

Obesity as a Risk Factor of Erosive Gastroesophageal Reflux Disease

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ABSTRACT

Background: Gastroesophageal reflux disease (GERD) is a pathological condition of esophagus caused by reflux of gastric content or gastric juice with multifactorial etiologies. Some complications may occur such as: ulcer, bleeding, stricture, Barret's esophagus and esophageal adenocarcinoma. One of risk factors that currently taken into concern is obesity. This study aimed to identify obesity and abdominal obesity as the risk factor in the development of erosive GERD and to recognize that abdominal obesity is more important factor compared to obesity itself as the risk factor on the incidence of erosive GERD.

Method: Our study was a cross-sectional study. Data was obtained from eligible patients at Division of Gastroenterology, Department of Internal Medicine, Faculty of Medicine, University of Indonesia between June and September 2009.

Results: Samples were 74 patients with mean age of 48.61 ± 8.64 years. The proportion of female patients was larger than male (60.81% vs. 39.19%). The endoscopic assessment of upper gastrointestinal tract based on Los Angeles classification included: 27.03% grade A, 16.21% grade B, 4.05% grade C, 1.35% grade D. Obesity (odds ratio (OR) 17.160; 95% confidence interval (CI) 5.219–56.418, $p = 0.000$) and abdominal obesity (OR 10.371, 95% CI 3.260–32.915; $p = 0.000$) has been proven as risk factors in the development of erosive GERD.

Conclusion: There is a correlation between obesity and abdominal obesity as risk factors on the development of erosive GERD. Obesity becomes a more important factor compared to abdominal obesity as the risk factor on the development of erosive GERD.

Keywords: erosive gastroesophageal reflux disease, obesity, abdominal obesity, risk factor

INTRODUCTION

Erosive gastroesophageal reflux disease (GERD) is a pathological condition on esophageal mucosa with multifactorial causes. The incidence of gastroesophageal

reflux disease is quite high. In Western countries, the prevalence is about 10–20%, but in Asia the prevalence only about 3–5%, except in Japan 13–15% and in Taiwan approximately 15%.¹ Syam et al in Faculty of Medicine, University of Indonesia, Cipto Mangunkusumo hospital reported that among 1,718 patients who underwent esophagogastroduodenoscopy (EGD) on indication of dyspepsia for 5 years period (1997–2002), there was increased prevalence of esophagitis from 5.7% in 1997 to 25.18% in 2002

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(mean 13.13%).² In United States, the incidence of gastroesophageal reflux disease increases significantly and almost 25% of population is found to have GERD. Such fact is more likely to be correlated to increased number of patients with obesity (body mass index (BMI) ≥ 30 kg/m²), i.e. approximately 30% of all adult population (more than 6 million people).³

Obesity is one of potential predisposition factors in the development mechanism of erosive GERD. Analysis on 1,524 patients revealed that obesity (BMI ≥ 30 kg/m²) is a very strong risk factor on the development of erosive GERD.⁴ Fox et al reported that there were 52% of 52 patients with obesity who fulfilled the diagnostic criteria of erosive GERD.⁵ In obesity, there may be increased intra-abdominal and intra-gastric pressure. Such increase in pressures is believed to be one of development mechanism of reflux gastric juice or gastric content into esophagus.⁶ Moreover, obesity may also cause weakness on the lower esophageal sphincter and increase the transient lower esophagus sphincter relaxation (TLESR), which may also considered as factors developing erosive GERD.^{1,7,8} Obesity may also increase the risk of hiatal hernia,^{9,10,11} induce delayed esophageal clearance¹² as well as delayed gastric emptying resulting from gastric distention and increased intra-gastric basal pressure.^{10,13} Abdominal obesity is defined by abdominal circumference ≥ 90 cm for male and > 80 cm for female, which is measured at the middle area between the most inferior part of costae angle and iliac crest.

When the erosive GERD lasts for a long period, some complications may occur including ulcer, bleeding, stricture, metaplasia (Barret's esophagus), and it may even develop into esophageal adenocarcinoma.^{14,15} Therefore, by concerning and controlling risk factors for erosive GERD, it is expected that we may prevent and lower the incidence of esophageal adenocarcinoma resulting from erosive GERD. Thus, the study was conducted to provide evidences whether obesity and abdominal obesity are risk factors for the development of erosive GERD.

