PO Box 2345, Beijing 100023, China
www.wjgnet.com
wjg@wjgnet.com

World J Gastroenterol 2005;11(6):839-841
World Journal of Gastroenterology ISSN 1007-9327


• BRIEF REPORTS •

# Correlation between severity of endoscopic findings and apnea-hypopnea index in patients with gastroesophageal reflux disease and obstructive sleep apnea

Pál Demeter, Katalin Várdi Visy, Pál Magyar

Pál Demeter, Department of Gastroenterology, St. Margaret's Hospital, Budapest, Hungary
Katalin Várdi Visy, Pál Magyar, Department of Pulmonology, Semmelweis Medical University, Budapest, Hungary
Correspondence to: Dr. Pál Demeter, Department of Gastroenterology, St. Margaret's Hospital, Bécsi út 132., Budapest 1032, Hungary. pauldemeter@axelero.hu
Telephone: +36-30-9222985 Fax: +36-23-457656
Received: 2004-06-15 Accepted: 2004-07-27

## Abstract

**AIM:** To assess the relationship between severity of gastroesophageal reflux disease and apnea-hypopnea index (AHI) as an indicator of the severity of obstructive sleep apnea.

**METHODS:** Data of 57 patients with proven obstructive sleep apnea and gastroesophageal reflux disease were analyzed. Patients were divided into two groups according to severity of the sleep apnea: "mild-moderate" (A)-AHI $\geqslant$5-30, $n$ = 27, "severe" (B)-AHI >30, $n$ = 30. All patients underwent apnea monitoring during the night, upper panendoscopy and were asked about typical reflux symptoms.

**RESULTS:** All examined patients in both groups showed a significant overweight and there was a positive correlation between body mass index and the degree of sleep apnea ($P$ = 0.0002). The occurence of erosive reflux disease was significantly higher in "severe" group ($P$ = 0.0001). Using a logistic regression analysis a positive correlation was found between the endoscopic severity of reflux disease and the AHI ($P$ = 0.016). Forty-nine point five percent of the patients experienced the typical symptoms of reflux disease at least three times a week and there was no significant difference between the two groups.

**CONCLUSION:** A positive correlation can be found between the severity of gastroesophageal reflux disease and obstructive sleep apnea.



**Key words:** Obstructive sleep apnea; Gastroesophageal reflux disease; Severity; Correlation

Demeter P, Visy KV, Magyar P. Correlation between severity of endoscopic findings and apnea-hypopnea index in patients with gastroesophageal reflux disease and obstructive sleep apnea. *World J Gastroenterol* 2005; 11 (6): 839-841
http://www.wjgnet.com/1007-9327/11/839.asp

## INTRODUCTION

There is an increasing mass of evidence for a link between the obstructive sleep apnea (OSA) and gastroesophageal reflux disease (GERD). The large negative intrapleural pressure swings during apnea should facilitate reflux events[1]. A further factor to be considered regarding the OSA-GERD relationship is that the diaphragm is connected to lower esophageal sphincter (LES) through the phreno-esophageal ligament (PEL). During apnea the respiratory work of the diaphragm increases extremely. This increased burden affects the cardia through the frequent change of the position of PEL. This leads partly to the loss of the cardia muscle tone[2]. The European Community Respiratory Health Survey published in 2002 noted that GERD development during sleep is an important determinant of the respiratory balance, since it may play a role as an aggravating or causal factor in relation to the nocturnal asthma, chronic cough, recurrent bronchitis and respiratory disorders during sleep[3]. A higher frequency of GER-related symptoms has been found in patients with OSA than in the control subjects[4,5]. More reflux events could be identified in OSA patients than in controls during one-channel esophageal pH-metry[6]. The number of reflux events could be reduced with nasal continuous positive airway pressure (nCPAP) treatment for both the patients with OSA and GERD[7-9]. These data suggest that OSA may be a significant cause of GERD.

The influence of the severity of OSA on endoscopic findings in patients with GERD and OSA has not been analyzed yet.

