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Low Biopsy Rates and PPI Use Limit Detection of Eosinophilic Esophagitis in Mexican Patients With Dysphagia

COHORT	MAIN ISSUES	PREDICTORS OF EoE
• 366 patients with EGD for dysphagia • 108 biopsied (30%) • 10 EoE diagnosed (2.7% overall / 9.3% biopsied)	🔬 Low biopsy rate (29.5%) 💊 On-PPI endoscopy (42.9%) 🔍 Normal mucosa often not biopsied	📉 Younger age → ↑ odds 🔵 Rings → strong predictor 🔵 Edema → strong predictor 💊 PPI use → lower odds (NS)

Systematic biopsy protocols and awareness may improve EoE detection in Mexico

Arenas-Martinez, et al.

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Low biopsy rates and proton pump inhibitors use limit detection of eosinophilic esophagitis in Mexican patients with dysphagia

Short Title:

Biopsy Rates and PPI Use Limit EoE Detection

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Revista Española de Enfermedades Digestivas
The Spanish Journal of Gastroenterology

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J.S.A: Conceptualization, Data curation, Formal Analysis, Investigation, Writing – original draft, Writing – review & editing; E.S.D.: Conceptualization, Methodology, Supervision, Writing – review & editing; O.E.F: Investigation, Validation, Writing – review & editing; M.F.G.: Data curation, Formal Analysis, Investigation, Methodology; D.A.: Data curation, Writing – review & editing; A.J.F.: Data curation, Writing – review & editing; D.I.C.: Data curation, Investigation; A.M.: Data curation, Investigation; L.E.Z: Investigation, Writing – review & editing; E.C.: Conceptualization, Supervision, Writing – review & editing

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Abbreviations list

EoE: Eosinophilic esophagitis

GERD: Gastroesophageal reflux disease

EGD: Esophagogastroduodenoscopy

PPIs: Proton pump inhibitors

MST: Minimal Standard Terminology

hpf: High-power field

BMI: Body mass index

IQR: Interquartile range

SD: Standard deviation

EREFS: Eosinophilic Esophagitis Endoscopic Reference Score

CI: Confidence interval

Statements and Declarations

Disclosures:

The authors declare that they have no conflict of interest.

Writing Assistance

None.

Data availability

We intend to share information regarding our research with de-identified individual participant data if appropriate permissions are in place. This is required to maintain data confidentiality, and may preclude it from being shared with third-party individuals.

Ethics approval

This research was conducted in full compliance with the ethical guidelines and regulations set forth by the institutional research and ethics committee (Comité de Investigación del Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubiran and Comité de Ética en Investigación del Insituto Nacional de Ciencias Médicas y Nutrición Salvador Zubiran, REF. GAS-4300-22-23-1). This study adhered to the ethical principles outlined in the Declaration of Helsinki.

Revista Española de Enfermedades Digestivas
The Spanish Journal of Gastroenterology

Abstract

Introduction: Eosinophilic esophagitis is a chronic, immune-mediated inflammatory disorder increasingly recognized worldwide, but its prevalence in Hispanic populations, particularly in Mexico, remains poorly characterized. This study aimed to determine the biopsy rate and prevalence of eosinophilic esophagitis among patients undergoing elective endoscopy for esophageal dysphagia in a tertiary referral center in central Mexico.

Methods: We conducted a cross-sectional, retrospective review of adult patients who underwent esophagogastroduodenoscopy (EGD) for esophageal dysphagia between January 2017 and December 2022. Patients with prior surgery, non-esophageal dysphagia, or incomplete endoscopic/histologic data were excluded. Demographics, endoscopic findings, biopsy practices, and pathology results were abstracted, and all biopsies were re-reviewed by an expert gastrointestinal pathologist. Multivariable logistic regression was used to identify predictors of biopsy acquisition and of eosinophilic esophagitis diagnosis.

Results: Of 853 EGDs performed for dysphagia, 366 met inclusion criteria (mean age 55.8 years; 69.7% women). Biopsies were obtained in 29.5% (n=108). Overall EoE prevalence was 2.7% (95%CI 1.32–4.97%) but increased to 9.3% (95%CI 4.53–16.37%) among those biopsied. The overall proton pump inhibitor use at the time of endoscopy was recorded in 42.9%. In the biopsy model, normal mucosa (OR 0.36, 95%CI 0.19–0.68) and achalasia (OR 0.16, 95%CI 0.04–0.69) were associated with decreased odds of biopsy, whereas EoE-suggestive findings increased biopsy likelihood (OR 11.9, 95%CI 1.38–103.1). In the diagnostic model, younger age (OR 0.95 per year, 95%CI 0.91–1.00), rings (OR 25.1, 95%CI 3.29–191.3), and edema (OR 14.5, 95%CI 1.38–151.8) were independent predictors of eosinophilic esophagitis.

Conclusion: In this Mexican dysphagia cohort, biopsy uptake was suboptimal and examinations frequently occurred under PPI therapy, likely contributing to underdetection. As one of the first large studies in an adult Hispanic population, our findings emphasize how local practices impact EoE detection. Implementing systematic biopsy protocols and enhancing clinician awareness may improve diagnostic yield in

Mexico.

Keywords: Eosinophilic esophagitis. Dysphagia. Proton pump inhibitors. Esophageal biopsy. Endoscopy.

Lay summary

Eosinophilic esophagitis is a chronic allergic disease of the esophagus that causes swallowing difficulties and can lead to food sticking (impaction) and constriction of the esophagus (strictures). Although eosinophilic esophagitis is increasingly recognized worldwide, it is not known how common it is in Mexico.

The main goal of this study was to estimate how often eosinophilic esophagitis is diagnosed among adults having an upper endoscopy for trouble swallowing (dysphagia) symptoms in a referral hospital in Mexico City. Other goals were to learn how often biopsies are taken during endoscopy for dysphagia, and to identify factors that influence both the decision to biopsy and the likelihood of diagnosing eosinophilic esophagitis.

Our main theory was that EoE is underdiagnosed in Mexico because doctors take esophageal biopsies infrequently and because many procedures are performed while patients are taking proton pump inhibitors, which are also a treatment of the Disease (so EoE can’t be deteted if it is treated).

