Original Research Article

A cross sectional study on combined prevalence of allergic rhinitis (AR) and bronchial asthma (BA) among construction workers

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Abstract

Background: Asthma is a heterogeneous syndrome with multiple phenotypes, the most prevalent of which is allergic asthma in association with allergic rhinitis. Construction is one of the important industries, which employs a large number of people on its workforce. In India about 340 million (92%) workers are in unorganized sector and about half of them are in construction industry. The construction workers are one of the most vulnerable occupational groups, prone to wide range of illnesses especially to respiratory morbidities like Asthma and allergic rhinitis. Despite this high risk very few studies are available on extent of asthma and AR in construction workers.

Objectives: To assess the prevalence and factors influencing allergic rhinitis and bronchial asthma among construction workers and to assess the degree of disease control using CARAT questionnaire

Materials and methods: The study was a cross sectional study conducted in sub urban areas of metropolitan city of Chennai. The participants were selected by multistage Cluster random sampling. World Health Organization (WHO)-sponsored Allergic Rhinitis and its Impact on Asthma (ARIA) guideline, Spirometry and CARAT scoring were used in the study.

Results: A total of 231 participants were included in the final analysis. The prevalence of any respiratory morbidity was 39% among study population. Out of the diseased 11 (4.8%) had AR alone, 12 (5.2%) subjects had BA alone and remaining 67 (29%) had both AR and BA. The prevalence of respiratory morbidity gradually increased with increasing age and was more in males. Upper airway symptoms were poorly controlled in 100% of the affected patients, this proportion was 66.7% for lower airway symptoms and 83.58% for combined airway score

Conclusion: Co-existence of Bronchial asthma and Allergic rhinitis is more common among construction workers compared to general population**.** Male workers in middle age group are more prone to airway allergy. Bronchial asthma is poorly controlled in workers with coexisting allergic rhinitis.

Key words

Allergic rhinitis, Bronchial asthma, Construction worker.

Introduction

Asthma is a heterogeneous syndrome with multiple phenotypes, the most prevalent of which is allergic asthma in association with allergic rhinitis [1]. The World Health Organization (WHO) recognizes the close relationship between asthma and rhinitis through the Allergic Rhinitis and its Impact on Asthma (ARIA) [2] guidelines and the Global Alliance against Chronic Respiratory Diseases (GARD) initiative [3]. This recognition has resulted in a call for a change in asthma management and led to a combined approach for asthma and its co-morbidities, particularly allergic rhinitis [4-7]. Lack simple assessment tools that can be readily used in clinical practice, particularly, in primary care has led to under diagnosis these important conditions.

Asthma frequently occurs in association with allergic rhinitis and a combined management approach has been suggested. Pathophysiological studies have provided compelling evidence for both anatomical and physiological similarities between the nose and the bronchi [8-10], as well as there being common agents which can trigger both asthma and rhinitis exacerbations and lead to similar inflammatory responses [9, 11, 12]. Indeed, evidence from some studies suggests that in 20–30% of patients with chronic allergic airway disease, allergen challenge in the upper airways results in significantly reduced lung function and increased bronchial responsiveness to methacholine. Rhinitis often precedes the development of asthma and is one of the strongest independent risk factors for the onset and incidence of asthma [13].

The Control of Allergic Rhinitis and Asthma Test (CARAT) is the first questionnaire to assess control of both diseases concurrently. However, to have an impact on healthcare it needs to be disseminated and adopted. Evidence suggests that more aggressive and better treatment of rhinitis is likely to improve asthma outcomes and asthma control, thus emphasizing the ARIA-WHO recommendation that patients with asthma and rhinitis should be treated for both conditions.

Construction is one of the important industries, which employs a large number of people on its workforce. In India about 340 million (92%) workers are in unorganized sector and about half

of them are in construction industry. The construction workers are one of the most vulnerable occupational groups, prone to wide range of illnesses. In spite of large numbers and high risk there are very few studies on the subjects. The present study is an attempt to fill the gap in this vital area.

Objectives

- To assess the prevalence and factors influencing allergic rhinitis and bronchial asthma among construction workers.
- To assess the degree of disease control using CARAT questionnaire.

Materials and methods

The study was conducted in sub urban areas of metropolitan city of Chennai. Multistage Cluster random sampling was used to select the study subjects into the study. A list of 100 living congregations of construction workers was prepared from the locality and out of that 25 congregations were selected by simple random sampling. From each of the cluster 25 subjects were selected by simple random sampling after line listing of all the people living in the site.

