



Strategies to prevent Barrett's esophagus associated esophageal adenocarcinoma

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Abstract

There has been a rise in the incidence of esophageal adenocarcinoma (EAC) over the past five decades in the United States, and it remains a highly lethal malignancy due to frequent late-stage diagnosis. Barrett's esophagus (BE), a well-established precursor to EAC, presents a critical window for early intervention through screening, surveillance, and endoscopic eradication therapy. Despite gastrointestinal society guideline recommendations for screening, the majority of patients with BE or early EAC remain undiagnosed until symptoms of late-stage cancer emerge. This review outlines current challenges and evolving strategies in the United States in BE detection and management, including risk stratification models, non-endoscopic screening tools, high-quality endoscopic techniques, tissue-based biomarkers, and artificial intelligence-enhanced imaging. We highlight best practices for surveillance, emphasizing the importance of thorough inspection of high-risk anatomic zones and the integration of advanced imaging. Endoscopic eradication therapy, including endoscopic mucosal resection and ablation, achieves high rates of complete eradication when performed with meticulous technique, especially with comprehensive treatment of the gastroesophageal junction and gastric cardia. Long-term surveillance remains essential due to the risk of recurrence. As new technologies continue to emerge, integrating precision tools into routine practice will be key to improving outcomes and reducing EAC mortality.

Key Words: Barrett's esophagus; Esophageal adenocarcinoma; Endoscopic eradication therapy; Barrett's esophagus screening; Barrett's esophagus surveillance

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Core Tip: The incidence of Barrett's esophagus associated esophageal adenocarcinoma continues to rise. Several factors contribute to this problem, including a lack of recognition of high-risk patients, inconsistent screening mechanisms, and ineffective endoscopic evaluation and management of recognized disease. In this review, we provide a comprehensive and multifaceted overview of strategies to improve in all three domains to help prevent esophageal adenocarcinoma.

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INTRODUCTION

The prevalence of esophageal adenocarcinoma (EAC) has increased in Westernized civilizations. Growing by more than sevenfold in the United States over the past 50 years, it represents one of the most drastic rises in solid tumor incidence among all cancers[1,2]. Despite excellent advancements in available medical, endoscopic, and surgical treatment modalities, a diagnosis of EAC is known for its highly aggressive nature and poor prognosis. This is primarily due to late-stage diagnosis and the absence of widespread early detection strategies. Therefore, adopting effective prevention measures and early screening modalities into standardized practice is crucial to reducing EAC associated morbidity and mortality[2].

The main risk factor for EAC is Barrett's esophagus (BE) - a premalignant condition characterized by the replacement of normal squamous epithelium with intestinal type columnar epithelium in the distal esophagus[2,3]. The progression from BE to EAC occurs through a well characterized stepwise histologic sequence: Non-dysplastic BE (NDBE), low-grade dysplasia (LGD), high-grade dysplasia (HGD), and ultimately, invasive carcinoma[2]. Understanding this defined trajectory provides a valuable window for intervention, where early identification of dysplasia allows for timely curative endoscopic eradication therapy (EET) and prevents malignant transformation[2].

Despite the well-established premalignant nature of BE, only a minority of EAC patients are diagnosed with BE prior to cancer diagnosis. The majority of patients with EAC are diagnosed at time of symptomatic presentation. In a meta-analysis of over 15000 EAC cases, fewer than 12% had a prior diagnosis of BE, and just under 30% had concurrent BE at the time of cancer diagnosis[4]. This suggests that many cases of BE remain undetected until they have already progressed to advanced disease[4], reflecting a critical gap in current screening and surveillance efforts.

EET, particularly with techniques such as radiofrequency ablation (RFA) and cryotherapy, has become the standard of care for BE with dysplasia. These modalities demonstrate high rates of complete eradication of dysplasia (CE-D) and intestinal metaplasia (CE-IM)[5]. The landmark AIM Dysplasia trial (ablation of intestinal metaplasia), a multicenter, randomized controlled study, showed that RFA significantly reduced progression to EAC by 90% in LGD and 78% in HGD - while achieving CE-D in 81% and CE-IM in 77% of patients[5]. These results firmly established RFA as an effective and durable treatment modality for dysplastic BE. Subsequent studies on cryotherapy[6] and meta-analyses evaluating RFA durability[7] have supported these findings. However, the persistent challenge to successful intervention is not therapeutic efficacy - it is accurate and timely detection of dysplasia. This challenge is amplified by the limitations of current screening strategies, which often rely on gastroesophageal reflux disease (GERD) symptoms, despite a significant subset of EAC patients being asymptomatic.