We reviewed 366 patients who had endoscopy for dysphagia. Of these, only 108 (29.5%) received esophageal biopsies. Among those biopsied, 10 patients were diagnosed with eosinophilic esophagitis, corresponding to 2.7% of the total group but 9.3% of those biopsied. These numbers suggest that when biopsies are performed, the prevalence is similar to that reported in other countries, but that many cases may go undetected because biopsies are not routinely obtained. In addition, nearly half of patients were on

proton pump inhibitors at the time of endoscopy, which may further reduce the chance of EoE diagnosis.

In conclusion, this study suggests that the “true” frequency of EoE in Mexico remains underestimated, but that it may be similar to other parts of the world where it is more commonl seen. Implementing standard biopsy protocols and raising awareness among doctors are key steps to improve detection and patient care.

Key Points

1. Eosinophilic esophagitis previously has had a reported low prevalence among adults undergoing endoscopy for esophageal dysphagia in Mexico.
2. Esophageal biopsies are performed in only 29.5% of patients evaluated for dysphagia.
3. Among those biopsied, eosinophilic esophagitis was identified in 9.3% of cases.
4. Increased clinical awareness and systematic biopsy practices may enhance diagnostic accuracy.

Revista Española de Enfermedades Digestivas
The Spanish Journal of Gastroenterology

Introduction

Eosinophilic esophagitis (EoE) is a chronic immune-mediated inflammatory disease that adversely affects quality of life [1–3]. EoE was considered a rare disease, but recent studies have shown that its incidence and prevalence are increasing at a rapid pace [4, 5]. EoE has been reported worldwide, but its prevalence appears to be higher in developed and Western countries [6]. However, it is not known whether this is due to a true low prevalence or due to low awareness and detection of the condition. If untreated, EoE results in increased wall stiffness and stricture formation, which are directly proportional to the length of the diagnostic delay [7–9].

The clinical presentation includes a wide spectrum of symptoms, such as dysphagia, heartburn, and in some cases endoscopic appearance can even appear normal [10]. This can lead to diagnostic delay, explained, among other factors, by a lack of awareness among physicians and patients [11, 12]. When EoE is suspected or dysphagia is present, esophageal mucosa samples should always be taken from patients being studied for esophageal dysphagia, regardless of endoscopic appearance, to rule out EoE [13, 14]. Although EoE has traditionally been reported as more common in White populations, detection bias and phenotypic variability may account for apparent ethnic differences [15–19] .

Prior Mexican studies have reported lower EoE prevalence [20, 21] than rates observed in dysphagia cohorts in other populations, which can be more than 20% [5], but whether this reflects true epidemiology or practice-related underdetection remains uncertain [22, 23]. In Latin America, reported prevalence rates vary between 0.4% and 6.5% among symptomatic populations undergoing endoscopy, in Brazil esophageal eosinophilia has been described in 5.2% of children with gastrointestinal symptoms [24].

Empirical data from adult Hispanic populations are scarce. Therefore, our primary objective was to estimate the prevalence of biopsy-confirmed EoE among adults undergoing elective endoscopy for esophageal dysphagia at a tertiary referral center in

central Mexico; secondary objectives were (1) to quantify the esophageal mucosal biopsy acquisition rate during dysphagia-directed endoscopies, (2) to identify clinical and endoscopic factors associated with biopsy acquisition, and (3) to assess the relationship between proton pump inhibitor (PPI) exposure at the time of endoscopy and EoE detection. We hypothesized that the apparently low prevalence observed in this setting would be partly attributable to suboptimal biopsy acquisition and to frequent on-therapy examinations with proton pump inhibitors that can mask histologic activity.

Methods

Study design

This cross-sectional study included adult patients who underwent upper endoscopy (EGD) for esophageal dysphagia symptoms between January 2017 and December 2022. Data on patients were collected from the physical and electronic records of the Endoscopy Department at the Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán (Mexico City, Mexico). This study was approved and conducted in full compliance with the ethical guidelines and regulations set forth by the institutional research and ethics committee (Comité de Investigación and Comité de Ética en Investigación del Insituto Nacional de Ciencias Médicas y Nutrición Salvador Zubiran, REF. GAS-4300-22-23-1). This study adhered to the ethical principles outlined in the Declaration of Helsinki.

The records of patients for whom the indication for EGD was dysphagia were reviewed retrospectively and clinical information was extracted from medical charts using a standardized data collection form for demographics, comorbidities, proton pump inhibitors (PPIs) and steroid use, approximate dysphagia onset date, endoscopic findings, whether biopsies were obtained, and histopathological results. Exclusion criteria were: (i) oropharyngeal dysphagia, defined clinically as transfer-type symptoms localized to the throat or difficulty initiating a swallow, with or without early coughing/choking or nasal regurgitation; (ii) history of foregut surgery (e.g., fundoplication, bariatric gastric bypass, Heller myotomy or POEM, esophagectomy); and (iii) incomplete key clinical data, operationalized as absence of either the endoscopy report or the histopathology report.

Patients with structural esophageal disease (e.g., Schatzki ring, peptic stricture) or esophageal motility disorders (e.g., suspected achalasia) were not excluded *a priori* (Figure 1). Due to the retrospective nature of the study, standardized dysphagia questionnaires were not able to be administered. Patients lacking key data were excluded at screening and no further information was extracted. For remaining variables, we used an available-case approach without imputation.

Upper endoscopy

Endoscopy was performed under the supervision of an attending physician by gastroenterology trainees and advanced endoscopy fellows using the Olympus Exera-180 and Exera-190 endoscopic video equipment (Olympus, Tokyo, Japan), Olympus gastroscope (Olympus), Fujifilm EPX-3500HD (Fujifilm, Tokyo, Japan) gastroscope. All findings were reported on electronic charts according to the minimal standard terminology for gastrointestinal endoscopy (MST, 3.0) [25]. If a patient had more than one EGD, the findings from either the index EGD or the EGD during which esophageal biopsies were obtained, were recorded. Esophageal mucosal biopsy acquisition was operator dependent and not protocolized across endoscopists. Documentation practices were also inconsistent: in many reports, the exact number of biopsy fragments and their anatomic location(s) were not recorded.

Histological analysis

At the time of collection, biopsies were processed in the usual manner according to the institutional protocol. All slides of patients with esophageal mucosal biopsies were recovered from the archive and re-reviewed by a single gastrointestinal pathology expert (OEF) for the purposes of this study. EoE was diagnosed based on the presence of eosinophilic inflammation with ≥15 eosinophils per high-power field (hpf; Nikon Eclipse E400 hpf size = 0.25 mm^2). The presence of eosinophilic microabscesses, basal cell hyperplasia, degranulation, spongiosis, and lamina propria fibrosis was also evaluated.

