

Research Article

Predictive Value of Body Mass Index for Hiatus Hernia and Esophagitis in Gastroesophageal Reflux Disease Patients

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Abstract

Objectives: Hiatus Hernia is one of the leading gastrointestinal problems in Pakistan. Despite the diagnostic challenges, obesity and increasing age are considered significant predictors of hiatus hernia. The study was conducted to establish the association between body mass index (BMI) and hiatus hernia and assess the predictive value of BMI in these patients.

Methods: During this descriptive case series 372 patients, presenting with GERD, underwent endoscopy using Olympus CLV-260 series gastroscope and findings were observed for hiatus hernia, grades of gastroesophageal flap valve (GEFV) according to Hill classification and stages of esophagitis according to Savary-Miller classification. BMI was calculated. Chi square test of independence for association between BMI & GEFV and a series of logistic regression analyses for predictive value of BMI were carried out during data analysis.

Results: The mean age of the patients was 48 years (SD=14.2). Normal BMI was most prevalent (36.3%) while grade II and III GEFV were the most common findings in 29.8% and 28.5% patients respectively. A chi square test of independence established that the association between BMI & GEFV was significant ($p < .01$) but no significant association was found between BMI and esophagitis ($p = .14$). A series of logistic regression analyses showed that BMI was not a significant predictor of hiatus hernia though age and gender were significant predictors.

Conclusion: BMI is not a significant predictor of hiatus hernia, grades of GEFV or esophagitis. However, further studies need to be conducted to establish stronger predictors for hiatus hernia and esophagitis.

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Introduction

Hiatus hernia is defined as herniation of the upper part of the stomach through the esophageal hiatus because of weakness or a tear in the diaphragm. This is thought to be caused by increased pressure within the abdomen due to heavy lifting, bending over, frequent coughing, sneezing, vomiting, straining or stress.¹ Approximately 60% of population,

aged 50 or older, have a hiatus hernia but only 9% of those are symptomatic.²

Increased body mass index (BMI) has been historically considered to be the primary cause of esophageal hiatus hernia. Despite the diagnostic challenges, this is however accepted that the prevalence of hiatus hernia parallels that of obesity, increasing with age.³ Samuel DO concluded in 2018 that BMI above

30Kg/M² has a negative association with hiatus hernia while the risk seems higher in women and those with BMI in overweight range.⁴ Population studies conducted in Sweden, Italy and China have shown a HH prevalence of 23.9%, 43.0% and 0.7%, respectively however no serial assessment of prevalence has been done in Pakistan.⁵ Butt AK, in 2014, studied the symptoms of GERD and evaluated the risk factors. They enrolled 954 patients and found out that 692 patients had typical GERD symptoms and majority of these patients were overweight. The study established various associated risk factors including regular use of non-steroidal anti-inflammatory drugs in 355(37.2%) and active smoking in 210(22.0%) while 666(70%) reportedly consumed spicy meals.⁶ In 2015, Taj MA published a review article concerning the guidelines for management of GERD in the local population and recommended endoscopic diagnosis of GERD related esophageal complications like esophageal hiatus hernia, esophageal stricture or ulceration, Barrett's esophagus or adenocarcinoma.⁷

The objective of the study was to assess the predictive value of BMI in cases of hiatus hernia. Moreover, the correlation between BMI and grades of gastroesophageal flap valve (GEFV) & reflux esophagitis was also studied.

Methods

During this ethically approved descriptive case series, 372 patients were enrolled (after an informed consent) from either gender, aged 18 years or above, who presented with miscellaneous complaints ranging from epigastric pain, retrosternal burning, refractory gastroesophageal reflux disease (GERD), hematemesis etc. All those patients who were pregnant or presented with hepatic encephalopathy, shock or a known history of bleeding disorders were excluded from the study.

These patients underwent endoscopy using Olympus CLV-260 series gastroscope while lying in left lateral decubitus and supine position. All the patients were given 4% lignocaine gargles and conscious sedation as part of the procedure and endoscopic findings regarding hiatus hernia, GEFV (confirmed through endoscopic aspect of the gastroesophageal valve seen from a retroflexed position) and esophagitis were noted. The patients were then discharged from the

facility after post-procedural observation period of 2 hours to account for any complications.

