v. 4, n. 2, 2024

International Journal of Health Science

DYSPLASTIC BARRETT'S ESOPHAGUS: SURVEILLANCE, TREATMENT AND FOLLOW-UP CARE

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Abstract: **INTRODUCTION:** Gastroesophageal reflux disease (GERD) is important due to its recurrence, being the main reason for consultations and with a prevalence of over 25% in Asia and Southeast Europe. The most feared complication of GERD is esophageal adenocarcinoma (EAC), preceded by Barrett's esophagus (BE). However, the epidemiology of this disease remains unknown due to the low specificity of the symptoms and the lack of consensus on the endoscopic characteristics for its diagnosis. In dysplastic forms of BE, which are more likely to progress to EAC, there has been little research into the best management of dysplastic BE. **OBJECTIVE:** to clarify controversies about the management of dysplastic BE. **METHOD:** a systematic horizontal review, PRISMA method through electronic search in PubMed, between 2018 and 2022, with descriptors: "Barrett's Esophagus" and "Surveillance AND dysplasia AND esophagus" for all age groups. Inclusion: articles in English, with compatible titles and abstracts. We obtained 620 results and after selection 17 articles were included. **RESULTS:** 13 articles indicate Seattle Protocol for diagnosis and surveillance; 5, anti-reflux therapy before endoscopy and 12, confirmation of dysplasia by a specialized pathologist. Low-grade dysplasia (LGD) follow-up: endoscopic eradication therapy (EET) and surveillance are equally acceptable in 6 articles, there is a preference for EET in 5 and surveillance in 1. High-grade dysplasia (HGD) follow-up: endoscopic therapies recommended in 12 articles. Follow-up after dysplastic eradication: periodic and continuous endoscopic surveillance indicated in 9 articles and treatment with proton pump inhibitors in 2 articles. **DISCUSSION:** Although Seattle Protocol is recommended for surveillance, it covers a small part of the esophageal mucosa, in addition to being time-consuming and having low adherence. There are still controversies about the management of LGD but, in general, ablation is advocated to the detriment of surveillance. There is consensus on endoscopic ablation therapy until complete eradication of HGD. Esophagectomy is not recommended. After eradication, continued surveillance and proton pump inhibitors. **CONCLUSION:** Disagreements persist due to discrepancies between studies, especially in low-grade dysplastic BE.

Keywords: Barrett's Esophagus, Gastrointestinal Endoscopy, Follow-up Care, Gastroesophageal Reflux, Adenocarcinoma

INTRODUCTION

The importance of gastroesophageal reflux disease (GERD) is due to its recurrence. In the United States, it is the main reason for outpatient consultations[1] and, globally, it is estimated that the prevalence is greater than 25% in South Asia, Southeast Europe and less than 10% in Southeast Asia, Canada and France.[2]

However, studies with the European population showed that around 46% of patients were asymptomatic, a fact that poses a problem, since the diagnosis can only be made when the complications of GERD are already established.[3] In this context, the most The feared of these complications, esophageal adenocarcinoma (EAC), is preceded by Barrett's esophagus (BE)[4], an intestinal metaplasia that occurs when the stratified squamous epithelium, which normally lines the distal esophagus, is replaced by an abnormal columnar epithelium with characteristic intestinal.[5,6]

This replacement makes the affected site more predisposed to malignancy with such intensity that patients with BE have a 55 times greater risk of developing EAC.[7] In this situation, the prognosis tends to be poor with a 5-year survival rate estimated at 10 to 15%.

of cases.[8]

Therefore, BE is a situation that represents a serious public health problem. Globally, its prevalence has increased dramatically in recent decades with an estimated range of 0.7 to 5.6%, while currently the estimated annual incidence in the general population is 1 to 2%. However, despite these data, the epidemiology remains largely unknown mainly because many individuals with BE are asymptomatic or manifest insensitive and non-specific symptoms generally similar to those related to GERD.[8]

Considering the low specificity and low sensitivity of symptoms, it is important to investigate risk factors to which this patient has been exposed throughout his life, mainly obesity, alcohol consumption and smoking.[5] However, the diagnosis of BE requires additional exams to be confirmed. Among them, the main one is endoscopy with biopsy confirmation.[9,10]

Although the 2006 Prague classification has improved the assertiveness of the diagnosis, renowned societies around the world continue to follow their own criteria for diagnosis, treatment and follow-up of this pathology. Thus, the lack of consensus on the endoscopic characteristics for defining the diagnosis poses another challenge for the accurate diagnosis of patients to elucidate such controversies, the diagnostic criteria recommended by each guideline for defining the diagnosis of BE are listed in Table 1.

