

Bronchial asthma: the Indian scene

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Purpose of review

Although asthma is a global disease, there are important differences in epidemiology, clinical spectrum and management practices in India. Some of these issues have been reviewed in this article.

Recent findings

The prevalence of 'ever asthma' was reported in 2.4% in a population study on 73 605 individuals conducted simultaneously at four major centres in India with the use of a single definition and uniform methodology employing a validated questionnaire. Of the several risk factors which were found to be significant, exposure to environmental tobacco smoke during childhood alone or both during childhood and adulthood was important in the development of and in increasing morbidity from asthma. Many other triggers and risk factors which include local aeroallergens and air pollutants have been identified. Allergic bronchopulmonary aspergillosis is an important cause of difficult to treat asthma and almost half of these patients receive antitubercular treatment at some stage. Simplified consensus guidelines based on international guidelines and local practices have been developed for use at the primary and secondary levels of healthcare.

Summary

The prevalence of asthma in India is somewhat similar to that seen in other Asian countries. Consensus management guidelines adapted from standard international guidelines adequately address the local concerns and issues.

Keywords

allergic bronchopulmonary aspergillosis, asthma epidemiology, asthma in India, environmental tobacco smoke, management guidelines

Introduction

There is a growing concern that the asthma incidence in India has significantly increased over the years. There is also an apparent increase in the number of patients with difficult to manage and severe asthma. While these trends are rather global in nature, there are differences between the epidemiology, clinical spectrum and management practices in India and those in the West [1^{••},2]. Some of these differences are attributable to the differences in environmental exposures and healthcare infrastructure in India; the others could be truly genetic or ethnic in origin.

Epidemiology

Epidemiological data on asthma from India in the past were rather limited. A good deal of information is now available, however, especially with reference to prevalence of asthma.

Prevalence

In early studies, prevalence figures of 1.76% in 15 805 urban subjects of all ages at Patna and 1.8% among beneficiaries of the Central Health Scheme of Delhi were reported in the 1960s [3]. Most subsequent studies have been conducted in the last decade (Table 1) [3–12,13^{••}]. One of the important global efforts, the International Study of Asthma and Allergies in Childhood (ISAAC), included India as one of 56 countries under its ambit [14].

The ISAAC study included children of 13–14 and 6–7-year age groups from 14 centres from India [4]. The methodology employed in the study consisted of a single page questionnaire meant for self-reporting of symptoms of asthma, allergic rhinoconjunctivitis and atopic eczema. The overall total Indian prevalence of 'ever asthma' was reported in 3.7% of 30 043 and 4.5% of 37 171 children respectively of 6–7 and 13–14-year age groups with the help of the written questionnaire [4]. A very high prevalence of 14.4% and 12.4% was reported from one centre (Kottayam, Kerala) in South India while all other centres reported prevalences between 1.3 and 3.8% and 2.4 and 6.5% respectively in the two age groups [5–7]. A few other studies conducted independently amongst either school children or in the field have reported variable prevalences [7–10].

The number of epidemiological studies in adults is even lower [11,12,13^{••}]. Asthma prevalence in Mumbai was reported as 3.5% by physician diagnosis with the use of the European Community Respiratory Health Survey

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Abbreviations

ABPA	allergic bronchopulmonary aspergillosis
COPD	chronic obstructive pulmonary disease
ETS	environmental tobacco smoke
ICMR	Indian Council of Medical Research
ISAAC	International Study of Asthma and Allergies in Childhood

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Table 1 Prevalence studies on asthma from India

Author	Study population			Age (years)	Definition/methodology	Prevalence (%)
	Region	Group	No.			
1. Viswanathan (1966) [3]	North (P)	Urban	15805	All ages	Symptoms on interview	1.8
Children						
2. Shah (2000) [4]	Multicentric	Schools	37171	13–14	Self reported, (ISAAC)	3.7
3. Awasthi (2004) [5]	North (L)	Schools	3000	6–7	As above	4.5
4. Mistry (2004) [6]	North (C)	Schools	575	13–14	Q. Wheezing	3.3
5. Chakravarthy (2002) [7]	South (TN)	Field	855	<12	Q. Diagnosed asthma	2.3
6. Chhabra (1998) [8]	North (D)	Schools	2609	4–17	Q. Current	12.5
7. Paramesh (2002) [9]	South (B)	Schools	6550	6–15		5
8. Gupta (2001) [10]	North (C)	Schools	9090	9–20	IUATLD based validated Q	11.6
Adults						
9. Chowgule (1998) [11]	West (M)	Field	2313	20–44	ECRHS Q	16.6
10. Jindal (2000) [12]	North (C)	Field	2016	18–>70	Validated Q	2.3
11. Aggarwal (2006) [13**]	Multicentric	Field	73605	>15	Validated Q	3.5
						2.8
						2.4