METHOD

The study was conducted between June and September 2009. The target population was all patients with dyspepsia in Indonesia. The source population was patients at the outpatient clinic, procedure room and wards of Department of Internal Medicine, Cipto Mangunkusumo hospital who underwent the EGD. Sample patients were the source population that fulfilled the inclusion and exclusion criteria. The sample was selected by consecutive sampling method. Based on sample size estimation, the minimal 74 patients were required.

The study has been approved and obtained ethical clearance from The Ethical Committee of Faculty of Medicine, University of Indonesia, in Jakarta.

RESULTS

Subject characteristics of 74 patients who had their upper gastrointestinal tracts endoscopy can be seen on table 1. We found larger proportion of patients who had finished their university degree (S1) among other education levels, i.e. 36.48%, followed by high-school graduates of 20.27%. On the proportion of eating habits, most patients had habits of eating spicy food 58.11%, followed by drinking coffee of 32.43%, smoking in 29.73% patients. The mean BMI was 25.25 ± 3.80 kg/m². The mean of abdominal circumference in male and female patients was differentiated. In male, the mean abdominal circumference was 78.28 ± 9.40 cm; while in female patients, it was 80.13 ± 9.10 cm (table 1).

Table 1. Patient's characteristic

Characteristics	n (%)
Age mean \pm SD (years)	48.61 \pm 8.64
Sex	
Male	29 (39.19)
Female	45 (60.81)
Ethnic	
Javanese	23 (31.08)
Betawi	10 (13.51)
Sundanese	21 (28.38)
Batak	8 (10.81)
Minangkabau	7 (9.46)
Others	5 (6.75)
Education	
No school	1 (1.35)
Elementary school	8 (10.81)
Junior high school	10 (13.51)
Senior high school	15 (20.27)
Academy/diploma	15 (20.27)
University degree	27 (36.48)
Religion	
Islam	62 (83.78)
Christian	8 (10.81)
Catholic	4 (5.41)
Habits	
Smoking	22 (29.73)
Drinking soda	18 (24.32)
Drinking coffee	24 (32.43)
Drinking alcohol	1 (2.35)
Drinking herb	7 (9.46)
Eating spicy food	43 (58.11)
Eating sour food	11 (14.86)
Eating fatty food	17 (22.97)
Eating chocolate	9 (12.16)
Body mass index mean \pm SD (kg/m ²)	25.25 \pm 3.80
Abdominal circumference mean \pm SD (cm)	male: 78.28 \pm 9.40 female: 80.13 \pm 9.10

On the assessment upper gastrointestinal tract endoscopy (upper GI endoscopy), we found the appearance of gastritis in 48.65% as the largest proportion. We also found the appearance of erosive esophagitis (in keeping with the Los Angeles classification) 27.03% grade A, 16.21% grade B, 4.05% grade C, 1.35% grade D (table 2).

Obesity as a Risk Factor of Erosive Gastroesophageal Reflux Disease
 Analysis by using Chi-square test demonstrated abdominal obesity as a risk factor on the development of erosive GERD with OR 10.371, 95% CI of 3.260-32.915; $p = 0.000$ (table 4).

Analysis was performed when there was only risk factor of obesity or abdominal obesity on erosive GERD, as well as when both risk factors occurred. The results suggested that if there was only obesity, the OR was 5.49 (95% CI 2.36-12.73), $p = 0.000$; when there was only abdominal obesity the OR was 4.64 (95% CI 1.97-10.94), $p = 0.000$; while when there were obesity and abdominal obesity, the OR was 37.00 (95% CI 4.57-299.43), $p = 0.000$ (table 5).

Multivariate analysis on the risk factors of obesity and abdominal obesity against erosive GERD demonstrated results that obesity and abdominal obesity were risk factors for erosive GERD with adjusted OR of 4.710 (95% CI of 0.275-0.679) and $p = 0.000$ on obesity and adjusted OR of 2.923 (95% CI of 0.096-0.510) and $p = 0.005$ on abdominal obesity (table 6).

