# Hiatal hernia and gastroesophageal reflux disease

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## Abstract

**Aim:** Hiatal hernia may cause reflux. The prevalence and size of hernias in patients with reflux including its subgroups (NERD, GERD, or Barrett's esophagus) was investigated in the current study conducted in Albania.
**Methods:** Patients were recruited at Regional Hospital of Shkodra, northern Albania. A total of 255 patients (53% male; overall mean age: 51.90±9.65 years) were included in this study. Following an assessment of medical history, all patients underwent a digestive endoscopy.
**Results:** There was a statistically significant difference between patients with esophagitis and Barret esophagus, and without esophagitis with regard to the presence and size of hiatal hernia (P<0.001). Hiatus hernia was found in 42% of the patients with GERD, in 66.7% of the patients with reflux esophagitis and in 69.2% of the patients with Barrett esophagus. Reflux esophagitis and Barrett esophagus were significantly related to hiatus hernia (P<0.001). The severity of esophagitis was significantly related to the presence and size of hernia (P<0.001).
**Conclusions**: Hiatal hernia was associated with an increased risk of physical complications from gastroesophageal reflux. The knowledge of risk factors may help to distinguish patients with increased risk of endoscopic lesions of the esophagus and, as a result, a higher risk of developing physical complications from GERD. Also, hiatal hernia is likely to contribute to the development of Barrett's esophagus. This is of particular importance for the occurrence of Barrett's esophagus, as a risk factor of the esophageal adenocarcinoma.

**Keywords:** Barrett's esophagus, erosive and nonerosive reflux disease, gastroesophageal reflux disease, hiatal hernia.

## Introduction

Gastroesophageal reflux disease (GERD) consists of a failure of the normal antireflux mechanism to protect against frequent and abnormal amounts of gastroesophageal reflux (GER) (1). In other words, GERD consists of the effortless movement of gastric contents from the stomach to the esophagus (1). Actually, GERD is a spectrum of disease usually producing symptoms of heartburn and acid regurgitation (1). Gastroesophageal reflux disease is the most common gastrointestinal diagnosis recorded during visits to outpatient clinics (1). In the United States, it is estimated that 14% to 20% of adults are affected, although such percentages are at best approximations, given that the disease has a nebulous definition and that such estimates are based on the prevalence of self-reported chronic heartburn (2). Gastro-esophageal reflux disease is a common problem and is expensive to manage in both primary and secondary care settings. The annual direct cost for managing the disease is estimated to be more than $9 billion dollars in the USA (3).

## Definition

There is no gold standard test for objectively diagnosing gastroesophageal reflux disease, and definitions have therefore relied on a combination of disease characteristics.

An international working group defined the disease as the reflux of gastric contents into the esophagus leading to esophagitis, reflux symptoms sufficient to impair quality of life, or risk of long-term complications. This definition emphasizes that gastroesophageal reflux becomes a disease when it either causes macroscopic damage to the esophagus or affects quality of life (3).

There have been major advances in the diagnosis, pathophysiology, and treatment of this disease. The disease can be subdivided into reflux esophagitis (ERD) and endoscopy-negative reflux disease (or non-erosive reflux disease, NERD). The presence and severity of esophagitis at endoscopy has been improved by the Los Angeles classification, which defines the disease by the occurrence of mucosal breaks (4). Patients with non-erosive reflux disease have no mucosal breaks in the esophagus, but have typical reflux symptoms. A consistent paradox in gastroesophageal reflux disease is the imperfect correspondence between symptoms attributed to the condition and endoscopic features of the disease (1). GERD encompasses a spectrum of conditions, ranging from symptoms only, with no visible esophageal damage which includes subgroups of patients with non-erosive reflux disease (NERD), to erosive disease (ERD), and/or Barrett's esophagus (BE) (5). GERD patients are not a homogenous group.

Since it is a very common disease affecting millions of people around the globe, it is quite important to clarify the causative lifestyle factors affecting various GERD symptoms and its complication (the presence of endoscopic lesions) (2).

### *Hiatal hernia*

Hiatal hernia alters the pressure topography of the gastro-oesophageal junction by (6,7):

- Reducing lower esophageal sphincter pressure and alters its dynamic responsiveness (LOS pressure);
- Altering its radial asymmetry;
- Reducing the sub-hiatal length of the high pressure zone;
- Hiatal hernia increases esophageal acid exposure through prolonged acid clearance of esophagus, especially in recumbent position, and increased susceptibility to reflux.

