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Spirometric Abnormalities in Patients with Allergic Rhinitis at Risk of Developing Asthma

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ABSTRACT

Background: Allergic rhinitis and asthma share many characteristics that warrants an integrated management. Studies suggest that there is subclinical allergic inflammation in the lower airway of patients with AR and that persistent AR must be evaluated for asthma.AR being a significant risk factor for the development of BA, it is well accepted that AR symptoms precede symptoms of BA which in turn cannot be managed until AR is controlled. Hence the need for asthma screening in patients with allergy is justified. Aim: To identify allergic rhinitis patients at risk of developing asthma and facilitate counselling and long-term management of the disease. **Methods:** This is a prospective study conducted on 103 patients over a period of 3 months at Sri Muthukumaran Medical College Hospital and Research Institute, diagnosed with allergic rhinitis by performing spirometry. **Results:** The mean age of the patients enrolled (Males 56 and Females 47) was36.8 years and the average duration of the disease was 2.97 years. Of the 103 patients enrolled spirometry abnormalities were seen in 29 (28.16%). The FEF25-75% was decreased in 29 (28.16%) of the patients and the FEV1 and FEF25-75% was combinedly decreased in 12 (11.7%) patients. The severity was more in patients with longer duration of symptoms (5.32 vs 2.03 years). Bronchodilator reversibility was significant in 9 (75%) of the patients. **Conclusion:** The lower airways should be evaluated by spirometry in all patients diagnosed with allergic rhinitis. This study provides evidence that in those patients diagnosed with Allergic Rhinitis, there is abnormality in lower airways (without symptoms of asthma). FEF 25-75 %can be considered as an early marker of bronchial involvement.

Keywords: Allergic rhinitis, Bronchial asthma, Spirometry, Atopy, United Airway Disease.

INTRODUCTION

Allergic rhinitis is defined as nasal hypersensitivity induced by an immunologically mediated (most often IgE mediated) inflammation after the exposure of the nasal mucous membranes to a specific allergen. Statistics show that 10 - 20 percent of the world's population shows symptoms of allergic rhinitis.

Globally asthma is a serious condition affecting all age groups. The WHO defines asthma as a disease characterized by recurrent attacks of breathlessness and wheezing which vary in severity and frequency from person to person. It is characterized by a reversible airflow obstruction and forced vital capacity in the first second is the gold standard to evaluate bronchial obstruction.[10]

Allergic rhinitis is not considered a serious health problem because it is not life threatening. But it reduces the quality of life by hindering with day to day activities impairing sleep and cognitive functions causing irritability and fatigue. Appropriate treatment improves the quality of life, school and work performance. Asthma on the other hand is a chronic health problem that encompasses the patient's entire lifetime leading to significant mental and social problems. In severe cases it is life threatening leading to a medical emergency.

The relationship between allergic rhinitis and bronchial asthma has now been well established and led to the evolution of a new concept called united airway disease.[2] As the upper and lower airway have similar epithelium, share common triggers and have same inflammatory mechanisms. Various studies have proved that allergic rhinitis is an important cause for the non optimal control of asthma.[3]

Studies provide evidence that the prevalence of BA in AR is 40% and that of AR in patients with BA is as high as 80%. This is based on a series of links at various epidemiological and pathophysiological levels.[3] Such links warrant for an integrated management. Being a unified functional and morphological unit, the connection between them has been well observed over the years in both health and disease. One of the most important concept regarding nose - lung interaction is the ' functional

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complementarity ' which assigns the protector role of the nose to the lungs.

Epidemiological and Pathophysiological Links

Atopy constitutes an important epidemiological link. Diseases related to atopy can present as urticaria, allergic rhinitis, atopic dermatitis, conjunctivitis, food allergy and asthma. According to the ARIA programme.

Now that allergic rhinitis is a significant risk factor for the development of bronchial asthma, here in our study we aim to broaden the perspectives for the primary prevention of bronchial asthma through the management of AR by a combined approach. The epithelial cells which are the first line barriers in the upper and lower respiratory airways are the main targets for such combined therapeutic approach.