Table 2. Assessment of upper gastrointestinal endoscopy

Variable	n (%)
Erosive esophagitis	
Grade A	20 (27.03)
Grade B	12 (16.21)
Grade C	3 (4.05)
Grade D	1 (1.35)
Gastritis	36 (48.65)
Duodenitis	6 (8.11)
Peptic ulcer	3 (4.05)
Duodenal ulcer	5 (6.76)
Hiatal hernia	2 (2.70)

* One patient may have more than one abnormality

Based on the upper GI endoscopy, patients were categorized into erosive GERD and non-erosive GERD groups. In erosive GERD group, the proportion of obesity was 35.13% and non-obesity was 13.51%. By using Chi-square test analysis, we found obesity as a risk factor for the development of erosive GERD (odds ratio (OR) 17.160, 95% CI 5.219-56.418, $p = 0.000$) (table 3). In the erosive GERD group, we found the proportion of abdominal obesity as 29.73% and the proportion of non-abdominal obesity as 18.92%.

Table 3. Obesity with erosive GERD

Risk factors	Erosive GERD	Non-erosive GERD	OR (CI 95%)	p*
Obesity	26 (35.13)	5 (6.76)	17.160(5.219 – 56.418)	0.000
Non-obesity	10 (13.51)	33 (44.59)		

p* Chi-square test

Table 4. Abdominal obesity with erosive GERD

Risk factors	Erosive GERD	Non-erosive GERD	OR (CI 95%)	p*
Abdominal obesity	22 (29.73)	5 (6.76)	10.371 (3.260 – 32.915)	0.000
Non-abdominal Obesity	14 (18.92)	33 (44.59)		

p* Chi-square test

Table 5. Analysis on obesity and/or abdominal obesity and erosive GERD

Risk factors	Erosive GERD	Non-erosive GERD	OR (CI 95%)	p
Obesity	7 (9.5)	4 (5.4)	5.49 (2.36 – 12.73)	0.000
Abdominal obesity	4 (5.4)	4 (5.4)	4.64 (1.97 – 10.94)	0.000
Obesity and abdominal obesitas	19 (25.7)	1 (1.4)	37.00 (4.57 – 299.43)	0.000
Non-obesity and non-abdominal obesity	6 (8.1)	29 (39.2)		

DISCUSSION

The study consisted of 74 patients who had undergone upper GI endoscopy and had fulfilled the inclusion and exclusion criteria. In our study, we found the appearance of gastritis on the assessment of upper GI as the largest proportion. Moreover, for erosive GERD appearance (according to the Los Angeles Classification), we found following appearance, i.e. erosive GERD grade A as the most

frequent, followed by grade B, grade C and grade D (table 2). A study conducted by Song et al on 105 patients with complaints on upper abdomen found 27.6% patients grade A and 1.9% grade B of erosive GERD.¹⁶ Sijabat et al reported the prevalence of esophagitis in Cipto Mangunkusumo Hospital between 2003 and 2005 as follows: 8.4% grade A, 55% grade B, 1.5% grade C of esophagitis.¹⁷ Furukawa et al evaluated the upper GI endoscopy in 6,010 patients

and found dominant proportion of erosive GERD were grade A and B in 9.6% and 4.6% patients respectively, while grade C and grade D were rarely found.¹⁸ Erosive GERD was usually found in mild form and predominantly as grade A or B.

According to the WHO Asia-Pacific guidelines, obesity is defined when BMI ≥ 25 kg/m². The prevalence of obesity is increasing with time not only in United States and Western countries but also in Asia.

