

Prevalence, severity, and risk factors of symptomatic gastroesophageal reflux disease among employees of a large hospital in Northern India

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Abstract

Background and aims Gastroesophageal reflux disease (GERD) is considered to be a common and chronic gastrointestinal disorder. The prevalence of GERD is believed to be less in Asia than in Western countries. Population-based data on GERD are lacking from India. The present study aimed at determining the prevalence of GERD symptoms in an adult Indian community and the potential risk factors associated with GERD.

Methods The study population consisted of all the employees of All India Institute of Medical Sciences, New Delhi. An interview-based observational study was done on the basis of an earlier validated questionnaire. The subjects were asked about the frequency and severity of heartburn and/or regurgitation experienced by them in the previous year. These symptoms were then scored from 0 to 18. Subjects with a score of at least 4 were considered to have symptomatic GERD. Association of GERD with factors like age, sex, BMI, Kuppuswamy social class index, smoking, alcohol, NSAID use, and comorbid illness was analyzed.

Results A total of 4079 employees were interviewed in person on a 29-item questionnaire from June 2003 to January 2005. Of the 4039 eligible subjects, 653 (16.2%) had GERD; 3.6% had heartburn on daily basis and 5.9% on a weekly basis. The corresponding prevalences for regurgitation were 3.3% and 5.0%, respectively. One hundred and eight of 4039 (2.7%) had severe GERD symptoms. Higher BMI (OR=1.90, 95% CI: 1.4–2.6 for BMI \geq 25),

current smoking (OR=1.48, 95% CI: 1.19–1.83), asthma (OR=3.13, CI: 2.06–4.76) and hypertension (OR=1.71, 95% CI: 1.16–2.50) were associated with the presence of GERD symptoms.

Conclusions Prevalence of GERD in an urban adult population from northern India is 16.2% which is similar to other industrialized countries. Higher body mass index, current smoking, and presence of asthma or hypertension predisposes to GERD in our population.

Keywords Heartburn · India · Prevalence · Regurgitation · Risk factors

Introduction

Gastroesophageal reflux disease (GERD) is a common and chronic gastrointestinal disorder with a significant negative impact on health-related quality of life [1, 2]. Quantitative estimates of the actual prevalence of GERD are difficult to obtain, because those who seek health care probably represent only a tip of the iceberg. Our current understanding of the epidemiology of GERD is primarily based on population-based cross-sectional studies conducted in the affluent Western regions like United States and Europe [1–5]. Population-based data on GERD is lacking from developing countries in Asia. The prevalence of GERD symptoms in the Western population ranges from 10% to 44%. The traditional belief is that GERD occurs less frequently in Asia than in Western countries [6–8]. However, there is an emerging suggestion that the prevalence of GERD might be on the rise in Asia [9, 10]. The exact reasons for these changes in the prevalence of GERD are difficult to determine but this reflects, in general,

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the dramatic socioeconomic development and consequent life style changes that are currently occurring in many Asian countries [11]. Hence, although increasing attention is being given to the epidemiology of GERD in Asia-Pacific region, yet community-based prevalence of this data is lacking from most countries in this region. Studies from this region are required as ethnic and geographical differences in disease frequency may highlight environmental or genetic influences that contribute to our understanding of the etiology of this disease.

Heartburn and acid regurgitation are considered to be reasonably specific symptoms for diagnosis of GERD [12]. A validated symptom score based on heartburn and regurgitation is a useful diagnostic tool to conduct epidemiological studies in GERD. Association of GERD with obesity, smoking, alcohol consumption, intake of NSAIDs or other drugs has not been firmly established [13, 14]. Hence, there is a need to study the prevalence of GERD in India and to identify various socioeconomic and life style factors associated with symptoms of GERD.

Methods

Study population

The study population consisted of employees of All India Institute of Medical Sciences (AIIMS), New Delhi, a large tertiary referral hospital in North India, and consisted of both males and females with age ranging from 18 to 62 years. The exclusion criteria were pregnancy at the time of interview and major psychiatric illness.

