Original Article

Coexistence of allergic rhinitis and asthma in Indian patients: The CARAS survey

Vikram Jaggi[1], Alpa Dalal[2], BR Ramesh[3], Sharad Tikkiwal[4], Anil Chaudhry[5], Nisha Kothari[6], Meena Lopez[6], Jaideep Gogtay[6]

[1]Asthma Chest and Allergy Centre, Delhi, India, [2]Department of Pulmonology, Jupiter Hospital, Mumbai, Maharashtra, India, [3]Department of Pulmonary and Sleep Medicine, Bhagwan Mahaveer Jain Hospital, Bengaluru, Karnataka, India, [4]Asthma Bhavan, Jaipur, Rajasthan, India, [5]Rajan Babu Institute for Pulmonary Medicine and Tuberculosis, Delhi, India, [6]Department of Medical Affairs, Cipla Ltd., Mumbai, Maharashtra, India

ABSTRACT

Context: Asthma patients often suffer from concomitant allergic rhinitis (AR). However, there is paucity of such data from India. **Aims:** This questionnaire-based survey evaluated the coexistence of AR in Indian asthmatics, and examined the inter-relationship between the two disease conditions. **Subjects and Methods:** This survey conducted in ten cities across India, aimed to generate information on exposure to risk factors, history of atopy, the severity of asthma, and treatment regimen in patients with physician-diagnosed asthma. **Results:** Data were obtained from 1161 asthma patients (mean age [±standard deviation]: 40.41 [±17.05] years). Prevalence of coexisting AR was found to be 65.24%, with the highest prevalence (80%) in the southern regions of India. Sneezing (71.78%) followed by watery, runny nose (63.59%) were the most common AR symptoms. Majority (72.32%) of the patients had seasonal AR. Coexistence of AR and asthma was significantly associated with the presence of personal and family history of atopy (odds ratio 2.53 and 1.51 respectively; both $P < 0.005$). Passive smoking, exposure to biomass fuel, and the presence of pets and animals at home were also significantly ($P < 0.005$) associated with AR-asthma coexistence. Prevalence of AR was found to increase with increasing asthma severity. The usage of oral steroids was significantly higher in patients with coexistent AR-asthma. Sixty-six percent of the patients with coexistent AR-asthma were prescribed intranasal corticosteroids. **Conclusions:** The results of the Coexistence of Allergic Rhinitis and ASthma (CARAS) survey highlight the high prevalence of concomitant AR in Indian patients with asthma, and reinforce the need for early diagnosis and guideline-based management of AR in patients with asthma.

KEY WORDS: Allergic rhinitis, asthma, CARAS, India, intranasal corticosteroids, prevalence

Address for correspondence: Dr. Meena Lopez, Department of Medical Affairs, Cipla Ltd., Bellasis Road, Mumbai Central, Mumbai - 400 008, Maharashtra, India. E-mail: meena@cipla.com

INTRODUCTION

Allergic rhinitis (AR) is the most common of all atopic conditions, affecting about 10%–30% of adults and up to 40% of children worldwide.[1] It has a significant impact on health and affects sleep quality, work productivity, and school performance. Despite this, it is often underdiagnosed and overlooked by physicians as well as patients.[2]

Most often, allergic diseases occur with associated conditions, and AR is no exception.[3] Globally, several studies have consistently shown that AR and asthma

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often co-exist in the same patient.[4-6] Both AR and asthma are immunoglobulin E-mediated allergies, triggered by similar allergens and have inter-related inflammatory and pathophysiological mechanisms. Therefore, the presence of AR is considered as a risk factor for, both the incidence as well as the severity of, asthma.[2,7] The coexistence of AR and asthma can lead to delay in the right treatment, as these patients often undergo rounds of consultations with chest physicians, allergy experts, otolaryngologists, general physicians, and pediatricians. Moreover, treatment focus is mainly on asthma with less attention given to the associated rhinitis, which often goes unrecognized.

