Effect of Nasal Allergy Over Spirometric Parameters: A Prospective Study

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Abstract Nasal allergy is characterized by an IgE mediated inflammatory response of nasal mucosa to allergens and it has a close association with Asthma. Nasal allergy has been demonstrated to be a strong risk factor for the onset of asthma in adults. Spirometric 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. The FEF_{25–75} % has been evidenced to be a reliable marker of early bronchial impairment in nasal allergy. Nasal allergy may be considered as the first step of the progression of respiratory allergy towards asthma. It has been demonstrated that FEF_{25–75} % is useful in predicting the presence of airway hyper responsiveness. It may be a more sensitive indicator of chronic airway obstruction than FEV1 and is considered as a risk factor for the persistence of respiratory symptoms in asthmatic patients. The impact of allergic rhinitis or nasal allergy on asthma (ARIA) guidelines, clearly underlined the role of allergic rhinitis as risk factor for asthma development. The possible presence of spirometric abnormalities in patient with allergic rhinitis has been well documented. So keeping this in mind, present study is undertaken to evaluate the impairment of spirometric parameters, like FEV1, FEF_{25–75} %, and forced vital capacity, in patients with nasal allergy and to predict the presence of airway hyper responsiveness.

Keywords Nasal allergy · Allergic rhinitis · Asthma · Spirometry · FEF_{25–75} % · FEV1 · Bronchial hyper responsiveness

Introduction

Despite the fact that asthma prevalence is increasing worldwide [15], asthma is still underdiagnosed, especially in children and young adults [4, 7]. Nasal allergy is one of the commonest problems met with in the practice of otorhinolaryngology. Close association between nasal allergy or allergic rhinitis and asthma has been demonstrated by several studies [1, 7, 14, 22]. Moreover, allergic rhinitis has been demonstrated to be a strong risk factor for the onset of asthma in adults [23].

Asthma is characterized by a reversible airflow obstruction and forced expiratory volume/1 s (FEV₁) is considered the main parameter to evaluate bronchial obstruction [2, 24]. Nevertheless, there is increasing interest to consider the involvement of small airways in the pathogenesis of asthma [16]. Even though there is no direct parameter capable of assessing small airways, it has been assumed that the forced expiratory flow at the 25 and 75 % of the pulmonary volume (FEF_{25–75}) might be considered as a measure of the caliber concerning distal airways [3]. Particularly, subjects with mild asthma and normal FEV₁, may show impaired FEF_{25–75} only [12, 19].

On the other hand, bronchial hyper responsiveness is a paramount feature of asthma. It may also be observed in a proportion of cases of allergic rhinitis [9, 17]. In this regard impaired spirometric parameters in patients with perennial nasal allergy could be considered as predictive for such cases to progress to develop asthma [5, 6].

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Considering these curiosities and facts in mind, the present study is aimed to determine if there is an effect of nasal allergy over spirometric parameters and the role of such impairment in predicting the association between nasal allergy and asthma.

Methods

The present study is a prospective study carried out on 100 patients between August 2012 and December 2013, suffering from nasal allergy, attending the department of Otorhinolaryngology and Head and Neck surgery, Gandhi Medical College and Hamidia hospital, Bhopal (M.P.), India. In each case, the clinical diagnosis of nasal allergy is made on the basis of characteristic history and corroborative clinical findings on complete examination.

Inclusion criteria Patients with nasal allergy (history of at least 1 year).

Exclusion criteria A known case of asthma, those with history of addiction (particularly smoking).

A detailed clinical history and a complete physical examination, including allergy evaluation, is performed. All cases are subjected to spirometry using spirometer sync master 594 MG samsung.

Results

In present study, 56 (56 %) are males and 44 (44 %) are females; Male:Female ratio being 1.27:1.

The age ranges from 11 to 45 years. Majority of cases 35 % are in the age group of 21–30 years followed by 27 % cases in the group of 31–40 years, 23 % cases in group of 11–20 years and minimum i.e. 15 % cases in the age group of 41–50 years.

Age and gender distribution is shown in Table 1.

In present study, detailed occupational history is also being considered and the maximum no. of cases (39 %) are found to be students followed by household workers (24 %) and then comes agriculture field worker (17 %) (Table 2).

Table 1 Age and gender distribution

S. no.	Age group (years)	Gender		Total percentage (%)
		Male	Female	
1	11–20	13	10	23
2	21–30	19	16	35
3	31–40	15	12	27
4	41–50	09	06	15
	Total	100		100

In present study, family history is also an important part of observation. Out of 100 cases, 27 % cases have history of single parent i.e. either father or mother being allergic. 15 % of cases cases have both father and mother with history of allergy in one form or other and 24 % give history of their siblings being allergic. 34 % cases do not give any significant family history (Table 3).