Given the increasing burden of EAC and the availability of endoscopic therapies that can prevent progression in patients with BE-related neoplasia[5-7], improving strategies for screening, surveillance, and risk stratification is paramount. This review provides a comprehensive overview of current and emerging tools for early detection and prevention of EAC, including risk models, novel non-endoscopic screening technologies, tissue-based and molecular biomarkers, artificial intelligence (AI)-assisted imaging, and enhanced endoscopic techniques.

SCREENING FOR BE: CHALLENGES AND STRATEGIES

Despite clear guidelines for BE screening, real-world implementation remains suboptimal. A major challenge is screening, with a study revealing that only 7% of patients diagnosed with EAC are identified through screening[8]. Compounding this issue, approximately 40% of patients with EAC have no prior symptoms of GERD, despite GERD being a major risk factor[8]. Alarming, 90% of patients who meet screening criteria are not being screened[8], reflecting systemic shortcomings in current practice.

To better understand the target population, it is important to consider BE prevalence across risk strata. The prevalence of BE increases significantly with the presence of additional risk factors[9]. For instance, the prevalence of BE is 2.3% among patients with GERD alone, but it rises to 12.2% with GERD plus one additional risk factor, 13.4% with two additional risk factors, and 14.6% with three or more risk factors[9]. Notably, a first-degree family history of BE or EAC is associated with a striking 23% prevalence[9], emphasizing the importance of considering familial risk. These findings support current American College of Gastroenterology (ACG) recommendations that patients with GERD and at least three additional risk factors - including male sex, age over 50, white race, obesity, smoking, and family history - should

undergo screening[10]. Although EAC most commonly affects older men, recent epidemiologic data indicate a rising incidence of early-onset EAC in individuals under 50 years old, often presenting at more advanced stages but paradoxically with improved survival compared to older counterparts[1]. These trends highlight the need for awareness regarding screening eligibility and risk stratification, particularly in younger and traditionally lower-risk populations within the medical community.

Unfortunately, even when patients meet these criteria, BE screening is rarely initiated in the primary care setting. A recent study found substantial missed opportunities in primary care, revealing that of 3535 patients deemed high risk for BE by primary care chart review, only 1077 (30%) were actually screened for BE with endoscopy[11]. In another retrospective study of 1127 screening-eligible patients in the primary care setting, only 39% underwent EGD. Most of the examinations were triggered by refractory symptoms rather than screening referrals, highlighting a need for improved dissemination and implementation of BE screening[12]. These data highlight a critical disconnect between guidelines and clinical practice.

To address this gap, risk prediction models, such as the Kunzmann criteria, offer promising solutions and can be integrated into electronic health records (EHRs) to automatically identify at-risk individuals for targeted screening[13,14]. Such algorithms rely on age, sex, body mass index, smoking status, and esophageal conditions (self-report of GERD, BE, hiatal hernia, esophageal stricture, fundoplication, or acid-reducing medications) as a screening mechanism to identify BE and early neoplasia and can be more accurate in identifying patients with BE than just the frequency and duration of GERD.

Beyond traditional endoscopy, non-endoscopic tools are gaining traction as more feasible and scalable alternatives. For example, DNA methylation-based assays have been developed to detect BE using non-invasive methods. Using a swallowed sponge or balloon-based cytology device, esophageal cells can be collected in a minimally invasive fashion [15]. These assays detect aberrant DNA methylation patterns, which are characteristic of intestinal metaplasia. Specifically, hypermethylation of gene promoters such as *VIM*, *CCNA1*, *ZNF682*, and *TFPI2* represents a hallmark of Barrett's epithelium and often occurs early in the neoplastic sequence. Several studies have validated the performance of these biomarker assays, demonstrating sensitivities of 80%-90% and specificities upwards of 90% for detecting NDBE and BE-associated neoplasia[16-19].

This approach enables a tiered screening model in which patients with a positive result from a non-endoscopic test are referred for confirmatory endoscopy. Such a model enhances feasibility and compliance by screening a broader population without overwhelming endoscopy resources. Most importantly, it decouples BE screening from reliance on GERD symptoms alone. Ideally, large health systems or primary care practices would identify candidates for screening using EHR-based risk models, provider education, or symptom-based criteria. These individuals would then undergo non-endoscopic testing. Those with positive methylation signatures would proceed to endoscopy, where dysplastic BE would prompt referral for EET, and NDBE would enter a surveillance program. Incorporating these emerging technologies with risk stratification strategies could revolutionize BE screening by detecting more patients before dysplasia or cancer develops. However, implementation will require a coordinated effort between gastroenterology, primary care, and health systems to translate these tools from research into routine care.