In patients with symptoms a detailed clinical evaluation of the cluster of symptoms, pattern of occurrence as well as the triggering factors are important. Family history is significant. Apart from history taking spirometry is an extremely useful investigation which is often overlooked. It not only aids in diagnosis but also helps to know about the prognosis and whether the patient is responding to treatment or not. Spirometry parameters like Forced expiratory volume at timed interval of 1 s (FEV1) and forced expiratory flow (FEF 25 - 75%) are impaired in patients with nasal allergy or allergic rhinitis. Also FEF 25 - 75% is a reliable indicator for airway hyper responsiveness. Also it is well known that it gives important information about large and small airways about lung parenchyma.[13] Hence the possible presence of spirometry abnormalities in patients with allergic rhinitis has clearly been documented.

Treatment protocols are based on classification, severity and triggers. Corticosteroids play a major role in treating both allergy and asthma.[3] Apart from steroids and antihistamines IgE therapy, leukotriene modifiers and immunotherapy (especially for moderate and severe cases) play a major role in treating both allergy and asthma.

MATERIALS AND METHODS

This is a prospective study of a total of 103 patients attending the ENT OPD for a period of 3 months. The Institutional Ethics Committee approval was obtained prior to the start of the study. Patients who are above 18 years of age with symptoms of allergic rhinitis and with signs of AR on DNE with blood tests consisting of total count (TC) & Absolute Eosinophil Count (AEC) are then subjected to a spirometry test.

Spirometry was done by a single, trained person using a computer-assisted Spirometer (Easy One Spirometer). Spirometry was done as per acceptable guidelines (ATS) using ERS/ECCS formula for predicted values. The Forced Expiratory Volume in 1 sec (FEV1), Forced Vital Capacity (FVC) and the Forced Expiratory Flow between 25% to 75% of FVC (FEF25-75%) Maximal Mid Expiratory Flow Rate (FEF25-75%). FEV1 values <80% predicted were taken as a marker for airflow obstruction. For those who had low values, Bronchodilator reversibility testing was also done 15 minutes after giving bronchodilator (Salbutamol 200 mcg).

Patients with symptoms of AR but without any signs or blood tests indicative of AR, patients having acute respiratory illness, known asthmatics, smokers and patients who are unfit to undergo spirometry are excluded from this study. Patients who are not willing to participate in this study also fall under exclusion criteria.

After a detailed history taking and thorough ENT examination these patients were asked to fill a questionnaire about the nature, duration and time course of the symptoms, their response to medications ,co morbid conditions and effects on the quality of life were noted. DNE findings such as pale allergic mucosa, inferior turbinate hypertrophy, mucoid secretions, presence of polypoidal changes were also noted. History regarding classical symptoms of AR such as sneezing, rhinitis, nasal block, sleep disturbances etc and how it affects school and work performance were noted and the patients were classified as mild moderate and severe (according to ARIA classification) depending upon its severity , duration and frequency. After this they were subjected to a spirometry test. Here we use a spirometer named Easy one as per the recommendations of ATS and as per manufacturer guidelines. The percentage predicted formula is calculated according to the ECS/ECCS guidelines. The changes in the spirometry values were noted. Reversibility was checked after 15 minutes of bronchodilator therapy (2 puffs of salbutomol were used for this) and the results were noted.

Treatment for AR was based on ARIA classification and all the patients were followed up to one year.

Statistical Analysis

Performed using Statistical Package for Social Sciences (SPSS, Version 17) for Microsoft Windows. Descriptive statistics were presented as numbers and percentages. The data were expressed as Mean and SD. Pearson Correlation analysis were used for continuous data. Pearson Chi Square test was used to evaluate whether distributions of categorical variables differed from one another. A two sided p value<0.05 was considered statistically significant.

RESULTS

Of the total number of 103 patients, normal spirometry values were recorded in 74 patients (78.8%) and 29 patients showed impairment of spirometry values (28.1%).