In present study, the predisposing allergens are identified from the objective history. Only those factors which cause maximum discomfort are considered. Majority of cases i.e. 32 % are found to be susceptible to the exposure of dust. Seasonal changes also seems to play a significant role in initiating symptoms of allergy in 20 % cases. Foods stuffs are reported as a cause in 16 % cases; while there is no history of any prior exposure in 10 % cases (Table 4).

In present study, the absolute eosinophil count (AEC) of all patient is tested and majority of cases i.e. 84 % are reported to have AEC more than than 300/cumm. Maximum no. of cases i.e. 45 % are found to have AEC between 501 and 800/cumm followed by 34 % cases with AEC between 301 and 500/cumm, 16 % cases with AEC below 300/cumm. And 5 % cases have AEC more than 801/cumm (Table 5).

In present study, all the three spirometric parameters (FVC, FEV₁ and FEF_{25–75} %) are found to be impaired in the 6 % of cases; while two parameters (FEV₁ and FEF_{25–75} %) are found impaired in 9 % of cases and only one parameter i.e. FEF_{25–75} % is found impaired in 64 % of

Table 2 Association with occupation

S. no.	Occupation	Percentage		Total (%)
		Male	Female	
1	Student	24	15	39
2	Household workers	Nil	24	24
3	Agriculture field worker	15	02	17
4	Office work	05	03	08
5	Shopkeeper	08	Nil	08
6	Painter	04	Nil	04
	Total	56	44	100

Table 3 Association with family history

S. no.	Family history of allergy	No. of cases	Total percentage (%)
1	Single parent	27	27
2	Both parent	15	15
3	Siblings	24	24
4	No family history	34	34
	Total	100	100

Table 4 Predisposing factors

S. no.	Predisposing factor	Percentage		Total (%)
		Male	Female	
1	Dust	15	17	32
2	Seasonal changes	12	08	20
3	Foods (fish/milk product)	11	05	16
4	Others (smoke, flowers)	12	04	16
5	Wheat flour	01	05	06
6	No allergic factor	05	05	10
	Total	56	44	100

Table 5 Absolute eosinophil count

S. no	Absolute eosinophil count (AEC)	Percentage of cases (%)
1	Up to 300/cumm	16
2	301–500/cumm	34
3	501–800/cumm	45
4	>801/cumm	05
	Total	100

cases. Remaining 21 % of cases do not show any spirometric parameter impairment. Impairment of spirometric parameters are statistically assessed in association with the epidemiological factors including sex, occupation and predisposing factors (Table 6).

In the present study, the significant $P < 0.05$ is reported only in association of predisposing factor with spirometric parameters. The P value is significant for FEV_{25-75} % as 0.001 and for FVC as 0.037. Rest of the assessed parameters do not show a significant association with spirometric parameters in cases of nasal allergy in the present study.

Discussion

The incidence of nasal allergy in the present study is maximum in the age group of 21–30 years comprising 35 % of total no. of cases which is in accordance with various studies.

Ciprandi et al. stated that majority of the cases of allergic rhinitis fall in the age group of 20–30 years of age [7]. Sheldon J.M had maximum number of cases between 20 and 40 years of the age [27]. MacMillan D in his study, found maximum no. of patients between the age of 15 to 34 years [21]. Lim M.Y reported highest number of patients of allergic rhinitis between 20 and 40 years of age [18].

In the present study, the incidence of allergic rhinitis is little higher in males with male to female ratio of 1.27:1 which is also similar to reports of various studies.

Wallace D.V. in his study reported 66.3 % male and 33.7 % female with male : female being 1.96:1 [28]. Settipane G.A in his case series showed 52 % male and 48 % female, the ratio being 1.08:1 [26]. Sengupta R.P in a total of 92 patients showed 43 male patients and 49 female patients with male to female ratio of 0.87:1 [25].

Occupational incidence being more in students, housewives and agriculture field workers clearly indicates association to increased and continuous allergen exposure.

In the present study, 66 % cases have a positive family history. Davila in the study on genetic aspects of allergic rhinitis emphasized the role of genetics and family history [11].

Woodward reported a positive family history in 48.4 % patients [30] and Ciprandi in 60 % of cases [8]. Lim M.Y studied family history in allergic rhinitis cases and found that 43 % of cases had positive family history [18].

In present study, majority of cases are susceptible to dust exposure. Seasonal changes and food stuffs also seem to play a significant role in initiation of allergic response.

