Original Article

The Association of the Presence of Esophageal and Colonic Diverticula with Hiatal Hernia: A Cross-sectional Study

B Luvsandagva, T Bai*, X Hou*

Division of Gastroenterology, Union Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China
*Bayasgalan Luvsandagva and Tao Bai contributed equally to this study.

Received: 23-Sep-2023;
Revision: 02-Mar-2024;
Accepted: 26-Oct-2024;
Published: 04-Dec-2024

Abstract

Objective: This study investigates the association between the presence of diverticula in the colon and esophagus and the occurrence of hiatal hernia, seeking to understand potential shared pathophysiological underpinnings and risk factors. **Methods:** A cross-sectional study was conducted at a tertiary care center, including patients aged ≥18 years who underwent both gastroscopy and colonoscopy over 2 years. Exclusion criteria were prior gastrectomy or colectomy, incomplete medical records, and non-consent. The presence of hiatal hernia, colonic, and esophageal diverticulosis was identified via endoscopy. Logistic regression analysis assessed the associations, adjusting for age and sex. **Results:** Among 3563 participants, males showed a higher prevalence of hiatal hernias compared to females (76.1% vs. 23.9%, $P < 0.001$). Hiatal hernia patients had a mean age of 51.28 years, slightly higher than those without (49.62 years, $P = 0.034$). A significant association was found between hiatal hernias and colonic diverticulosis (11.8% vs. 1.8%, $P < 0.001$), as well as between hiatal hernias and esophageal diverticulosis (2.4% vs. 0.3%, $P < 0.001$). Adjusted logistic regression revealed a 5–7 times higher likelihood of colonic diverticulosis in patients with hiatal hernias (odds ratio = 5.64, 95% confidence interval: 3.60–8.83; $P < 0.001$). **Conclusion:** The study demonstrates a notable association between hiatal hernias and the presence of both colonic and esophageal diverticula, suggesting common pathophysiological processes. These findings highlight the need for further research into shared risk factors and mechanisms underlying these conditions, potentially guiding improved management strategies for affected patients.

Keywords: *Colonic diverticula, diverticulosis, esophageal diverticula, hiatal hernia*

Introduction

Hiatal hernia and colonic diverticula represent prevalent gastrointestinal disorders with increased incidence within the aging demographic.[1] Interestingly, while the occurrence of esophageal diverticula remains relatively rare, the pathophysiological underpinnings of these conditions exhibit notable similarities.[2,3] Specifically, a hiatal hernia is characterized by the herniation of the gastric portion through the esophageal hiatus of the diaphragm, a deviation from normal anatomical boundaries that can lead to clinical manifestations such as acid reflux and heartburn.[1,4,5] In a parallel manner, diverticulosis is defined by the herniation of mucosal and submucosal layers through the smooth muscular layer of the digestive tract wall, culminating in forming of the pouch-like structures.[6-10] Despite the disparate locations of herniation, namely the esophageal wall, colonic wall, and hiatus of the diaphragm, these conditions share a fundamental pathophysiological feature: the process of tissue herniation through surrounding smooth muscular structures.[11-15]

Access this article online

Quick Response Code:

Website: www.njcponline.com

DOI: 10.4103/njcp.njcp_690_23

Address for correspondence: Dr. B Luvsandagva, 1277. Jiefang Avenue, Wuhan, Hubei, China.
E-mail: l.bayasgalan@gmail.com

How to cite this article: Luvsandagva B, Bai T, Hou X. The association of the presence of esophageal and colonic diverticula with hiatal hernia: A cross-sectional study. Niger J Clin Pract 2024;27:1235-8.

Despite the clinical significance, the pathophysiological relationship between hiatal hernias and diverticular diseases still needs to be fully understood. Previous research has primarily focused on the epidemiology and management of these conditions independently. However, recent studies have suggested a possible association between hiatal hernias and diverticula in the colon and esophagus, possibly due to shared risk factors such as connective tissue disorders, diet, or altered intestinal motility.[16,17]

This study investigates the association between the presence of diverticula in the colon and esophagus and the occurrence of hiatal hernias.

Materials and Methods

We conducted a cross-sectional study involving patients who underwent upper gastrointestinal endoscopy and colonoscopy within a single tertiary care center over 2 years. Inclusion criteria comprised adult patients (age ≥18 years) with both gastroscopy and colonoscopy examinations. Exclusion criteria included patients with a history of either gastrectomy or colectomy surgery, those with incomplete medical records, and those who declined to participate in the study. The Institutional Ethical Review Committee of Huazhong University of Science and Technology reviewed and approved the study protocol.

