Age > 40 years

2. A diagnosis of Barrett's esophagus can be confirmed based on which of the following criteria?
   A. An "irregular-appearing" Z–line seen on upper endoscopy
   B. The presence of columnar epithelium at the gastroesophageal junction
   C. The presence of specialized intestinalized epithelium with goblet cells in the distal esophagus
   D. Proximal displacement of the gastroesophageal junction relative to the diaphragmatic hiatus

3. Which of the following statements is TRUE?
   A. Smoking and alcohol are the predominant risk factors for the development of esophageal adenocarcinoma
   B. The risk of esophageal adenocarcinoma in patients with Barrett's esophagus is roughly 0.5% to 1% per year
   C. The incidence of Barrett's esophagus is equal in both men and women
   D. Barrett's esophagus is present in all patients with esophageal adenocarcinoma

4. Which of the following statements is TRUE?
   A. Proton pump inhibitors are recommended in all patients with Barrett's esophagus because they have been shown to decrease the likelihood of progression to esophageal adenocarcinoma
   B. Histamine$_2$ blockers are recommended in all patients with Barrett's esophagus because they have been shown to decrease the likelihood of progression to esophageal adenocarcinoma
   C. Endoluminal therapy for Barrett's with low-grade dysplasia has been shown to reduce the progression to esophageal adenocarcinoma
   D. Endoluminal therapy for Barrett's with high-grade dysplasia has been shown to reduce the progression to esophageal adenocarcinoma

5. All of the following are acceptable options for the management of high-grade dysplasia in Barrett's esophagus EXCEPT
   A. Esophagectomy
   B. Endoscopic surveillance every 12 months
   C. Endoscopic mucosal resection
   D. Radiofrequency ablation

EVALUATION FORM: Barrett's Esophagus: Evaluation and Management

Participants may earn 1 credit by reading the article named above and correctly answering at least 70% of the accompanying test questions. A certificate of credit and the correct answers will be mailed within 6 weeks of receipt of this page to those who successfully complete the test.

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