Despite these promising innovations, several barriers continue to hinder widespread implementation of BE screening programs. First, patient education and awareness about BE and EAC remain limited, particularly in underserved populations. Many eligible individuals are unaware of their risk or the availability of screening[11,12]. Second, lack of insurance coverage or underinsurance creates a financial barrier to accessing both endoscopic and non-endoscopic diagnostic procedures, especially in lower socioeconomic groups[20]. Third, payors often resist approving non-endoscopic tools or endoscopic eradication therapies due to perceptions of investigational status or insufficient cost-effectiveness data, which slows broader adoption[21]. Finally, a shortage of gastroenterologists trained in advanced techniques - such as RFA, volumetric laser endomicroscopy (VLE), and AI-enhanced imaging - further limits the quality and geographic reach of care, especially in community or rural settings[22]. Addressing these systemic issues will be essential for equitable and effective deployment of emerging tools and updated clinical guidelines.

HIGH-QUALITY SCREENING AND SURVEILLANCE EXAMS

High-quality endoscopic screening and surveillance for BE are critical to reducing the incidence of post-endoscopy EAC (PEEC). PEEC includes cancers missed at baseline or those that develop after a negative endoscopy. Several large studies, including population-based and meta-analytic data, have demonstrated the ongoing burden and time trends of PEEC in the United States and globally[23-25]. These cancers are often categorized as prevalent (missed on index exam), interval (detected between scheduled surveillance exams), or incident (truly new cancers), with the first two categories largely attributed to suboptimal endoscopic technique[24,25]. Avoiding these failures depends on meticulous adherence to best practices in surveillance.

Understanding the anatomic distribution of dysplasia and EAC should guide surveillance strategy. Dysplasia tends to cluster near the gastroesophageal junction (GEJ) and on the right hemisphere of the esophagus[26,27]. Thus, these regions warrant particular attention during inspection and biopsy. Studies have confirmed that the majority of early neoplasia in BE occurs in these predilection zones, reinforcing the need for thorough and directed examination[26,27].

The ACG has outlined a ten-step approach to performing high-quality BE surveillance exams, aimed at reducing the likelihood of missed dysplasia or early neoplasia[10]. These steps include: (1) Correct identification of esophageal landmarks; (2) The use of a distal attachment cap to flatten folds and enhance visualization; (3) Thorough cleaning of mucosal surfaces; (4) Spending adequate inspection time; (5) Use of high-definition white-light endoscopy; (6) Chromoen-

doscopy or virtual chromoendoscopy; (7) Application of the Prague classification for segment length; (8) Use of Paris classification for visible lesions; and (9) Adherence to the Seattle biopsy protocol. These standardized techniques improve diagnostic yield and consistency, especially when paired with technological adjuncts.

Among such adjuncts, wide-area transepithelial sampling with three-dimensional analysis (WATS-3D) has been shown to significantly enhance the detection of both BE and dysplasia beyond forceps biopsies alone[28-32]. WATS-3D collects a larger and deeper mucosal sample and uses AI-assisted analysis to identify histologic abnormalities, proving effective in both long- and short-segment BE[31]. Studies have consistently shown that the addition of WATS-3D to standard forceps biopsy can increase the diagnostic yield for BE and dysplasia by as much as 200% in some settings[29,30].

In addition to detection, tissue-based risk stratification tools like TissueCypher and Previsio have emerged to help guide surveillance intervals and personalize patient care. These epigenetic and histologic biomarker assays assess tissue-level changes to estimate the risk of progression in patients with NDBE, identifying individuals who may benefit from closer surveillance or early intervention[18,33,34]. Often, these tools may help detect prevalent dysplasia that would have otherwise been missed. In these circumstances a high risk score prompts another endoscopy that yields dysplasia.

AI is also poised to redefine BE surveillance. Deep learning models, particularly convolutional neural networks, have been trained on large annotated datasets of endoscopic images to distinguish between non-dysplastic mucosa, LGD, HGD, and early EAC. These models learn to identify subtle mucosal and vascular patterns often missed by the human eye. In head-to-head comparisons, AI systems have outperformed expert endoscopists in sensitivity for dysplasia detection, with some achieving sensitivities of 90%-94% and specificities exceeding 85% in validation cohorts[35-37].