In India, the burden of allergic diseases has been on a rising trend in terms of prevalence as well as severity. The All-India Co-ordinated Project on Aeroallergens and Human Health, New Delhi, in 2000, showed that about 20%– IBM Singapore Pvt Ltd. 30% of the Indian population suffers from AR, and that 15% develop asthma.[8] Although the simultaneous presentation of AR and asthma has been evaluated in the Indian population in a few small studies,[9,10] nationwide data is lacking. This study aimed to assess the co-existence of AR in patients with asthma in India and examine the inter-relationship between the two disease conditions.

SUBJECTS AND METHODS

A nationwide epidemiological survey was conducted from March to May 2015, across ten cities in India [Table 1]. We aimed to obtain data from 1000 patients, for which 100 chest physicians across the country were randomly selected from the Cipla database (which covers 100% of the universe of chest physicians of India) from the four main zones (North, South, East, and West) of India and invited to participate in the study. Each doctor was asked to provide data on 10–15 patients, who were diagnosed with asthma as per their clinical judgment. Asthma was further classified as mild, moderate, or severe as per the physician's judgment. Diagnosis of AR was based on the AR and its Impact on Asthma (ARIA)[11] guideline questionnaire.

The participating physicians were asked to fill a survey questionnaire (Appendix), which included eight major questions assessing demographic data (age, gender, and residence), data on exposure to risk factors, namely personal and family history of atopy, exposure to pets/animals at home, smoking status, exposure to biomass as well as any occupational exposure to allergens. The use of current medications for asthma and AR and their inter-relationship was also evaluated. The study was approved by the Independent Ethics Committee, Pune.

Statistical analysis

Data analysis mainly included descriptive statistics, frequency distributions, and subgroup analysis of variables. The proportion of patients with asthma and those with concomitant AR were determined, and the results presented as mean ± standard deviation (SD). Data were analyzed using the Student's *t*-test and Chi-square test to examine the association between two variables. Chi-square test for comparing proportions was used to ascertain the significance of differences between proportions. The analysis was performed using IBM SPSS Statistics for Windows, Version 22.0, (IBM Singapore Pte Ltd, Singapore).

RESULTS

Participant demographics

We received data on 1161 asthmatic patients from 83 physicians across India [Figure 1]. The mean age (±SD) was 40.88 (±17.03) years; 56% were male. Majority (52.38%) of the patients had moderate asthma (52.38%), followed by mild (33.73%), and severe asthma (13.89% of patients).

The prevalence of co-existing AR in asthma patients was found to be 65.24% [n = 672; Figure 2]. Nearly 17% of patients with coexisting AR-asthma had never been diagnosed for their AR earlier. The presence of co-morbid asthma and AR was found to be the highest in the age group of 19–44 years; the prevalence was found to decrease with increasing age [Figure 3]. The AR-asthma comorbidity was more frequent in males (56%) than in females (44%). The highest prevalence (80%) of the AR-asthma coexistence was seen in the southern regions of India [Figure 4].

Table 1: Participating doctors and patients as per city and zone, across India

Zone	City	Participating doctors			Patients surveyed		
		Number	Percentage city-wise	Percentage zone-wise	Number	Percentage city-wise	Percentage zone-wise
North	Delhi	18	21.69	33.73	313	27.7	38.85
	Lucknow	8	9.64		78	6.9	
	Meerut	2	2.41		48	4.25	
East	Kolkata	8	9.64	9.64	160	14.16	14.16
West	Jaipur	1	1.2	8.43	69	6.11	9.65
	Mumbai	6	7.23		40	3.54	
South	Chennai	9	10.84	48.19	96	8.5	37.35
	Hyderabad	7	8.43		43	3.81	
	Thiruvananthapuram	10	12.05		150	13.27	
	Bengaluru	14	16.87		133	11.77	
Total		83			1130		