Statistical analysis

Continuous data are described as median and interquartile range, whereas categorical data are described as counts and percentages. The EoE prevalence was expressed as a relative proportion using a 95% confidence interval. The Chi-square test was used to compare categorical variables, while the Student's t-test was used to evaluate continuous variables. Binomial logistic regression analyses were performed to identify associations between biopsy sampling, and EoE diagnosis adjusting for relevant covariates (model included sex, age, endoscopic features, atopic comorbidities, food allergies and previous use of PPI and steroids), were adjusted using Nagelkerke's R^2. Odds ratios (OR) with 95% confidence intervals (CI) were reported , and a p-value of <0.05 was considered statistically significant.

To identify independent predictors of esophageal mucosal biopsy acquisition and of EoE diagnosis, we performed multivariable binomial logistic regression analyses. For the first model, the dependent variable was whether an esophageal biopsy was obtained. Candidate covariates included demographic variables (age and sex), medication exposure at the time of endoscopy (PPI or steroid use), and endoscopic findings (normal mucosa, esophageal strictures, achalasia, and characteristic features suggestive of EoE such as edema, rings, furrows, exudates, and an EREFS report). A second set of models was constructed to evaluate predictors of biopsy-confirmed EoE among patients who underwent biopsy. Because of the small number of EoE cases, two complementary approaches were adopted: (i) an exploratory model including demographic, clinical, and endoscopic variables, presented as supplementary material; and (ii) a parsimonious model including clinically relevant variables to minimize overfitting. The final parsimonious model retained age, sex, PPI use at the time of endoscopy, and key endoscopic features (edema, rings, and exudates). Odds ratios (OR) with 95% confidence intervals (CI) were calculated. Model performance was evaluated using Nagelkerke's R^2, the likelihood ratio (overall model) test, and the area under the receiver operating characteristic curve (AUC).

Statistical analysis was performed using Jamovi (The Jamovi project, Sydney, Australia) version 2.3 for the Mac OS.

Results

Patient Demographics

As detailed in Figure 1, of 853 EGDs, 366 met inclusion criteria. Of these, 255 (69.7%) were women, the mean age was 55.8 (SD 16.6) years, and median body mass index was 24.4 (IQR 21.6, 27.7) kg/m^2. There were eight (2.2%, 95%CI 0.68-3.7%) patients with asthma, while one (0.3%, 95%CI 0 - 8.1%) with an environmental allergy, five (1.4%, 95%CI 0.17-2.5%) with food allergy, 41 (11%, 95%CI 7.9-14.4%) with drug allergies, and 17 (4.6%, 95%CI 2.5-6.8%) with atopic dermatitis. The median time between the reported onset of symptoms and the performance of an EGD at our institute was 32.1 (IQR 10, 104) weeks.

Endoscopic Findings and Concomitant Medications

At the time of EGD, 157 (42.9%, 95%CI 37.8-48%) of the subjects were taking PPIs and 32 (8.7%, 95%CI 5.8-11.7%) were using systemic or inhaled steroids, of whom 28 were taking systemic steroids, 2 were taking inhaled steroids and 2 were taking both. The median duration of PPI use prior to upper endoscopy was 29 (IQR, 9–143) weeks, and the median time for steroid use prior to upper endoscopy was 56 (IQR 17, 154) weeks.

The esophageal mucosa was reported to be normal in 95 (26%, 95%CI 21.4-30.5%) of patients, and 76 (20.8%, 95%CI 16.6-24.9%) had gastroduodenal findings without esophageal abnormalities. Among the remaining patients, 63 (17.2%, 95%CI 13.3-21.1%) were diagnosed with erosive esophagitis, 30.2% (19) had Los Angeles A, 7.9% (5) had Los Angeles B, 36.5% (23) had Los Angeles C, 25.4% (16) had Los Angeles D, and 2.7% (10) patients had a peptic stricture. Additionally, 27 (7.4%, 95%CI 4.6-10.1%) of the patients had findings suggestive of achalasia, 13 (3.6%, 95%CI 1.6-5.4%) had a Schatzki ring, 10 (2.7% 95%CI 1-4.4%) had candida esophagitis, 30 (8.2%, 95%CI 5.3-8.2%) had hiatal hernia, and 15 (4.1%,95%CI 2-6.1%) had tumors. Thirty-seven (10.1%, 95%CI 7-13.2%) patients had characteristic endoscopic findings of EoE (Table 2). The EoE Endoscopic Reference

Score (EREFS)[26] was reported in 34 (9.3%, 95%CI 6.3-12.3%) of the total EDGs and in 73% (27) of the endoscopies with characteristic EoE findings.

Biopsy Rates and EoE Prevalence

The clinical, demographic, and endoscopic features of patients with and without esophageal biopsies are summarized in Table 1. Esophageal mucosal biopsies were obtained in 29.5% (108) of the EGDs, and 41.7% (45) of those patients were taking PPIs at the time of EGD (Figure 2). After re-evaluation of biopsies, eosinophilic esophagitis (EoE) was diagnosed in 10 patients in this study. Of these, the initial histopathological evaluation had identified 5 patients with EoE, while 2 showed increased eosinophils without a specified count, and 3 were initially diagnosed with reflux esophagitis.

Additionally, a 68-year-old female patient had 22 eos/hpf in the context of a cardia neoplasm and esophageal hyperkeratosis; therefore, EoE was not considered. Table 3 shows the frequency of esophageal eosinophilia in the patients who underwent mucosal biopsies with EGD for dysphagia. The overall prevalence of EoE was 2.7% (95%CI 1.32-4.97%). However, among the 108 patients who underwent biopsy, EoE was diagnosed in 8/63 (12.7%, 95%CI 5.6-23.5%) of those not receiving PPIs at the time of endoscopy compared with 2/45 (4.4%, 95%CI 0.5–15.1%) of those on PPI therapy. This corresponded to an unadjusted odds ratio of 0.32 (95%CI 0.07–1.73; p = 0.192), indicating a lower probability of histologic EoE detection among PPI users, although the difference was not statistically significant (p = 0.189).

Among EoE cases, heartburn and abdominal pain were the most frequently reported symptoms (30% each), while rings (30%), edema (20%), and strictures (20%) were the most common endoscopic findings. Median peak eosinophil count was 22 eos/hpf (IQR 17–38). Full clinical and histologic features are shown in Table 2.