The development of erosive GERD on obesity is almost always correlated to some mechanisms including: reduced lower esophageal sphincter tone,¹⁹ increased frequency of transient lower esophageal sphincter relaxation (TLESR)^{7,20}; increased intra-abdominal pressure leading to increased intra-gastric pressure^{19,21,22} delayed gastric emptying^{6,12,13,23-25} and the presence of hiatal hernia.^{11,14,26} The prevalence of erosive GERD increases in people with obesity compared to non-obesity.²⁷⁻²⁹

In the present study, our results demonstrated that obesity is a risk factor in the development of erosive GERD (table 3). In a cross-sectional study conducted by Murray et al in 10,537 patients, they found that overweight ($25 \leq \text{BMI} \leq 30$ kg/m²) was correlated to the symptoms development of heart burn (OR 1.82; 95% CI 1.33–2.50) and regurgitation (OR 1.50; 95% CI 1.13–1.99) in erosive GERD compared to normal weight. In addition, they found correlation between obesity (BMI > 30 kg/m²) and the development of heart burn (OR 2.91; 95% CI 2.07–4.08) and regurgitation symptom (OR 2.23; 95% CI: 1.44–3.45) compared to normal weight.³⁰ Hampel et al who conducted a meta-analysis study to evaluate the correlation between obesity and erosive GERD, found that there was a correlation between overweight ($25 \leq \text{BMI} < 30$ kg/m²) and erosive GERD (OR 1.43; 95% CI 1.158–1.774); as well as between obesity (BMI ≥ 30 kg/m²) and erosive GERD symptom (OR 1.94; 95% CI 1.468–2.566).³¹ A study conducted by Lagergren et al in 1,128 patients of a randomized-controlled trial on *Helicobacter pylori* eradication found that there was no difference in the development of GERD symptoms between patients with obesity and without obesity (OR 1.13; 95% CI 0.64–2.01).³²

Abdominal obesity is defined by abdominal circumference ≥ 90 cm for male and ≥ 80 cm for female, which is measured at the middle area between the most inferior part of costae angle and iliac crest. Our study also found that abdominal obesity was one of risk factors in the development of erosive GERD (table 3). The abdominal circumference (abdominal obesity) has a correlation with intra-abdominal

pressure, i.e. the greater the sagittal diameter of abdomen, the greater the intra-abdominal pressure,³³ while increased intra-abdominal pressure is one of mechanism in the development of GERD. A study result conducted by Kang et al found that abdominal obesity was a risk factor for the development of erosive GERD (OR 2.3; 95% CI, 1.6–3.1).³⁴

BMI is used as an estimation of total fat body and has been used as a scale to determine obesity (BMI ≥ 25 kg/m² for Asia-Pacific region). However, BMI may not be a precise estimation of total fat body, particularly in men who have larger mass of muscles. Moreover, obesity may not always be accompanied with abdominal obesity. Therefore, obesity and abdominal obesity may occur simultaneously as well as separately. Analysis on obesity, abdominal obesity and both conditions on erosive GERD suggested that the incidence of erosive GERD will increase in obesity which is accompanied with abdominal obesity. Statistically, it has been demonstrated that when the risk factor of obesity and abdominal obesity occur concurrently, it will increase the possibility of erosive GERD development by 37 times compared to those without risk factor of obesity or abdominal obesity. Furthermore, when there is only the risk factor of obesity, it will increase the possibility of erosive GERD by five times; while when there is only risk factor of abdominal obesity, it will increase the possibility of erosive GERD by four times compared to without obesity and without abdominal obesity (table 5). Such result may suggest that the risk factor of obesity and concurrent abdominal obesity will increase the risk for erosive GERD development compared to obesity and abdominal obesity separately or when both risks are absent. Increased incidence of erosive GERD in obesity and abdominal obesity may be caused by hormonal, metabolic and mechanical factors that appear simultaneously and those factors have important role in the pathophysiology of erosive GERD.

After multivariate analysis between obesity, abdominal obesity and erosive GERD has been conducted, we found that both obesity and abdominal obesity are risk factors for erosive GERD (table 6). Based on such data analysis, it can be said statistically that in obesity there is more possibility of developing erosive GERD compared to abdominal obesity. It may occur since obesity is a chronic pathological condition that lasts over long period of a time and it is assumed that hormonal and metabolic factor have important roles in the development of obesity. In this case, the hormonal and metabolic factors may be much more important than mechanical factor in association with the development of erosive GERD.

CONCLUSION

Obesity is a risk factor for the development of erosive GERD. Abdominal obesity is also a risk factor for erosive GERD. Obesity is more important than abdominal obesity as a risk factor for the development of erosive GERD.

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