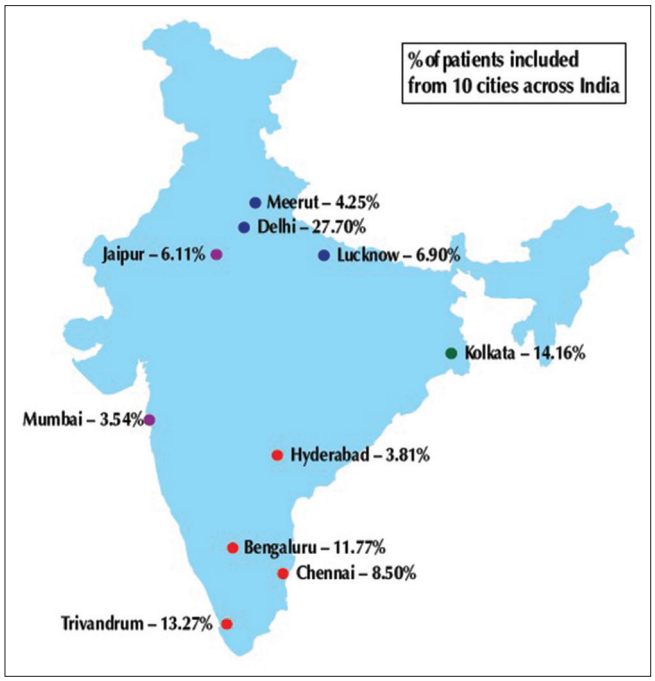

Figure 1: Participating centres

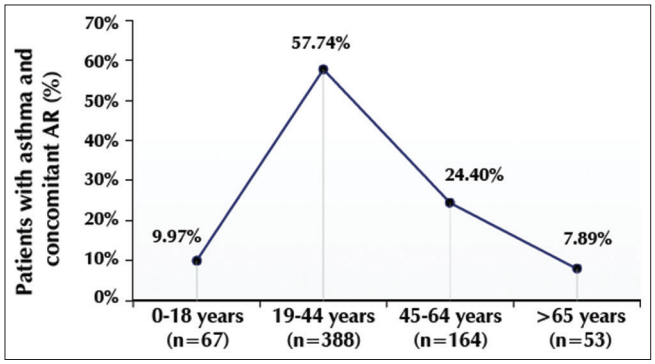

Figure 3: Correlation of age with coexistence of asthma and allergic rhinitis

The clinical and demographic characteristics of the patients are shown in Table 2.

Association of atopy with allergic rhinitis-asthma coexistence

The co-existence of AR and asthma was significantly associated with the presence of personal and family history of atopy (odds ratio 2.53 and 1.51, respectively; both $P < 0.005$). Passive smoking, exposure to biomass fuel, and the presence of pets and animals at home was also found to be significantly ($P < 0.005$) associated with AR-asthma coexistence [Figure 5]. Out of the total study population, 79 patients (7.83%) underwent a skin prick test, of which, nearly 62 patients were sensitized to at least one aeroallergen. Majority of the patients were positive to house dust or house dust mites ($n = 45$) followed by cockroach allergen ($n = 22$).

No association was found between smoking, exposure to molds/fungus and coexistent AR-asthma.