Demographic data, including age and gender, were collected from electronic medical records. The presence of hiatal hernia, colonic diverticulosis, and esophageal diverticulosis was identified based on endoscopic findings documented by gastroenterologists or endoscopists. Hiatal hernia was classified based on standard endoscopic criteria, while colonic and esophageal diverticulosis were identified by the presence of diverticula noted during the endoscopic examination. Splenic flexure was borderline between the distal and proximal colon.

Descriptive statistics summarized the demographic and clinical characteristics of the study population, and categorical variables were compared using the Chi-square test. The association between hiatal hernias and the presence of colonic and esophageal diverticula was assessed using logistic regression analysis. Univariate models were first constructed to explore potential associations, followed by multivariate models adjusting for age and sex to control for potential confounders. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated to estimate association strengths, considering a P value of less than 0.001 as statistically significant, with all analyses conducted using SPSS Statistics version 19.

Results

In this study, we included a total of 3563 participants and investigated the association between hiatal hernias and the presence of diverticula in the colon and esophagus. The analysis included demographic comparisons, an assessment of the co-occurrence of conditions, and logistic regression analyses to explore associations while adjusting for potential confounders. Table 1 reveals demographic features highlighted a significant gender disparity in the prevalence of hiatal hernias, with males exhibiting a higher propensity (76.1%) compared to females (23.9%), as denoted by a Chi-square value of 47.59 and a highly significant P value (<0.001). The comparison of mean ages between patients with and without hiatal hernia revealed a slight difference; patients with hiatal hernia had a mean age of 51.28 years, whereas those without the condition had a mean age of 49.62 years (P = 0.034). Moreover, 11.8% of patients with hiatal hernias were

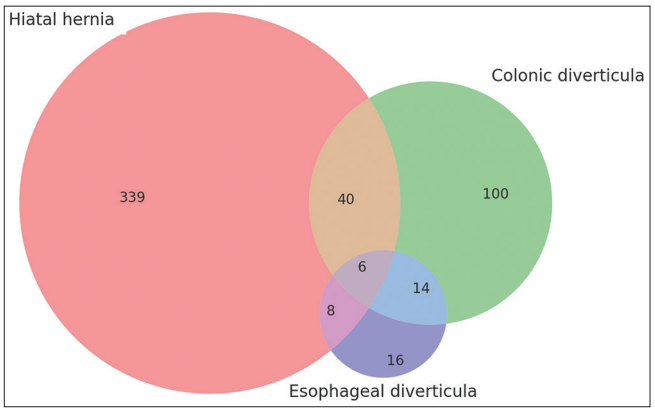

Figure 1: Co-occurrence of hiatal hernia with colonic and esophageal diverticula

Table 1: Demographic features of included patients

	Hiatal hernia		λ^2 or t	P
	Yes	No		
	n (%) or Mean±SD			
Gender			47.59	<0.001
Male	258 (76.1)	1797 (56.7)		
Female	81 (23.9)	1373 (43.3)		
Age/years	51.28±13.75	49.62±12.53	−2.16	0.034
Colonic diverticulosis			113.97	<0.001
No	299 (88.2)	3113 (98.2)		
Yes	40 (11.8)	57 (1.8)		
Location of diverticula			7.03	0.008
Distal	4 (10)	2 (3.5)		
Proximal	29 (72.5)	54 (93.1)		
Pan colon	7 (17.5)	1 (1.8)		
Esophageal Diverticulosis			25.51	<0.001
No	331 (97.6)	3162 (99.7)		
Yes	8 (2.4)	8 (0.3)		

Table 2: Esophageal and colonic diverticulosis associated with hiatal hernia: a logistic regression analysis

Variable	β	s.e.	Wals	*P*	OR	95% CI	
Colonic diverticulosis							
Univariate	1.99	0.22	85.59	<0.001	7.31	4.79	11.14
Multivariate†	1.73	0.23	57.10	<0.001	5.64	3.60	8.83
Esophageal diverticulosis							
Univariate	2.26	0.50	20.11	<0.001	9.55	3.56	25.62
Multivariate†	1.12	0.57	3.91	0.048	3.06	1.01	9.29

†, adjusted by age and sex

also diagnosed with colonic diverticulosis, compared to only 1.8% of those without hiatal hernias. This association was statistically significant, as evidenced by a Chi-square value of 113.97 and a *P* value of less than 0.001. The distribution of diverticula locations revealed a notable association between those with and without hiatal hernia. Specifically, distal colonic diverticula were more frequently observed in patients with hiatal hernia, with a prevalence of 10.0%, compared to 3.5% in those without hiatal hernia. Conversely, proximal colonic diverticula were predominantly seen in patients without hiatal hernia, accounting for 93.1% (n = 54) of cases, in contrast to 72.5% (n = 29) in patients with hiatal hernia. Esophageal diverticulosis also demonstrated a significant association with hiatal hernias, occurring in 2.4% of patients with the hernias versus 0.3% of those without, which is statistically significant ($P < 0.001$).