It is also relevant to highlight that Barrett's Esophagus can present itself in two main forms according to its evolution and severity: the non-dysplastic form and the dysplastic form. As a rule, dysplasia can be seen as the expression of disordered growth and, according to the degree of histological abnormalities, it can be classified as low-grade or high-grade dysplasia.[7,11] Furthermore, there may be cases in which dysplasia is classified as undefined, with approximately 4.3 to 8.4% of BE biopsies being diagnosed as undefined.[12]

The study of dysplastic forms of BE is important, since it is estimated that the progression of these forms to esophageal adenocarcinoma is greater than in non-dysplastic forms. While the risk of progression from non-dysplastic BE to EAC is estimated to be 0.3%, the risk of progression from low-grade dysplasia (LGD) to EAC is estimated to be 0.5% per year and 6.6% per year in the case of high-grade dysplasia (HGD).[12]

In view of this, it is essential that guidelines be established for early detection, treatment and follow-up of these dysplasia in order to improve patient survival and prevent deaths from esophageal cancer.[6] However, just as there is no consensus on these guidelines for BE as well as there are no well-defined guidelines when it comes to dysplastic BE.[10]

Considering this panorama, research that delves deeper into clarifying the best approaches to dealing with dysplastic BE becomes important in order to direct medical practice according to the most recent evidence.

OBJECTIVE

The objective of this research is to elucidate the controversies related to the management of dysplastic BE through the analysis of consensus and divergences in the guidelines recommended by the most influential global organizations on this subject to direct medical conduct according to the most current scientific evidence.

METHOD

This systematic review was carried out in accordance with the PRISMA checklist.

LITERATURE SEARCH

An advanced electronic search was performed in the PubMed database for systematic reviews published between 2018

Guideline	Extension Criteria	Histological Criteria
AGA	Any lenght	Intestinal metaplasia
Australian guideline	Any lenght	Intestinal metaplasia
Japanese Society	Any lenght	Columnar metaplasia with or whithout intestinal metaplasia
ACG	At least of 1cm in length	Intestinal metaplasia
ESGE	At least of 1cm in length	Intestinal metaplasia
BSG	At least of 1cm in length	Columnar metaplasia
Asia-Pacific Consensus	At least of 1cm in length	Columnar metaplasia
ASGE	Does not define extension criteria	Intestinal metaplasia

Table 1. Criteria accepted by each guideline for the definition of the diagnosis of Barrett's Esophagus.