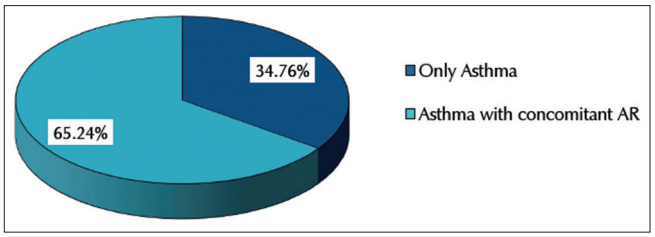

Figure 2: Prevalence of concomitant allergic rhinitis in patients with asthma

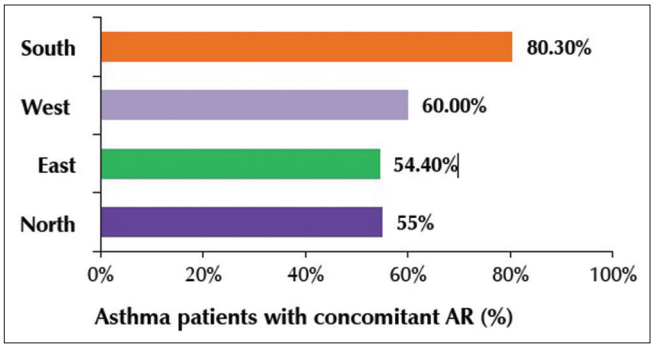

Figure 4: Prevalence of concomitant allergic rhinitis in asthma patients across India, as per zone. AR: allergic rhinitis; South zone: Chennai, Hyderabad, Thiruvananthapuram, Bengaluru; West zone: Jaipur, Mumbai; East zone: Kolkata; North zone: Delhi, Lucknow, Meerut

Table 2: Patient demographics and clinical characteristics

Patients with physician-diagnosed asthma (n=1161)	
Parameter	**Value**
Mean age of patients (years)	40.41±17.5
Gender (%)	
Female	43.52
Male	56.48
Personal history of atopy (%)	
Atopic dermatitis	30.79
Food allergy	35.30
Allergic conjunctivitis	33.90
Family history of atopy (%)	
Allergic rhinitis	33.89
Asthma	62.03
Atopic dermatitis	4.09
Smoking status (%)	
Nonsmoker	76.55
Ex-smoker	15.76
Current smoker	7.69
Exposure to trigger factors (%)	
Passive smoke	29.92
Biomass fuel	33.46
Pets/animals	24.48
Mould/fungus	10.60
Mean age at which asthma was diagnosed (years)	27.49
Severity of asthma (as per physician's judgment) (%)	
Mild asthma	33.73
Moderate asthma	52.38
Severe asthma	13.89

Correlation of allergic rhinitis symptoms with asthma severity

Majority (72.32%) of the patients had seasonal AR, while the rest had perennial AR (27.68%). Sneezing (71.78%),

followed by watery, runny nose (63.59%) were the most common AR symptoms [Figure 6]. The prevalence of concomitant AR in patients with severe, moderate, and mild asthma was 66.94%, 70.31%, and 56.39%, respectively. This prevalence was found to be significantly higher in severe and moderate asthmatic patients as compared to those that with mild asthma ($P < 0.05$).

The prevalence of perennial AR in mild, moderate, and severe asthma was 19%, 29%, and 40%, respectively [$n = 1008$; Figure 7]; the prevalence of perennial AR was also shown to be associated with the severity of asthma ($P < 0.001$).

The use of oral steroids was significantly ($P < 0.001$) higher in patients with concomitant AR-asthma [Figure 8]. Sixty-six percent of the patients with comorbid AR-asthma were prescribed intranasal corticosteroids (INCS), while 58.93% of patients received a prescription for an antihistamine-antileukotriene combination. Of the patients previously diagnosed with AR, 97% were receiving medications for managing their AR, of which INCS was the most preferred choice of treatment. Nearly 45% of severe asthmatics with concomitant AR received INCS. INCS was also prescribed more often in patients with seasonal AR as compared to those with perennial AR [30.49% and 12.92%, respectively; $P < 0.005$; Figure 9].