When embedded into endoscopy platforms, AI tools offer real-time image analysis by highlighting suspicious regions (heatmaps) or providing diagnostic classification overlays, enabling more targeted biopsies and fewer sampling errors. For example, an AI system was shown to detect dysplasia with significantly higher accuracy than endoscopists using white-light endoscopy alone, and it maintained strong performance when validated across multiple clinical centers[36]. Beyond endoscopic imaging, AI is also being applied to clinical data to optimize screening. Iyer *et al*[38] developed a deep learning algorithm that analyzes EHR variables - such as demographics, symptoms, and comorbidities - to stratify patients by BE risk. In a prospective multicenter study, the model demonstrated excellent discrimination with areas under the receiver operating characteristic curve of 0.86[38]. Collectively, AI-driven tools represent a paradigm shift in BE care by improving early neoplasia detection, eliminating interobserver variability, reducing the rate of missed dysplasia (a key contributor PEEC), and enabling more personalized risk-based screening. Future work should aim to standardize training datasets, ensure interpretability of AI outputs, and validate performance across diverse clinical settings.

Advanced endoscopic imaging, such as VLE and confocal laser endomicroscopy (CLE), further augments dysplasia detection by allowing real-time microstructural assessment of the BE segment[39]. VLE enables high-resolution, cross-sectional imaging of the esophageal mucosa and submucosa in real time. It offers subsurface imaging, facilitating the detection of buried glands, subsquamous BE, and residual dysplasia following EET[39]. When combined with AI-based image enhancement and laser marking for targeted biopsy, VLE significantly increases dysplasia detection rates compared to the Seattle protocol or random biopsies alone[39]. In a comparative study, VLE-guided targeted biopsies demonstrated higher incremental yield of dysplasia over standard four-quadrant biopsy protocols, especially in post-ablation surveillance where neoplastic foci can be patchy or subtle[39]. VLE is not currently commercially available.

CLE, although less widely available, offers another real-time, *in vivo* microscopic imaging modality that can provide cellular-level resolution of the mucosal surface, allowing for immediate assessment of dysplastic changes during endoscopy. CLE has shown promise in identifying goblet cells, architectural distortion, and atypical vascular patterns in BE patients, which may complement or guide traditional biopsies. While CLE has not yet been incorporated into routine surveillance guidelines, its utility may lie in expert centers or in patients with complex or equivocal findings on conventional endoscopy. Collectively, these imaging modalities offer promising adjuncts to traditional endoscopic surveillance, particularly in high-risk or post-ablation populations, and they may support earlier detection of recurrence or persistent disease that would otherwise go unnoticed with standard sampling techniques[39]. Together, these strategies: Adherence to high-quality endoscopic technique, adjunctive sampling methods, biomarker-based screening and risk assessment, and AI-enhanced imaging form a comprehensive approach to BE surveillance that may significantly reduce the risk of PEEC and improve long-term outcomes in this high-risk population.

COMPARISON OF NATIONAL AND INTERNATIONAL GUIDELINES

Multiple gastroenterology societies have issued guidelines on the screening, surveillance, and management of BE, including ACG, the American Society for Gastrointestinal Endoscopy, the British Society of Gastroenterology, and the European Society of Gastrointestinal Endoscopy (ESGE). While these guidelines share foundational principles - such as endoscopic surveillance of dysplasia and the use of EET for HGD, there are key differences that may influence clinical practice which are summarized in Table 1.

ACG, for example, recommends screening men with chronic GERD and at least two additional risk factors[10], whereas the ESGE suggests a broader approach, including considering BE screening in patients with chronic GERD symptoms and a family history of BE or EAC, but does not specify a minimum number of risk factors. The British Society of Gastroenterology recommends a one-time endoscopic screening for patients with chronic GERD and multiple risk factors but does not endorse population-wide screening due to lack of cost-effectiveness[40]. The American Society for Gastrointestinal Endoscopy supports screening similar to ACG but further emphasizes the importance of shared decision-making and patient preferences[41]. Surveillance intervals for NDBE also vary. ACG recommends intervals of 3-5 years [10], while ESGE advises surveillance every 3 years[42]. For LGD, ACG recommends ablation or close surveillance,

Table 1 Comparison of major society guidelines on screening, surveillance, and management of Barrett's esophagus

