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Lichenoid Esophagitis: A Clinicopathological Comparison with Lymphocytic and Eosinophilic Esophagitis

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ABSTRACT

Background & Aims: Lichenoid esophagitis (LichE) is rarely encountered by gastrointestinal endoscopists. Using a large nationwide database of clinicopathological records, the demographic and clinical characteristics of patients with LichE were compared to patients with lymphocytic esophagitis (LyE) and eosinophilic esophagitis (EoE).

Methods: In a case-control study, cases with a diagnosis of LichE, LyE, or EoE were compared to a control population of all patients without these 3 conditions. In addition to histopathology, patients' demographics, clinical presentation, and gastrointestinal comorbidities were considered. Statistical significance was assessed using odds ratios (OR) and 95% confidence intervals (95%CI).

Results: Among 967,773 unique patients with esophageal biopsies, LichE was found in 511 (0.05%), LyE in 1,786 (0.18%), EoE in 56,474 (5.84%), and none of these 3 diagnoses in a control population of 909,002 patients. LichE patients were significantly older, and EoE patients were significantly younger than the control population ($p<0.0001$). LichE and LyE significantly prevailed in females (OR=1.69; 95%CI: 1.40-2.04 and 1.34; 1.22-1.47, respectively). EoE was significantly less common in females (OR=0.49; 95%CI: 0.48-0.49). All 3 types of esophagitis were significantly less common among Hispanics, with their respective ORs of 0.70 (95%CI: 0.50-0.98), 0.83 (95%CI: 0.70-0.98), and 0.55 (95%CI: 0.53-0.57). EoE was also less common in persons of East and South Asian ancestry, with respective ORs of 0.52 (95%CI: 0.47-0.56) and 0.66 (95%CI: 0.56-0.76).

Conclusions: Increasing clinical awareness of LichE may enhance its clinico-pathological recognition, clarify its natural history, and ultimately lead to more effective clinical management.

Key words: clinical epidemiology – dysphagia – eosinophilic esophagitis – lichenoid esophagitis – esophagitis.

Abbreviations: CI: confidence interval; EGD: esophago-gastro-duodenoscopy; EoE: eosinophilic esophagitis; *H. pylori: Helicobacter pylori*; HPF: high-power field; LichE: Lichenoid esophagitis; LP: lichen planus; LPE: lichen planus esophagitis; LyE: lymphocytic esophagitis; esophagitis; OR: odds ratio.

INTRODUCTION

Lichen planus (LP) is a chronic inflammatory condition that affects the skin and mucous membranes, including the esophagus - lichen planus esophagitis (LPE).

In 2023, Salaria et al. [1] defined "lichenoid esophagitis pattern" [usually abbreviated to lichenoid esophagitis (LichE)] lesions that resemble LPE but lack its immunofluorescence pattern and are not associated with clinical evidence of coexisting oral, pharyngeal, or genital manifestations. Moreover, LPE is primarily associated with viral hepatitis, HIV infection, and the use of a variety of medications [1-3], while LichE is either associated with oral or cutaneous lichen planus or, most commonly, idiopathic.

In the original description, the typical histological phenotype includes a prominent band-like lymphocytic infiltrate involving the esophageal squamous epithelium and the lamina propria coexisting with dyskeratotic keratinocytes (Civatte bodies). This morphologic pattern is like that expected in LichE.

The endoscopic appearance has been mostly provided in individual case reports of very small series, including esophageal redness and friability, rings, furrows, and sloughing. Since all these features are frequently interpreted as manifestations of other, more common conditions (e.g., gastroesophageal

reflux, eosinophilic esophagitis, and *esophagitis dissecans superficialis*), they are unlikely to elicit a suspicion of the rare and still overlooked lichenoid esophagitis [4-6].

The aim of the present study was to analyze the demographic and clinical characteristics of patients with a histopathologic diagnosis of lichenoid esophagitis (LichE) and compare them with those of patients with lymphocytic (LyE) and eosinophilic esophagitis (EoE), as well as the general population of patients who undergo endoscopic workup for esophageal disease. Based on the large dimension of the study population, the present data should prompt clinicians who receive a histological diagnosis of lichenoid esophagitis to collect a thorough medical history that will help frame this finding into the spectrum of a lichen planus condition or – at least temporarily – accept it as an idiopathic disorder.