DISCUSSION

The association between AR and asthma has been extensively reported in the literature.[1,12-15] There is a considerable variation in the observed prevalence of AR in patients with asthma globally, with a nearly 50%–100% prevalence being reported in the United States and Europe[16] to 6.2% in China.[17] In the International Study of Asthma and Allergies in Childhood study conducted in 56 countries (including India), many centers which had the highest prevalence of allergic-rhinoconjunctivitis (ARC) symptoms were not represented among the centers with the highest prevalence of asthma symptoms; however the centers with the lowest prevalence of ARC symptoms were similar to the centers for asthma symptoms.[18]

In India too, different studies have reported varying results in the coexistence of AR and asthma, with frequencies ranging from 15% to >80%.[1,9,12,13,15] In a questionnaire-based study involving 646 asthmatics, 75% of children and 80% of adults showed co-existence of AR.[6] In another study which evaluated 111 children with AR, 74% had both AR and asthma, while only 8% and 17% had asthma alone and AR alone, respectively.[19]

Our study is a nationwide survey, documenting the epidemiological link between the two diseases. The prevalence of AR in our study was found to be as high as 65.24% among Indian asthmatics.

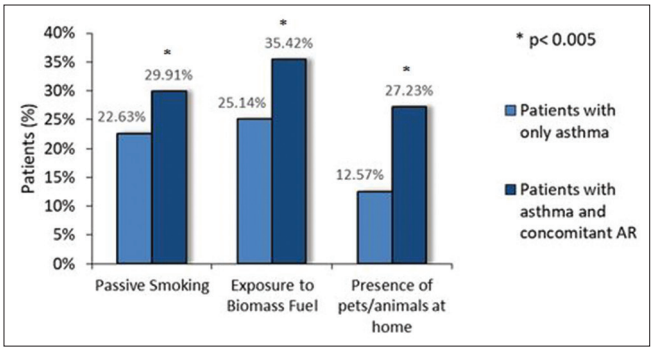

Figure 5: Exposure to risk factors in asthma patients with and without allergic rhinitis

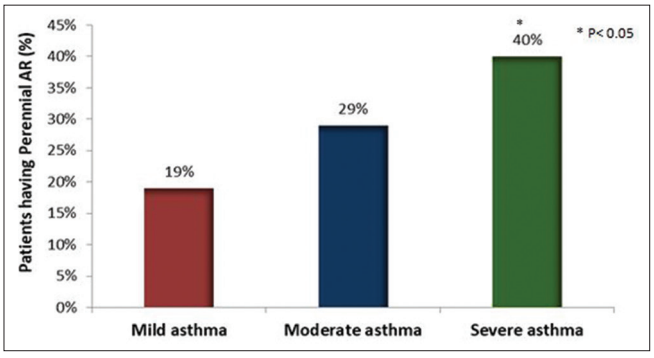

Figure 7: Prevalence of perennial allergic rhinitis across different asthma severities

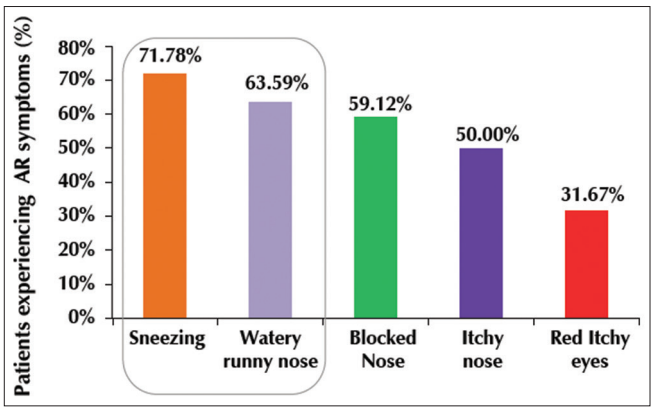

Figure 6: Prevalence of allergic rhinitis symptoms

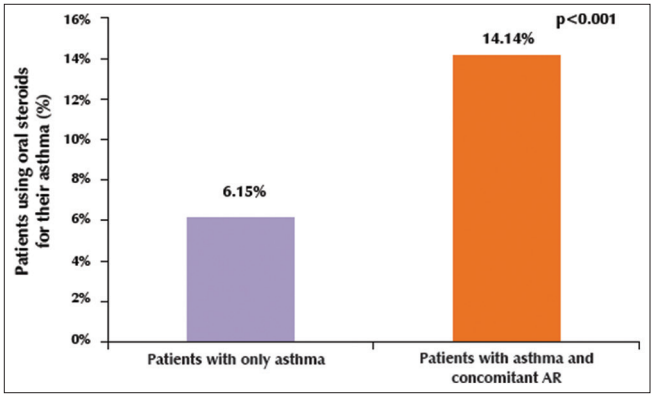

Figure 8: Oral steroid usage in asthma patients with and without allergic rhinitis