	ACG[10], 2022	ASGE[41], 2019	ESGE[42], 2017	BSG[40], 2014
Screening recommendations	Men with chronic GERD and ≥ 2 risk factors (age > 50, White race, obesity, smoking, family history)	Similar to ACG; shared decision-making emphasized	GERD with ≥ 1 risk factor (family history, male sex, obesity, age > 50, smoking)	Longstanding GERD with multiple risk factors; no general population screening
Screening modality	High-definition white light endoscopy + Seattle protocol biopsies	Endoscopy preferred; non-endoscopic tools under evaluation	Endoscopy with biopsies; non-endoscopic tests promising but investigational	Endoscopy and systematic biopsies
Surveillance of NDBE	Every 3-5 years	Every 3-5 years	Every 3 years	3-5 years depending on segment length and risk
Management of LGD	Confirm by expert pathology; recommend RFA or continued surveillance	Recommend RFA; confirmation by expert pathologist essential	Ablation preferred; mandatory second pathologist confirmation	Surveillance or ablation based on shared decision
Management of HGD/IMC	EET preferred over surgery	Endoscopic therapy first-line	Endoscopic therapy preferred; surgery if technically unfeasible	Endoscopic therapy recommended
Role of biomarkers	May aid in select cases; not standard of care	Under active investigation	Considered promising but not validated for routine use	Not routinely recommended
Role of AI/emerging tools	Recognized as promising adjuncts; not yet standard	Potential role noted	Await further validation	Not addressed

ACG: American College of Gastroenterology; ASGE: American Society for Gastrointestinal Endoscopy; ESGE: European Society of Gastrointestinal Endoscopy; BSG: British Society of Gastroenterology; GERD: Gastroesophageal reflux disease; NDBE: Non-dysplastic Barrett's esophagus; LGD: Low-grade dysplasia; RFA: Radiofrequency ablation; HGD: High-grade dysplasia; IMC: Intramucosal carcinoma; EET: Endoscopic eradication therapy; AI: Artificial intelligence.

whereas ESGE prefers a second expert pathology review before proceeding with endoscopic therapy.

These differences reflect ongoing controversies and the limited high-quality data in certain areas - particularly around cost-effectiveness, screening in younger populations, and the management of indefinite for dysplasia. Standardizing definitions (*e.g.*, for LGD) and surveillance intervals, as well as adopting validated risk stratification tools, remain unmet needs across guidelines. Harmonizing these recommendations, or clearly acknowledging their divergences, would assist clinicians in making evidence-informed decisions, particularly in multinational settings or diverse patient populations.

HIGH QUALITY ENDOTHERAPY AND ERADICATION EXAMS

EET has revolutionized the management of BE with dysplasia and EAC, and is now the standard of care for BE with confirmed dysplasia or intramucosal carcinoma, offering a minimally invasive and organ-sparing alternative to esophagectomy. The goal of EET is twofold: To completely remove neoplastic epithelium and to eliminate all IM and reduce disease recurrence or progression[5,7,43]. EET typically follows a sequential multimodal paradigm, beginning with endoscopic mucosal resection (EMR) of all visible lesions to allow accurate histological staging and removal of focal neoplasia. EMR specimens provide critical insight into tumor depth, lymphovascular invasion, and margin status, guiding further therapy[5,43]. Following successful resection of focal disease, ablation of residual NDBE is standard, with RFA being the most widely studied modality. Randomized controlled trials and large observational studies have confirmed the efficacy and durability of RFA, achieving CE-D in approximately 90% of cases and CE-IM in 70%-80% of patients[5,7,43]. The combination of EMR followed by ablative therapies, such as RFA or cryotherapy, offers high rates of CE-D and CE-IM[5-7].

Critical to the success of EET is the delivery of high-quality exams, defined by adequate visualization, complete mapping and treatment of BE, and adherence to procedural best practices. One of the most important yet underemphasized technical considerations is the comprehensive ablation of the GEJ and the top of the gastric folds. Studies have demonstrated that failure to ablate the GEJ and gastric cardia mucosa may result in residual or recurrent BE and dysplasia[26,27]. This is due to the presence of buried glands or skip lesions in the cardia region, which may harbor or develop neoplasia[26]. VLE can be used for refined lesion detection in this area, especially when paired with laser marking as it allows precise localization and treatment of subtle or buried neoplastic lesions that are often missed with conventional white light endoscopy[39]. Expert societies and high-volume BE centers now emphasize deliberate and thorough ablation extending 1-2 cm below the GEJ (encompassing the top of the gastric folds) to ensure complete treatment of all metaplastic tissue as recurrence after EET most commonly occurs at this location[10,26,27,44].