METHODS

Study Setting and Data Source

This study included all unique patients who underwent esophago-gastro-duodenoscopy (EGD) with esophageal mucosal biopsies diagnosed at Inform Diagnostics, a specialized pathology laboratory serving outpatient endoscopy centers throughout the United States. If a patient had multiple EGDs, only the first procedure when a diagnosis of either lymphocytic or lichenoid esophagitis was made was included. Patient records are stored in the IDEA (Inform Diagnostics Electronic Archives), which contains all histopathologic diagnoses, coded in a pre-defined and searchable fashion, demographic information, indications for EGD, and either a summary or an electronic record of the endoscopic procedure. The IDEA has been previously used for several studies on the epidemiology of a variety of gastrointestinal disorders [7-9]. All specimens are processed following identical embedding, sectioning, and staining procedures.

Study Design and Statistical Analysis

In this case-control study, we compared cases with a histopathologic diagnosis of either LichE, LyE or EoE to a (control) population of all patients without any of these 3 diagnoses. Case and control subjects' average age (and corresponding standard deviation) were compared using Student's *t*-test. Case and control subjects were also compared with respect to their (1) demographic characteristics (gender and ethnicity), (2) presenting signs and symptoms that led to the endoscopic procedure, and (3) the concurrence of other relevant histopathologic findings in the upper gastrointestinal tract. In comparing the frequency of such categorical variables among case and control subjects, we calculated odds ratios (OR) and their corresponding 95% confidence intervals (CI). A comparison was considered significant if the 95%CI of the OR did not include unity, that is, the value 1.00.

Diagnostic Guidelines and Internal Consistency

Approximately 20 experienced subspecialty-trained gastrointestinal pathologists review the biopsies and interpret the findings using standardized protocols with uniform diagnostic criteria.

As previously detailed elsewhere [10], this group has achieved a high degree of consistency in the diagnostic approach to the interpretation of cases by a combination of methods, which include: 1) a terminology committee that frequently reviews and updates diagnostic criteria and issues guidelines to which all pathologists are expected to adhere; 2) the requirement that all diagnostic headlines be entered through a code associated with one specific diagnosis (*e.g.*, the code LICHE results in the diagnosis "Lichenoid Esophagitis"). Then pathologists may insert an editable prepared comment, which often includes pertinent references, or may write their own comment as a free text; and 3) the mandatory attendance to a daily consensus conference during which complex cases are discussed, diagnoses are debated, and a consensus is reached.

The diagnostic criteria for the conditions addressed in this study have not significantly changes during the period covered by our analysis (from 1/2009 until 12/2022); therefore, a satisfactory level of internal consistency can be confidently assumed.

The study protocol was approved through an expedited review by the Inform Diagnostics Institutional Review Board (IRB). All data were collected exclusively by reviewing pre-existing records, and no contact was made with either patients or providers. No individual patient information was revealed, and all patient records were de-identified before being included in the present analysis. For these reasons, the study protocol was exempted from the need for informed consent from its participants.

Histopathologic Criteria

The approach to the evaluation of esophageal biopsies at Inform Diagnostics is guided by adherence to a set of internal criteria based on published histopathological and clinicopathological guidelines for each condition (when available), in addition to the collective experience of the team of pathologists. The histological criteria used to assess conditions related to lymphocyte-predominant esophagitis are summarized in Table I.

Eosinophilic esophagitis (also included in Table I) is diagnosed when esophageal biopsies show at least one high-power field with ≥15 eosinophils per high-power field (HPF) in a patient with a history of dysphagia or endoscopic evidence (*e.g.*, rings, furrows) suggestive of EoE [1]. Lymphocytic esophagitis was diagnosed using the set of diagnostic criteria proposed by Haque and Genta [11] in 2011, which included peripapillary lymphocytic infiltrates, spongiosis, and the virtual absence of polymorphonuclear neutrophilic granulocytes, eosinophils, and Civatte bodies [12]. No counts of intraepithelial lymphocytes per HPF were performed. Figs. 1 (A and B) illustrates the histological phenotype of LychE. For comparison, Fig 1C C illustrates the histopathologic appearance of LyE.

While the criteria for the clinicopathological diagnosis of EoE have evolved through several consensus meetings and the current guidelines are generally followed by both clinicians and pathologists [10, 12], there is no consensus on the histopathological diagnosis of either LyE or LichE [1, 4, 11]. As detailed above, by establishing our own criteria – largely based on the existing literature and our own personal experience – we have reached a high degree of internal consistency.