Study design

This was a prospective cross-sectional observational study. Each subject was interviewed by one of the two physicians with the aid of a questionnaire containing 29 items elicited the demographic, lifestyle factors and the symptom score for GERD. The symptom score was based on the presence and severity of heartburn and regurgitation in the past 1 year. The interview questions included data on age, sex, height, weight, socioeconomic status as assessed by revised Kuppaswamy socioeconomic status scale [15], smoking, tobacco chewing, alcohol drinking, drug intake, co-morbid illnesses, and previous abdominal surgery. The investigators went to every department of AIIMS with a checklist of registered employees. The employees who consented to be a part of the study were interviewed. A repeat visit to each department was made a month later to interview employees who could not be contacted during the first visit. Subjects receiving continuous acid suppressive therapy including H₂ blockers or proton pump inhibitors were also included in

the study and their symptom score was calculated on the basis of symptoms prior to the initiation of acid suppressive therapy.

Symptom definitions

The following definitions were used to identify the symptoms of GERD: (i) *Heartburn* was defined as a burning sensation or discomfort behind the breastbone in the chest. (ii) *Acid regurgitation* was defined as a bitter or sour tasting fluid coming in to the mouth.

Assessment of symptom score and its validation

The questionnaire-based symptom score used for defining GERD has been validated in our population earlier [16]. The final score for each symptom, i.e., heartburn and regurgitation was obtained by multiplying the scores for severity and frequency [17]. The total score was obtained by adding the final scores of individual symptoms. Thus the final score ranged from 0 to 18. The presence of GERD was defined as a score ≥ 4 [16]. GERD was further classified as mild, moderate, and severe based on the final symptom score range of 4–8, 9–13, and 14–18, respectively.

Statistical analysis

Categorical variables are presented as frequencies and continuous variables as mean (standard deviation). Categorical variables were compared using chi-square test and continuous variables were compared using Student *t*-test. To assess the association of presence of GERD with potential risk factors each independent variable (age, sex, Kuppaswamy socioeconomic class, body mass index [BMI], smoking, tobacco chewing, alcohol intake, diet, use of NSAID/calcium channel antagonist/nitrates, and presence of co-morbid illness like asthma, diabetes, hypertension, or ischemic heart disease) was tested by univariate and multivariate analysis using forward logistic regression. Odds ratios (OR) were obtained and their 95% confidence interval (CI) were used to test the association of GERD with the respective independent variable. *p*-value < 0.05 was considered significant. SPSS version 10.0 statistical software (SPSS, Chicago, IL, USA) was used for analysis.

Results

A total of 4079 subjects were interviewed from June 2003 to January 2005. Of these 40 were excluded (28 pregnant females and 12 subjects were taking antipsychotic drugs at the time of interview). One thousand four hundred and

eighty-two subjects were not interviewed as they could not be contacted even in the repeat visit or did not give consent for the interview. Data from 4039 subjects were available for analysis.

The baseline characteristics of 4039 subjects are shown in Table 1. Five hundred and eighty-eight of 653 (90%) of subjects who had GERD were taking some form of treatment including antacids (11%), H₂ receptor antagonists (19%), proton pump inhibitors (22.8%), and a combination (14.4%) for symptom relief.

Prevalence of gastroesophageal reflux symptoms

Of 4039 subjects, 653 (16.2%) had symptoms score ≥ 4 which was the cut off for defining presence of GERD. If any degree of symptoms (symptom score ≥ 1) was also

Table 1 Baseline demographic characteristics of 4039 subjects

Parameters	
Age (years) (mean [SD]) [range]	35.7 (9.6) [18–65]
Sex	n (%)
Male	2902 (71.8%)
Female	1137 (28.2%)
BMI (kg/m ²) (mean [SD]) [range]	23.5 (3.6) [13.1–42.0]
Kuppuswamy socioeconomic class	
I	594 (14.7%)
II	2301 (57.0%)
III	907 (22.5%)
IV	237 (5.9%)
V	0
Smoking status	
Non-smokers	3111 (77%)
Current smokers	816 (20.2%)
Ex-smokers	112 (2.8%)
Tobacco chewers	200 (5.0%)
Betel nut user	110 (2.7%)
Alcohol drinkers	789 (19.5%)
Vegetarian	1303 (32.3%)
Non-vegetarian	2736 (67.7%)
Drug use	
NSAID	149 (3.7%)
Calcium blockers/nitrates	168 (4.7%)
Co-morbidity	
Asthmatics	104 (2.6%)
Diabetes	126 (3.1%)
Hypertension	157 (3.8%)
IHD	14 (0.3%)
Previous abdominal surgery	351 (8.7%)
	250 (71%) LSCS

