Mucosal Ablation Techniques for Barrett's Esophagus and Early Esophageal Cancer

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KEYWORDS

• Barrett's esophagus • Cryotherapy • Catheter ablation • Endoscopy • Esophageal neoplasm • Esophagoscopy • Metaplasia • Precancerous conditions

KEY POINTS

- Barrett's esophagus is intestinal metaplasia of the normally squamous lined esophageal mucosa and can pathologically be classified as nondysplastic, low-grade dysplasia, or high-grade dysplasia.
- Radiofrequency ablation of Barrett's esophagus results in a high rate of eradication of intestinal metaplasia and dysplasia and a reduced risk of disease progression.
- Several studies have also reported high eradication rates of nondysplastic and dysplastic Barrett's esophagus with cryoablation, using both liquid nitrogen and pressurized carbon dioxide.
- Current guidelines support the use of ablation in patients with Barrett's esophagus with high-grade and low-grade dysplasia, although patients without dysplasia should undergo surveillance rather than ablation.

INTRODUCTION

Columnar-lined intestinal metaplasia of the normally squamous esophageal mucosa is termed Barrett's esophagus (BE). Gastroesophageal reflux disease (GERD) is considered one of the major risk factors for the development of BE, particularly in older patients with long-standing disease.[1] The estimated prevalence of GERD (19.8%) and BE (5.6%) have increased significantly in the United States in recent years, possibly related to increasing obesity rates.[2,3]

Endoscopically, BE characteristically appears as coarse salmon-colored mucosa in contrast to the pale or pearly colored stratified squamous epithelium that normally lines the inner esophagus.[4] Use of high-definition white light imaging or new imaging modalities including narrow band imaging, chromoendoscopy, optical coherence tomography, and laser confocal microscopy may improve the ability of endoscopists to detect BE, as well as any associated dysplastic changes.[4] A detailed review of these advanced endoluminal technologies is included elsewhere in this issue. In addition to its appearance, a diagnosis of BE is confirmed with biopsies demonstrating intestinal metaplasia $\geq$1 cm above the gastroesophageal junction.[5]

BE is further characterized as short-segment (<3 cm) or long-segment ($\geq$3 cm). Additionally, the Prague Criteria is a classification system often used to describe the circumferential and maximal extent of metaplastic disease.[6] In addition to providing a common language among endoscopists to report the degree of BE present, this system

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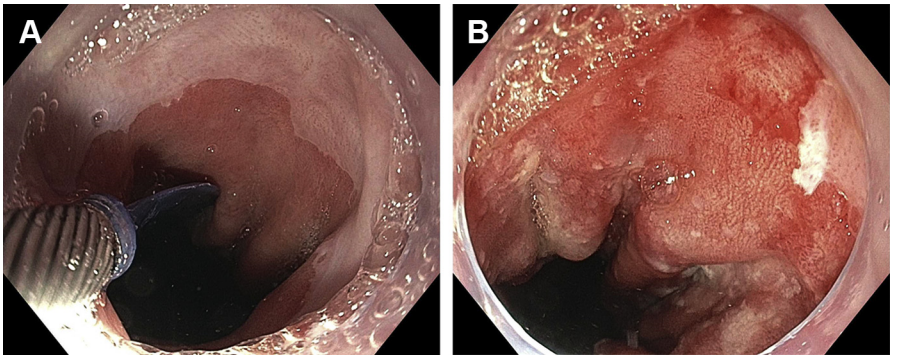

Fig. 1. RFA performed in a patient with BE. (*A*) Pre-ablation with catheter seen adjacent to area of metaplastic disease. (*B*) Posttreatment after RFA.

has also been prospectively validated as having a high reliability coefficient (RC) for recognizing BE segments ≥1 cm (RC 0.72), although not for segments <1 cm (RC 0.22).[6]

This use of endoscopic ablation therapies for the management of nondysplastic and dysplastic BE has grown considerably in the past several years. Although a number of different modalities have been described, including photodynamic therapy and argon plasma coagulation, they have largely been supplanted by evidence favoring the use of radiofrequency ablation (RFA). Additionally, several studies have demonstrated promising results from the use of cryoablation. This review highlights the use of RFA and cryoablation in BE and early esophageal adenocarcinoma (EAC), as well as current evidence-based guidelines for the use of these technologies.

RADIOFREQUENCY ABLATION

Endoscopic RFA is performed using a specialized heated ablation catheter for targeted, intentional mucosal injury and cellular destruction (Fig. 1). Energy conduction usually reaches the level of the lamina propria and is directed at areas of known or suspicious intestinal metaplasia and/or dysplasia. Several endoscopic treatment sessions are typically required to achieve complete eradication of intestinal metaplasia (CEIM). A successful outcome from endoscopic ablation is considered complete clearance of a patient's BE as well as any associated areas of dysplasia.[5] Evidence suggests that endoscopists with higher RFA volume may achieve higher rates of CEIM.[7]

Radiofrequency Ablation for Dysplastic Barrett's Esophagus

Several studies have evaluated the use of endoscopic RFA for the treatment of BE with or without dysplasia. The AIM Dysplasia Trial was a multicenter study of patients with non-nodular dysplastic BE who were randomized to either RFA or a sham procedure.[8] Patients with both low-grade dysplasia (LGD) and high-grade dysplasia (HGD) were included. The primary outcomes of this study included the proportion of patients with CEIM by 12 months as well as eradication of both LGD and HGD during this period. In total, 127 patients were randomized. Intention-to-treat analyses demonstrated 77.4% of patients in the RFA group had CEIM compared with 2.3% in the control group. Additionally, when comparing RFA with sham procedures, there were significant differences in complete eradication of both LGD (90.5% vs 22.7%, respectively) and HGD (81.0% vs 19.0%, respectively). Furthermore, disease progression in the sham group was significantly higher when compared with the RFA group (16.3% vs 3.6%, respectively). Patients with HGD, in particular, benefited from RFA in that 19.0% of those randomized to a sham procedure had progression to EAC, whereas only 2.4% of those in the ablation group had progression of disease. Patients in the RFA group underwent a mean of 3.5 treatment sessions. Adverse effects of RFA were reported in some patients, including a higher reported degree of chest discomfort compared with controls. Esophageal stricture occurred in 6.0% of ablated patients with all undergoing subsequent successful endoscopic dilation. Excellent long-term rates of eradication of dysplasia have also been reported. In a follow-up study of patients enrolled in the AIM Dysplasia Trial, 55 (98%) of the 56 patients in the RFA group with 3-year follow-up had eradication of their dysplasia.[9]

In the Surveillance versus Radiofrequency Ablation (SURF) trial, 136 patients with BE and LGD were randomized to either RFA or endoscopic surveillance.[10] The primary outcome in this study was progression to either HGD or adenocarcinoma at 3-year follow-up. Progression of disease was