Table I. Histological criteria applied for the diagnosis of lymphocyte-predominant esophagitis and eosinophilic esophagitis

Lymphocytic	1 Intraepithelial lymphocytosis predominantly peripapillary
	2 Marked dilatation of intercellular spaces (DIS)
	3 Lymphocytes are mostly round, many with a halo around them,
	4 Rare or absent dyskeratotic keratinocytes (Civatte bodies)
	5 Rare intraepithelial eosinophils
	6 No neutrophils
	7 Basal cell hyperplasia
Lichenoid	1 Prominent band-like intraepithelial lymphocytosis
	2 Lymphocytes are mostly "squiggles"
	3 Prominent Civatte bodies (mid- and lower third of epithelium)
	4 Rare intraepithelial neutrophils; no eosinophils
	5 Basal cell hyperplasia
Candida spp.	1 Numerous neutrophils in superficial layers
	2 Variable intraepithelial lymphocytosis
	3 Civatte bodies near the surface or in the upper third of epithelium
	4 Fungal forms often visible on or within epithelium
GVHD	1 Clinical history of allogeneic hematopoietic stem cell transplant
	2 Intraepithelial lymphocytosis
	3 Separation of epithelium from lamina propria
	4 Epithelial apoptosis
Eosinophilic	1 A minimum 15 eosinophils in at least one high-power field (with an area of 0.237 mm2) in the esophageal squamous epithelium
	2 A clinical suspicion of EoE, and/or a history of dysphagia, food impaction, or other manifestation compatible with EoE
	3 An endoscopic description of esophageal rings, longitudinal furrows, white specks

GVHD: graft versus host disease.

We are, however, unable to determine whether most pathologists, particularly those not specifically trained in gastrointestinal pathology, would consistently apply similar criteria.

Endoscopic Appearance

We searched the summary of endoscopy reports for terms often associated with LichE, including "rings", "furrows", "friability", "sloughing", and "stricture" and determined the percentage of cases that had one or more such descriptor in the endoscopic report. We also reviewed manually the reports of the 511 patients with a diagnosis of LichE, in an attempt to discover other descriptors that could help detect more cases. An image of a typical endoscopic appearance in a patient with histology-confirmed diagnosis of LichE is depicted in Fig. 2. The figure shows multiple ring-like obstructions of the tubular esophagus and some minor superficial trauma with bright red blood on top from trying to pass the endoscope though these obstructions.

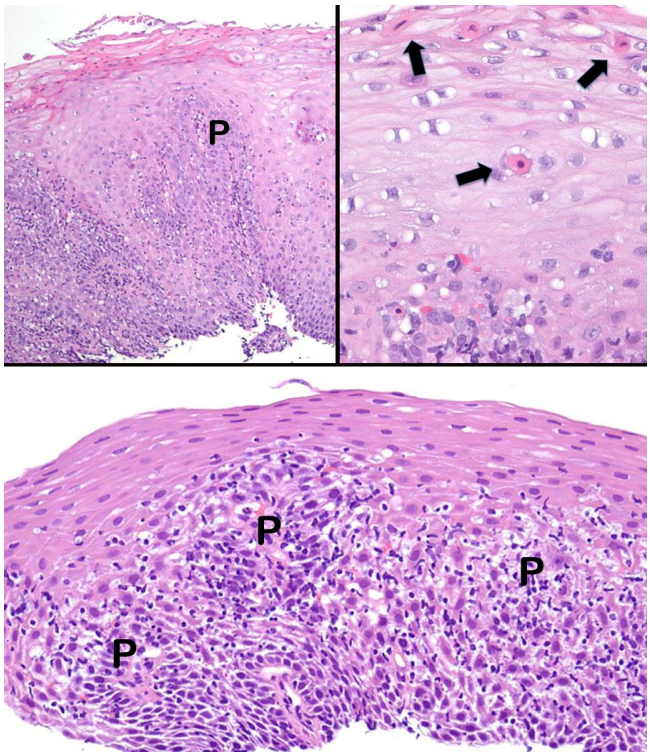

Fig. 1. Histopathology of lichenoid esophagitis in low-power (panel A) and high-power (panel B) magnification; histopathology of lymphocytic esophagitis (panel C). P indicates intraepithelial peri-papillary lymphocytosis. The arrows point at Civatte bodies (dyskeratotic keratinocytes).