LSCS: lower segment caesarian section; BMI: body mass index

taken into account, 1190 (29.4%) subjects had either heartburn and/or regurgitation of some degree during the past 1 year. Of these 1190 subjects, 847 (71.1%) had heartburn and regurgitation, 251 (21%) only heartburn, and 92 (7.7%) had only regurgitation.

GERD symptoms were present in 127 of 508 (25%) doctors as compared to 89 of 635 (14%) nursing staff ($p=0.002$).

Heartburn occurred on a daily basis (≥ 4 days in a week) in 3.6%, on a weekly basis (at least twice in a week) in 5.9%, and occasionally (one to four times a month) in 17.7%. The corresponding frequencies of regurgitation were 3.3%, 5.0%, and 14.8%, respectively.

Three hundred and eighty subjects (9.7%) had mild, 165 (4.1%) had moderate, and 108 (2.7%) of 4039 had severe symptoms of GERD. Table 2 shows the relationship between frequency of the symptom and its severity. Subjects with very frequent heartburn or regurgitation also had severe GERD as judged by the symptom score of 14 or more.

Factors associated with gastroesophageal reflux symptoms

On univariate analysis, increasing age, higher BMI, higher socioeconomic class, current smoking, use of drugs like NSAID and/or calcium channel antagonists/nitrates, presence of asthma, and hypertension were significantly associated with the presence of GERD. On multivariate analysis, only four factors were significant. Higher BMI (OR=1.90, 95% CI: 1.4–2.6 for BMI ≥ 25), current smoking (OR=1.48, 95% CI: 1.19–1.83), asthma (OR=3.13, CI: 2.06–4.76), and hypertension (OR=1.71, 95% CI: 1.16–2.50) were significantly associated with presence of GERD (Table 3).

Discussion

Gastroesophageal reflux disease has traditionally been considered as a disease of affluent people. Hence, in developing countries like India, GERD was not considered as a significant health problem until now. This study was designed so as to generate objective data regarding the prevalence of this disease and its risk factors in a defined cohort. For epidemiological studies, diagnosis of GERD can be made on the basis of symptoms only, without the use of invasive tests.

In this urban community, 16.2% of adults had symptoms of GERD. Heartburn was present in 3.6% on daily basis, 5.9% on weekly basis, and 17.7% on an occasional basis. Similarly prevalence for regurgitation was 3.3%, 5%, and 14.8%, respectively. These prevalence rates are lower than those in the USA [1] (17.8–20%), Finland [3] (15%), and Belgium [18] (11.3%), but similar to Italy [19] (5.4%),

Table 2 Frequency and severity of heartburn and regurgitation

Severity	Frequency		
	Occasional (1–4 days/month)	Frequent (2–4 days/week)	Very frequent (≥ 4 days/week)
Heartburn			
No GERD (≤ 3)	434 (60.9)	18 (7.6)	3 (2.1)
Mild (4–8)	269 (37.7)	87 (36.5)	15 (10.3)
Moderate (9–13)	10 (1.4)	133 (55.8)	19 (13.1)
Severe (14–18)	0	0	108 (74.5)
Regurgitation			
No GERD (≤ 3)	301 (50.2)	17 (8.4)	7 (5.2)
Mild (4–8)	272 (45.4)	68 (33.7)	13 (9.6)
Moderate (9–13)	26 (4.3)	117 (57.9)	8 (5.8)
Severe (14–18)	0	0	108 (79.4)

GERD: gastroesophageal reflux disease. Values are as *n* (%).