Predictors of Biopsy Acquisition

Revista Española de Enfermedades Digestivas
The Spanish Journal of Gastroenterology

In the first logistic regression model (Table X), a normal-appearing esophagus was associated with lower odds of biopsy (OR 0.36, 95%CI 0.19–0.68; p = 0.002). Findings consistent with achalasia were also associated with decreased biopsy likelihood (OR 0.16, 95%CI 0.04–0.69; p = 0.015). In contrast, the presence of endoscopic features suggestive of EoE significantly increased the odds of biopsy (OR 11.9, 95%CI 1.38–103.1; p = 0.024). Male sex showed a non-significant trend with higher biopsy rates (OR 1.54, 95%CI 0.92–2.58; p = 0.099). The model had modest explanatory power (Nagelkerke's R^2 = 0.164) and moderate discrimination (AUC = 0.705). The overall model test was significant (χ^2 = 44.9, df = 7, p < .001).

Predictors of EoE Diagnosis

Among the 108 patients who underwent biopsy, 10 were diagnosed with EoE. In the exploratory model (Supplementary Table A1), several endoscopic features, including rings, edema, exudates, and furrows, as well as younger age and food allergy, were associated with increased odds of EoE, with particularly strong associations for rings (OR 94.3, 95%CI 2.56–3468.8; p = 0.013) and edema (OR 7.55, 95%CI 1.38–1256.3; p = 0.045). The model demonstrated excellent discriminative ability (AUC = 0.898) but unstable estimates due to sparse data.

The final parsimonious model (Table Y) retained age, sex, PPI use, and the endoscopic features edema, rings, and exudates. Younger age was independently associated with EoE (OR 0.95 per year, 95%CI 0.91–1.00; p = 0.040). Rings (OR 25.1, 95%CI 3.29–191.3; p = 0.002) and edema (OR 14.5, 95%CI 1.38–151.8; p = 0.026) were the strongest predictors of EoE. PPI use showed a non-significant inverse association (OR 0.50, 95%CI 0.09–2.71; p = 0.420). Model performance was good, with Nagelkerke's R^2 = 0.287, AUC = 0.850, and a significant overall model test (χ^2 = 24.0, df = 6, p < .001).

Discussion

While the prevalence of EoE has rapidly increased over the last three decades, rates vary widely by geographic region, including non-Western and developing countries, and have been reported to be lower in Asian, African, and Hispanic populations [4, 5]. It is not known whether this is because of the truly lower disease frequency or lower rates of detection with endoscopy and biopsy. Our study assessed a population of Hispanic patients in Mexico, an area previously noted to have a low EoE prevalence [20–22]. In this study, which comprehensively assessed all patients undergoing upper endoscopy for esophageal dysphagia, we identified a prevalence of EoE of 2.7% among patients with dysphagia, yet esophageal biopsy rates were only 29.5%. Our prevalence increased by 3.4-fold to 9.3% in those undergoing biopsies, more consistent with rates reported elsewhere [5] . This finding underscores the importance of considering EoE in the differential diagnosis of dysphagia as well as performing biopsies. A longitudinal study demonstrated that education on the need for biopsies can increase EoE detection by 40% as well as identify other non-EoE conditions [27, 28]. Importantly, the low biopsy rate observed in our cohort represents a significant source of bias and likely contributes to underestimation of the true prevalence, limiting the accuracy of epidemiologic inference. Therefore, the low biopsy rate in our series likely resulted in missed cases. If we extrapolate the 9.3% prevalence rate to 70% of cases without biopsies, an additional 25 cases could have been identified. Additionally, after histopathological re-evaluation, the number of cases doubled from 5 to 10. This significant increase underscores the importance of thorough histopathological review in accurately diagnosing and classifying this condition. Increased awareness has led to more standardized and precise histopathological evaluations for EoE [29].

Moreover, we identified another potential reason for the falsely lower prevalence of EoE in our population. There were 157 (43%) subjects who were taking PPIs at the time of endoscopy, with an inverse association between PPI use and histologic EoE detection, although not statistically significant, likely due to the small numbers of subjects. Given that PPI response rates in EoE have been reported as high as 50% [30, 31], if we

conservatively estimate a PPI response of 33% then approximately 50 additional patients could have had “masked” or treated EoE, which would have more than doubled our EoE prevalence. This estimate does not consider patients who also underwent endoscopy on steroid treatment (systemic or inhaled), which can also potentially mask the diagnosis of EoE. These findings highlight the potential for PPI therapy to mask histologic disease activity, supporting the strategy of withdrawing PPIs before endoscopy when clinically feasible. If withdrawal is not possible, repeat endoscopy off therapy may be required to avoid false-negative results in patients where EoE is suspected. Although characteristic endoscopic features suggestive of EoE were present in a subset of patients, only a fraction of these individuals were ultimately diagnosed with EoE based on histological evaluation.

Epidemiologic studies demonstrate that the worldwide incidence of EoE is increasing rapidly[5]. There are few studies that explore the epidemiology of EoE in Mexico, and the affords have focused on pediatric population, and adults with refractory heartburn or general gastrointestinal symptoms [20, 21, 32, 33]. In a small cohort of Mexican patients with EoE, it was observed that blinded evaluation of endoscopic findings was accurate in only 53% of the first evaluations, increasing to 96% in the second review, and diagnostic agreement of the pathologists was 88% for EoE [33]. This implies a need for enhanced training and standardization of diagnostic procedures for EoE in Mexico to ensure timely and accurate diagnosis. To date, the impact of biopsy practices on EoE detection has not been systematically explored in Latin America. However, studies from other regions have shown that even in patients with cardinal symptoms such as dysphagia or food impaction, biopsy uptake may be below 50% in routine clinical practice, and is influenced by patient age, sex, and the presence of suggestive endoscopic findings [34] . In contrast, international guidelines recommend obtaining at least six esophageal biopsies from different esophageal levels to maximize diagnostic sensitivity, a standard not consistently achieved in our setting[13, 35, 36] .