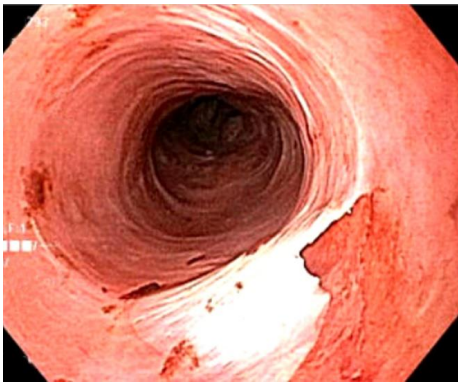

Fig. 2. Endoscopic appearance of lichenoid esophagitis (courtesy of SJ Spechler, Center for Esophageal Diseases, Baylor University Medical Center, Dallas, Texas).

RESULTS

Demographics

Among 967,773 unique patients with esophageal biopsies, the histopathological diagnosis of LichE was made in 511 (0.05%), LyE in 1,786 (0.18%) patients, and EoE in 56,474 (5.84%) patients. The control population comprised 909,002 patients without any of the 3 diagnoses. Table II shows the demographic characteristics of all case and control subjects. Patients with LichE were significantly older, and EoE patients with were significantly younger than the control population ($p<0.0001$). Lichenoid esophagitis and LyE were significantly

Table II. Demographic characteristics of case and control subjects

Demographic characteristic	LichE		LyE		EoE		Controls	
	N	%	N	%	N	%	N	%
Total patients	**511**	**100**	**1,786**	**100**	**56,474**	**100**	**909,002**	**100**
Age, Gender								
Age (SD)	65.6	(13.0)	58.5	(16.8)	45.6	(16.3)	56.3	(16.2)
Male	159	31.1	649	36.3	34,514	61.1	393,790	43.3
Female	352	68.9	1,137	63.7	21,960	38.9	515,212	56.7
Ethnicity								
Hispanic	37	7.2	150	8.4	3,257	5.8	90,684	10.0
East Asian	0	0.0	20	1.1	483	0.9	14,971	1.6
South Asian	1	0.2	10	0.6	181	0.3	4,437	0.5

LichE: lichenoid esophagitis; LyE: lymphocytic esophagitis; EoE: eosinophilic esophagitis; N: number of subjects or years (for age); SD: standard deviation.

more common in females, with their ORs and 95%CI being 1.69 (1.40-2.04) and 1.34 (1.22-1.47), respectively. In contradistinction, EoE was significantly *less* common in females, with an OR of 0.49 (95%CI: 0.48-0.49).

All 3 types of esophagitis were significantly less common among Hispanics, with their respective ORs of 0.70 (95%CI: 0.50-0.98), 0.83 (95%CI: 0.70-0.98), and 0.55 (95%CI: 0.53-0.57). Only EoE was less common in persons of East and South Asian ancestry, with respective ORs of 0.52 (95%CI: 0.47-0.56) and 0.66 (95%CI: 0.56-0.76).

Clinical Indications for the Esophagogastroduodenoscopy

Patients could present with multiple indications. Table III lists the most common indications; in both case and control patients, dysphagia was the most frequent symptom, with lichenoid esophagitis taking the lead (OR=6.66, 95%CI: 5.53-8.04) followed by lymphocytic esophagitis (OR=3.88, 95%CI: 3.54-4.26) and eosinophilic esophagitis (OR=3.60, 95%CI: 3.54-3.66). Vomiting and anemia were significantly less prevalent in lichenoid and eosinophilic esophagitis than in control subjects. Weight loss was more common in LichE (OR=1.64, 95%CI: 1.13-2.37) and LyE (OR=1.58, 95%CI: 1.29-1.93), but less common in eosinophilic esophagitis (OR=0.49, 95%CI: 0.46-0.52) than among controls.

All 3 types of esophagitis were significantly associated with less frequent occurrence of *Helicobacter pylori (H. pylori)* than the control population, with ORs of 0.63 (95%CI: 0.40-0.99), 0.65 (95%CI: 0.52-0.83), and 0.62 (95%CI: 0.60-0.65) respectively. Lymphocytic esophagitis was significantly associated with lymphocytic gastritis (OR=5.41, 95%CI: 2.90-10.11) and celiac disease (OR=3.91, 95%CI: 2.26-6.75). The above comparisons only refer to patients who had additional gastric and duodenal biopsies besides esophageal biopsies.