Wallace in his study found that majority of patient of allergic rhinitis were susceptible to dust, followed by wheat flour and milk [28]. Douglas macmillan in a study of 50 cases of perennial rhinitis, found majority of cases being sensitive to dust [21]. Various other studies have shown similar results [10, 13].

In present study, the AEC of all patient was done and majority of cases have AEC more than 300/cumm. William T. K reported 74 % cases of hay fever having blood eosinophilia [29]. D. Macmillan reported eosinophilia in 8 out of 15 cases of allergic rhinitis [21]. Lowell F.C et al. had similar results [20].

In present study, all the three spirometric parameters (FVC, FEV_1 and FEF_{25-75} %) are found to be impaired in the 6 % of cases; while two parameters (FEV_1 and FEF_{25-75} %) found impaired in 9 % of cases and only one parameter i.e. FEF_{25-75} % is found impaired in 64 % of cases. Remaining 21 % of cases do not show any spirometric parameter impairment.

G.Ciprandi, I Cirillo, Tosca MA, Vizzaccaro A. in their study of bronchial hyperactivity and spirometric impairment in patients with perennial allergic rhinitis, studied 100 patients and found 5 cases with reduced FEV_1 and 48 with reduced FEF_{25-75} % [6].

G.Ciprandi, I Cirillo, A. Pistorio in their study of impact of allergic rhinitis on asthma, found 6 % cases with $FVC < 80$ %, 12.8 % cases with $FEV_1 < 80$ % and 87 % cases with $FEF_{25-75} \% < 80$ % of predicted [8].

Ciprandi G, Cirillo I, Klersy C, Marseglia GL, Vizzaccaro A, Pallesstrini E, et al. in their study found 7.9 % cases with impaired FEV_1 values and 24.5 % cases with impaired FEF_{25-75} % values and concluded that impaired FEF_{25} and 75 % values constitutes a relevant predictive factor for severe bronchial hyper responsiveness [7].

Table 6 Effect over spirometric parameters

	FEV _{25–75} %		P Value	FEV ₁		P Value	FVC		P Value
Gender	<80 %	>80 %	0.540	<80 %	>80 %	0.715	<80 %	>80 %	0.557
Female									
No	36	8		6	38		2	42	
%	82	18		14	86		5	95	
Male									
No	43	13		9	47		4	52	
%	77	23		16	84		7	93	
Occupation									
Agriculture			0.304			0.914			0.858
No	14	3		2	15		1	16	
%	82	18		12	88		6	94	
Household workers									
No	17	7		3	21		1	23	
%	71	29		13	88		4	96	
Others									
No	14	6		3	17		2	18	
%	70	30		15	85		10	90	
Students									
No	34	5		7	32		2	37	
%	87	13		18	82		5	95	
%	88	13		13	88		0	100	
%	61	39		6	94		0	100	
%	82	18		18	82		9	91	
Predisposing factor									
Dust			0.001			0.205			0.037
No	27	5		6	26		1	31	
%	84	16		19	81		3	97	
Others									
No	26	0		3	23		2	24	
%	100	0		12	88		8	92	
Seasonal									
No	18	2		2	18		0	20	
%	90	10		10	90		0	100	
Smoke									
No	8	4		4	8		3	9	
%	67	33		33	67		25	75	

Conclusion

Nasal allergy and asthma should be considered as components of a single syndrome involving two parts of the respiratory tract, and from previous studies, it is evident that these two disorders affect each other [14, 22]. Allergic rhinitis frequently present bronchial hyper responsiveness even in the absence of asthmatic symptoms. In these subjects with normal FEV₁ values, bronchial hyper responsiveness may be envisaged as a marker of susceptibility to

develop asthma. On the other hand, in mild asthmatics during inter-critical periods, lung function may be normal concerning FEV₁ values [24]. Moreover, asthma is a chronic inflammatory disease of airways and using other parameters it has been demonstrated as a persistence of inflammation, also in absence of symptoms, mainly involving smaller airways [16, 19]. In these cases, abnormal FEV_{25–75} values may be observed. It has been reported that FEV_{25–75} may be reduced in asthmatics with normal FEV₁ and FVC values [19]. It has been suggested that

FEF_{25–75} might be considered a marker of small airways impairment in mild asthmatics with normal FVC values [3].

The present study further strengthens the impaired spirometric parameters indicating the progression of allergic rhinitis to asthma and highlights the frequent coexistence of bronchial impairment in patients with nasal allergy, thereby supporting the strong link between upper and lower airways. Thus, a careful evaluation of lower airways should be performed also in those patients with nasal allergy alone.

Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

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