Table 1: Showing statistical data of mean age / sex incidence and height

	N	Minimum	Maximum	Mean	Std. Deviation
Age	103	19	59	36.77	9.457
Height	103	149	176	162.87	6.119
Valid N (listwise)	103				

Table 2: Demographic data of age groups involved and parameters impaired in each group

Age Group (in years)	No of patients	Impairment of FEF25-75%	Impairment of both FEF25-75% and FEV (1)
18 - 20	4	0	0
21- 30	26	6	4
31- 40	35	6	4
41-50	30	5	2
Above 50	8	0	2
Total	103	17	12

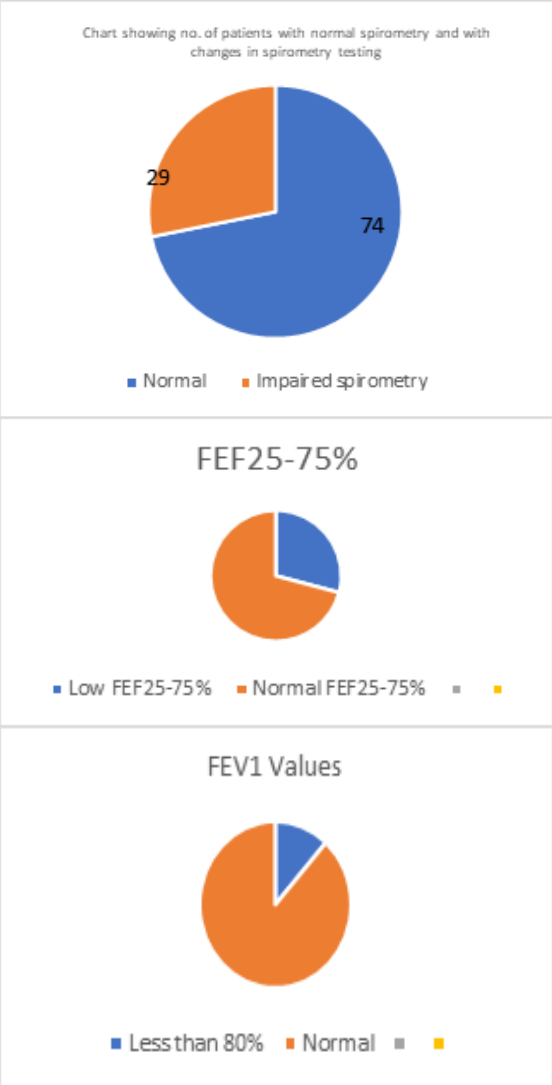

Figure 1: Showing the number of patients with normal and impaired spirometry values

Table 3: Showing AEC values in all the 103 patients (in percentage)

Absolute Eosinophil Count (AEC) value	No. of patients	Percentage %
< 300 /cumm	74	78.8
301 - 500/ cumm	21	20.3
501 - 800/cumm	7	6.7
>800	1	< 1

Table 4: Duration of Allergic Rhinitis

Duration of disease	
< 2 years	38
2-7 Years	57
>7 years	8

DISCUSSION

Allergic rhinitis and bronchial asthma are related to one another in such a way that they are manifestations of a single syndrome in two parts of the respiratory tract. The activation of mediators of inflammation in the airways like eosinophils, basophils, mast cells, T – lymphocytes and triggering of the surrounding airway epithelium and smooth muscles becomes an important mechanism which involves both the conditions. Kelly et al. series of 2003 suggest that there is a three-fold risk of developing asthma in people with allergy when compared to people who do not have any allergic symptoms.[8]

According to the WHO, the prevalence of chronic obstructive lung disease is estimated about 251 million cases around the world, one such obstructive condition being asthma. Allergic rhinitis is a predecessor in most cases.[13,15] Epidemiological studies have shown that the prevalence of asthma in patients with allergy is 19 – 30 % which is a much higher percentage compared to prevalence of asthma in the normal population.[16]

In our study out of the total 103 patients, 56 were males (54.37%) and 47 patients were females (45.70%) and all patients were above 18 years of age. The mean age incidence being 36.8 years. This is similar to other studies such as Cpirandi et al. series of 2008 and Lim MY et al. series of 2010, where majority of cases were between 20 – 40 years of age.[7,17]

They were graded as mild (35 %), Moderate (49 %) and severe (16 %) according to the ARIA classification.