Endoscopic Appearance

In 511 unique patients with LichE, esophageal strictures were the most common abnormality found in 80 (15.7%) patients. Esophageal rings were diagnosed in 65 (12.7%) patients. Longitudinal furrows were mentioned in 9 (1.8%) patients and friability in 7 patients (1.4%).

In 1,786 LyE-patients, esophageal strictures were found in 153 (8.6%) patients and esophageal rings in 152 (8.5%) patients. The prevalence of esophageal furrows and friability was lower than 1% (15 and 12 patients, respectively).

Table III. Demographic characteristics of case and control subjects

Symptoms & Histopathology	LichE		LyE		EoE		Controls	
	N	%	N	%	N	%	N	%
Total patients	**511**	**100**	**1,786**	**100**	**56,474**	**100**	**909,002**	**100**
Indications								
Dysphagia	351	68.7	1,002	56.1	30,627	54.2	225,103	24.8
Chest pain	7	1.4	40	2.2	980	1.7	18,288	2.0
Vomiting	11	2.2	85	4.8	2,415	4.3	43,198	4.8
Anemia	14	2.7	74	4.1	1,065	1.9	43,656	4.8
Weight loss	30	5.9	101	5.7	1,025	1.8	33,311	3.7
Other histopathology								
Lymphocytic gastritis	1	0.2	10	0.6	61	0.1	945	0.1
H. pylori	20	3.9	72	4.0	2,174	3.8	54,958	6.0
Celiac sprue	0	0.0	13	0.7	137	0.2	1,703	0.2
DIL	1	0.2	30	1.7	501	0.9	11,030	1.2

DIL: duodenal intraepithelial lymphocytosis. For the rest of abbreviations see Table I.

In 56,474 patients with EoE, strictures were identified in 5,696 patients (10.1%), esophageal rings in 6,651 patients (11.8%), longitudinal furrows in 2,225 patients (3.9%), and mucosal friability in 401 patients (0.7%).

In nearly all patients with rings, furrows, or strictures in the esophagus, biopsy samples were taken with the clinical suspicion of EoE. In 12 patients who had previously been diagnosed with lichen planus, the clinical request specifically prioritized the need to rule out lichenoid esophagitis.

DISCUSSION

The present study aimed to compare the clinical and histopathologic features of LichE with LyE and EoE to identify any notable characteristics that could help clinicians recognize this condition. Whereas EoE is diagnosed relatively frequently, LyE and LichE remain rarely diagnosed. Whereas LichE and LyE were more common in females, EoE was more common in males. Patients with LichE also tended to be older than the general populations of subjects who undergo endoscopic workup for esophageal disease, whereas patients with EoE tended to be younger. Dysphagia, frequently reported in all patients who undergo esophagoscopy, was common in all three types of esophagitis, especially in patients with LichE. Weight loss was also more often associated with LichE than with other types of esophagitis. Concerning other concurrent upper gastrointestinal histopathology, all three types of esophagitis were associated with a less frequent concurrence of *H. pylori* gastritis. While this has been established for EoE [11,12], it represents a novel finding for LichE and EoE. Since all these three conditions are related to altered immune responses [13, 14], it seems plausible to regard *H. pylori* infection as an indicator of exposure to a less sanitized environment at an early age, relating the emergence of these esophageal conditions to a common "hygiene hypothesis" [15-18].