P, Patna; ISAAC, International Study on Allergies and Asthma in Children; L, Lucknow; C, Chandigarh; Q, questionnaire; TN, Tamil Nadu; D, Delhi; B, Bangalore; IUATLD, International Union Against Tuberculosis and Lung Disease; M, Mumbai; ECRHS, European Community Respiratory Health Survey.

(ECRHS) methodology [11]. We used a validated Hindi adaptation of the International Union Against Tuberculosis and Lung Disease (IUATLD)-1984 questionnaire and rigid criteria for definition of asthma and reported 'true' prevalences calculated with the help of an index derived from the sensitivity and specificity of the questionnaire as 4 and 1.3% respectively in men and women [12].

The most authentic data on asthma prevalence in adults have now become available from the Indian Council of Medical Research (ICMR) study conducted simultaneously at four different centres in the country with the help of the above mentioned questionnaire and methodology on 73 605 individuals aged 15 years or over [13**]. The overall presence of ever asthma was diagnosed in 2.4% of individuals while one or more respiratory symptoms were present in 4.3–10.5% of subjects [13**].

Variations in prevalence rates reported in different studies are often due to the differences in the methodologies employed and the definitions used for diagnosis of asthma in different studies. Different parameters have been used in different studies for validation of the diagnosis of asthma. Physician-diagnosed asthma, demonstration of variable airflow obstruction or bronchial hyperreactivity have been used as gold standards for questionnaire validation [15,16]. A highly sensitive questionnaire is likely to overdiagnose while a highly specific questionnaire will underdiagnose asthma. In studying population prevalence of diseases such as asthma, it is appropriate to use a more specific than sensitive questionnaire even at the cost of underestimation. The IUATLD questionnaire, validated against histamine challenge test in 833 adults in two English villages, was used for the ICMR study in India after adaptation and revalidation against physician-diagnosed asthma [12,13**,17]. Moreover, the study was conducted simultaneously utilizing a common questionnaire, a single definition of asthma and a uniform method of data collection

and analysis at four different centres: Chandigarh, Delhi, Kanpur and Bangalore. It may be important to note that asthma prevalence reported from some other Asian countries, for example China and Indonesia, is similar to that in India [18**]. Because of the large populations of each of these countries, however, the total burden is assessed as more than in most other regions.

Risk factors and triggers

Host factors as well as several other environmental factors have been identified in different studies from India (Table 2) [19–28,29*,30–35,36**,37,46,47**,48].

Host factors

India has a diverse population of multiple cultures and ethnicities. Differences in host factors therefore assume an enormous significance in disease occurrence and causation.

Asthma is more common in children than in adults and in boys than in girls. Adult asthma, however, is higher in

Table 2 Some common risk factors or triggers of asthma in adults identified in Indian studies

Factors	Study
Host factors	
Ethnic and genetic factors	[13**,19–25]
Increasing age	[13**]
Female sex	[13**]
Lower socio-economic status	[13**]
Environmental exposures	
Aero-allergens	[26–28,29*]
Air pollution	[9,13**,30–32]
Environmental tobacco smoke	[10,32–35,36**,37,38]
Foods: blackgram	[39]
Pets and animal dander	[41]
Miscellaneous	
Gastroesophageal reflux	[40]
Obesity	[42]
Exercise	[43]
Presence of allergic rhinitis or other allergies	[13**,31,44]
Allergic bronchopulmonary aspergillosis	[45,46,47**]
Pulmonary tuberculosis	[48]

women than in men. The odds ratio in favour of higher female prevalence was 1.435 (95% CI, 1.230–1.675) and increased with increasing age in adults in India [13^{••}]. Usual residence in urban areas and lower socio-economic status were other important factors in occurrence of asthma.

