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Association of metabolic syndrome with erosive esophagitis and Barrett's esophagus in a Chinese population

Shou-Wu Lee [a,b,*], Han-Chung Lien [a,c], Chi-Sen Chang [a,b], Teng-Yu Lee [a,b], Yen-Chun Peng [a,c], Hong-Zen Yeh [a,c]

[a] *Division of Gastroenterology, Department of Internal Medicine, Taichung Veterans General Hospital, Taichung, Taiwan, ROC*
[b] *Department of Internal Medicine, Chung Shan Medical University, Taichung, Taiwan, ROC*
[c] *Department of Internal Medicine, National Yang-Ming University School of Medicine, Taipei, Taiwan, ROC*

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Abstract

Background: Metabolic syndrome has been highlighted as a risk factor for several gastrointestinal diseases, including gastroesophageal reflux disease and Barrett's esophagus (BE). The aim of this study was to investigate the association of metabolic syndrome with erosive esophagitis (EE) and BE.
Methods: Data were retrospectively collected from patients who visited the Medical Screening Center at Taichung Veterans General Hospital, Taichung, Taiwan from January 2006 to December 2009. All patients underwent an open-access transoral upper gastrointestinal endoscopy, and serum laboratory data were collected. The exclusion criteria included prior gastric surgery, or presence of esophageal varices or peptic ulcers. These patients were assigned to groups according to their endoscopic findings as follows: (1) normal group; (2) EE group; and (3) BE group. Metabolic syndrome was diagnosed based on the International Diabetes Federation criteria.
Results: There were 560/6499 (8.6%) patients, 214/1118 (9.6%) patients, and 19/95 (20%) patients with metabolic syndrome in the normal, EE, and BE groups, respectively. There was a significantly higher percentage of cases with hypertriglyceridemia in the EE group (67%) compared with the other groups. The BE group had significantly higher rates of central obesity (33%) and hypertension (29.5%) compared with rates in the normal and EE groups. After adjusting for confounders, the positive association with metabolic syndrome still existed in both the EE group (adjusted odds ratio = 2.43; 95% confidence interval = 1.02−3.44) and the BE group (adjusted odds ratio = 2.82; 95% confidence interval = 2.05−3.88).
Conclusion: Our research indicated that in fact there is a greater risk of concurrent metabolic syndrome in patients with EE or BE.

Keywords: Barrett's esophagus; erosive esophagitis; metabolic syndrome

1. Introduction

Metabolic syndrome is described in association with cardiovascular disease and type 2 diabetes, where the usual screening variables are waist circumference, circulating levels of triglyceride (TG), high-density lipoprotein (HDL) cholesterol, fasting glycemia, and blood pressure.[1] Metabolic syndrome has become a major public health challenge worldwide. In Taiwan, the prevalence rate of metabolic syndrome is 20%.[2,3] Metabolic syndrome has been highlighted as a risk factor for some gastrointestinal diseases, including gastroesophageal reflux disease (GERD) and Barrett's esophagus (BE).[4] Patients with GERD may present with a broad range of troublesome symptoms that can damage quality of life, and BE is associated with the presence of premalignant lesions that lead to adenocarcinoma of the esophagus and gastroesophageal junction. BE is defined by the pathological phenotype of

Conflicts of interest: The authors declare that they have no conflicts of interest related to the subject matter or materials discussed in this article.

* Corresponding author. Dr. Shou-Wu Lee, Division of Gastroenterology, Department of Internal Medicine, Taichung Veterans General Hospital, 1650, Section 4, Taiwan Boulevard, Taichung 407, Taiwan, ROC.
E-mail address: ericest@vghtc.gov.tw (S.-W. Lee).

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specialized intestinal metaplasia.[5] The aim of this study was to investigate the association between metabolic syndrome and erosive esophagitis (EE) or BE in a Chinese population.

2. Methods

Data from patients who visited the Medical Screening Center at Taichung Veterans General Hospital, Taichung, Taiwan were retrospectively collected from January 2006 to December 2009. The general data of enrolled patients were recorded, including age, gender, body weight, body mass index (BMI), waist circumference, blood pressure, fasting glucose, TG, and HDL. All patients underwent an open-access transoral upper gastrointestinal endoscopy, and the findings of each case were collected. The exclusion criteria included prior gastric surgery, or presence of esophageal varices or peptic ulcers.

All endoscopic procedures were performed by experienced endoscopists. The patients were assigned to groups according to whether upper gastrointestinal endoscopy showed normal appearance (normal group), EE, or BE. BE was defined as endoscopically suspected esophageal metaplasia with specialized intestinal metaplasia documented by biopsy pathology.