Figure 1 shows the comorbidity of hiatal hernia with colonic and esophageal diverticulosis. Specifically, within the subgroup of patients with colonic diverticulum, 41.2% (40 out of 97 patients) were also diagnosed with a hiatal hernia. The association between hiatal hernia and esophageal diverticulum was even more pronounced; half of the patients with esophageal diverticulum (8 out of 16 patients, 50%) had a concurrent diagnosis of hiatal hernia.

Logistic regression analysis evaluated the association between hiatal hernia and diverticular diseases, specifically colonic and esophageal diverticulosis. The results are presented in Table 2. For colonic diverticulosis, the univariate logistic regression model demonstrated a significant association with hiatal hernia, as evidenced by an OR of 7.31 (95% CI: 4.79–11.14; $P < 0.001$). After adjusting for sex and age in the multivariate model, the association persisted, showing a significant OR of 5.64 (95% CI: 3.60–8.83; $P < 0.001$), indicating that patients with hiatal hernias are about 5–7 times more likely to develop colonic diverticulosis compared to those without hiatal hernias.

Discussion

The findings of this cross-sectional study provide statistical evidence for a significant association between hiatal hernia and the presence of diverticula in both the colon and esophagus. This association persists even after adjusting for confounding factors such as age and gender, suggesting an underlying pathophysiological link between these conditions. Consistent with prior literature, our study observed a higher prevalence of hiatal hernia among males. This observation aligns with established patterns in the medical literature, which have consistently reported a male predominance in the incidence of hiatal hernias. The mechanisms underlying this gender-specific distribution remain fully elucidated; however, they may involve differential exposures to risk factors, variances in anatomical structure, or hormonal influences predisposing males to develop hiatal hernias.[18,19]

Age was a significant factor, with patients presenting with hiatal hernias and diverticula being older on average than those without these conditions (51.28 ± 13.75 vs. 49.62 ± 12.53 years, $P = 0.034$). This age disparity reinforces the notion that advancing age may contribute to the pathogenesis of hiatal hernias, potentially due to age-related changes in tissue elasticity and muscle strength. This finding aligns with existing literature that suggests a higher prevalence of diverticular diseases with advancing age.[1,2,7,8,18,20]

The statistical significance of the association between hiatal hernias and colonic diverticulosis, with an OR indicating a five to sevenfold increase in risk, is particularly compelling. This finding aligns with previous research suggesting common risk factors, such as alterations in connective tissue integrity or motility disorders, may play a role in concurrently presenting these conditions.[16,20-22] However, the cross-sectional nature of our study precludes the establishment of a causal relationship, and we cannot discount the possibility of unmeasured confounding factors influencing these associations. Moreover, although rarer, esophageal diverticulosis exhibits a significant co-occurrence with hiatal hernias. This coexistence could suggest a shared vulnerability in the esophageal and diaphragmatic structures, predisposing individuals to both conditions. The fact that 50% of patients with

esophageal diverticulum also had a concurrent diagnosis of hiatal hernia underscores the need for heightened clinical vigilance for comorbid diverticular disease in patients presenting with hiatal hernias.

The distribution of colonic diverticula about hiatal hernias presented a notable pattern in our study: right-sided colonic diverticula were more frequently observed in patients with hiatal hernias while being less common in those without (P = 0.008). Patients with hiatal hernia are observed to have a higher incidence of distal colonic diverticula compared to those without hiatal hernia. However, the prevalence of distal colonic diverticula is also noted among patients without hiatal hernia. Importantly, there is an age-related differentiation, with older patients more likely to present with hiatal hernia and subsequently a greater likelihood of developing distal colonic diverticula. Conversely, younger patients, regardless of the presence of hiatal hernia, exhibit a similar predisposition to distal colonic diverticula. This data indicates a complex interplay between age, hiatal hernia presence, and the development of distal colonic diverticula, necessitating further research to clarify these associations. This outcome supports the concept that right-sided diverticula might have a congenital origin, contrasting with the typically acquired left-sided diverticula, as suggested by prior publication.[23]

Our study's reliance on endoscopic findings as the diagnostic criterion for hiatal hernias and diverticulosis provides a robust basis for the observed associations. However, we acknowledge the limitations inherent in a single-center study, which may affect the generalizability of the results. Further multicenter studies with more extensive and diverse populations are required to confirm our findings and investigate the mechanisms underlying these associations.