Hiatus hernia was diagnosed when the endoscopic view confirmed an apparent separation of more than 2 cm between squanocolumnar junction and diaphragmatic impression and GEFV was classified according to the Hill classification (Table 1).⁸

Grade I: Prominent fold of tissue closely approximates the endoscope at its entry point to the stomach

Grade II: Prominent fold is present but there are occasional episodes of rapid opening and closing of the tissue around the endoscope

Grade III: There is barely a fold present and there is no circular gripping of the endoscope shaft. However, there is no herniation of gastric cardia through this persisting aperture

Grade IV: Herniation is present and squamous epithelium of the distal esophagus can be seen from the retroflexed endoscopic view.

Esophagitis was classified according to Savary-Miller classification on endoscopic view.⁹

Grade 1: Single erosion above gastro-esophageal mucosal junction

Grade 2: Multiple, non-circumferential erosions above gastro-esophageal mucosal junction

Grade 3: Circumferential erosion above mucosal junction

Grade 4: Chronic change with esophageal ulceration and associated stricture

Grade 5: Barrett's esophagus with histologically confirmed intestinal differentiation within columnar epithelium

A chi square test of independence was performed to examine the association between BMI and GEFV as well as Esophagitis. A series of logistic regression analyses were conducted to determine the predictive ability of levels of BMI for hernia and for differentiating between grades of Esophagitis.

Results

The mean age of participants was 48 years (SD=14.2). Normal BMI was most prevalent (36.3%) while grade II and III GEFV were the most common findings in 29.8% and 28.5% patients respectively. Most of the participants showed evidence of Grade II GEFV and Grade III Esophagitis (see Table 1).

A chi square test of independence was performed to examine the association between BMI and GEFV as

Table 1: Demographic Characteristics of Hiatus Hernia Patients (N=372)

	F	%	M	SD
Age (Years)			48	14
Gender				
Male	171	46		
Female	201	54		
BMI				
Under weight	51	13.7		
Normal	135	36.3		
Over weight	114	30.6		
Obese	72	19.4		
GEFV				
Grade I	60	16.1		
Grade II	111	29.8		
Grade III	106	28.5		
Grade IV	95	25.5		
Esophagitis				
Absent	17	4.6		
Present				
Grade I	59	15.9		
Grade II	101	27.2		
Grade III	171	46.0		
Grade IV	24	6.5		
Hiatus Hernia				
Present	201	54%		
Absent	171	46%		

well as Esophagitis (see Table 2). The association between BMI & GEFV was significant, $\chi^2(9, N=372) = 22.56$, ($p < .01$) but no significant association was found between BMI and Esophagitis, $\chi^2(9, N=355) = 13.63$, ($p = .14$). The results of the Chi-square test revealed that there was no significant association between Gender and GEFV, $\chi^2(3, N=372) = 5.78$, ($p = .12$). However, significant association was found between Esophagitis and grades of GEFV $\{\chi^2(12, N=372) = 103.93, p < 0.01\}$ (Table 3).

A series of logistic regression analyses were conducted to determine the predictive ability of levels of

Table 2: Descriptive Statistics for GEFV, Esophagitis & BMI

		Body Mass Index			
		Under weight	Normal	Over weight	Obese
GEFV	Grade I	10	17	16	17
	Grade II	12	41	35	23
	Grade III	6	46	33	21
	Grade IV	23	31	30	11
Esophagitis	Grade I	9	11	23	16
	Grade II	16	38	31	16
	Grade III	23	73	49	26
	Grade IV	3	7	8	6

Table 3: Descriptive Statistics for GEFV by Esophagitis and Gender (N= 372)

		GEFV			
		I	II	III	IV
Gender	Male	26	61	47	37
	Female	34	50	59	58
	Absent	4	7	5	1
Esophagitis	I	24	24	9	2
	II	20	31	33	17
	III	12	49	55	55
	IV	0	0	4	20

Table 4: Univariate Analysis predicting Hiatus Hernia from Age, Gender & Body Mass Index

Predictors	Hiatus Hernia				
	B	S.E	OR	95%CI	
				LL	UL
Age	-.03***	.01	.97	.96	.99
Gender	-.58*	.23	.56	.36	.88
BMI Levels					
Underweight vs Obese	-.43	.39	.65	.30	1.42
Normal vs Obese	-.78*	.31	.46	.25	.85
Overweight vs Obese	-.53	.32	.59	.32	1.09
Model χ^2 (df)	21.96***(5)				
Cox and Snell R ²	.06				

Note. (N=372). Coding for Hiatus Hernia; (0= Absent, 1= Present), Coding for gender (0=men, 1=women), Dummy coding for levels of BMI; first level mentioned is "1" and the second level is "0". S.E = Standard Error, OR = Odd Ratio, CI = Confidence Interval, LL = Lower Limit, UL = Upper Limit.