Ethnic or genetic differences, known to influence the prevalence rates, clinical spectrum and severity of asthma among different racial groups may account for some of these differences in the Indian population [19–21]. An earlier study on Chinese, Malay and Indian ethnic groups in Singapore showed prevalence differences not entirely explained by differences in atopy, or history of smoking and other environmental exposures [19]. Differences were reported in respiratory symptoms with higher national hospital admission rates for asthma in Indian than the Fijian children in Fiji [22]. Similarly, in Blackburn, UK, the admission rates from acute asthma were higher in the Indian subcontinent ethnic groups than the white ethnic groups [23]. Within India, centre to centre variations were seen in the two multicentric studies on asthma [4,13^{••}].

Differences observed in ethnic groups within a country may be partly genetic and partly related to sociocultural factors which determine environmental exposures or treatment seeking behaviour of different groups. There is little information on the genetics of asthma from India. Familial occurrence, however, is well known. The odds ratio (6.104) for the first degree relative having asthma was highly significant (95% CI 5.385–6.946) in the ICMR study on multiple logistic regression modelling [13^{••}]. Similarly, the odds ratio for history suggestive of other atopies was 12.304 (95% CI 11.057–13.691) [13^{••}]. In the study on sequencing and genotyping of 351 bronchial asthma patients and healthy individuals, 10 variable single nucleotide polymorphism sites were identified in the *ADRB* gene [24]. Another study [25] indicated the association of *IL4* gene polymorphisms in asthma in North Indian individuals.

Environmental exposures

The general environmental exposures important for asthma in India are akin to those described in the literature, but somewhat different both qualitatively and quantitatively.

Many different airborne pollens, fungal spores, dust mites and insect debris have been investigated for their role in asthma. An All India Coordinated Project on Aeroallergens and Human Health was undertaken at 18 different centres and some of the allergenically important pollens reported were *Prosopis juliflora*, *Ricinus communis*, *Morus*, *Mallotus*, *Argemone*, *Amaranthis*, *Cannabis* and others [26]. *Parthenium* (also known as Congress grass), originally an American grass weed now widely spread all over India, is

notoriously responsible for a lot of contact dermatitis and at least for some asthma [27,28]. A high incidence of skin sensitivity to the Himalayan tree pollens in the foothills of the Himalayas was also observed [29[•]].

Urbanization and air pollution are considered as important factors for an increased prevalence and severity of asthma. A hospital-based study on 20 000 children under the age of 18 years showed an increasing prevalence from 1979 to 1999 in the city of Bangalore [9]. Indoor air exposure to solid fuel combustion has been often debated. Availability of a separate kitchen in the house and a higher standard of living were both associated with a lower prevalence of asthma in the elderly [30]. On the other hand, no significant effect of air pollution and overcrowding was seen either with development or severity of asthma in children between 5 and 15 years of age [31]. In the multicentric ICMR study in adults, the highest prevalence was seen in the relatively less polluted city of Bangalore and the lowest in one of the more polluted cities, Delhi [13^{••}]. Similarly the prevalence in rural children was reported to be lower [32].

A few studies on the adverse role of environmental tobacco smoke (ETS) exposure in the development as well as aggravation of symptoms of asthma are available from India [10,32–35,36^{••}]. The odds ratio for being asthmatic for children of 9–20 years age exposed to ETS compared to those not exposed was 1.78 (95% CI 1.33–2.31) [10]. In the ISAAC study on 2000 school-going children near Delhi, the odds ratio for ETS exposure for asthma was 3.33 (95% CI 1.88–7.65) [37].

In adults, the ETS exposure during childhood and both during childhood and adulthood was significantly associated with an increased prevalence, while exposure during only adulthood was not associated with this risk [36^{••}]. Among 62 109 nonsmoking individuals, prevalence of asthma was higher in the ETS exposed than the non-ETS exposed individuals (2.2% versus 1.9%, $P < 0.05$) [36^{••}]. ETS exposure was also shown to be responsible for increased indices of morbidity and poorer control of asthma in adults such as in nonsmoking women exposed to smoking from their husbands [34]. Acute exacerbations were also more frequent in the ETS-exposed asthmatic patients [37]. Bronchial responsiveness of nonsmoking asymptomatic individuals, who were ETS exposed was higher than in the non-ETS exposed individuals [38].