Our findings complement recent data from Chile, where the first prospective adult cohort of EoE in Latin America was reported [37]. In that study, all patients underwent systematic biopsy with at least six samples obtained from proximal and distal esophagus, in accordance with international guidelines, and importantly, proton pump inhibitors were withdrawn prior to endoscopy. In contrast, only 29.5% of dysphagia-directed endoscopies in our series included esophageal biopsies, and nearly half of procedures were performed while patients remained on PPI therapy, both factors likely contributing to underdiagnosis. Despite these procedural differences, the Chilean cohort demonstrated a clinical presentation similar to ours, with dysphagia as the predominant symptom and frequent subtle or even normal endoscopic findings. Furthermore, therapeutic outcomes in Chile—where histologic remission was achieved in 77% and endoscopic remission in 93% of patients treated mainly with PPIs—were comparable to international reports. Taken together, these data suggest that the underdiagnosis of EoE in Mexico and other Latin American countries is more likely attributable to practice-related factors rather than true differences in disease biology.

This study has several limitations that should be considered. First, the small sample size and focus on specific subgroups may limit the generalizability of our findings to the broader Mexican population. Additionally, the retrospective nature of the data collection and reliance on data from a single tertiary center could introduce potential biases. Despite these limitations, this study had several strengths. It addresses a significant gap in the literature by providing insights into the epidemiology of EoE in Mexico, particularly in adults. This study's emphasis on the need for standardized endoscopic and pathological assessments highlights important areas for improving diagnostic accuracy, and the re-review of the esophageal biopsies for the purpose of this study increases the validity of the findings. Furthermore, by drawing attention to the potential underestimation of EoE prevalence in Mexico, this research paves the way for future, more comprehensive epidemiological studies

In conclusion, our study of a tertiary care hospital in Mexico City found that patients undergoing EGD for esophageal dysphagia had a low biopsy rate and a high number of on-PPI studies, which may lead to an underdiagnosis of EoE. Nevertheless, this study found a higher prevalence of EoE in patients with dysphagia and esophageal biopsy than previously reported in Mexico, and when prevalence rates were assessed just within those patients who had esophageal biopsy, it was close to that reported in other countries. Our findings should not be interpreted as the true prevalence of EoE in Mexico, but rather as evidence that diagnostic practices currently limit accurate detection. Overall, our findings contribute to the growing body of literature on EoE epidemiology and diagnosis, particularly in the context of the evolving understanding of this condition in diverse patient populations, and highlight that the low prevalence of EoE in Mexico may be due to practice patterns, and that educational efforts may increase the diagnosis of EoE. Future research efforts should aim to further elucidate the epidemiology, clinical presentation, and management strategies of EoE in larger and more diverse patient cohorts to inform evidence-based practice and improve diagnostic rates and patient outcomes.

References

1. Straumann A, Katzka DA (2018) Diagnosis and Treatment of Eosinophilic Esophagitis. Gastroenterology 154:346–359. https://doi.org/10.1053/j.gastro.2017.05.066

2. Mukkada V, Falk GW, Eichinger CS, et al (2018) Health-Related Quality of Life and Costs Associated With Eosinophilic Esophagitis: A Systematic Review. Clin Gastroenterol Hepatol 16:495-503.e8. https://doi.org/10.1016/j.cgh.2017.06.036

3. Stern E, Taft T, Zalewski A, et al (2018) Prospective assessment of disease-specific quality of life in adults with eosinophilic esophagitis. Dis Esophagus 31:dox128. https://doi.org/10.1093/dote/dox128

4. Navarro P, Arias Á, Arias-González L, et al (2019) Systematic review with meta-analysis: the growing incidence and prevalence of eosinophilic oesophagitis in children and adults in population-based studies. Aliment Pharmacol Ther 49:1116–1125. https://doi.org/10.1111/apt.15231

5. Dellon ES, Hirano I (2018) Epidemiology and Natural History of Eosinophilic Esophagitis. Gastroenterology 154:319-332.e3. https://doi.org/10.1053/j.gastro.2017.06.067

6. Hahn JW, Lee K, Shin JI, et al (2023) Global Incidence and Prevalence of Eosinophilic Esophagitis, 1976–2022: A Systematic Review and Meta-analysis. Clin Gastroenterol Hepatol 21:3270-3284.e77. https://doi.org/10.1016/j.cgh.2023.06.005

7. Dellon ES, Kim HP, Sperry SLW, et al (2014) A phenotypic analysis shows that eosinophilic esophagitis is a progressive fibrostenotic disease. Gastrointest Endosc 79:577-585.e4. https://doi.org/10.1016/j.gie.2013.10.027

8. Schoepfer AM, Safroneeva E, Bussmann C, et al (2013) Delay in Diagnosis of Eosinophilic Esophagitis Increases Risk for Stricture Formation in a Time-Dependent Manner. Gastroenterology 145:1230-1236.e2. https://doi.org/10.1053/j.gastro.2013.08.015

9. Lipka S, Kumar A, Richter JE (2016) Impact of Diagnostic Delay and Other Risk Factors on Eosinophilic Esophagitis Phenotype and Esophageal Diameter. J Clin Gastroenterol 50:134–140. https://doi.org/10.1097/mcg.0000000000000297

10. Eluri S, Corder S, Kim E, et al (2020) Clinical features and time trends associated with an endoscopically normal esophagus in active eosinophilic esophagitis. Endoscopy 53:886–892. https://doi.org/10.1055/a-1284-5891

11. Reed CC, Koutlas NT, Robey BS, et al (2018) Prolonged Time to Diagnosis of Eosinophilic Esophagitis Despite Increasing Knowledge of the Disease. Clin Gastroenterol Hepatol 16:1667–1669. https://doi.org/10.1016/j.cgh.2018.01.028

12. Murray FR, Kreienbuehl AS, Greuter T, et al (2022) Diagnostic Delay in Patients With Eosinophilic Esophagitis Has Not Changed Since the First Description 30 Years Ago: Diagnostic Delay in Eosinophilic Esophagitis. Am J Gastroenterol 117:1772–1779. https://doi.org/10.14309/ajg.0000000000001950

13. Dellon ES, Liacouras CA, Molina-Infante J, et al (2018) Updated International Consensus Diagnostic Criteria for Eosinophilic Esophagitis: Proceedings of the AGREE Conference. Gastroenterology 155:1022-1033.e10. https://doi.org/10.1053/j.gastro.2018.07.009

14. Cook IJ (2008) Diagnostic evaluation of dysphagia. Nat Clin Pr Gastroenterol Hepatol 5:393–403. https://doi.org/10.1038/ncpgasthep1153