Japan [20] (6.6%), Malaysia [21] (6%), and China [22] (5.8%). The prevalence rate in India seems to be higher than in Singapore [23] (1.6%) and Iran [24] (2.7%). The fact that the prevalence of GERD in this study was similar to other Asian countries supports the earlier observation that GERD is more common in Western world compared with Asians [6, 25]. Possible reasons for a low prevalence of GERD in the east are lower gastric acid output in Asians, higher prevalence of *H. pylori*, lower BMI, differences in diet, and lifestyle [25]. However, these factors have not been examined in this study.

The strength of the present study is the interview-based design where two physicians have recorded the symptoms of GERD and evaluated heartburn and regurgitation using a symptom score. This has the advantage of bypassing the shortcoming of self-administered questionnaires, particularly, the misinterpretation of non-reflux dyspeptic symptoms for GERD when the responder himself fills the questionnaire. Most population-based studies have used self-reported questionnaire to assess the prevalence of GERD. There are very few studies in literature where interview-based design have been used and most of them have sample size ranging from 300 to 2600 subjects [8, 19, 26, 27]. The second strength of this study is that we have used a previously validated symptom score. In an earlier study we had evaluated and found that a symptom score ≥ 4 had a high diagnostic accuracy for GERD [16]. The third strength of this study is that we have not only measured the frequency of GERD symptoms, but also quantified the frequency and severity of symptoms in the form of a symptom score. Another advantage of this study is that the questionnaire has also incorporated elucidation of risk factors predictive for GERD. The weakness of this study is that it is not a true community-based study. Whether these results can be extrapolated to the general Indian population needs further

studies in community-based urban and rural settings. This study evaluates heartburn and regurgitation that are the cardinal symptoms of GERD and does not evaluate atypical clinical features of GERD. Hence, it may be providing an underestimation of the disease burden.

This study did not find any relationship of GERD with age on multivariate analysis. The effect of age on the prevalence of reflux symptoms is inconsistent in literature. Most studies have found no association whatsoever [4, 5, 18, 20, 23, 28, 29] and one study found an inverse relationship [1]. This study did not show any gender differences in the prevalence of reflux symptoms, which is consistent with the literature [1, 3, 5, 13, 20, 28]. However in endoscopy-based studies the prevalence of reflux esophagitis and Barrett's esophagus is predominant in men [25, 29].

The effect of obesity on the prevalence of GERD symptoms is unclear. The present study shows significant association of prevalence of GERD symptoms with increasing BMI that is in line with the findings in other populations [3, 5, 13, 14, 29]. This association is not consistently observed. Other investigators have shown that the reflux symptoms in the morbidly obese have not differed markedly from control population [30, 31]. Very few epidemiological studies have looked at the association of reflux symptoms with socioeconomic class. This study did not find any such association, which is in accordance with the data from Spain [5]. However, in our organization-based cohort, it was found that among the specific professional groups, doctors had more prevalence of GERD symptoms when compared with nursing staff.

This study revealed that current smoking of cigarettes was associated with the presence of reflux symptoms. This is in agreement with other studies [3, 4, 13, 31–33]. However, a Spanish study of 2500 subjects did not find that smoking predisposes to reflux symptoms [5]. Experimental