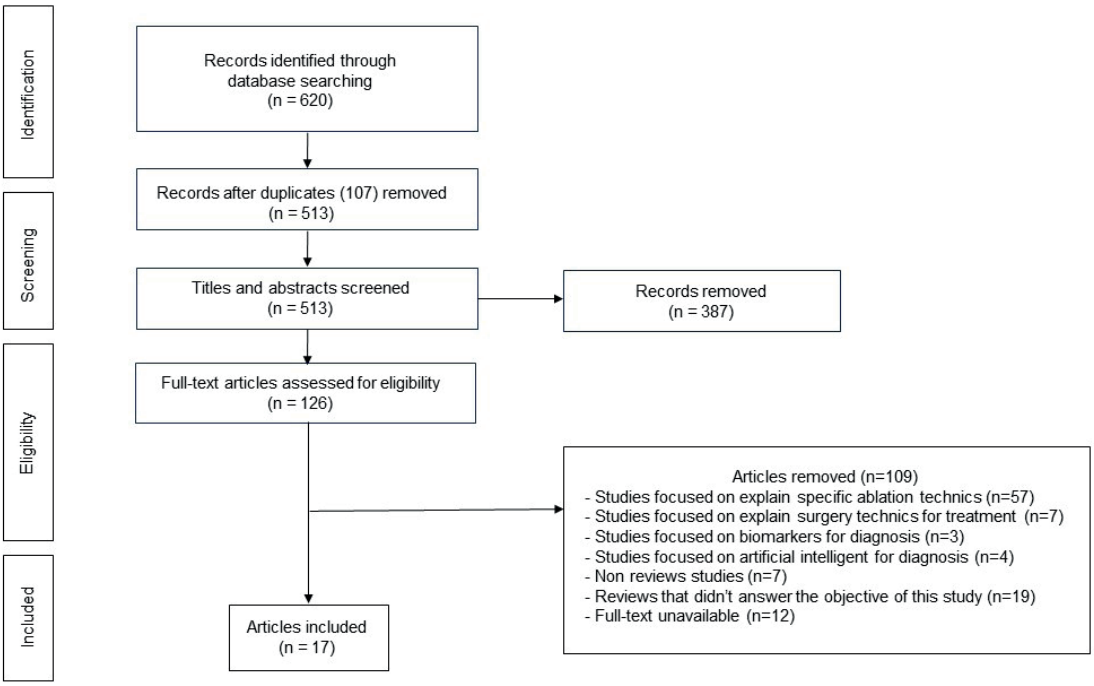

Figure 1. Selection process according to the PRISMA checklist

and 2022 initially using the descriptors "Barrett's Esophagus" and subsequently using the descriptors "Surveillance AND dysplasia AND esophagus" in all age groups. This search was carried out between September and November 2022; eligible articles up to this period were considered for inclusion.

DATA SELECTION AND EXTRACTION

Two independent reviewers identified studies for inclusion and analyzed the selected articles and discrepancies were resolved by discussion. The selection process for this study is illustrated in Figure 1.

First, titles and abstracts were reviewed to only include articles published in the last 5 years and exclude manuscripts that were published in non-English language journals, any study model that did not qualify as a review and that did not address surveillance of dysplastic lesions. The remaining full articles were assessed for eligibility and excluded if they did not fit the questions to be answered by this research.

RESULTS

The results found in the studies included in this systematic review are explained in table 2.

DISCUSSION

SURVEILLANCE OF DYSPLASTIC LESIONS IN BARRETT'S ESOPHAGUS

Regarding the definition, all current guidelines agree that there must be the presence of columnar mucosa in the esophagus instead of squamous epithelium for Barrett's esophagus be characterized.[13,14] However, there is no consensus on the extent of this metaplasia in order to impairs diagnostic accuracy. The BSG, ACG and ESGE consider that there must be at least 1 cm of columnar mucosa extension above the proximal gastric fold, while the Japanese Society, the AGA and the Australian guideline have not determined the minimum length for this definition. Finally, ASGE does not cite criteria for the extent of the change.[9,15]

From these considerations based on metaplastic extension, the Prague criteria were created with the aim of standardizing the endoscopic report of the extent of metaplasia of the esophageal epithelium based on the circumferential extension and maximum visualized extension.[9,16,17,18] In this analysis, at least one minute should be used to inspect every centimeter of Barrett's mucosa, with a particular focus on the right wall and proximal segment.[15]

These definitions are important, because these metaplastic cell development changes, called dysplasia, must be identified early on the routine surveillance that these patients diagnosed with BE must undergo.