15. Ricker J, McNear S, Cassidy T, et al (2011) Routine screening for eosinophilic esophagitis in patients presenting with dysphagia. Ther Adv Gastroenterol 4:27–35. https://doi.org/10.1177/1756283x10384172

16. Mahon M, Romo ND, Vos G de, Levanon D (2021) Race-specific characteristics in pediatric eosinophilic esophagitis in an urban inner-city clinic. Ann Allergy, Asthma Immunol 127:349–353. https://doi.org/10.1016/j.anai.2021.05.010

17. Sperry SL, Woosley JT, Shaheen NJ, Dellon ES (2012) Influence of Race and Gender on the Presentation of Eosinophilic Esophagitis. Am J Gastroenterol 107:215–221. https://doi.org/10.1038/ajg.2011.342

18. Ocampo AA, Xue Z, Chang NC, et al (2024) Clinical Features and Treatment Response to Topical Steroids in Ethnic and Racial Minority Patients With Eosinophilic Esophagitis. Am J Gastroenterol 119:262–269. https://doi.org/10.14309/ajg.0000000000002532

19. Horsley-Silva JL, Sprague G, Pitt J, et al (2023) Sa1298 INFLUENCE OF HISPANIC ETHNICITY ON THE PRESENTATION OF PEDIATRIC PATIENTS WITH EOSINOPHILIC

ESOPHAGITIS. Gastroenterology 164:S-358. https://doi.org/10.1016/s0016-5085(23)01831-0

20. Cruz-Patiño ED la, Juárez IR, Daza AM, et al (2015) Eosinophilic esophagitis prevalence in an adult population undergoing upper endoscopy in southeastern Mexico. Dis Esophagus 28:524–529. https://doi.org/10.1111/dote.12238

21. García-Compeán D, González JAG, García CAM, et al (2011) Prevalence of eosinophilic esophagitis in patients with refractory gastroesophageal reflux disease symptoms: A prospective study. Dig Liver Dis 43:204–208. https://doi.org/10.1016/j.dld.2010.08.002

22. García-Compeán D (2025) Eosinophilic esophagitis: Current state and perspectives in Latin America. Rev Gastroenterol México (Engl Ed) 90:4–7. https://doi.org/10.1016/j.rgmxen.2024.09.003

23. García-Compeán D, Jiménez-Rodríguez AR, González-Martínez CE (2025) Eosinophilic esophagitis: Current concepts of pathophysiology, diagnosis, and treatment. Rev Gastroenterol México (Engl Ed) 90:63–76. https://doi.org/10.1016/j.rgmxen.2024.09.005

24. Strozzi D, Botacin MAS, Mekdessi MA, et al (2018) Frequency of Esophageal Eosinophilia in a Pediatric Population from Central Brazil. Sci Rep 8:5000. https://doi.org/10.1038/s41598-018-23178-9

25. Aabakken L, Rembacken B, LeMoine O, et al (2009) Minimal standard terminology for gastrointestinal endoscopy – MST 3.0. Endoscopy 41:727–728. https://doi.org/10.1055/s-0029-1214949

26. Hirano I, Moy N, Heckman MG, et al (2013) Endoscopic assessment of the oesophageal features of eosinophilic oesophagitis: validation of a novel classification and grading system. Gut 62:489. https://doi.org/10.1136/gutjnl-2011-301817

27. Kanakala V, Lamb CA, Haigh C, et al (2010) The diagnosis of primary eosinophilic oesophagitis in adults: missed or misinterpreted? Eur J Gastroenterol Hepatol 22:848–855. https://doi.org/10.1097/meg.0b013e32832c7709

28. Liu LWC, Andrews CN, Armstrong D, et al (2018) Clinical Practice Guidelines for the Assessment of Uninvestigated Esophageal Dysphagia. J Can Assoc Gastroenterol 1:5–19. https://doi.org/10.1093/jcag/gwx008

29. Keshishian J, Vrcel V, Boyce HW, et al (2014) Eosinophilic esophagitis: a paradigm shift for pathology. J Clin Gastroenterol 48:607–12. https://doi.org/10.1097/mcg.0b013e3182a9a9cc

30. Dellon ES, Speck O, Woodward K, et al (2013) Clinical and Endoscopic Characteristics do Not Reliably Differentiate PPI-Responsive Esophageal Eosinophilia and Eosinophilic Esophagitis in Patients Undergoing Upper Endoscopy: A Prospective Cohort Study. Am J Gastroenterol 108:1854–1860. https://doi.org/10.1038/ajg.2013.363

31. Lucendo AJ, Arias Á, Molina-Infante J (2016) Efficacy of Proton Pump Inhibitor Drugs for Inducing Clinical and Histologic Remission in Patients With Symptomatic Esophageal Eosinophilia: A Systematic Review and Meta-Analysis. Clin Gastroenterol Hepatol 14:13-22.e1. https://doi.org/10.1016/j.cgh.2015.07.041

32. Pierre R, Vieira M, Vázquez R, et al (2019) Prevalence of eosinophilic esophagitis: A multicenter study on a pediatric population evaluated at thirty-six Latin American gastroenterology centers. Rev Gastroenterol México (Engl Ed) 84:427–433. https://doi.org/10.1016/j.rgmxen.2018.10.002

33. Soto-Solís R, Anda KS, González-Uribe N, et al (2017) How to improve the diagnosis of eosinophilic esophagitis: Experience from a case series in Mexico. Rev Gastroenterol México (Engl Ed) 82:5–12. https://doi.org/10.1016/j.rgmxen.2016.11.002

34. Voulgaris T, Alexopoulos T, Vlachogiannakos J, et al (2024) Patients with cardinal symptoms of eosinophilic esophagitis. Prejudice affects clinical practice…. Eur J Gastroenterol Hepatol 36:1298–1304. https://doi.org/10.1097/meg.0000000000002833

35. Dellon ES, Muir AB, Katzka DA, et al (2025) ACG Clinical Guideline: Diagnosis and Management of Eosinophilic Esophagitis. Am J Gastroenterol 120:31–59. https://doi.org/10.14309/ajg.0000000000003194

36. Aceves SS, Alexander JA, Baron TH, et al (2022) Endoscopic approach to eosinophilic esophagitis: American Society for Gastrointestinal Endoscopy Consensus Conference. Gastrointest Endosc 96:576-592.e1. https://doi.org/10.1016/j.gie.2022.05.013

37. Muhlenbrock C von, Núñez P, Quera R, et al (2025) Descripción clínica de adultos con esofagitis eosinofílica atendidos en un centro universitario chileno. Rev Gastroenterol México 90:8–14. https://doi.org/10.1016/j.rgmx.2024.04.010

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Tables

Table 1. Clinical, Demographic, and Endoscopic Characteristics of Patients With and Without Esophageal Biopsies During Endoscopy for Dysphagia.