Table 3 Variables associated with GERD on univariate and multivariate analysis

Characteristics	GERD (<i>n</i> =653) [<i>n</i> (%)]	No GERD (<i>n</i> =3386) [<i>n</i> (%)]	Univariate OR (95% CI)	Multivariate OR (95% CI)
Age (years)				
18–29	148 (12.7)	1032 (87.3)	1	–
30–39	275 (16.4)	1385 (83.6)	1.35 (1.085–1.668)	
40–49	131 (18.5)	584 (81.5)	1.56 (1.205–2.006)	
50–59	83 (20.4)	318 (79.6)	1.76 (1.312–2.370)	
≥ 60	16 (20.5)	67 (79.5)	1.77 (1.010–3.09)	
Sex				
Male	469	2433	1	–
Female	184	953	1.01 (0.83–1.21)	
BMI (kg/m²)				
< 20	66 (11.4)	511 (88.6)	1	1
20–24.9	330 (15.0)	1861 (85.0)	1.36 (1.03–1.81)	1.31 (0.98–1.7)
25–25.9	219 (20.4)	863 (79.6)	1.99 (1.48–2.67)	1.91 (1.4–2.6)
≥ 30	37 (19.9)	149 (80.1)	1.92 (1.24–2.99)	1.71 (1.1–2.7)
Kuppuswamy class				
I	140	454	1	–
II	358	1943	0.59 (0.48–0.74)	
III	128	779	0.53 (0.41–0.69)	
IV	27	250	0.42 (0.27–0.65)	
Smoking (cigarettes)				
Never	476	2634	1	1
Current smoker	154	662	1.29 (1.05–1.57)	1.48 (1.19–1.83)
Ex-smoker	23	89	1.43 (0.89–2.28)	1.36 (0.84–2.21)
Tobacco chewing				
Non chewer	630	3209	1	–
Chewer	23	177	0.66 (0.43–1.03)	
Alcohol use				
None	144	645	1	–
User	509	2741	1.20 (0.98–1.47)	
Diet				
Vegetarian	220	1083	1	
Non-vegetarian	433	2303	0.93(0.78–1.11)	
Drugs				
No drugs	573	3120	1	–
NSAID and/or calcium channel blocker/nitrates	78	239	1.64 (1.26–2.14)	
Co-morbid illness				
None	551	3091	1	1
Asthma	38	66	3.21 (2.13–4.83)	3.13 (2.06–4.76)
Diabetes	18	108	0.93 (0.57–1.56)	0.71 (0.42–1.23)
Hypertension	47	110	1.98 (1.37–2.88)	1.62 (1.20–2.50)
IHD	3	11	1.11 (0.24–5.1)	0.82 (0.68–2.67)

GERD: Gastroesophageal reflux disease; IHD: Ischemic heart disease

studies have shown that the association of smoking with reflux episodes maybe related to reduction of the lower esophageal sphincter pressure during smoking [34]. Tobacco chewing is unique to the population in Indian subcontinent, however, this study did not find any association of

reflux symptoms with tobacco chewing. Similar to smoking, alcohol use has been shown to evoke reflux episodes [35]. We did not find any association of alcohol consumption with presence of reflux symptoms. This is in accordance with previous studies [5, 23, 33]. Few studies

have shown that heavy alcohol consumption is associated with reflux symptoms [4, 13, 27]. This study did not find any difference in the prevalence of reflux symptoms when dietary preference for vegetarian versus non-vegetarian diet was compared.

Some studies have observed an association between the use of aspirin/NSAIDs or calcium channel antagonist/nitrates and the presence of GERD [8, 36] whereas others have not [4, 13]. In this study the use of NSAIDs and/or use of calcium channel antagonist/nitrates were not associated with GERD symptoms. This may be because ours was a predominantly a healthy and active population with very few subjects (3.7–4.7%) using these drugs.

Gastroesophageal reflux disease and asthma are frequently associated. Esophagitis has been found in up to 39% of patients with asthma [37, 38]. This study found that 36.5% of asthmatics have reflux symptoms in our population and presence of asthma was associated with reflux symptoms on multivariate analysis. Presence of diabetes was not associated with GERD symptoms. A study from Japan found type 2 diabetes mellitus as a risk factor for GERD; however, this particular association has not been looked at in other population-based studies [39]. The present study found that the presence of hypertension is also associated with GERD. We did not find any other study that had looked for this association. It is possible that the intake of antihypertensive drugs like calcium channel antagonists may contribute to this association. This finding needs to be validated in further studies.

In conclusion, this large interview-based study from Indian subcontinent found that the prevalence of symptoms of GERD in an adult population from Delhi is 16.2%. This study shows that the general impression of low prevalence of GERD in Asia may not be true. This prevalence is similar to other Asian countries and many European countries but is less than that in United States. The risk factors predisposing to GERD are higher BMI, current smoking, and presence of asthma or hypertension.

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