* $p < .05$, *** $p < .001$

BMI (Under-weight, Normal, Over-weight and Obese) for hernia (see Table 6) and for differentiating between grades of Esophagitis (Grade 1, Grade 2,

Table 5: Univariate Analysis predicting Esophagitis from Age, Gender & Body Mass Index

Predictors	Esophagitis															
	Grade 1 & Grade 4				Grade 2 & Grade 4				Grade 3 & Grade 4							
	B	S.E	OR	95%CI	B	S.E	OR	95%CI	B	S.E	OR	95%CI				
			LL	UL				LL	UL			LL	UL			
Age	.02	.01	1.02	.99	1.04	.01	.01	1.01	.99	1.03	-.01	.01	.99	.98	1.01	
Gender	-.17	.31	.85		1.54	-.41	.25	.67	.41	1.08	.37	.22	1.45	.94	2.23	
BMI Levels																
Underweight and Obese	.34	.47	1.41	.56	3.57	-.42	.42	.66	.29	1.51	-.09	.38	.91	.43	1.94	
Normal and Obese	1.25**	.44	3.51	1.48	8.28	-.33	.36	.72	.36	1.44	-.56	.32	.57	.31	1.07	
Overweight and Obese	.20	.38	1.22	.59	2.56	-.21	.36	.81	.39	1.64	-.09	.32	.91	.49	1.71	
Model χ^2 (df)	14.24* (5)				4.65(5)				10.29 (5)							
Cox and Snell R ²	.04				.01				.03							

Note. (N=355). Dummy coding for grades of esophagitis; first grade mentioned in heading is "1" and the second grade is "0". Coding for gender (0=men, 1=women), Dummy coding for levels of BMI; first level mentioned is "1" and the second level is "0". S.E = Standard Error, OR = Odd Ratio, CI = Confidence Interval, LL = Lower Limit, UL = Upper Limit

*p<.05, **p<.01.

Grade 3 and Grade 4) (Table 5).

Table 4 shows that the overall model significantly predicted the outcome of hiatus hernia and 6% of the variance was explained by age, gender and BMI. As the age increased, the likelihood of suffering from hiatus hernia decreased. Similarly, patients with a male gender and normal BMI had increased likelihood of suffering from hiatus hernia.

Table 5 shows that the overall model for one group of Esophagitis (Grade 1 versus Grade 4) emerged as significant. 4% of the variance was explained by age, gender and BMI levels in the outcome of esophagitis. Moreover, it was seen that patients having normal BMI had increased likelihood of having Esophagitis (Grade 1). The overall models for the following two groups of Esophagitis i.e. (Grade 2 versus Grade 4) and (Grade 3 versus Grade 4) were insignificant and all the predictors i.e. age, gender and BMI levels emerged as insignificant for the outcome of Esophagitis.

Discussion

Hiatus hernia, one of the leading gastrointestinal problems, remains under-diagnosed due to the difficulty in confirming the diagnosis. The current estimated prevalence varies from 10% to 80% of the adults in North America with a general acceptance that hiatus hernia is mainly associated with obesity and age however the prevalence varies in different Asian and European countries.¹⁰ Despite the lack of a direct prevalence study in Pakistan, the data shows

that the Pakistani students present with more episodes of acid reflux in a week as compared to the general asian population.^{11,12}