Adult construction workers, working in the construction field for at least 1 year were included in the study. Workers with active infections (pulmonary TB, LRI etc.), with active hemoptysis, with history of cardiac diseases (unstable angina, supraventricular tachycardia) and with recent (3months) abdominal or thoracic surgeries were excluded from the study. Out of 250 eligible subjects selected 231 subjects were willing to participate in the study; hence the non-participation rate was 9.24% in the study.

Allergic rhinitis was diagnosed by clinical history of specific symptoms, as per according to the evidence-based World Health Organization (WHO)-sponsored Allergic Rhinitis and its Impact on Asthma (ARIA) guideline. A family history of any allergic disease (e.g. summer hay fever), which makes a diagnosis of AR and asthma more likely is also taken. Patient was examined for reduced nasal airflow, mouth breathing, and horizontal nasal crease across the dorsum of the nose, and differences in contour of the nasal bridge. Examination for polyps, crusting, a perforated septum, or mucosal congestion was done, all of which can indicate persistent rhinitis. All workers were screened using pulmonary function test (spirometer) to diagnose bronchial asthma.

CARAT, which is a simple, feasible, and acceptable tool for assessing asthma and/or rhinitis in primary care, was used to assess the control of AR and BA. CARAT has recently been recognized by the ARIA group as the first tool to help implement ARIA guidelines in primary care. The CARAT questionnaire is composed of 10 questions that address upper and lower airway symptoms, sleep interference, activity limitation, and the need to increase medication over a four-week period The answers are rated on a four-point scale, with a total possible score ranging from 0 (minimum control) to 30 (maximum control) [21].

Approval of institute Human Ethics committee was obtained. Informed written consent was obtained from all the participants, after explaining the objectives of the study, risks and benefits involved. The personal details of the patients were kept confidential throughout the study.

Prevalence of AR and BA and the disease control status as assessed by CARAT were considered as primary outcome variables. Age and gender were considered as the explanatory variables. Descriptive analysis of the data was done by using frequency and percentage. Prevalence was compared among different age groups and gender by cross tabulation and comparing the proportions. Chi square test was used to test the statistical significance of the differences. P value < 0.05 was considered as statistically significant.

IBM SPSS version 21 was used for statistical analysis.

Results

A total of 231 participants were included in the final analysis. Majority of the study participants (74%) belonged to 20 to 39 year age group, with only 3 (1.3%) subjects above 60 years of age. Males constituted 91.8% of the study subjects. (**Table - 1**)

Table - 1: Sociodemographic profile of study population (N=231).

Parameter	Frequency	Percentage
Age group (Years)		
Below 20	20	8.7
20 to 39	171	74.0
40 to 59	37	16.0
60 and above	3	1.3
Gender		
Male	19	8.2
Female	212	91.8

The prevalence of any respiratory morbidity was 39% among study population. Out of the diseased 11 (4.8%) had AR alone, 12 (5.2%) subjects had BA alone and remaining 67 (29%) had both AR and BA. (**Table - 2**)

Table - 2: Prevalence of AR and BA among study population (N=231).

Morbidity	Frequency	Percentage
Normal	141	61.0
Allergic Rhinitis	11	4.8
Bronchial Asthma	12	5.2
Both	67	29.0
Total	**231**	**100.0**

The prevalence of respiratory morbidity gradually increased with increasing age group as the proportion of normal subjects was 65%, 62% and 55% respectively among <20 year, 20 to 39 year and 40 and above age groups. But the differences in the proportion among different age groups were statistically not significant. The prevalence of any respiratory morbidity was more in males, compared to females, which was statistically significant. (**Table - 3**)

The disease control as assessed by CARAT score was poor in majority of the study population. Upper airway symptoms were poorly controlled in 100% of the affected patients, this proportion was 66.7% for lower airway symptoms and 83.58% for combined airway score. (**Table - 4**)

Discussion

The global prevalence of asthma is anticipated to be approximately 4.5 per cent [14, 15]. There are about 300 million patients with asthma affecting all age groups, across the world, out of which about a tenth of those is living in India. The prevalence of asthma has been estimated to range 3-38% in children and 2-12% in adults [16]. The prevalence of asthma has increased over time and an additional 100 million people worldwide are expected to develop asthma by the year 2025 [17]. In the Indian study on epidemiology of asthma, respiratory symptoms and chronic bronchitis in adults (INSEARCH), a survey conducted in two phases across 16 centers in India, the prevalence of asthma in adults was 2.05 per cent, with an estimated burden of 17.23 million [18]. A study carried, over 30 years ago in Delhi reported around 10% allergic rhinitis and 1% asthma in 1964 [19]. Thereafter later studies have reported that 20% to 30% of the population suffers from allergic rhinitis and that 15% develop asthma [20, 21]. The prevalence of both bronchial asthma and allergic rhinitis among construction workers is more compared to general population.