Metabolic syndrome was diagnosed based on the 2005 International Diabetes Federation criteria with ethnicity-specific values: central obesity (waist circumference $\geq$ 90 cm for men and $\geq$ 80 cm for women), combined with any two of the following four conditions: (1) TG levels $\geq$ 150 mg/dL); (2) HDL levels < 40 mg/dL for men and < 50 mg/dL for women; (3) fasting glucose levels > 100 mg/dL); and (4) systolic blood pressure $\geq$ 130 mmHg or diastolic blood pressure $\geq$ 85 mmHg.

Data are expressed as standard deviation of the mean for each of the measured parameters. Gender, positive ratio of metabolic syndrome and its associated components are expressed as a percentage of the total patient number. Statistical comparisons were made using Pearson's χ^2 test to compare the effects of gender and positive ratio of metabolic syndrome and individual components. Independent t test was used to analyze age, body weight, and BMI. A p value < 0.05 was considered statistically significant. Multivariate Cox's regression was used to examine the strength of association between metabolic syndrome and EE or BE, and odds ratios (OR) with 95% confidence interval (CI) were reported.

3. Results

Among all 7712 enrolled patients, there were 6499 (84.3%), 1118 (14.5%), and 95 (1.2%) in the normal, EE, and BE groups, respectively. The characteristics of these patients are summarized in Table 1. The mean ages of the three groups were similar. The patients in the EE group (69.52 kg, 25.1 kg/m^2) had significantly higher body weight and BMI than patients in the normal group (64.3 kg, 24.07 kg/m^2) and BE group (65.38 kg, 23.92 kg/m^2). The male predominance was significant in the EE (80.2%) and BE (64.2%) groups. The propotion of patients with EE L.A. Grades A/B and C/D were 81.7% (913 cases) and 18.3% (205 cases), respectively.

Among all of the enrolled cases, there were 686 individuals (8.9%) with metabolic syndrome; the associations of normal cases, EE, and BE with metabolic syndrome are displayed in Table 2. There were 560 (8.6%) cases, 214 (9.6%) cases, and 19 (20%) cases with metabolic syndrome in the normal, EE and BE groups, respectively. The difference was significant ($p = 0.001$). Among individuals in the BE group, there were significantly higher percentages of abnormal waist circumference (33%) and hypertension (29.5%) compared with those of the other groups. The EE group had the highest prevalence of hypertriglyceridemia (61.7%), which was statistically significant.

The strength of the association between each group and metabolic syndrome is disclosed in Table 3. After adjustment for measured potential confounders, including age, sex, and body weight, a significant positive association with metabolic syndrome was found in the EE group (adjusted OR = 2.43; 95% CI = 1.02−3.44) and BE group (adjusted OR = 2.82; 95% CI = 2.05−3.88).

4. Discussion

Among all 7712 enrolled cases in our study, the rates of EE and BE were 14.5% and 1.2%, respectively. According to the results of a large series reported in an epidemiological study, the frequency of EE in Western countries was in the upper range, with rates between 7% and 22%; but in Eastern

Table 1
The characteristics of enrolled patients.

	Normal (n = 6499, 84.3%)		EE (n = 1118, 14.5%)		BE (n = 95, 1.2%)		p
	Mean ± SD	n %	Mean ± SD	n %	Mean ± SD	n %	
Age	52.34 ± 11.81		52.48 ± 12.17		53.00 ± 12.87		0.649
BW	64.30 ± 11.70		69.52 ± 11.58		65.38 ± 12.22		0.001
BMI	24.07 ± 3.39		25.10 ± 3.35		23.92 ± 3.20		0.001
Gender							
M		3447 (53.0)		897 (80.2)		61 (64.2)	0.001
F		3052 (47.0)		221 (19.8)		34 (35.8)	

* p values were analyzed with Pearson's χ^2 test; independent t test.
BE = Barrett's esophagus; BMI = body mass index; BW = body weigh; EE = erosive esophagitis; F = female; M = male; n = number of patients; SD = standard derivation.

Table 2
The association of cases with normal, erosive esophagitis or Barrett's esophagus with metabolic syndrome.[a]

	Normal ($n = 6499$, 84.3%)	EE ($n = 1118$, 14.5%)	BE ($n = 95$, 1.2%)	p*
	n %	*n* %	*n* %	
Metabolic syndrome	560 (8.6)	107 (9.6)	19 (20.0)	0.001
Waist	1042 (16.0)	170 (15.2)	31 (33.0)	0.003
TG	3042 (46.8)	690 (61.7)	32 (33.7)	0.001
HDL	864 (13.3)	112 (10.1)	16 (16.8)	0.086
Glucose	1576 (24.2)	346 (30.9)	21 (21.8)	0.335
BP	158 (2.4)	22 (2.0)	18 (29.5)	0.001