The perturbed anatomy associated with hiatal hernia predisposed to eliciting TLESRs (Transient Lower Esophageal Sphincter Relaxation) in patients with GERD. The degree of augmentation in TLESR frequency was directly proportional to the size of hiatal hernia. Physiological studies analyzing the mechanism, by which gastroesophageal reflux events occur, have identified LES hypotension and especially TLESR as the dominant mechanisms of reflux.

***Study aim***

To investigate the relationship between the presence and the size of hiatal hernia with the presence and severity of endoscopic lesions (erosive esophagitis and Barrett esophagus) from Gastroesophageal Reflux Disease (GERD).

## Methods

This is a study conducted in the Regional Hospital of Shkodra in which 255 patients diagnosed with GERD (Gastroesophageal Relux Disease) from January 2011 to December 2013 are included. Inclusion criteria were male or non-pregnant female patients over 18 years of age on the basis of their main symptoms suggestive of GERD such as heartburn and or regurgitation. Heartburn was defined as 'a burning or ache behind the breast bone that is not due to heart trouble' and acid regurgitation as 'a very sour or acid tasting fluid at the back of your throat'. Symptoms of reflux are reliable diagnostic indicator and valid for GERD, because pyrosis and regurgitation are highly specific for GERD (8,9).

Exclusion criteria were: patients with upper GI malignancy, patients who did not accept to do upper endoscopy, those who used a PPI within 28 days prior to baseline visit, patients who had been subjected to gastrointestinal surgery.

Those symptoms were assessed both by investigator questions and patient questionnaire (GSAS) before endoscopy (10). We assessed each patient's medical history, including current GERD symptoms and relevant medication, history of GERD including past treatment with GERD-specific medication, disease-specific surgical treatments, as well as general comorbidities such as significant cardiovascular, pulmonary, renal, or gastrointestinal diseases. Also by using patient questionnaires were assessed risk factors such as obesity, smoking, use of nonsteroidal anti-inflammatory drugs and alcohol consumption.

Upper endoscopy was offered to all participants. Standardized non-sedated endoscopic examination of the esophagus, stomach, and duodenum was performed and patients were subsequently classified as having non-erosive or erosive disease, according the presence of esophagitis. Erosive Reflux Disease (ERD) or erosive esophagitis is defined by the presence of macroscopic esophageal erosions in endoscopy and, when present, has been described according to the classification of Los Angeles, graded from A to D (4). Barret's esophagus (BE) was defined in patients with endoscopic suspicion (i.e., indications of any columnar-lined epithelium in the esophagus) or histologic proof of Barrett's mucosa. Also it was verified the presence of hiatal hernia. A hiatal hernia was diagnosed when the esophagogastric junction or gastric folds were seen 2 cm or more above the diaphragmatic hiatus during quiet respiration.

Measurement of hiatal hernia size was performed at the end the endoscopic examination after deflation of the stomach, observing the length withdrawn when moving the tip of the endoscope from the diaphragm to the Z-line.

According to the hiatal hernia size, patients with hiatal hernia were divided in two groups: 2-4 cm and >4 cm. Data were expressed as mean values ± standard deviation (SD) for continuous variables and as proportions for categorical variables.

OD and confidence interval were calculated for some variables. Patient groups were compared with the chi-square tests for categorical variables, the *t*-test or ANOVA for normally distributed continuous data.

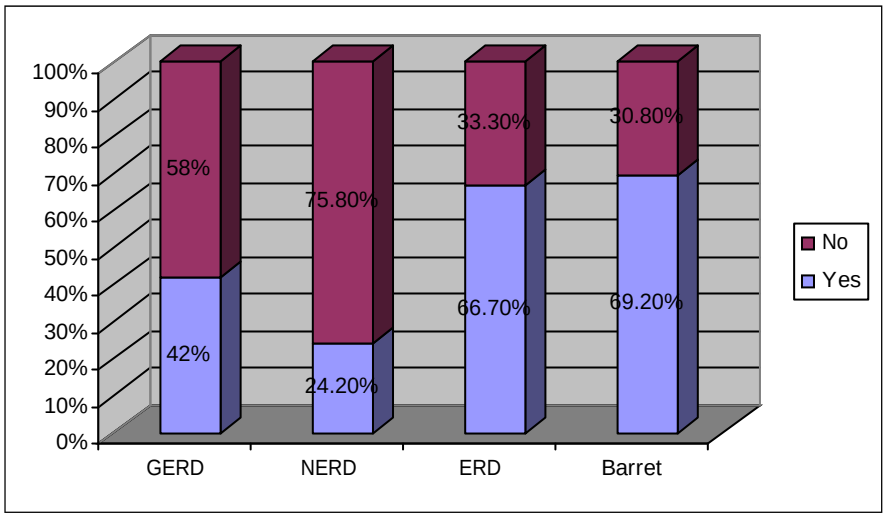
Logistic regression models were used to estimate the proportion of occurrences of NERD, ERD, and BE in relation to various (risk) factors. The level of significance was $p \leq 0.05$.