Thus, the main function of any surveillance program is the early detection of dysplasia so that treatment can be properly implemented.[13,15,16,17,18] Currently, the guidelines recommend that surveillance should be carried out by means of endoscopic examinations carried out over certain periods of time. This gap is important because there is a direct relationship between the time the examination is carried out and the detection of dysplasia. So, a complete and regular evaluation of the mucosa is essential for an effective surveillance.[13,15]

To optimize this assessment, all the guidelines recommend using the Seattle Protocol, which consists of biopsying four quadrants obtained every 2 cm for patients without dysplasia and every 1 cm for patients with previous dysplasia.[15,17,19,20]

However, this protocol has some challenges. One is that surveillance from random biopsies only shows a small proportion of the Barrett's Esophagus mucosa. In addition, it is a tedious

No. articles	SURVEILLANCE OF DYSPLASTIC LESIONS IN BARRETT'S ESOPHAGUS
13	Seattle Protocol[7,8,10,14,15,16,17,18,19,20,22,23,26]
12	Diagnostic confirmation is required by two pathologists, one of whom must be specialized in gastrointestinal pathology[7,8,10,17,18,19,20,21,22,23,24]
8	Endoscopy with high-definition white light technique[7,8,9,14,17,20,22,26]
5	Biopsy only after resolution of esophageal inflammation[10,15,17,18,22]
No. articles	**LOW-GRADE DYSPLASIA MANAGEMENT**
6	Endoscopic eradication therapy and surveillance are acceptable[7,9,14,15,16,22]
5	Preference for endoscopic eradication therapy[8,17,18,23,26]
1	Preference for surveillance[25]
No. articles	**HIGH-GRADE DYSPLASIA MANAGEMENT**
12	Consider endoscopic therapies as ideal for surveillance and follow-up[7,8,9,14,15,18,21,22,23,24,25,26]
6	Preference for radiofrequency ablation (RFA)[8,9,18,24,25,26]
2	Preference for Endoscopic Mucosal Resection (EMR)[15,23]
3	Surgery/esophagectomy not recommended[7,14,23]
2	Surveillance when low life expectancy < 5 years[21,23]
No. articles	**FOLLOW-UP AFTER LESION ERADICATION**
9	Periodic and continuous endoscopic surveillance[7,9,14,15,18,19,20,23,26]
2	Proton pump inhibitors[9,23]

Table 2. Results

Guidelines	Surveillance Intervals
ACG, ASGE	Yearly
AGA	Every 6 to 12 months
BSG, Australian guideline, Asia-Pacific Consensus	Every 6 months
Japanese Society, ESGE	No data found in the studies evaluated

Table 3. Intervals for periodic surveillance of LGD recommended by each guideline

and time-consuming protocol, which is a difficulty for patient compliance, especially those who have longer mucosa segments affected and have a higher risk of progression to other prevalent types of cancer. It has therefore been shown that low adherence is associated with lower rates of dysplasia detection.[21]

It is worth emphasizing that surveillance biopsies should only be obtained after resolution of active esophageal inflammation or in cases of esophagitis previously treated with anti-reflux therapy. This is recommended because inflammation can cause the pathologist to confuse regenerative changes with dysplasia itself, leading to misdiagnosis.[13,16,18,22,23]

Another consensus among international guidelines is that any visible dysplastic lesion, whether low-grade or high-grade, should be diagnosed by at least two pathologists, one of whom should be a specialist in gastrointestinal pathology and use a high-quality endoscopic technique to confirm the diagnosis.[8,9,13,14,18,20,22,23] This recommendation was established in order to minimize the chances of misdiagnosis, since low-grade dysplasia can often be confused with non-dysplastic BE even among experienced pathologists.[13,24]

Even though, for diagnostic confirmation, the British Society of Gastroenterology (BSG), the European Society of Gastrointestinal Endoscopy (ESGE) and the Australian guideline recommend repeating the same endoscopic evaluation in 6 months.[9,16,19,25]

In in addition to the consensus criteria, the American societies of the American Gastroenterological Association (AGA), the American Society of Gastrointestinal Endoscopy (ASGE) and the American College of Gastroenterology (ACG) recommend the use of proton pump inhibitors before the second endoscopy, with the AGA recommending that they be performed at an interval of 8-12 weeks.[10,17]

LOW-GRADE DYSPLASIA

As for low-grade dysplasia (LGD), there is still some controversy among guidelines regarding its approach. However, radiofrequency ablation therapy (RFA) and endoscopic surveillance are the leading treatments.