In conclusion, the findings of this study demonstrate a statistical association between hiatal hernias and the presence of both colonic and esophageal diverticula. These findings suggest a commonality in pathophysiological processes that warrants further study.

Acknowledgments

We would like to thank Ms. HanhuaXiong, Ms. Xiaoli Pan, Mr. Hongyu Ren, and Other physicians for the data collection.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Yu HX, Han CS, Xue JR, Han ZF, Xin H. Esophageal hiatal hernia: Risk, diagnosis and management. Expert Rev Gastroenterol Hepatol 2018;12:319-29.
2. Herbella FA, Patti MG. Modern pathophysiology and treatment of esophageal diverticula. Langenbecks Arch Surg2012;397:29-35.
3. Sato H, Takeuchi M, Hashimoto S, Mizuno KI, Furukawa K, Sato A, *et al*. Esophageal diverticulum: New perspectives in the era of minimally invasive endoscopic treatment. World J Gastroenterol 2019;25:1457-64.
4. Siegal SR, Dolan JP, Hunter JG. Modern diagnosis and treatment of hiatal hernias. Langenbecks Arch Surg 2017;402:1145-51.
5. Menezes MA, Herbella FAM. Pathophysiology of gastroesophageal reflux disease. World J Surg 2017;41:1666-71.
6. Parra-Blanco A. Colonic diverticular disease: Pathophysiology and clinical picture. Digestion 2006;73(Suppl 1):47-57.
7. Kupcinskas J, Strate LL, Bassotti G, Torti G, Herszènyi L, Malfertheiner P, *et al*. Pathogenesis of diverticulosis and diverticular disease. J Gastrointestin Liver Dis 2019;28(Suppl 4):7-10.
8. Strate LL, Morris AM. Epidemiology, pathophysiology, and treatment of diverticulitis. Gastroenterology 2019;156:1282-98.e1.
9. Tursi A, Papa A, Danese S. Review article: The pathophysiology and medical management of diverticulosis and diverticular disease of the colon. Aliment Pharmacol Ther 2015;42:664-84.
10. Tursi A, Scarpignato C, Strate LL, Lanas A, Kruis W, Lahat A, *et al*. Colonic diverticular disease. Nat Rev Dis Primers 2020;6:20.
11. El Sherif A, Yano F, Mittal S, Filipi CJ. Collagen metabolism and recurrent hiatal hernia: Cause and effect? Hernia 2006;10:511-20.
12. Eren S, Ciris F. Diaphragmatic hernia: Diagnostic approaches with review of the literature. Eur J Radiol 2005;54:448-59.
13. Commane DM, Arasaradnam RP, Mills S, Mathers JC, Bradburn M. Diet, ageing and genetic factors in the pathogenesis of diverticular disease. World J Gastroenterol 2009;15:2479-88.
14. Stollman N, Raskin JB. Diverticular disease of the colon. Lancet 2004;363:631-9.
15. Almy TP, Howell DA. Medical progress. Diverticular disease of the colon. N Engl J Med 1980;302:324-31.
16. Reichert MC, Kupcinskas J, Krawczyk M, Jüngst C, Casper M, Grünhage F, *et al*. A variant of COL3A1 (rs3134646) is associated with risk of developing diverticulosis in white men. Dis Colon Rectum 2018;61:604-11.
17. Asling B, Jirholt J, Hammond P, Knutsson M, Walentinsson A, Davidson G, *et al*. Collagen type III alpha I is a gastro-oesophageal reflux disease susceptibility gene and a male risk factor for hiatus hernia. Gut 2009;58:1063-9.
18. Menon S, Trudgill N. Risk factors in the aetiology of hiatus hernia: A meta-analysis. Eur J Gastroenterol Hepatol 2011;23:133-8.
19. Wilkerson JA, Fatima H, Ceppa DP. Gender differences and hiatal hernias. Foregut 2023;3:208-12.
20. Barbaro MR, Cremon C, Fuschi D, Marasco G. Pathophysiology of diverticular disease: From diverticula formation to symptom generation. Int J Mol Sci 2022;23:6698.
21. Barbara G, Camilleri M, Sandler RS, Peery AF. Etiopathogenetic mechanisms in diverticular disease of the colon. Int J Mol Sci 2020;9:15-32.
22. Cameron R, Duncanson K, Hoedt EC, Eslick GD, Burns GL, Nieva C, *et al*. Does the microbiome play a role in the pathogenesis of colonic diverticular disease? A systematic review. J Gastroenterol Hepatol 2023;38:1028-39.
23. Feuerstein JD, Falchuk KR. Diverticulosis and diverticulitis. Mayo Clin Proc 2016;91:1094-104.