## Results

The study population consisted of 255 patients (53% male and mean age 51.90±9.65) diagnosed with GERD (Gastroesophageal Reflux Disease).Patients complained heartburn and/or acid regurgitation at least once in a week. After endoscopic examination 148 (58%) patients resulted without esophageal lesions and were diagnosed with Non Erosive Reflux Disease (NERD). With esophageal mucosal breaks resulted 94 (36.8%) patients and were diagnosed with erosive Reflux Disease (ERD) graded according to Los Angeles (LA) classification. Thirteen (5.2%) patients were diagnosed

with Barrett's esophagus (BE), because it was observed the presence of columnar mucosa above gastroesophageal junction in both endoscopy and biopsy. One hundred and seven (42%) patients with GERD were diagnosed by endoscopy with hiatal hernia.

**Figure 1. Graphical representation of the presence of hiatal hernia according to endoscopy status**




In our study the prevalence of hiatal hernia in patients with reflux's symptoms present, but without endoscopic lesions (NERD) was 24.2%. In the patients with endoscopic lesions it was 66.7% for esophagitis (ERD) and 69.2% for Barrett esophagus. There was a statistically significant difference between patients with GERD with endoscopic lesions (esophagitis and Barrett) and without endoscopic lesions (NERD) with regard to the presence of hiatal hernia (P<0.001).

**Table 1. Association of hiatal hernia with GERD with and without endoscopic lesions – regression analyses**

| Variable | OR (CI 95%) | P-value |
|---|---|---|
| **Hiatal hernia:** | | |
| No | Reference | <0.001 |
| Yes | 3.70 (1.97-4.65) | |

In patients with hiatal hernia the odds of the presence of endoscopic lesions versus without endoscopic lesions is more than 3.7 fold that of being without hiatal hernia. In regression analyses, the presence of hiatus hernia was the predictor variable with the strong influence in distinguishing between cases with endoscopic lesions in comparison to a group of patients with non-erosive reflux disease (P<0.001).

**Table 2. Relationship of hiatus hernia to reflux esophagitis**

| | Esoph grade A | Esoph grade B+C+D | P value* |
|---|---|---|---|
| No. of esophagitis 94 cases | 72 (76.6%) | 22 (23.4%) | <0.001 |
| No. of esoph + HH 62 cases | 45 (62.5%) | 17 (80.9%) | <0.001 |

* Chi-square test

About 62% of the cases with esophagitis grade A and 80.9% of the cases with esophagitis grade B+C+D had hiatal hernia.

As the severity of erosive esophagitis increased, there was a significant increase in the proportion of patients with hiatus hernia (P<0.001).

**Table 3. Relationship of hiatus hernia size to severity of reflux esophagitis**

| | Esoph grade A (N=72) | Esoph grade B+C+D (N=22) | Esoph total (N=94) | P value* |
|---|---|---|---|---|
| Without HH | 27 (37.5) | 5 (19.0) | 31 (33.3) | <0.001 |
| HH with size 2-4cm | 31 (43.1) | 9 (42.9) | 40 (43.0) | |
| HH with size >4cm | 14 (19.4) | 8 (38.1) | 22 (23.7) | |

* Chi-square test

Hiatal hernia size 2-4 cm was observed almost in the same percentage in both groups of esophagitis, meanwhile that >4 cm was observed in 38.1% of patients with esophagitis grade B+C+D versus 19.4% of patients with esophagitis grade A. As the severity of erosive esophagitis increased, there was a significant increase in the proportion of patients with hiatus hernia size >4cm (P<0.001).