Firstly, it is important to emphasize that patients should be informed about benefits and limitations of each treatment as well as the importance of adherence to the chosen treatment. This is important to enable informed decision-making between the doctor and the patient before choosing the approach to this disease and is also a way to strengthen the doctor-patient bond.[8,17,19]

RFA involves delivering high-frequency currents to the tissue to promote protein denaturation and therefore local cell death.[13] This technique stands out as one of the main treatments, as it has been shown to have better effects in reducing progression to high-grade dysplasia and has led to the eradication of dysplasia and intestinal metaplasia in a significant number of patients.[13] For these reasons, all the guidelines recommend ablation over surveillance, with the exception of the AGA, the Australian guideline and the Asia-Pacific Consensus.[10,16,25]

The randomized "SURF" study compared the efficacy of radiofrequency ablation therapy with that of endoscopic surveillance in 136 patients with LGD previously confirmed by three pathologists. As a result, this study showed that ablation reduced the risk of progression to high-grade dysplasia (HGD) and esophageal adenocarcinoma (EAC) by 25%, while surveillance reduced the risk by only 8.8% in the control arm during a 3-year follow-up period.[14,15,16,17,23] Similarly, the prospective randomized study "AIM

DYSPLASIA" demonstrated that ablation was associated with a higher rate of eradication of LGD, as well as a decreased risk of progression from LGD to HGD/EAC. Therefore, the risk of progression was assessed at only 5% for follow-up with ablation and 14% with 12-month surveillance.[17,23]

Based on this evidence, the ACG, the British Society of Gastroenterology (BSG), the European Society of Gastrointestinal Endoscopy (ESGE) and the American Society of Gastrointestinal Endoscopy (ASGE) all recommend ablation therapy for confirmed cases of LGD. However, the annual surveillance recommended by the ACG and ASGE and the 6-monthly surveillance recommended by the BSG would only be an alternative management for those patients where the risks may outweigh the benefits.[13,18,19,24]

Despite all the recommendations indicating ablative therapy as the best option, it is known that there are complications associated with it. Among them, post-procedure stenosis occurs in around 6% of cases and is the most common, and the risk of neoplasia is not insignificant after endoscopic ablation therapy, and there may be recurrences.[10] Despite this, the ablation technique is the most recommended because there are few studies comparing ablative techniques and the current literature indicates that the risks of stenosis and other complications associated with endoscopic ablation therapy are lower.[10] Therefore, these other techniques may play an additional role in the future, namely argon plasma coagulation, cryoablation, cryotherapy and photodynamic therapy.[10,24]

On the other hand, surveillance remains an acceptable first-line management in some of the international guidelines. In 2019, an expert review was commissioned with the aim of guiding AGA members, which demonstrated that both endoscopic therapy and surveillance are equally effective options for the management of patients with confirmed LGD.[8] In these patients, it is considered relevant to provide a new examination every 3 to 6 months with high-definition white light endoscopy and preferably optical chromoendoscopy using the Seattle Protocol in order to rule out the presence of visible lesion that could harbor malignancy and therefore justify that endoscopic resection would be better suited instead of the surveillance.[8,15,23,26]

In the event of any visible abnormality found on endoscopic surveillance examination, endoscopic mucosal resection (EMR) should be performed, as this alteration suggests a greater likelihood of neoplastic development.[8,15] A study by Peters et.al. showed that histological evaluation using EMR led to a 49% change in the diagnosis of these lesions evaluated and a change in the treatment plan in 30% of cases.[15,26]

However, a major obstacle to reaching a consensus on the surveillance interval and biopsy protocol for LGD is that these approaches are based only on expert opinion who have received this title in the absence of well-defined criteria for calling a professional an expert. Moreover, the reliability of their histological interpretation and the low quality of scientific evidence are also obstacles to a correct diagnosis. Therefore, these parameters continue to differ slightly between international guidelines.[10,21,24]

Therefore, the AGA recommends periodic surveillance at an interval of 6 to 12 months as the first line of treatment.[8,19,20] On the other hand, an interval of only 6 months is recommended by the Australian guideline and the Asia-Pacific Consensus and supported by the study carried out by Jia et. al.[19,25]