The ARIA guidelines recommend optimal control of both asthma and allergic rhinitis airway disease as the primary goal of their treatment [22]. A combined approach of upper and lower airway disease management is a key issue that has been extensively proposed [23-25]. To assess the effects of treatment on the control, validated questionnaires have been

identified as key instruments [26-28]. The use of a formal methodological approach in the development of the questionnaire and the good measurement properties observed in the validation studies suggest that CARAT can be used in both clinical studies and clinical practice, allowing comparison between groups and the evaluation of individual patients over time.

Table - 3: Age and gender wise prevalence of AR and BA in study population (N=231).

Parameter	FD				Chi square value	P-value
	Normal	AR	BA	Both		
Age group						
Below 20 (N=20)	13 (65.0%)	3 (15.0%)	0 (0.0%)	4 (20.0%)	8.096	0.231
20 to 39 (N=171)	106 (62.0%)	7 (4.1%)	10 (5.8%)	48 (28.1%)		
40 to 59 (n=40)	22 (55.0%)	1 (2.5%)	2 (5.0%)	15 (37.5%)		
Gender						
Female	7 (36.8%)	3 (15.8%)	0 (0.0%)	9 (47.4%)	10.75	0.013
Male	134 (63.2%)	8 (3.8%)	12 (5.7%)	58 (27.4%)		

Exposures in the workplace continue to contribute to asthma morbidity among adults and are a cause of disability and economic consequences for both the worker and the society [29, 30]. Asthma at worksite often goes unrecognized [31] and a correct and early diagnosis is important to limit consequences of the disease [32]. Several hundred of occupational agents have been identified as causing work-related asthma, mainly allergens but also irritants such as ammonia, chlorine, sulfur dioxide and substances with unknown pathogenic mechanism [33].

Table - 4: Control of AR and BA among study population.

CARAT score	Control	No	%
Upper airway score (n=11)	**Poor**	11	100
	Good	0	0
Lower airway score (n=12)	**Poor**	8	66.7
	Good	4	33.3
Combined airway score	**Poor**	56	83.58
	Good	11	16.42

Workers represent half the world's population and are major contributors to economic and social development [34]. In India, nearly two-thirds of the contribution to the net domestic product is by the unorganized sector [35]. According to the National Sample Survey Organization (NSSO, 1999–2000), 370 million workers constituted 92% of the total unorganized workforce in the country [36]. Construction industry plays a major role in the economic growth of a nation and construction workers are at increased risk of work-related disorders worldwide [37, 38]. Allergic diseases represent a major health problem in most developing countries and are associated with serious adverse health and socioeconomic outcomes [39, 40]. Working conditions in the construction industry have improved in many industrialized countries during past decades, but heavy physical work with recurrent exposure to chemical agents, dust, and climatic influences still represents considerable risk for construction workers and may affect their health [41].

Occupational rhinitis is defined as that occurring secondary to exposure in the workplace to high-molecular-weight (HMW) agents, low-molecular-weight (LMW) agents and irritant substances through immunological or less well known non-immunological pathogenic mechanisms. This condition often coexists with occupational asthma. Occupational rhinitis has been reported as an early stage of respiratory

impairment. If exposure to the offending agent persists, occupational rhinitis may develop into asthma [2]. Exposures in the workplace continue to contribute to asthma morbidity among adults and is a cause of disability and economic consequences for both the worker and the society [6, 7]. Asthma at worksite often goes unrecognized [8] and a correct and early diagnosis is important to limit consequences of the disease [9]. Work-related asthma is currently one of the most common occupational respiratory diseases in many industrialized countries and 15–25% of adult asthmatic patients are estimated to have asthma attributable to occupational factors.

Work-related asthma includes two major disorders: Occupational asthma (OA) (caused by well-established causative agents at workplace) and work-exacerbated asthma (triggered by various work-related factors such as aeroallergens, irritants, or exercise in workers who are known to have pre-existing or concurrent asthma occurring at workplace). Two types of OA are distinguished (a) allergic: it is the most common type with more than 90% of the cases [21] and it appears after a latency period necessary for the worker to be sensitized to the causal agent (mostly high and some low molecular weight agents with IgE-mediate mechanism) (b) Non allergic: irritant-induced OA such as the Reactive Airways Dysfunction Syndrome (RADS) which occurs as an acute onset of asthma after high level single exposure to an irritating gas, smoke, or vapor [15]. A few cases of irritant-induced OA with a not sudden onset of asthma that follows multiple exposures to high levels of irritants are reported.