Miscellaneous factors

Foods are commonly blamed for asthma and several other types of allergic and nonallergic problems in India. Blackgram hypersensitivity was present in the history of 35 patients, of whom 16 showed skin test positivity out of 816 patients of asthma and rhinitis [39]. Gastroesophageal reflux is a common problem in India bearing a strong

relationship with asthma [40]. Contact with pets and animals was recognized in one study [41]. In another interesting report, close animal contact, mud flooring of houses and breast feeding in infancy were shown as protective from asthma in children [49^{••}]. Exclusive breast feeding in the first 4 months was the most protective factor for the development of asthma [31]. A strong association was shown between obesity and asthma among adult Indian women age 15–49 years [42]. Exercise-induced asthma was reported as more common in urban school children aged 7–15 years [43]. Presence of other allergic diseases especially allergic rhinitis had strong association for asthma in both children and adults [13^{••},31,44].

Allergic bronchopulmonary aspergillosis (ABPA) has become an important issue in asthma [45–47^{••}]. In one study, 15% of 107 children with perennial asthma had ABPA while in another, 89 of 651 patients (14%) suspected of ABPA had positive Rosenberg criteria [45,46]. A large number of patients with ABPA show bronchiectasis at presentation, and almost half are misdiagnosed and treated as tuberculosis [47^{••}]. Pulmonary tuberculosis also bears a complex relationship with asthma. Bronchial asthma was reported to emerge in 42 of 55 adults (76.3%) after completion of antitubercular treatment [48]. Asthmatic children and adolescents exhibited a greater frequency of a BCG scar diameter of less than 5 mm than nonasthmatics [50]. Asymptomatic mycobacterial infection and BCG vaccination have been also proposed to protect from asthma. The overall evidence in support of a protection hypothesis is debatable.

Diagnosis and management

Diagnosis of asthma poses some difficulties at first presentation especially at the primary levels of healthcare. For example, it was shown that perceptions of asthma and asthma symptoms in Chennai did not match the presentation of asthma depicted in the ISAAC video [51[•]]. In children, the onset before 6 months of age, persistent recent symptoms, first life-threatening episode of cough, noisy breathing, breathlessness or chest tightness and presence of unusual symptoms should make one suspect an alternate diagnosis [1^{••}]. In adults, asthma and chronic obstructive pulmonary disease (COPD) are often confused. Presence of additional symptoms of fever, expectoration or chest pain should raise suspicion of complications or diagnoses of chest infections (e.g. tuberculosis), COPD or ischemic heart disease. Incidentally, pulmonary tuberculosis, which is an altogether different disease, is included in the algorithms for the diagnoses of both asthma and COPD in the standard Indian guidelines because of its widespread prevalence and the recommendations that sputum of each patient who presents the first time with cough (or other symptoms) of more than a 3-week duration should be examined for the presence of acid fast bacilli [1^{••},52].

The guidelines for both pharmacological treatment and patient education are fairly well described [1^{••},53,54]. The most frequent concerns pertain to the misuse of oral corticosteroids. In a study of 120 samples of quick-fix alternate medicines used for asthma, arthritis and other ailments, 38.3% were adulterated with steroids [55]. There is a greater reliance on oral medicines including the β -agonists. The Indian guidelines, however, include oral theophyllines and long acting β -agonists as alternate options, in addition to inhaled corticosteroids for moderate asthma [1^{••}]. Lack of awareness amongst both patients and physicians, and the high costs of inhalers are the significant factors responsible for the underuse of inhalation therapy and suboptimal control of asthma [56,57]. Several different kinds of alternative therapies are also popular. There is no well conducted scientific study on these remedies or practices. Occasional published reports on the use of yoga and *Pranayam* exercises lack the strength of evidence. Unfortunately, any attempt at a well planned study to investigate their role is extremely difficult. It is not therefore possible to make general recommendations based on individuals' claims and benefits.

Conclusion

Bronchial asthma in India poses a huge national burden and several challenges in management of patients. Widespread morbidity and poorer control are important clinical concerns. Lack of awareness, misuse of drugs and quick fix remedies are rather widespread. Exclusion of tuberculosis is also an important issue in diagnosis. Patient and physician education, control of environmental exposures as well as reduction in costs of inhalational therapy are important considerations. A comprehensive approach taking the local conditions into consideration, is essential.

References and recommended reading

Papers of particular interest, published within the annual period of review, have been highlighted as:

- of special interest
- of outstanding interest

Additional references related to this topic can also be found in the Current World Literature section in this issue (p. 88).

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