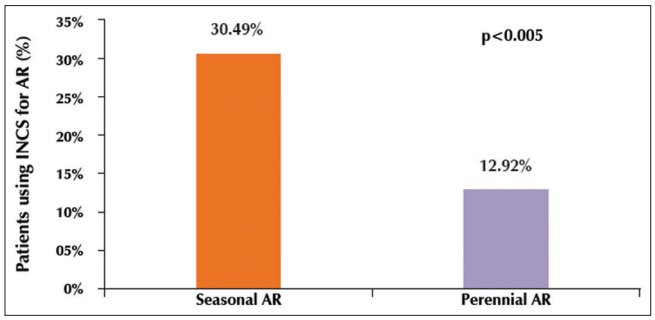

Figure 9: Intranasal corticosteroid usage in patients with seasonal/perennial allergic rhinitis

The prevalence of coexistent AR-asthma was found to be the highest in the southern region of India, followed by the western, northern, and eastern regions of India. Possible reasons for this regional diversity could be due to environmental differences and allergic triggers, which may have led to the high prevalence of co-existence of the two conditions in these patients.

Our study indicates that males have a higher prevalence of concomitant AR-asthma as compared to females. Similar trends were seen in a Finnish study, where the risk of AR was significantly higher in males than in females.[20]

Age has been shown to significantly influence the prevalence of AR in patients with asthma. Studies have shown that the frequency of AR in asthmatics decreases with increasing age.[21,22] In a study by Matsuno *et al*., the prevalence of AR was seen in 66% of asthmatics aged <60 years, whereas only 39% of asthmatics above 60 years of age had concomitant AR.[23] Thus, the results of our study, which showed the highest prevalence of the AR-asthma coexistence in the age group of 19–44 years, and decreasing with increasing age, are in concordance with the published literature.[20,23] These findings may be attributed to the fact that generally, rhinitis subsides during the natural course of the chronic airway inflammatory disease. Alternatively, the more pronounced severity of asthma with increasing age may lead to under-diagnosis of AR.

Allergic sensitization to domestic allergens, aeroallergens, and exposure to trigger factors appears to be an important risk factor in the association between AR and asthma. In this study, the presence of pets and animals at home was found to be two-fold higher in patients with co-existing AR-asthma. Several other studies have also shown a higher frequency of AR-asthma comorbidity in subjects sensitized to pollens and animal dander.[24,25]

Our study also throws light on the relationship between the presence of AR and the severity of asthma. A higher prevalence of concomitant AR was demonstrated in patients with moderate and severe asthma (70.31% and 66.94%, respectively; $P < 0.0001$) as compared to mild asthma (56.39%). The prevalence of perennial AR was found to increase with increasing severity of asthma, from mild (19%) to moderate (29%) to severe (40%) ($P < 0.05$). This may indicate that greater the severity of asthma, higher is the prevalence of comorbid AR. A similar correlation was reported in a study by Ponte *et al*., which demonstrated a 3.8-fold increase in the odds of emergency room visits (95% confidence interval [CI]: 2.00–7.35) in patients with moderate-to-severe rhinitis as compared to patients without rhinitis. In addition, patients with moderate-to-severe rhinitis had a 12.7-fold increase (95% CI: 1.73–92.85) in the odds of having uncontrolled asthma as compared to those without rhinitis.[26] Thus, as proposed by the ARIA working group, AR and asthma may be manifestations of one syndrome in two different parts of the respiratory system, with more severe AR corresponding directly with more severe asthma.[11] Our study also showed a positive correlation between perennial AR and the severity of asthma, indicating that the presence of perennial AR may be a potential contributing factor to more severe asthma. This is in tandem with the previously stated facts that long-term, uncontrolled AR is a major contributory factor for poor asthma control, which has been highlighted in several previous studies.