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Characteristic **N = 366**	**Non-Biopsied patients** **n = 258**	**Biopsied patients** **n = 108**	**p value**
Female	190 (73.6%)	65 (60.2%)	0.01
Age (years)	56 (44 – 67)	59 (46 – 68)	0.59
BMI (kg/m^2)	24.5 (21.8 – 28.6)	24.5 (21.5 – 26.7)	0.27
Asthma	6 (2.3%)	2 (1.9%)	1.0
Environmental allergies	0 (0%)	1 (0.9%)	0.29
Food allergies	1 (0.4%)	4 (3.7%)	0.02
Drug allergies	33 (12.8%)	8 (7.4%)	0.13
Atopic dermatitis	11 (4.3%)	6 (5.6%)	0.59
PPI use during EGD	112 (43.4%)	45 (41.7%)	0.75
Steroid use during EGD	21 (8.1%)	11 (10.2%)	0.52
Symptoms			
Heartburn	101 (39.1%)	42 (38.9%)	0.96
Chest pain	49 (19%)	19 (17.6%)	0.75
Vomit	35 (13.6%)	16 (14.8%)	0.75
Abdominal pain	57 (22.1%)	22 (20.4%)	0.71
Odynophagia	17 (6.6%)	4 (3.7%)	0.27
Food impaction	17 (6.6%)	6 (5.6%)	0.71
Transient food impaction	4 (1.6%)	1 (0.9%)	1.0

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The Spanish Journal of Gastroenterology

Characteristic **N = 366**	**Non-Biopsied patients** **n = 258**	**Biopsied patients** **n = 108**	**p value**
Food impaction leading to emergency department	5 (1.9%)	1 (0.9%)	0.675
Endoscopic findings			
Normal EGD	81 (31.4%)	14 (13%)	<0.001
Edema	0 (0%)	6 (5.6%)	<0.001
Rings	1 (0.4%)	6 (5.6%)	0.003
Exudantes	0 (0%)	2 (1.9%)	0.08
Furrows	0 (0%)	4 (3.7%)	0.007
Stricture	12 (4.7%)	18 (16.7%)	<0.001
EREFS reported	14 (5.4%)	20 (18.5%)	<0.001
Schatzki Ring	12 (4.7%)	1 (0.9%)	0.11
Erosive Esophagitis	45 (17.4%)	18 (16.7%)	0.85
Hiatal Hernia	26 (10.1%)	4 (3.7%)	0.06
Candida esophagitis	6 (2.3%)	4 (3.7%)	0.48
Achalasia	25 (9.7%)	2 (1.9%)	0.009
Benign stricture	6 (2.3%)	4 (3.7%)	0.46
EoE findings	13 (5%)	24 (22.2%)	<0.001

Values are expressed as *n* (%) or median (interquartile range). Comparisons between groups were performed using the χ^2 test for categorical variables, Mann–Whitney U test for continuous variables, and Fisher's exact test when expected frequencies were <5. EREFS, Eosinophilic Esophagitis Endoscopic Reference Score; EoE, Eosinophilic Esophagitis;

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The Spanish Journal
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PPI, Proton Pump Inhibitor.

Table 2. Characteristics of Patients With Eosinophilic Esophagitis (N=10)

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Characteristic	n (%)	**95% CI**
Demographics		
Female	6 (60)	26.2-87.8
Age, median (IQR)	49 (34 – 56.8)	-
BMI, median (IQR)	22.7 (20.6 – 26.3)	-
Symptoms		
Food allergies	1 (10)	0.02 – 44.5
Heartburn	3 (30)	6.6 – 65.2
Chest pain	2 (20)	2.5 – 55.6
Vomit	1 (10)	0.02 – 44.5
Abdominal pain	3 (30)	6.6 – 65.2
Food impaction	1 (10)	0.02 – 44.5
PPI use	2 (20)	2.5 – 55.6
Endoscopy		
Normal EGD	2 (20)	2.5 – 55.6
Edema	2 (20)	2.5 – 55.6
Rings	3 (30)	6.6 – 65.2
Exudates	1 (10)	0.02 – 44.5
Furrows	2 (20)	2.5 – 55.6
Stricture	2 (20)	2.5 – 55.6
Reported EREFS Score	1 (10)	0.02 – 44.5
Histopathology		
Eosinophils per high-power field, median (IQR), eos/HPF	22 (17 – 38)	-

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Characteristic	n (%)	**95% CI**
Microabscesses	8 (80)	44.3 – 97.4
Degranulation	8 (80)	44.3 – 97.4
Basal zone hyperplasia	10 (100)	69.1 - 100
Spongiosis	10 (100)	69.1 - 100
Lamina propia fibrosis	7 (70)	34.7 – 93.3

IQR, interquartile range; BMI, body mass index; EGD, esophagogastroduodenoscopy; EREFS, EoE Endoscopic Reference Score; HPF, high-power field; PPI, proton-pump inhibitor. Values are No. (%) or median (IQR). 95% CIs are exact binomial and are shown only for proportions.

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Table 3. Distribution of Esophageal Eosinophil Counts per High-Power Field in Biopsied Patients With Dysphagia (N=108)

Eosinophils per HPF	n (%)	**95% CI, %**
0-5	95 (87.9)	80.3-93.4
5-10	2 (1.9)	0.2-6.5
11-15	1 (0.9)	0.02-5
>15	10 (9.2)	4.5-16.3

HPF indicates high-power field. Percentages use the total biopsied sample as denominator (N=108). 95% CIs are exact binomial.