This study has several limitations, as well as several strengths. The lack of information on the dermatological, otolaryngological, gynecological, or dental consultations may have had limited our ability to distinguish "lichenoid" from "lichen planus" esophagitis, a term used when the histopathological features of lichenoid esophagitis are associated with known extra-esophageal lichen planus. All clinical information relied on data from the endoscopy reports. The procedure indications may have varied by patient age or physician's familiarity with common versus uncommon complaints. A professional bias towards complaints associated with the digestive tract may have also limited how often LichE was truly recorded as being accompanied by oral or dermal LP. The absence of follow-up and detailed information on specific treatments prevented us from concluding the long-term clinical significance of LichE and its natural history. Both etiology and precipitating factors remain unknown, and the absence of data about the patients' environmental exposures, social habits, and medication use does not allow us to put forward an evidence-based theory on the mechanisms that lead to these peculiar esophageal lesions. The lack of information about medications, particularly the use of proton pump inhibitors (PPI), could have led us to misclassify some cases. PPIs are widely prescribed to patients with esophageal symptoms. In addition, by inhibiting acid secretion, these drugs include anti-inflammatory effects and, in a subgroup of patients with EoE, can considerably decrease the eosinophilic infiltrates [19, 20]. Thus, some cases diagnosed as either LyE or LichE could theoretically have been from patients with treated forms of PPI-responsive EoE. This is, however, unlikely since in treated EoE, rarely, if ever, are there large peripapillary lymphocytic infiltrates (a *sine qua non* for the diagnosis of LyE) or abundant neutrophils and numerous Civatte bodies (characteristic of LichE).

The strengths of this study lie in the extensive information that can be obtained from our large database. The clinico-pathological data was generated by expert gastroenterologists and pathologists, and the study population was collected in an unbiased manner, representing a diverse range of demographics and socio-economic backgrounds across the United States. As a result, this retrospective analysis accurately reflects the reality of community-based clinical gastroenterology in America. However, due to the low prevalence of the disease, implementing a prospective study design to address the remaining questions is challenging.

While patients' demographics can affect the occurrence of different types of esophageal disease, their clinical profiles at the time of presentation tend to be similar across various gender, age, and ethnic groups. For example, both male and female patients with LichE or EoE may exhibit comparable disease patterns. Thus, the clinical index of suspicion remains low and is rarely communicated to the pathologist when esophageal biopsies are submitted.

Most patients were clinically assumed to have EoE, now a well-established and widely known condition. The awareness of LichE amongst pathologists, particularly those who are not specialized in gastrointestinal conditions, is very low and, in the absence of a suggestive "rule out LichE", they are unlikely to search for the specific features that would make its histopathologic diagnosis not only possible but, in many cases, even obvious.

CONCLUSIONS

The data presented in this study may help clinicians recognize, or at least suspect, LichE and communicate their concerns to pathologists. The results suggest that heightened awareness among both endoscopists and pathologists could reveal that LichE is more prevalent in the dysphagic population than currently believed. Increasing awareness of both endoscopic and microscopic findings may identify potentially overlooked LichE patients. This could enhance the current understanding of the disease's natural history, associate conditions, and warning signs, ultimately leading to more effective clinical management of this elusive illness.

Conflicts of interest: None to declare

Authors' contributions: S.H. conceived the study, collected, and revised the histopathology of the cases. S.M.K.M. revised the data and partially analyzed the data. S.M.K.M prepared the sections "Introduction" and "Results" in the manuscript. A. Singhal provided database and supported for its use by the authors; revised the

section "Methods". A. Sonnenberg performed data analysis and statistics, prepared the tables, and contributed to section "results". R.M.G. conceived the study, extracted data for analyses, examined the slides and prepared the pictures. R.M.G. wrote several drafts of the manuscript. M.R. conceived the study and critically analyzed the data and results. M.R wrote much of the discussion. All authors participated in editing and revising the several drafts of the manuscript and eventually approved of the contents of the submitted version.