Normal spirometry values were observed in 74 patients.

Considering that severe and moderate cases of allergic rhinitis as the main predictors of severe asthma according to other studies,[9] in our study we have emphasized on the importance of adequate

allergy control for the optimal control of asthma, thus enabling an individual for a better quality of life.

Of the total number of 103 patients, normal spirometry values were recorded in 74 patients (78.8%) and 29 patients showed impairment of spirometry values (28.1%). Out of the three parameters, 29 patients (28.16%) showed impairment in FEF 25-75 % alone and 12 patients (11.70%) showed impairment of both FEV(1) and FEF 25-75 %. This has correlated with other studies where impairment of these parameters have been similarly recorded in patients without any single symptom of asthma. Hence these parameters, especially FEF 25-75 %can be considered as an early marker of bronchial involvement.[6,7,10]

In another series of Yousser et al. of 2011, FEF 25-75 % changes were seen in 87% of cases. Impairment of FEF 25- 75% signifies inflammation of small airways hence it is considered as an early predictor of airway obstruction.[14] Also impairment of FEF 25-75 % is the most common and is seen in a vast majority of patients in many studies (> 90 % of cases) which is similar to our studies.

The second most commonly impaired is FEV (1) followed by FVC, making FEF25-75% evidenced to be a reliable marker of early bronchial impairment in nasal allergy.

Out of the 29 patients, Bronchodilator reversibility was seen in 9 patients (75%).

Allergic rhinitis was also treated adequately with proper counselling, avoidance of triggers and medications such as antihistamines (both oral and intra nasal) and steroids (depending on the severity of allergy) for the long term management of both the diseases.

Here the absolute eosinophil count (AEC) obtained shows that all patients who had a normal spirometry (78.8%) had values below 300/ cumm. 21 patients (20.3%) had values between 301- 500/cumm, 7 patients (6.7%) had values between 501-800/cumm and one patient had values above 800/cumm (less than 1%) [Table 3]

Also the duration of rhinitis has been noted here which correlates with the disease severity that is longer the duration of allergy, greater is it's impact on the spirometry parameters.[18]

In our study the average duration of AR symptoms was 2.97 years [Table 4]. The duration of AR symptoms in those who demonstrated abnormal spirometry values was 5.32 years in comparison to 2.03 years in those who had no spirometry abnormalities. In a study done by Thiruvengadam et al, bronchial hyper-reactivity was seen in 62% of allergic rhinitis patients who had not yet developed bronchial asthma.[19]

CONCLUSION

Allergic rhinitis and Bronchial Asthma represent global health problems for all age groups. ARIA clearly states that allergic rhinitis should be considered as a risk factor for asthma along with other risk factors and patients with allergic rhinitis must be evaluated for both the upper and lower airways and treated adequately for the same. It has been postulated that Childhood allergic Rhinitis is a strong risk factor for development of Asthma in adulthood by 3-fold.

This relationship has been proven through the years as they share a considerable level of immunopathology and pathophysiology. Through this combined approach, patients will show good improvement and hence we will be able to achieve adequate control of allergy as well as lower the incidence of bronchial asthma in susceptible individuals thus ensuring a better quality of life as well as school and work performance. Our study provided evidence that spirometry abnormalities are present in allergic rhinitis patients. The bronchial tree is hyperreactive in most of the patients diagnosed to have allergic rhinitis prior to them developing overt asthma symptoms. The risk of these allergic rhinitis patients developing asthma increases with the duration and the severity of allergic rhinitis. Also this study provides evidence that by screening patients for impaired FEF 25-75 % values, early bronchial impairment can be identified. Hence the need for asthma screening in patients with allergic rhinitis is justified. All patients diagnosed with AR (especially moderate and severe categories) should be evaluated with spirometry to identify at an earlier stage, prior to developing asthma.