A two-fold increase was observed in the use of oral steroids for managing asthma, in patients with co-existing AR-asthma in our study, which may indicate a greater worsening of asthma in those having concomitant AR. The use of INCS in patients with co-existing AR-asthma was also found to be more in patients with seasonal AR than perennial AR, which emphasizes the need to study the barriers pertaining to the prescription of INCS (recommended treatment for persistent AR) by physicians and their acceptance by patients.

Study limitations

Our study has a few limitations. Participants included in the survey were identified based on physicians' diagnosis of asthma and could not be objectively verified. Furthermore, the patients' asthma was classified as mild, moderate and severe as per the physician's clinical judgment and could not be verified objectively. Further, subjects included in the study were not sequentially enrolled, hence the possibility of sampling bias cannot be ruled out.

Despite these limitations, we think our study is a valuable addition to the existing literature, as data available on the prevalence of comorbid AR and asthma and its inter-relationship in the Indian population is currently limited. Moreover, our study had a large sample size of 1161 patients and was conducted across ten cities of the country, providing a uniform geographical representation as well.

CONCLUSIONS

The results of the CARAS survey highlight the high prevalence of concomitant AR in Indian patients with

asthma, especially in the southern region of India. A positive link was found between perennial AR and severity of asthma, suggesting that patients with perennial AR may be at a higher risk of developing more severe asthma. The high use of oral steroids indicates that the presence of concomitant AR in asthmatics may be associated with worsening of asthma symptoms. This reinforces the need for early diagnosis and guideline-based management of AR in patients with asthma.

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Conflicts of interest

Nisha Kothari, Meena Lopez and Jaideep Gogtay are employees of Cipla Ltd.