In this situation, surveillance would consist of an annual endoscopic examination following the Seattle protocol. If two consecutive examinations are negative for dysplasia, the regimen used for Non-Dysplastic Barrett's

Esophagus should be resumed with biopsies in 4 quadrants at 2 cm intervals[13,14,17,19] and if no dysplasia is found, surveillance should continue with endoscopic examinations at intervals of 3 to 5 years.[13,19] The downside is that, because it requires a long period of time, this biopsy protocol can be affected by poor patient adherence over the years.[16,22]

These information about surveillance intervals recommended by each guideline are elucidated in Table 3.

HIGH-GRADE DYSPLASIA

When it comes to high-grade dysplastic lesions, all the guidelines recommend endoscopic ablation therapy as a good option, to be performed in sessions every 2-3 months until complete eradication of the alteration is achieved.[9,10,13,16,18,20] Despite the lack of consensus, eradication is generally defined as endoscopic remission of all metaplasia and dysplasia after two negative biopsies obtained in 4 quadrants at 1cm intervals.[13] However, even in those patients who do not achieve complete eradication of Barrett's mucosa, the overall 5-year survival rate is good and appears to be approximately 90%.[23]

Demonstrating the efficacy of ablation in the scientific literature, the study by Shaheen et. al. showed that patients with HGD were randomized to receive radiofrequency ablation or a sham procedure. As a result, 81% of those treated with ablation achieved complete eradication of dysplasia compared to 19% who achieved the same outcome with the sham procedure. Similarly, eradication of intestinal metaplasia was achieved in 77% of patients with ablation versus 2% of patients with sham therapy. Finally, the 3-year follow-up results of the same cohort showed complete eradication of dysplasia in 98% and of intestinal metaplasia in 91%.[14]

In particular, the AGA recommends in its latest 2019 update that a new examination should be requested in 6-8 weeks with high-definition white light endoscopy for patients with confirmed high-grade flat dysplasia to rule out visible lesions that could be resected. This becomes necessary because resection would precede ablation in the presence of visible lesions, aiming for better staging as well as for complete eradication of the segment.[8,13,14,20,23] In these cases, an additional advantage of endoscopic resection is the availability of large tissue samples, consequently leading to better conditions for pathological assessment and staging.[24]

As for the choice of resection technique, endoscopic resection remains to be the preferred method according to all guidelines, although recent Japanese studies have shown fewer local recurrences for squamous cell carcinomas when endoscopic submucosal dissection was applied.[24]

Surveillance is therefore restricted to patients with HGD who have a limited life expectancy and surveillance should be stopped in cases that this expectancy is less than 5 years.[14,21] Before starting ablative therapy, the AGA, ASGE, ACG and ESGE recommend surveillance every 3 months in these situations.[14,25]

Hence, current evidence shows that it is possible both to eradicate intestinal dysplasia and metaplasia and to regress the levels of progression to adenocarcinoma[16,18] with no need for esophagectomy.[8,14,15] But the main reason why esophagectomy is not the most recommended option is the lack of high-quality evidence on survival and recurrences after surgery, since most studies are retrospective and with small numbers.[23]

However, the risk of stenosis developing in around 5.6% of patients undergoing the ablation or endoscopic resection treatment recommended for HGD is still a challenge for these approaches. Therefore, in an attempt to minimize these outcomes, it is recommended

that patients should receive high-dose proton pump therapy to mitigate stenosis formation, following evidence of its use in reflux esophagitis.[15,23] Other serious adverse events of these endoscopic procedures include bleeding in 1% and perforation rate in 0.6%. Post-procedure chest pain, in the absence of these serious complications, can occur in 1.5% to 5.4% of cases.[23]

CONTINUED SURVEILLANCE AFTER LESION ERADICATION

There is no evidence to support discontinuing surveillance even after multiple negative endoscopies in cases of both LGD and HGD. However, a recent study found that recurrence of metaplasia and dysplasia is uncommon. Therefore, more studies are needed to determine the best surveillance strategies in patients who have had their lesions eradicated.[13,15,19] Currently, in the same way as the surveillance is carried out in cases of dysplasia, follow-up after eradication consists of taking biopsies from 4 quadrants every 1 cm along the original dysplastic segment and the gastric cardia, with most recurrences detected in the distal 2 cm of the esophagus.[26]