REFERENCES

1. Juniper EF , O' Byrne PM , Guyatt GH, Ferrie PJ , King DR. Development and validation of a questionnaire to measure asthma control. Eur Respir J. 1999:14(4): 902-907.doi :10.1034/j.1399-3003.1999.14d29.x
2. Bourdin A, Gras D, Vachier I, Chanez P. Upper airway x 1: Allergic rhinitis and asthma: united disease through epithelial cells. Thorax.2009: 64(11): 999-1004 doi:10.1136/thx.2008.112862
3. Bergeron, C., Hamid, Q. Relationship between asthma and rhinitis: Epidemiologic, Pathophysiologic and Therapeutic Aspects. All Asth Clin Immun1,81(2005) https://doi.org/10.1186/1710-1492-1-2-81
4. Diana S Church , Martin K Church. Allergic Rhinitis : Impact, diagnosis, treatment and management. Clinical Pharmacist, August 2016, Vol 8, No 8
5. Ciprandi G, Signori A, Tosca MA, Cirillo I. Spirometry abnormalities in patients with allergic rhinitis: Indicator of an" asthma march "‘? Am J Rhinol Allergy. 2011; 25 (5): e181-e185.
6. Vijay Kumar Poorey, SmitaSoni, Pooja Thakur, Alok Gupta. Indian J Otolaryngol Head Neck Surg.2016 Mar; 68(1): 6-10.
7. Ciprandi G, Pristorio A. Impact of allergic rhinitis on asthma: Effects on spirometry parameters. Allergy 2008:63; 255-260.
8. Kelly EA, Busse WW, JarjourNN.A comparison of the airway response to segmental antigen bronchoprovocation in atopic asthma and allergic rhinitis. J Allergy Clin Immunol 2003: 111: 79-86.
9. Jafari M (2016). Effects of persistent allergic rhinitis on spirometry parameters. J Allergy Ther 7:242. doi:10.4172/2155-6121.1000242

10. Nevine El-Helaly, SamiaM, Samy Tarek, Ibrahim William M, Morcos Hassan M, El- Hoshy, Dina A. Mohammed. Pulmonary Function changes in Allergic rhinitis with or without Bronchial asthma; Journal of American Science 2012; 8(1):110-114
11. Togias A. Rhinitis and Asthma: evidence for respiratory system integration. J Allergy Clin Immunol 2003:111; 1171-84.
12. Pawankar R. Allergic rhinitis and asthma -the link, the new ARIA classification and global approaches to treatment. CurrOpin Allery Clin Immunol2004 :4:1-4
13. Sonawane, Nilesh &Gour, Sanjay &Munje, Radha & B. Spirometry evaluation in patients with allergic rhinitis emphasizing need of early diagnosis: a tertiary care experience from central India. Indian Journal of Advances in Medicine.5.1460.10.18203/2349-3933.ijam20184757.
14. Yousser Mohammad, Rafea Shaaban, Moustafa Ibrahim, Moussa Ismail. Lung function changes in non asthmatic allergic rhinitis patients: a case series; Prim Care Respir Journal.2011, Dec: 20(4):454-456.
15. Schofield G, Farooque S. Recommended management and recent advances in allergic rhinitis. Prescriber.2014 May 5; 25(9): 21-8
16. Purohit CS. Spirometry changes in Patients of Allergic Rhinitis: A Prospective study. Int Arch BioMed Clin Res.2018;4(3):47-49.
17. Lim MY , Leong JL (2010) Allergic Rhinitis: Evidence based practice. Singapore Med J 51(7) : 542 – 550.
18. Jafari M. (2016). Effects of Persistant Allergic Rhinitis on Spirometry Parameters. J Allergy Ther.doi10.4172/2155-6121.1000242
19. Thiruvengadam. K.V et al: Broncjial reactivity in Allergic Rhinitis. Lung India (1982); No 1: 32-34

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