REFERENCES

1. Egan M, Bunyavanich S. Allergic rhinitis: The "Ghost diagnosis" in patients with asthma. Asthma Res Pract 2015;1:8.
2. Giavina-Bianchi P, Aun MV, Takejima P, Kalil J, Agondi RC. United airway disease: Current perspectives. J Asthma Allergy 2016;9:93-100.
3. Shah A, Pawankar R. Allergic rhinitis and co-morbid asthma: Perspective from India – ARIA Asia-pacific workshop report. Asian Pac J Allergy Immunol 2009;27:71-7.
4. Settipane RJ, Hagy GW, Settipane GA. Long-term risk factors for developing asthma and allergic rhinitis: A 23-year follow-up study of college students. Allergy Proc 1994;15:21-5.
5. Lombardi C, Passalacqua G, Gargioni S, Senna G, Ciprandi G, Scordamaglia A, *et al*. The natural history of respiratory allergy: A follow-up study of 99 patients up to 10 years. Respir Med 2001;95:9-12.
6. Shah A, Punjabi C, Maurya V. Asthma and Rhinitis: the Co-Occurrence in Delhi. KL Malaysia: Proceedings of the Third Malaysian Congress of Allergy and Immunology; 2002.
7. Valovirta E, Pawankar R. Survey on the impact of comorbid allergic rhinitis in patients with asthma. BMC Pulm Med 2006;6 Suppl 1:S3.
8. Varshney J, Varshney H. Allergic rhinitis: An overview. Indian J Otolaryngol Head Neck Surg 2015;67:143-9.
9. Pherwani A, Mankekar G, Chavan K, Periera C, Bansode G. The study of co-morbid conditions in adults with allergic rhinitis, from Mumbai, Maharashtra, India and their comparison with children. Indian J Otolaryngol Head Neck Surg 2009;61:5-8.
10. Gaur SN, Gupta K, Rajpal S, Singh AB, Rohtagi A. Prevalence of bronchial asthma and allergic rhinitis among urban and rural adult population of Delhi. Ind J Allergy Asthma Immunol 2006;20:90-7.
11. Bousquet J, Khaltaev N, Cruz AA, Denburg J, Fokkens WJ, Togias A, *et al*. Allergic rhinitis and its impact on asthma (ARIA) 2008 update (in collaboration with the World Health Organization, GA (2) LEN and AllerGen). Allergy 2008;63 Suppl 86:8-160.
12. Pawankar R. Allergic rhinitis and asthma: From the link to emerging therapies. Indian J Chest Dis Allied Sci 2003;45:179-89.
13. Vinuya RZ. Upper airway disorders and asthma: A syndrome of airway inflammation. Ann Allergy Asthma Immunol 2002;88:8-15.
14. Feng CH, Miller MD, Simon RA. The united allergic airway: Connections between allergic rhinitis, asthma, and chronic sinusitis. Am J Rhinol Allergy 2012;26:187-90.
15. Scadding G, Walker S. Poor asthma control? – Then look up the nose. The importance of co-morbid rhinitis in patients with asthma. Prim Care Respir J 2012;21:222-8.
16. Gaugris S, Sazonov-Kocevar V, Thomas M. Burden of concomitant allergic rhinitis in adults with asthma. J Asthma 2006;43:1-7.
17. Celedón JC, Palmer LJ, Weiss ST, Wang B, Fang Z, Xu X. Asthma, rhinitis, and skin test reactivity to aeroallergens in families of asthmatic subjects in Anqing, China. Am J Respir Crit Care Med 2001;163:1108-12.
18. Worldwide variation in prevalence of symptoms of asthma, allergic rhinoconjunctivitis, and atopic eczema: ISAAC. The international study of asthma and allergies in childhood (ISAAC) steering committee. Lancet 1998;351:1225-32.
19. Sharma A, Shah A. The Co-Occurrence of Bronchial Asthma and Allergic Rhinitis and the Effect of Environmental Tobacco Smoke in these Patients. Abstract Presented at the 9th Asian Research Symposium in Rhinology and 10th Biennial Congress of the Trans-Pacific Allergy and Immunology Society; 2004.
20. Huurre TM, Aro HM, Jaakkola JJ. Incidence and prevalence of asthma and allergic rhinitis: A cohort study of Finnish adolescents. J Asthma 2004;41:311-7.
21. Tsao SM, Ko YK, Chen MZ, Chiu MH, Lin CS, Lin MS, *et al*. A survey of allergic rhinitis in Taiwanese asthma patients. J Microbiol Immunol Infect 2011;44:139-43.
22. Navarro A, Valero A, Juliá B, Quirce S. Coexistence of asthma and allergic rhinitis in adult patients attending allergy clinics: ONEAIR study. J Investig Allergol Clin Immunol 2008;18:233-8.
23. Matsuno O, Miyazaki E, Takenaka R, Ando M, Ito T, Sawabe T, *et al*. Links between bronchial asthma and allergic rhinitis in the Oita prefecture, Japan. J Asthma 2006;43:165-7.
24. Leynaert B, Bousquet J, Neukirch C, Liard R, Neukirch F. Perennial rhinitis: An independent risk factor for asthma in nonatopic subjects: Results from the European community respiratory health survey. J Allergy Clin Immunol 1999;104:301-4.
25. Boulet LP, Turcotte H, Laprise C, Lavertu C, Bédard PM, Lavoie A, *et al*. Comparative degree and type of sensitization to common indoor and outdoor allergens in subjects with allergic rhinitis and/or asthma. Clin Exp Allergy 1997;27:52-9.
26. Ponte EV, Franco R, Nascimento HF, Souza-Machado A, Cunha S, Barreto ML, *et al*. Lack of control of severe asthma is associated with co-existence of moderate-to-severe rhinitis. Allergy 2008;63:564-9.