REFERENCES

1. Salaria SN, Abu Alfa AK, Cruise MW, Wood LD, Montgomery EA. Lichenoid esophagitis: clinicopathologic overlap with established esophageal lichen planus. Am J Surg Pathol 2013;37:1889-1894. doi:10.1097/PAS.0b013e31829dff19
2. Pasricha S, Gupta A, Reed CC, Speck O, Woosley JT, Dellon ES. Lymphocytic Esophagitis: An Emerging Clinicopathologic Disease Associated with Dysphagia. Dig Dis Sci 2016;61:2935-2941. doi:10.1007/s10620-016-4230-2
3. Vangimalla S, Gordon I, Thota PN. Image of the Month: Lymphocytic Esophagitis in Common Variable Immune Deficiency. Am J Gastroenterol 2016;111:170. doi:10.1038/ajg.2015.178
4. Jacobs JW Jr, Kukreja K, Camisa C, Richter JE. Demystifying Esophageal Lichen Planus: A comprehensive Review of a Rare Disease You Will See in Practice. Am J Gastroenterol 2022;117:70–77. doi:10.14309/ajg.0000000000001485
5. Carmack SW, Vemulapalli R, Spechler SJ, Genta RM. Esophagitis dissecans superficialis ("sloughing esophagitis"): a clinicopathologic study of 12 cases. Am J Surg Pathol 2009;33:1789-1794. doi:10.1097/PAS.0b013e3181b7ce21
6. Katz PO, Dunbar KB, Schnoll-Sussman FH, Greer KB, Yadlapati R, Spechler SJ. ACG Clinical Guideline for the Diagnosis and Management of Gastroesophageal Reflux Disease. Am J Gastroenterol 2022;117:27-56. doi:10.14309/ajg.0000000000001538
7. Sonnenberg A, Lash RH, Genta RM. A national study of Helicobacter pylori infection in gastric biopsy specimens. Gastroenterology 2010;139:1894-1901.e2. doi:10.1053/j.gastro.2010.08.018
8. Genta RM, Sonnenberg A. Big data in gastroenterology research. Nat Rev Gastroenterol Hepatol 2014;11:386-390. doi:10.1038/nrgastro.2014.18
9. Sonnenberg A, Turner KO, Genta RM. Low Prevalence of Helicobacter pylori-Positive Peptic Ulcers in Private Outpatient Endoscopy Centers in the United States. Am J Gastroenterol 2020;115:244-250. doi:10.14309/ajg.0000000000000517
10. Dellon ES, Liacouras CA, Molina-Infante J, et al. Updated International Consensus Diagnostic Criteria for Eosinophilic Esophagitis: Proceedings of the AGREE Conference. Gastroenterology 2018;155:1022-1033.e10. doi:10.1053/j.gastro.2018.07.009
11. Haque S, Genta RM. Lymphocytic oesophagitis: clinicopathological aspects of an emerging condition. Gut 2012;61:1108-1114. doi:10.1136/gutjnl-2011-301014
12. Lucendo AJ, Molina-Infante J, Arias A, et al. Guidelines on eosinophilic esophagitis: evidence-based statements and recommendations for diagnosis and management in children and adults. United European Gastroenterol J 2017;5:335-358. doi:10.1177/2050640616689525
13. Lehman JS, Tollefson MM, Gibson LE. Lichen planus. Int J Dermatol 2009;48:682-694. doi:10.1111/j.1365-4632.2009.04062.x
14. Rubio CA, Ichiya T, Schmidt PT. Lymphocytic oesophagitis, eosinophilic oesophagitis and compound lymphocytic-eosinophilic oesophagitis I: histological and immunohistochemical findings. J Clin Pathol 2017;70:208-216. doi:10.1136/jclinpath-2016-203782
15. Okada H, Kuhn C, Feillet H, Bach JF. The 'hygiene hypothesis' for autoimmune and allergic diseases: an update. Clin Exp Immunol 2010;160:1-9. doi:10.1111/j.1365-2249.2010.04139.x
16. Dellon ES, Peery AF, Shaheen NJ, et al. Inverse association of esophageal eosinophilia with *Helicobacter pylori* based on analysis of a US pathology database. Gastroenterology 2011;141:1586-1592. doi:10.1053/j.gastro.2011.06.081
17. Jensen ET, Dellon ES. Environmental factors and eosinophilic esophagitis. J Allergy Clin Immunol 2018;142:32-40. doi:10.1016/j.jaci.2018.04.015
18. Shah SC, Tepler A, Peek RM Jr, Colombel JF, Hirano I, Narula N. Association Between *Helicobacter pylori* Exposure and Decreased Odds of Eosinophilic Esophagitis-A Systematic Review and Meta-analysis. Clin Gastroenterol Hepatol 2019;17:2185-2198.e3. doi:10.1016/j.cgh.2019.01.013
19. Spechler SJ, Genta RM, Souza RF. Thoughts on the complex relationship between gastroesophageal reflux disease and eosinophilic esophagitis. Am J Gastroenterol 2007;102:1301-1306. doi:10.1111/j.1572-0241.2007.01179.x
20. Franciosi JP, Mougey EB, Dellon ES, et al. Proton Pump Inhibitor Therapy for Eosinophilic Esophagitis: History, Mechanisms, Efficacy, and Future Directions. J Asthma Allergy 2022;15:281-302. doi:10.2147/JAA.S274524