Asthma and allergic rhinitis are common diseases that have a negative influence on social life, school performance and work productivity. Epidemiologic studies have shown that asthma and allergic rhinitis frequently co-exist; i.e., 70–90% of patients with asthma also have allergic rhinitis and 40–50% of patients with allergic rhinitis also have asthma [42-44]. Furthermore, there is a probable association between the severity of asthma and allergic rhinitis [45, 46].

Allergic diseases comprise of asthma, rhinitis, anaphylaxis, drug, food and insect allergy, eczema and urticaria and angioedema. Approximately 20% to 30 % of total population suffers from at least one of these allergic diseases in India. A study carried, over 30 years ago in Delhi reported around 10% allergic rhinitis and 1% asthma in 1964.Thereafter later studies have reported that 20% to 30% of the population suffers from allergic rhinitis and that 15% develop asthma. Recently, a multi-centre population study, Indian Study on Epidemiology of Asthma, Respiratory Symptoms and Chronic Bronchitis (INSEARCH) has also been conducted. The study covered 12 centres comprising of both rural and urban areas spread over different parts of India. The prevalence of bronchial asthma pooled for all the 12 centres was found to be 2.05% (range, 0.4%–4.8%).

Advancing age, smoking, household environmental tobacco smoke (ETS) exposure, asthma in a first degree relative and use of unclean cooking fuels have been associated with increased odds of asthma. Correspondingly the prevalence rates of asthma in India have also been studied and was found to be around 3% - 3.5% A survey in UK general practice recently showed that asthma patients with significant rhinitis were 4–5 times more likely to have poorly controlled asthma compared to patients without rhinitis, with an odds ratio greater than that for poor compliance with asthma therapy [47-50].

On the basis of our results, the prevalence of allergic rhinitis and bronchial asthma are more commoner among construction workers which could be attributed to more pollution and exposure to irritants such as paints, quick drying glues, Portland cement, ammonia, chlorine, sulfur dioxide, synthetic substances used in construction and silica exposure. Similar to our

study results were also observed in R Michael sly, et al. [23].

The symptoms of both upper and lower airways are more prevalent among construction workers as compared to general population according to our study around 30% of the workers from various tasks in construction industry had prevalence of bronchial asthma and allergic rhinitis.

In our study we also analyzed that prevalence of allergic rhinitis and bronchial asthma was more prevalent between the age group 20-39 (48%).

The association of Bronchial asthma and allergic rhinitis are found to be more common in male (58%) when compared to females (9%) with significant p value of 0.013. similar findings were observed in nationwide large scale study conducted in India by Sutapa Agrawal, et al. [24]. Our study shows a prevalence of around 30% among construction workers for Bronchial asthma. Similar study conducted by Manish J Biswas, et al. [25] in India shows prevalence of around 22%.

Once work-related disorder is confirmed, adequate fitness for work should be assessed for the worker impaired by health condition, since persistence of exposure to an agent causing work-related asthma leads to a worsening of the disease and even life-threatening consequence [51].

All Allergic rhinitis patients having bronchial asthma showed greater fall of FEV1 as stated by other studies, An excess of cases of bronchial obstruction (defined as FEV1/FVC < 75% and FEV1 < 80% predicted) attributable to occupational exposure in the construction sector was found during a prevalence survey in the US general population [51] and a case-control study conducted in Italy confirmed these data showing a higher risk of bronchial obstruction (OR 3.13) for the occupational tasks in the construction industry [52, 53].

What this study adds:

This is one of the very few studies in our country, which has estimated the prevalence of AR and asthma with their severity and control among construction workers using Spirometry and CARAT scoring.

Limitations

- Only limited number of risk factors was evaluated for their association with asthma and in the study, leaving out many established risk factors and potential confounders.
- Control of Allergic rhinitis and Bronchial asthma is attributed to avoidance of exposure to risk factors which in our case was not specifically identified and intervened.

Conclusions

Co-existence of Bronchial asthma and Allergic rhinitis is more common among construction workers compared to general population. Male workers in middle age group are more prone to airway allergy. Bronchial asthma poorly controlled in workers with coexisting allergic rhinitis.

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