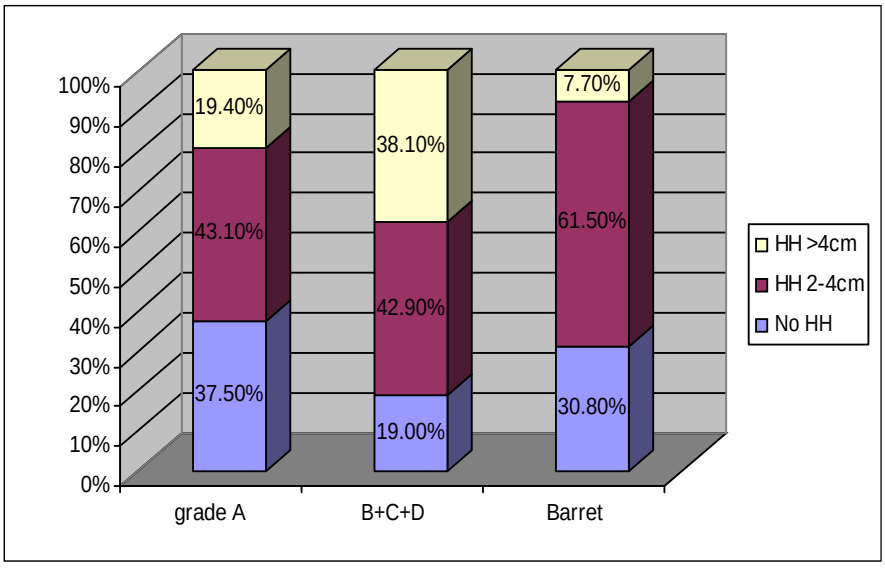
**Table 4. Relationship of hiatus hernia to Barrett's esophagus**

| | Barrett (N=13) | P value* |
|---|---|---|
| Without HH | 4 (30.8) | <0.001 |
| HH with size 2-4cm | 8 (61.5) | |
| HH with size >4cm | 1 (7.7) | |

* Chi-square test

About 69% of the patients with Barrett esophagus had hiatal hernia and 61.5% of those had hiatal hernia size 2-4 cm.

**Figure 2. The presence and size of hiatal hernia in the patients with reflux endoscopic lesions (erosive esophagitis and Barrett's esophagus)**



## Discussion

The presence and size of hiatal hernia was a significant risk factor for the presence and severity of endoscopic lesions in the patients with GERD (erosive esophagitis and Barrett esophagus). Our results presented evidence favoring an even closer association between hiatal hernia and GERD and supports the clinical significance of an endoscopically detected hiatal hernia.

The investigations by Kahrilas et al (6,7) suggested that hiatal hernia may lead to increased esophageal acid exposure both by increasing the susceptibility to reflux and by prolonging the process of acid clearance. The presence and severity of endoscopic lesions of GERD are positively correlated with total esophageal acid exposure.

The population for this study was recruited from patients on the recommendation of their physician who suspected physic complications by reflux. It is, therefore, possible that the study population is comprised of patients with prolonged or severe heartburn and that the population screened is not entirely representative of the general population of patients with GERD.

Many studies, some of which will be mentioned below, have reported an association between hiatus hernia and gastroesophageal reflux.

Endoscopic and radiographic studies have found that the prevalence of hiatus hernia is 60-90% of all patients with reflux disease, whereas hiatus hernia was reported far less frequently (13-40%) in control subjects without reflux disease (11).

Sontag et al (12) attempted to clarify the etiology of erosive reflux esophagitis by using a case-control design to study potential risk factors in a large group of patients. Their results clearly demonstrated that the presence of hiatus hernia increased the risk of all grades of esophagitis. Hiatal hernia was associated with a 5-fold increased risk of esophageal erosions. Furthermore the authors referred that by endoscopic, radiographic, and manometric studies. Hiatus hernia in 50-94% of all patients with reflux disease was found (12).

For erosive esophagitis with GERD male sex (OR=2.21), hiatus hernia (OR=10.05), overweight (OR=2.18) and obesity (OR=3.29) remained statistically significant risk factors in Kalixanda study report. Hiatus hernia (OR=1.71) remained as significant risk factor and for GERD without erosive esophagitis (13).