In 1999, Wilson LJ concluded that BMI was associated with the presence of hiatus hernia as well as esophagitis. Multiple logistic regression in a retrospective analysis of 1389 patients indicated that BMI and hiatal hernia were significant factors for the presence of esophagitis but gender and race had no effect. Samuel DO and Nabe BR though refuted the findings of this study in 2018 when they proved that a high BMI of 30Kg/M² or above has a negative association with hiatus hernia. It was proposed that the risk of developing hiatus hernia seemed to be higher in women especially those with BMI in the overweight range. Moreover, it was observed that normal and overweight ranges of BMI had a higher risk of hiatus hernia as compared to the obese patients.¹³

In this current study of 372 patients, the results of the Chi-square test revealed that there is a significant association between BMI & hiatus hernia ($p < 0.01$) as well as esophagitis and hiatus hernia ($p < 0.01$). However, the results were unable to prove any significant association between gender and hiatus hernia (as shown in Table 2 and 3).

A series of logistic regression analyses were conducted to determine the predictive ability of different levels of BMI for hiatus hernia and esophagitis. The

levels of BMI did not emerge as a significant predictor of hiatus hernia. Although normal BMI range proved to be a factor but overweight and obese categories were not significant predictors for the likelihood of developing hiatus hernia. Analysis showed that an increase in age is not directly proportional to an increased likelihood of hiatus hernia.

Lee SW studied the impact of BMI and gender on 173 patients who suffered from GERD and showed that the patients who were obese were more likely to suffer from erosive esophagitis and hiatal hernia.¹⁴ When gender differences were taken into account, it was observed that the men presented with severe endoscopic and clinical features but women endured a worse influence on mental health. When the results of Lee's study were compared to this study, it was seen that patients having normal BMI had increased likelihood of Grade 1 esophagitis. The overall models however were insignificant and all the predictors i.e. age, gender and BMI levels emerged as insignificant for the outcome of esophagitis.

In the light of these findings, the historical perspective that a high body mass index is directly proportional to the risk of developing hiatus hernia is true since the association is proved in multiple studies.^{15,16} A high BMI leads to hiatus hernia albeit with no effect on the severity of the problem as evident from different grades of hiatus hernia which in turn had no relation with stages of esophagitis. This means that BMI has no predictive value in diagnosing hiatus hernia and the grades of hernia have no bearing on the levels of esophagitis.¹⁷

This poses a difficulty when developing a treatment algorithm for diagnosis and treatment of various grades and stages of hiatus hernia and esophagitis.^{18,19} The currently employed treatment regimens (both medical and surgical) might be rendered ineffective if the severity of hiatus hernia and esophagitis is not taken into account.²⁰ An endoscopic study will thus become the cornerstone of the management plan for any patient who is clinically suspected to be a case of hiatus hernia. This brings forth the challenges facing the diagnosis or management of hiatus hernia and related complications (barrett's esophagus being the most important variety).²¹ The latest interventional modules (fundoplication or Stretta procedure) will be

dependent on follow-up endoscopic studies to document the improvement or worsening in hiatus hernia and subsequent esophagitis.²²

Despite the results being statistically valid and showing associations, the present study did not take into account the symptom severity and the related grades of hiatus hernia or esophagitis which can be further studied as part of a large scale multicentre study that enrolls patients from different ethnicities and regions to confirm these findings across different groups. The study, however, underlines the importance of developing better predictive tools for hiatus hernia and related complications instead of relying on the historic model of BMI and symptomatic presentation of the patients to determine the severity and course of management for a healthy outcome in this group of patients.

Conclusion

Despite finding an association between BMI and hiatus hernia, there was a lack of predictive value for BMI in cases of hiatus hernia and esophagitis. However, age and gender emerged as possible predictors in certain groups. Further studies need to be conducted to establish stronger predictors to assess severity and grades of hiatus hernia and esophagitis.

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References

1. Badillo R, Francis D. Diagnosis and treatment of gastroesophageal reflux disease. *World J Gastrointest Pharmacol Ther.* 2014;5(3):105-12.
2. Gyawali CP, Fass R. Management of gastroesophageal reflux disease. *Gastroenterology.* 2018; 154(2): 302-18.
3. Barbara F, Nadaletto BS, Fernando AM, Herbella MD, Marco G, Patti MD. Gastroesophageal reflux disease in the obese: pathophysiology and treatment. *Surgery.* 2016;159(2):475-86.
4. Samuel DO, Nabe BR. Hiatus Hernia and Body Mass Index (BMI): A Possible Correlation? *American J of Med Case Reports.* 2018;6(4):75-8.
5. Koh YX, Ong LW, Lee J, Wong AS. Para-oesophageal and para-hiatal hernias in an Asian acute care tertiary hospital: an underappreciated surgical condition. *Singapore Med J.* 2016;57(12):669-75.