## MATERIALS AND METHODS

Fifty-five patients with proven OSA were referred for upper panendoscopy. Diagnosis of sleep apnea was based on a 12-channel polysomnography (2-channel EEG/ electroencephalography/, EOG/electrooculography/, chin EMG/electromyography/, ECG/electrocardiography/, nasal and oral flow-metry, detection for O2-saturation, pulseoxymetry, detection for thoracic and abdominal movements, phonometry) performed using the Morpheus Medatech system in our sleep lab. All patients underwent upper panendoscopy and were asked about the frequency of typical reflux symptoms. Epworth sleepiness scale (ESS)[10] was completed by patients to measure their daytime sleepiness.

The classification of GERD was based on endoscopic findings. We used the conventional Savary-Miller classification of the disease[11]. The patiets' data were collated on an Excel 9.0 worksheet, including the severity grades of GERD (0-4), the apnea-hypopnea index (AHI), the frequency of typical GERD symptoms (heartburn, regurgitation of gastric content, dysphagia, age, gender, the score of ESS and body mass index /BMI/. The patients were divided into two groups according to the severity of sleep apnea[12] : "mild-moderate" (A)-AHI ⩾5-30, $n$ = 27; "severe" (B)-AHI >30, $n$ = 30.

### *Statistical analysis*

In case of continuous and category variables, a nonparametric $t$ test (Mann-Whitney), one way ANOVA test and $\chi^2$ test were used. In the event of dichotomous variables, $\chi^2$ "for trend" test was performed. The relationship between the severity of reflux disease and AHI was analyzed with the help of logistic regression analysis.

We relied on the conventional $P$<0.05 critical values regarding the statistical tests of the results. We used the *SPSS 9 for Windows* software package for the statistical procedures.

## RESULTS

The total available population covered 57 patients. This population was characterized by an average age of 51.38 years (SD±9.16), a male/female ratio of 2.8:1 (73.7% *vs* 26.3%) and an average BMI of 34.20 kg/m² (SD±8.79). Using the Savary-Miller definitions, our patients displayed the following distribution alongside the endoscopic categorization of reflux disease: 11 (19.3 %) GERD 0 subjects, 13 (22.8%) GERD I subjects, 20 (35.1%) GERD II subjects, 7 (12.3%) GERD III subjects, and 6 (10.5%) GERD IV subjects (Table 1).

**Table 1** Distribution of GERD types

| Population ($n$ = 57) | Occurrence | Percentage (%) |
|---|---|---|
| GERD 0 | 11 | 19.3 |
| GERD 1 | 13 | 22.8 |
| GERD 2 | 20 | 35.1 |
| GERD 3 | 7 | 12.3 |
| GERD 4 | 6 | 10.5 |

The population mean of AHI used as a direct measure of the severity of sleep apnea was 40.8 (SD±35.18). The patients were divided into two groups according to the severity of sleep apnea: "mild-moderate" (A)-AHI ⩾5-30, $n$ = 27 and "severe" (B)-AHI >30, $n$ = 30. Comparison of clinical data of groups is summarized in Table 2.

The percentage of female patients was 37% in group A and 16% in B. The BMI was significantly higher in group B than in group A ($P$ = 0.0002). There was no significant difference between two groups in respect of typical reflux symptoms (52% *vs* 47%), but in 50.5% of the study population these symptoms were negative (poor) according to our determination. When the endoscopic findings of GERD were analyzed, a higher frequency of severe cases was found in group B ($P$ = 0.0001). In group A the incidence of GERD 0 was one-third of the cases, whereas in group B that was only 7%.

We compared the clinical (sleep) parameters and GER-related symptoms in each grade of GERD (Table 3). No significant difference was found between grades in respect of age, gender and GER-related symptoms. A positive correlation could be found between the severity of GERD and BMI. A very close connection was demonstrated between the severity of GERD and AHI values and the scores of Epworth scale.

**Table 2** Comparison of clinical data between A and B group

| Variable | "A" group (AHI⩽30) | "B" group (AHI>30) | Total | $P^1$ |
|---|---|---|---|---|
| Number of cases | 27 | 30 | 57 | - |
| Age (yr) | 51 (41-54)[1,2] | 53.5 (48-59.5) | 52 (44.5-57.5) | 0.07 |
| Gender (women, %) | 37 | 16 | 26 | 0.13 |
| BMI | 31.2 (27.1-34.3) | 36.4 (32.3-41.9) | 33.8 (28.6-38.0) | 0.0002 |
| AHI | 10.1 (7-21) | 56.7 (38.3-88.0) | 35 (10.6-60) | <0.0001 |
| GER-related symptoms +(%) | 52 | 47 | 49.5 | 0.79 |
| GERD endoscopic findings (%) | 0:33 | 0:7 | 0:19 | <0.0001 |
| | 1:33 | 1:13 | 1:23 | |
| | 2:34 | 2:37 | 2:35 | |
| | 3:0 | 3:23 | 3:12 | |
| | 4:0 | 4:20 | 4:11 | |

[1]Non-parametric $t$-test (Mann-Whitney), $\chi^2$ -test, endoscopic findings: $\chi^2$-test for trend [1, 2]median (interquartile range).