* All p values were analyzed with Pearson's χ^2 test.
BE = Barrett's esophagus; BP = blood pressure; EE = erosive esophagitis; HDL = high-density lipoprotein; M = mean; n = number of patients; TG = triglyceride.
[a] Positive for waist means circumference ≥ 90 cm for men and ≥ 80 cm for women; positive for TG means TG levels ≥ 150 mg/dL; positive for HDL means HDL levels < 40 mg/dL for men and < 50 mg/dL for women; positive for glucose means fasting glucose levels > 100 mg/dL; positive for BP means systolic BP ≥ 130 mmHg or diastolic BP ≥ 85 mmHg.

countries, similar large endoscopic series revealed a lower frequency of EE. Furthermore, studies on the prevalence of BE in Asians are scarce. One previous report in Taiwan found nine (2%) cases diagnosed with BE among 464 patients underwent endoscopy for a variety of upper gastrointestinal symptoms.[6] However, with changes in lifestyle, dietary habits, and body mass, an increasing trend of GERD has been reported,[7] which may potentially increase the prevalence rates of BE in the future.[8]

With respect to EE, a significant positive association with male gender and increased BMI were reported.[9] Obesity is associated with increased intra-abdominal pressure, impaired gastric emptying, decreased lower esophageal sphincter pressure, and increased frequency of transient sphincter relaxation, thus leading to increased esophageal acid exposure and esophagitis.[10] A retrospective case−control study in Taiwan found that more patients with metabolic syndrome had EE compared with those without metabolic syndrome (OR = 1.76; 95% CI = 1.27−2.44).[11] A cross-sectional study of 7078 South Korean individuals undergoing upper endoscopy during a health check-up reported metabolic syndrome was associated with EE (OR = 1.42; 95% CI = 1.26−1.60).[12] Another cross-sectional study in South Korea involving 1679 cases with EE and 3358 control cases, also found a positive association between EE and metabolic syndrome (OR = 1.25; 95% CI = 1.04−1.49).[13] Regarding BE, obesity was associated with a 2.5-fold increase in the risk of BE.[14]

In our study, the percentages of patients with metabolic syndrome were 9.6% and 20% in the EE and BE groups, respectively, which were significantly higher than that found in the normal group. The strength of the association between metabolic syndrome and both EE and BE was strongly positive. Our result provides evidence that up to 20% of patients with BE could have concurrent metabolic syndrome, but the prevalence rate was lower in EE patients (9.6%).

Table 3
The strength of the association between cases with normal, erosive esophagitis or Barrett's esophagitis and metabolic syndrome.

Endoscopic findings	OR (95% CI)	OR[a] (95% CI)
None	1.0 (reference)	1.0 (reference)
EE	2.21 (0.94−3.82)	2.43 (1.02−3.44)
BE	2.70 (1.97−3.71)	2.82 (2.05−3.88)

Analyzed with multivariate Cox's regression
BE = Barrett's esophagus; CI = confidence interval; EE = erosive esophagitis; OR = odds ratio.
[a] Adjusted for age, sex, and body weight

Among the individual components of metabolic syndrome, previous studies found central obesity and hypertriglyceridemia were significantly associated with EE.[11,12] Our results indicated that hypertriglyceridemia, but not waist circumference, was significantly associated with EE. The reason for the high prevalence of elevated serum TG levels in patients with EE might reflect lifestyle factors including consumption of high-fat meals, which could delay gastric emptying, thus leading to EE.[11] Another Japanese study reported that BMI and triglyceride levels were predictors of an increased prevalence of EE, but central obesity did not show a similar prevalence after adjusting for confounders.[15]

By contrast, the enrolled cases with BE in our study had significantly higher rates of central obesity and hypertension. Interestingly, body weight and BMI were significantly higher in individuals with EE, but not in cases with BE. One previous retrospective case−control study showed that visceral obesity, measured by computed tomography scan, was an even stronger independent risk factor for BE than BMI.[16] These findings imply that central obesity plays a major a role in the risks of BE, but only a partial role in EE. For example, male gender, hiatal hernia, *Helicobacter pylori* infection, smoking, and alcohol consumption were also reported as risk factors of EE.[17,18]

There were several limitations in this study. First, potential risk factors for EE and BE, such as *H. pylori*, hiatal hernia, lifestyle, and dietary habits, were not assessed. Second, we did not determine if patients were on medications to control blood pressure, lipids, or glucose, which might have underestimated the ratio of metabolic syndrome. In addition, those patients on medication with anti-acid secretory agents were not adjusted. Third, our study was hospital based and all participants were enrolled from a self-paid health check-up. Selection bias might have existed due to the relatively high socioeconomic status of these individuals. Finally, our study was not intended to clarify

the prevalence of EE among metabolic syndrome patients because GERD is considered to be a risk factor for metabolic syndrome. However, further community-based research with analysis of more variables is needed.

In conclusion, our study found that patients with EE as well as those with BE had a higher prevalence rate of metabolic syndrome. A large proportion of cases with EE had hypertriglyceridemia, and there was a greater prevalence of central obesity and hypertension in patients with BE.

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