The interval between biopsies depends on the degree of dysplasia before the lesion is eradicated. The ACG and the UK's National Halo Registry recommend that surveillance be carried out in the first and third year after eradication for LGD.[8,14,19,26] In contrast, the study by Singh et. al. states that surveillance after eradication of LGD should be every 6 months in the first year and annually from the second year onwards if there is no recurrence.[14]

For cases of eradicated HGD, the ACG, the ASGE and the Australian guideline recommend surveillance every 3 months during the first year, every 6 months during the second year and annually from the third year onwards, while the ESGE recommends surveillance every 3 months during the first year and annually from the second year onwards.[8,10,14,15,19] The UK's National Halo Registry and the AGA recommend surveillance at 3 months, 6 months and 1 year after eradication.[8,14,15,19] The Asia-Pacific Consensus does not state any recommendations in this regard.

These surveillance evaluations should be conducted using high-definition white-light endoscopies and should include careful inspection of the neo squamous mucosa and gastric cardia, along with following the Seattle Protocol by taking the collection of 4-quadrant biopsies every 1 cm.[8,26]

In this context, a prospective cohort supported the findings of the "AIM DYSPLASIA" prospective study, showing recurrences of Barrett's esophagus and dysplasia at 5.2 and 1.8 per 100 person-years respectively, with most of the recurrences occurring in the first two years.[15] So it could justify the higher frequency of surveillance biopsies in the first years after complete eradication of metaplasia and dysplasia. In parallel with this prolonged monitoring, treatment with proton pump inhibitors is recommended, mainly by the ASGE, ACG and AGA guidelines.[10,14]

If there are recurrences, it is recommended that they be treated in a similar way to the initial treatment protocols involving mucosal resection and ablative modalities.[15,26] Together, anti-reflux therapy is recommended even in recurrence cases to achieve symptom control and the absence of erosive esophagitis.[26]

LIMITATIONS

Firstly, the articles' selection, data extraction and the evaluation of quality information was made by only two investigators, which may be a source of bias.

In the second place, the unclear conclusions drawn from the articles included in this review show that there are still doubts about

the best practices to be recommended for the treatment and follow-up of dysplastic Barrett's esophagus. Therefore, this directly affects the response to the objective of this study, which is based on elucidating the controversies about these practices.

CONCLUSION

This review summarizes the most recent data on the surveillance and treatment of dysplastic Barrett's esophagus, concluding that there is considerable consensus among international guidelines to optimize good medical practice regarding the diagnosis, treatment, follow-up, and stratification of this pathology.

What can be said at the end of this study is that the diagnosis of dysplastic lesions should be made using the Seattle Protocol, which should be applied in the absence of signs of esophageal inflammation, because of this, two approaches are valid. The first is based on repeating the endoscopy 6 months after the first suspicious finding and the second is based on repeating the examination after the use of PPIs. In addition, diagnostic confirmation by at least a second specialist pathologist is necessary.

As for LGD and HGD, we found that RFA has more evidence of being more effective than other approaches. However, there are still disagreements to be clarified. One reason for these discrepancies is the lack of scientific evidence and clinical studies comparing the approaches to dysplastic BE, especially when it comes to low-grade dysplasia.

Once the lesions have been eradicated, endoscopic surveillance should be carried out without there being any indication for its interruption.

ACKNOWLEDGEMENTS

None.

DECLARATIONS OF INTERESTS

The authors declare that they have no personal relationships that could influence this study and have received no financial support to perform this search.

AUTHORS' STATEMENT

The authors declare that this article is not under consideration, and will not be submitted to publication, in another journal.

AUTHORS CONTRIBUTIONS

S.A.V. developed the performed the data analysis and wrote the manuscript draft. E.Z.C. designed the study, performed data analysis, and reviewed the manuscript.

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