6. Butt AK, Hashemy I. Risk factors and prescription patterns of gastroesophageal reflux disease: HEAL study in Pakistan. *JPMA*. 2014;64(7):751-56
7. Niaz SK, Quraishy MS, Taj MA, Abid S, Alam A, Nawaz AA, et al. Guidelines on gastroesophageal reflux disease. *JPMA*. 2015;65(5):532-41.
8. Hansdotter I, Björ O, Andreasson A, Agreus L, Hellstrom P, Forsberg A, et al. Hill classification is superior to the axial length of a hiatal hernia for assessment of the mechanical anti-reflux barrier at the gastroesophageal junction. *Endoscopy International Open*. 2016;4(3):311-7
9. Ida T, Inamori M, Inoh Y, Fujita K, Hamanaka J, Chiba H, et al. Clinical Characteristics of Severe Erosive Esophagitis among Patients with Erosive Esophagitis: A Case-control Study. *Intern Med*. 2017;56(11):1293-1300.
10. El-Serag HB, Sweet S, Winchester CC, Dent J. Update on the epidemiology of gastro-oesophageal reflux disease: a systematic review. *Gut*. 2014; 63(6): 871-80
11. Riaz, H, Kamal SW, Aziz S. Gastroesophageal reflux disease (GERD) in students of a government medical college at Karachi. *J Pak Med Assoc*. 2010; 60:147-50
12. Sugimoto M, Uotani T, Ichikawa H, Andoh A, Furuta T. Gastroesophageal Reflux Disease in Time Covering Eradication for All Patients Infected with *Helicobacter pylori* in Japan. *Digestion*. 2016;93:24-31.
13. Samuel DO, Nabe BR. Hiatus Hernia and Body Mass Index (BMI): A Possible Correlation? *American Journal of Medical Case Reports*. 2018;6(4):75-8.
14. Zhang L, Tu L, Chen J, Song J, Bai T, Xiang SL, et al. Health-related quality of life in gastroesophageal reflux patients with non-cardiac chest pain: Emphasis on the role of psychological distress. *World J Gastroenterol*. 2017;23(1):127-34.
15. Kim YS, Kim N, Kim GH. Sex and gender differences in gastroesophageal reflux disease. *J Neurogastroenterol and Motility*. 2016;22:575-88.
16. Chang P, Friedenberg F. Obesity and GERD. *Gastroenterol Clin North Am*. 2013;43(1):161-73.
17. Tolone S, Savarino E, Bortoli N, Frazzoni M, Furnari M, d'Alessandro A, et al. Esophagogastric junction morphology assessment by high resolution manometry in obese patients candidate to bariatric surgery. *Intl J Surg*. 2016;28(1):109-13.
18. Franzén T, Tibbling L. Is the severity of gastroesophageal reflux dependent on hiatus hernia size?. *World J Gastroenterol*. 2014;20(6):1582-4.
19. Sharifi A, Dowlatshahi S, Moradi Tabriz H, Salamat F, Sanaei O. The Prevalence, Risk Factors, and Clinical Correlates of Erosive Esophagitis and Barrett's Esophagus in Iranian Patients with Reflux Symptoms. *Gastroenterol Res Pract*. 2014;1:6962-94.
20. Rossetti G, Limongelli P, Cimmino M, Napoletano D, Bondanese MC, Romano G, et al. Outcome of medical and surgical therapy of GERD: Predictive role of quality of life scores and instrumental evaluation. *Intl J Surg*. 2014;12(1):112-16.
21. Brar TS, Draganov PV, Yang D. Endoluminal therapy for gastroesophageal reflux disease: in between the pill and the knife. *Dig Dis Sci*. 2017;62(1):16-25.
22. Runge TM, Abrams JA, Shaheen NJ. Epidemiology of Barrett's Esophagus and Esophageal Adenocarcinoma. *Gastroenterol Clin North Am*. 2015; 44(2): 203-31.