**Table 3** Relationship between the severity of endoscopic findings, clinical parameters and GER-related symptoms

| Variable | GERD "0" | GERD "1" | GERD "2" | GERD "3" | GERD "4" | $P^1$ |
|---|---|---|---|---|---|---|
| Number of cases | 11 | 13 | 20 | 7 | 6 | |
| Age (yr) | 52 (42-53)[2] | 53 (45-55) | 53 (43-59) | 53 (48-60) | 50 (48-50) | 0.79 |
| Gender (women, %) | 18 | 31 | 35 | 29 | 0 | 0.197 |
| BMI | 29.5 (26.9-36.1) | 33.9 (31.2-37.4) | 32.3 (28.6-35.0) | 37.8 (33.2-40.6) | 40.8 (35.8-47.3) | 0.04 |
| Epworth | 11 (8-14) | 9 (7-12) | 12.5 (10-16.5) | 15 (14-19) | 17 (16-18) | 0.006 |
| AHI | 14 (8-26) | 11.2 (10-35) | 31.5 (16.4-66.1) | 65 (56.7-99.3) | 63.4 (45-83) | 0.0001 |
| GER-related symptoms +(%) | 18.2 | 61.5 | 60 | 57.1 | 50 | 0.178 |

[1]In case of continuous variable one-way ANOVA and dichotomous variable $\chi^2$-test for trend ($P$<0.05 significant) [2]median (interquartile range).

We could reach essentially similar conclusions on the basis of logistic regressions investigating the severity of endosopic findings and AHI values as indicator of the severity of OSA (Table 4).

**Table 4 Logistic regression analysis in terms of the severity of GERD[1] and the relationship between BMI and AHI**

| | Not-adjusted model | Adjusted at AHI[2] |
|---|---|---|
| BMI[3] | 1.9 (0.64-5.88) 0.23[4] | 1.27 (0.38-4.15) 0.68 |
| AHI[3] | 4.09 (1.31-12.74) 0.016 | 3.79 (1.25-12.4) 0.028 |

[1]Severity of GERD: mild: 0-1, severe: 2-4 [2]Classifying the AHI values: low: ≤the median of all patients (35); high: > the median of all patients (35); [3]Classifying the BMI: low: ≤the median of all patients (33.8); high: >the median of all patients (33.8); [4]Confidence interval; $P<0.05$ significant.

This model showed that in case of a high AHI, the presence of severe GERD was 4.09-fold. The weak connection between BMI and the severity of GERD (Table 3) was not significant in this model.

## DISCUSSION

Characteristics of our OSA population were consistent with the patients who were overweight with males in the majority[13-15].

In this study, the characteristics of GERD and their connection with the severity of OSA were demonstrated. We verified a positive and significant correlation between the severity of OSA and endoscopic findings of GERD with different statistical methods and established that more severe OSA was accompanied with more severe GERD. Indeed, a high frequency of reflux esophagitis (about 80%) in OSA patients was already found in contrast to the general population, however, 40-60% of patients with typical reflux symptoms had no esophageal erosions[16]. Ing *et al*[6] performed 24-h esophageal pH-metry in patients with OSA and found more severe reflux parameters in patients with more severe OSA. Even a higher frequency of GER-related symptoms was found in patients with OSA than in the control subjects[4,5]. In our study, typical and explicit complaints of GERD were also investigated. There was no difference between the two groups, but these symptoms were not significant in 50.5% of our patients. However, we classified the patients according to the endoscopic findings (Savary-Miller). A close connection was demonstrated between the severity of GERD and the scores of Epworth scale as an indicator of daytime somnolence. It is consistent with our previous results. We found a positive correlation between the body mass index and the degree of sleep apnea, which is also consistent with the reported data.