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Figures

Figure 1. Patient Flow Diagram (STROBE)

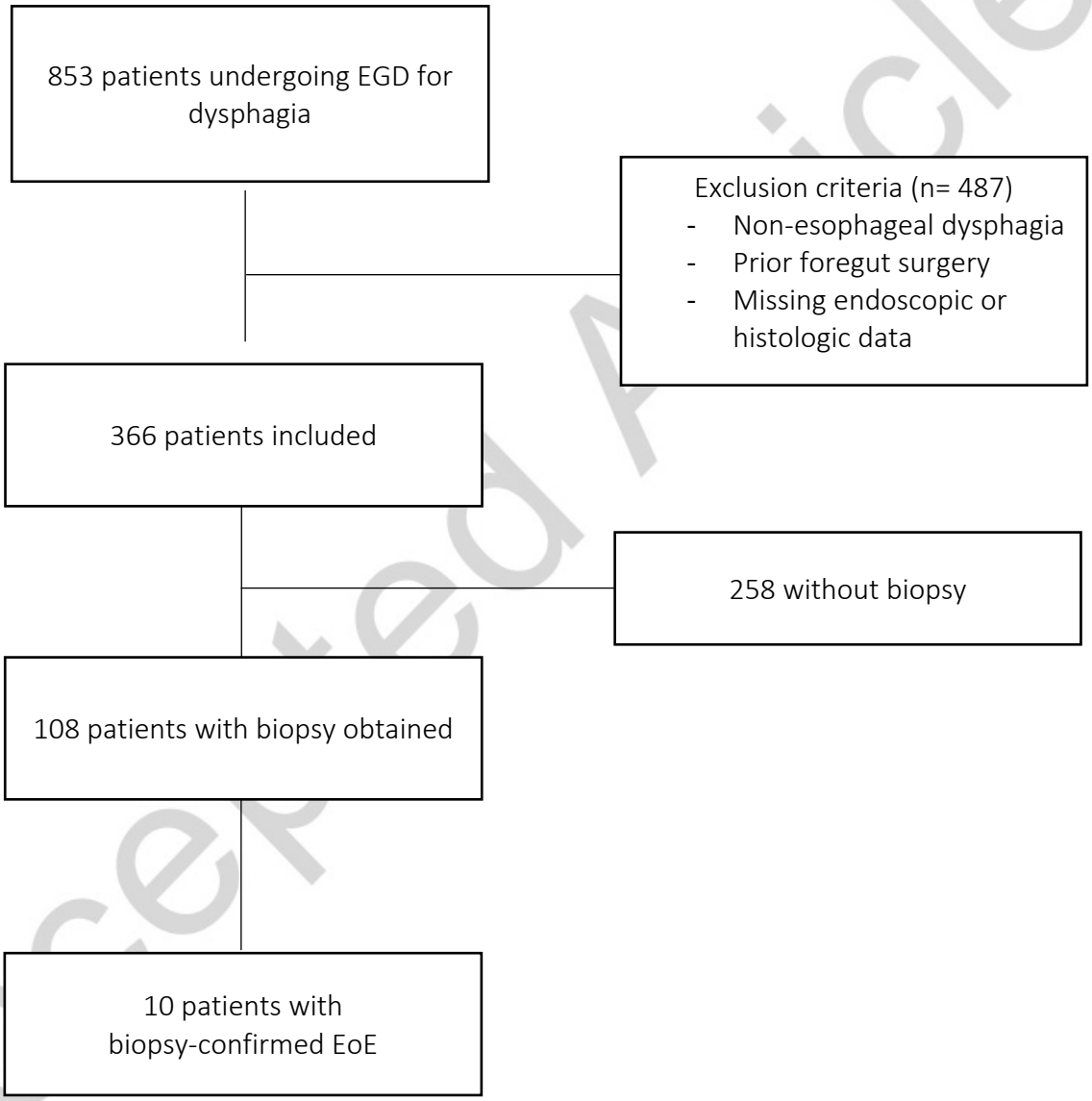

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Figure 1. Flow diagram of patient inclusion and outcomes. A total of 853 patients underwent upper endoscopy for esophageal dysphagia, of whom 366 met inclusion criteria. Esophageal biopsies were obtained in 108 patients, and eosinophilic esophagitis (EoE) was confirmed in 10 cases. This flowchart follows STROBE recommendations for transparent reporting.

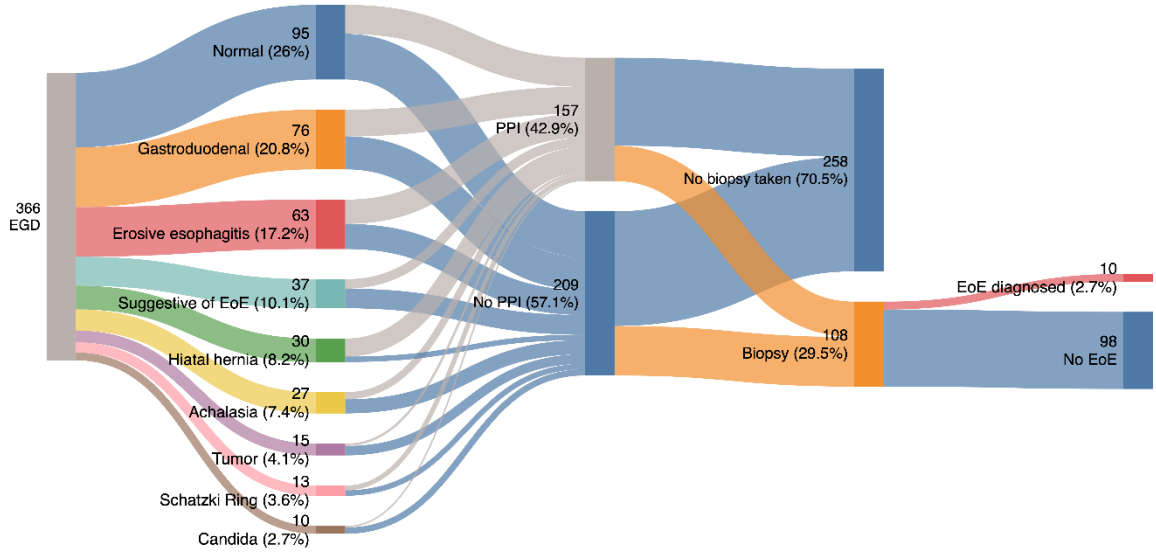

Figure 2. Sankey diagram illustrating patient distribution by endoscopic findings, PPI use, biopsy acquisition, and final diagnostic outcomes. Of the total cohort, 29.5% (n=108) underwent biopsy, among whom 9.3% (n=10) were diagnosed with EoE, corresponding to an overall prevalence of 2.7%. The majority of patients (70.5%) did not undergo biopsy and were therefore not histologically assessed. Percentages are shown relative to the

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de Enfermedades Digestivas
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total cohort. PPI, proton pump inhibitors; EoE, Eosinophilic Esophagitis.