Optimal ablation also requires careful technique to ensure circumferential and uniform energy delivery, whether using RFA or cryotherapy. Incomplete contact or insufficient energy delivery can lead to skip areas and treatment failure. Thus, procedural quality indicators for ablation include documentation of energy settings, complete circumferential treatment including the GEJ, and photo-documentation of post-ablation mucosal appearance[43].

Ultimately, delivering high-quality EET involves more than just applying ablation - it requires meticulous technique, comprehensive anatomic coverage (especially at the GEJ and gastric folds), and integration of enhanced imaging modalities when needed. These practices reduce recurrence and improve the long-term durability of CE-IM and CE-D, with studies showing that recurrence after complete treatment can be effectively managed with retreatment if detected early[26,43,44].

SURVEILLANCE AFTER EET

Surveillance following EET is critical for ensuring durable treatment success and detecting recurrence of IM, dysplasia, or early carcinoma. Even after achieving CE-D and CE-IM, patients remain at lifelong risk of recurrence, necessitating structured and risk-based surveillance strategies[43,44]. The recurrence rate of BE following successful eradication is not insignificant, with studies reporting rates ranging from 15% to 25% over a 5-year period[26,44]. Dysplastic recurrence may be more common in patients with longer baseline BE segments, multifocal dysplasia, or incomplete initial eradication[26,27]. These findings underscore the need for vigilant endoscopic follow-up using high-definition imaging and adherence to established surveillance intervals. ACG and other expert societies recommend stratifying post-eradication surveillance intervals based on baseline histologic grade and presence of high-risk features[10,44]. For instance, patients treated for LGD may undergo surveillance every 12 months initially, while those with HGD or early carcinoma may benefit from more frequent examinations (*e.g.*, every 3-6 months in the first year)[10,44].

Understanding the spatial distribution of recurrence is also important and has practical implications for biopsy protocols. Meta-analyses and pooled data suggest a circumferential and longitudinal recurrence pattern, with recurrence often clustering near the GEJ and proximal gastric cardia[26]. This observation supports that post-EET surveillance should incorporate both careful inspection of this area where recurrence tends to localize, with targeted biopsies of any visible abnormalities[10,27,44]. In addition, the use of four-quadrant biopsies at the squamocolumnar junction, proximal gastric cardia, and distal esophagus will maximize dysplasia yield.

Advanced imaging tools can significantly enhance the detection of recurrence. VLE, particularly when combined with computer-assisted image analysis or laser marking, has demonstrated increased yield for detecting subsquamous or focal dysplasia that might otherwise go unnoticed with standard white light endoscopy or narrow-band imaging[39]. AI-augmented VLE or deep-learning algorithms may further refine post-EET surveillance by increasing sensitivity and reducing variability in endoscopic interpretation[36,37,39].

The importance of ongoing surveillance is further underscored by evidence showing that most post-EET recurrences, when detected early, can be effectively managed with repeat ablation or EMR without the need for surgical intervention [43,44]. However, missed or delayed detection of recurrence remains a serious concern, and quality metrics must include documentation of adherence to surveillance protocols and lesion detection rates[43].

Post-EET surveillance is a cornerstone of comprehensive BE management. Risk-adapted surveillance schedules, enhanced imaging techniques, and rigorous adherence to biopsy protocols are essential for early detection of recurrence. Ongoing research and integration of AI-assisted tools may further improve the precision and outcomes of BE surveillance in the years ahead.

CONCLUSION

The rising incidence of EAC highlights an urgent need for improved early detection and intervention strategies targeting BE. While effective tools for screening, surveillance, and EET now exist, their real-world implementation remains inconsistent. High-quality exams, targeted biopsies, and the use of advanced imaging technologies can maximize diagnostic yield and minimize recurrence. Furthermore, risk stratification tools, AI-assisted diagnostics, and novel non-endoscopic approaches offer exciting opportunities to close existing gaps in care. Ensuring durable success in EET also requires structured post-treatment surveillance that is risk-adapted and enhanced by imaging and biomarker technologies. Ultimately, integrating these advances into clinical workflows and primary care settings will be critical to changing the natural history of BE and EAC and improving patient outcomes across diverse populations.

FOOTNOTES

Author contributions: Singh DM and Trindade AJ contributed equally to this work. Trindade AJ and Singh DM conducted the literature review, did the analysis, interpretation of data and drafted the original manuscript. All authors prepared the draft and approved the submitted version.

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