Even though the ultimate therapeutic solution was the nCPAP treatment in most cases, it appeared that the complementary treatment of GERD is important as well. This view seems to be shared by Foresman who noted that patients suffering from OSA and GERD simultaneously presented a therapeutic challenge. As an illustration of this challenge, Wolf *et al* presented a case of a long-term severe GERD patient who was treated with a high dose of omeprasole and antacids. Eventually OSA was identified in the background of this condition, which came into light due to the complaint of daytime somnolence. The nCPAP therapy achieved a significant improvement regarding GERD and other symptoms as well. However, nCPAP could decrease gastroesophageal reflux in patients without OSA by increasing the intra-esophageal pressure[9].

In conclusion, severity of OSA and GERD is probably parallel to each other. A high percentage of patients with fewer and indefinite complaints suggests the role of nocturnal GERD in OSA patients. Severity of OSA is correlated to the endoscopic findings in GERD.

## REFERENCES


1 **Field SK,** Flemons WW. Is the relationship between obstructive sleep apnea and gastroesophageal reflux clinically important? *Chest* 2002; **121**: 1730-1733

2 **Stiennon O.** The longitudinal muscle in esophageal disease. Madison, WI: WRS Press, 1985

3 **Knox J,** Jarvis D, Walter EH. The European Community Respiratory Health Survey II. *Eur Respir J* 2003; **21**: 556; author reply 556

4 **Teramoto S,** Ohga E, Matsui H, Ishii T, Matsuse T, Ouchi Y. Obstructive sleep apnea syndrome may be a significant cause of gastroesophageal reflux disease in older people. *J Am Geriatr Soc* 1999; **47**: 1273-1274

5 **Valipour A,** Makker HK, Hardy R, Emegbo S, Toma T, Spiro SG. Symptomatic gastroesophageal reflux in subjects with a breathing sleep disorder. *Chest* 2002; **121**: 1748-1753

6 **Ing AJ,** Ngu MC, Breslin AB. Obstructive sleep apnea and gastroesophageal reflux. *Am J Med* 2000; **108** Suppl 4a: 120S-125S

7 **Green BT,** Broughton WA, O'Connor JB. Marked improvement in nocturnal gastroesophageal reflux in a large cohort of patients with obstructive sleep apnea treated with continuous positive airway pressure. *Arch Intern Med* 2003; **163**: 41-45

8 **Kerr P,** Shoenut JP, Millar T, Buckle P, Kryger MH. Nasal CPAP reduces gastroesophageal reflux in obstructive sleep apnea syndrome. *Chest* 1992; **101**: 1539-1544

9 **Kerr P,** Shoenut JP, Steens RD, Millar T, Micflikier AB, Kryger MH. Nasal continuous positive airway pressure. A new treatment for nocturnal gastroesophageal reflux? *J Clin Gastroenterol* 1993; **17**: 276-280

10 **Johns MW.** A new method for measuring daytime sleepiness: the Epworth sleepiness scale. *Sleep* 1991; **14**: 540-545

11 **Savary M,** Miller G. The esophagus: Handbook and atlas of endoscopy. Solothurn, Switzerland: *Verlag Gassman* 1978: 135-142

12 **Sleep-related breathing disorders in adults: recommendations for syndrome definition and measurement techniques in clinical research**. The Report of an American Academy of Sleep Medicine Task Force. *Sleep* 1999; **22**: 667-689

13 **Tasali E,** Van Cauter E. Sleep-disordered breathing and the current epidemic of obesity: consequence or contributing factor? *Am J Respir Crit Care Med* 2002; **165**: 562-563

14 **Bixler EO,** Vgontzas AN, Lin HM, Ten Have T, Rein J, Vela-Bueno A, Kales A. Prevalence of sleep disordered breathing in women: effects of gender. *Am J Respir Crit Care Med* 2001; **163**: 608-613

15 **Mohsenin V.** Gender differences in the expression of sleep-disordered breathing: role of upper airway dimensions. *Chest* 2001; **120**: 1442-1447

16 **Armstrong D.** Endoscopic evaluation of gastro-esophageal reflux disease. *Yale J Biol Med* 1999; **72**: 93-100


**Edited by** Wang XL