In one study about Risk Factors for Erosive Reflux Esophagitis by Avidan et al, 70% prevalence rates of hiatus hernia was reported among cases with erosive reflux esophagitis. The presence of hiatus hernia was the predictor variable with the strongest influence in distinguishing between cases with and without erosive esophagitis. They clearly demonstrate the crucial role played by hiatus hernia in the development of all severity grades of erosive reflux esophagitis (14).

In another study by El-Seraget it was emphasized that the overall frequency of hiatus hernia in this study was 63% and the presence of hiatus hernia was among the strongest independent risk factors for severe versus mild erosive esophagitis and as the severity of EE increased, there was a significant increase in the proportion of patients with hiatus hernia ($P<0.0001$). Patients with hiatal hernia reported 2 times more likely to have reflux esophagitis grade C+D [OR=2.08, 95%CI=1.84-2.34] (15).

The association of increasing hiatal hernia size with increasing severity of esophagitis is logical. The presence and severity of esophagitis are positively correlated with total esophageal acid exposure. Hiatal hernia increases esophageal acid exposure by impairing refluxate clearance, and the impairment in esophageal acid clearance worsens as hernia size increases (16).

Although absolute values of hiatal hernia size are influenced by the method used to measure them, it is clear that larger hiatal hernias impair refluxate clearance more significantly than do smaller hernias. Esophagitis severity and esophageal acid exposure increase significantly for hernias >3 cm in length as measured endoscopically (17).

Our data are in agreement with some multivariate

analyses that identified hiatal hernia size as the strongest predictor of esophagitis presence and severity and Barrett esophagus presence (17-23).

Jones et al have demonstrated in their study concerning hiatal hernia size and Gastroesophageal Reflux, that esophagitis presence and severity are influenced by hiatal hernia size, LESP and male gender. Of these, hiatal hernia size was the most strongly correlated predictive factor in association with esophagitis (P=0.0001) compared with others (18).

Other workers found that there was dependence between the severity of ES and the size of hiatal hernia. No similar relationship, however, in this study it was found between the size of hiatal hernia and the symptoms. The present study also has confirmed the close association between hiatal hernia and erosive esophagitis (19). In one early Norway study, it was confirmed that reflux esophagitis was significantly (P<0.001) related to hiatus hernia and the severity of the esophagitis was significantly (P<0.05) related to the presence and the size of hernia (20).

A stepwise multiple regression analysis by Sloan et al identified size of hiatus hernia, decreased pressure of the lower esophageal sphincter, and an interaction between these two factors to strongly affect susceptibility to gastroesophageal reflux (21).

Shaheen et al in one study on Barret's esophagus reported that the risk and segment length of Barrett's esophagus increase with the amount of acid exposure in the distal esophagus, and are both associated with the presence and size of hiatal hernias. So the patients with Barrett's esophagus have long exposure to caustic concentrations of gastric acid (pH<3, or pH<2), high proximal extent of acid reflux in long-segment disease and high frequency of hiatal hernias (76% in Barrett's esophagus vs 36% in reflux patients) (22).

The study by Cameron showed that most patients with BE (96%) have hiatal hernia (HH). In addition to an increased prevalence of hiatal hernia, patients with BE had larger hernias. The increased prevalence of hiatal hernia in patients with reflux esophagitis was confirmed in the present study, HH being found in 71% of patients with esophagitis. As a result of their HH, probably combined with other factors including a low LES pressure, patients with Barrett have more severe reflux. Thus, they are more liable to damage to the normal squamous lining of the esophagus and its subsequent replacement by specialized

columnar (Barrett's) epithelium. HH is likely one etiological factor in the development of BE. Also, BE is the principal risk factor for the development of esophageal adenocarcinoma, so HH may also be a risk factor (23).

## Conclusions

Our results confirm a significant association between hiatus hernia and reflux esophagitis, Barrett esophagus. Increasing hiatal hernia size was significantly associated with the presence and severity of esophagitis. It seems to be that this association is logical.

The presence and severity of esophagitis are positively associated with total exposure acid of esophagus.

Hiatal hernia increases esophageal acid exposure by impairing reflux clearance, and the impairment in esophageal acid clearance worsens as hernia size increases.

Although absolute values of hiatal hernia size are influenced by the method used to measure them, it is clear that larger hiatal hernias impair reflux clearance more significantly than do smaller hernias. It is more evident in hiatal hernia >4 cm measured by endoscopy.

**Conflicts of interest**: None declared.

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