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ORIGINAL ARTICLE

Peak Expiratory Flow Rate Assessment to Screen for Asthma in Children With Allergic Rhinitis

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ABSTRACT
The study is to identify bronchial hyper responsiveness in children with allergicrhinitis diagnosed by ARIA, prior to the onset of asthmatic symptoms, by measuring peak expiratory flow rate (PEFR) and its clinical correlates. The effect of treatment of allergic rhinitis on bronchialhyper- responsiveness was determined.
Keywords: *Peak Expiratory Flow Rate, Asthma, Prevalence, Biomass*

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INTRODUCTION

The allergic diseases occur due to the multifaceted collaboration between genetic and environmental factors. In the past 3-4 years, high- income countries have faced allergy epidemics, and nearly a quarter of children have been diagnosed with allergic rhinitis, asthma or eczema. In the Indian subcontinent, there are also reports of rising prevalence of allergic rhinitis and asthma [1, 2]. The burden of asthma in India surpasses the number of people infected with HIV or tuberculosis. The International Study of Asthma and Allergy in Children (ISAAC) reported that the current overallprevalence of wheezing among children aged 6 to 7 and 13 to 14 in India is 7%, with a maximum prevalence of 10 to 20 years.[2] Prominently, more than 50% of this cohort suffer from severe uncontrolled asthma [1]. PreviousIndian study described that the occurrence of allergic rhinitis was 11.3% among children aged 6-7 years and 24.4% among children aged 13-14 years [2,3]. ISAAC Study [4] reports that the current overall prevalence of eczemais 2.7% among Indian children 6-7 years old, and 3.6% among Indian children 13-14 years old. Compared with the high incidence of rhinitis, asthma and eczema, the incidence of food allergies in Indian children between 6 and 11 years old is as low as 0.14% [5]. In the world, India is one of the most concentrated areas of air pollution caused by biomass, fossil fuels and vehicle exhaust. The use of mosquito coils, incense and oil fume sticks is an important cause of indoorpollution [6]. Nearly 77% of India's population is exposed to $PM_{2.5}$ levels thatexceed the 40 μg/m^3 limit set by the Indian National Air Quality Standard (the limit set by the World Health Organization is <10 μg/m^3) [7]. Exposure to ambient $PM_{2\cdot5ary}$ is associated with asthma exacerbations, cardiovascular events, and premature deaths, and is associated with 26·2% of global disability adjusted life years [7,8]. In India, weather, pollen and fungal spores, cockroaches and other insects and other living conditions vary greatly, and there are few meteorological data about environmental allergens [9]. Due to the lack of environment, changes in this situation and lack of data make the situation more complicated. India's method of obtaining standardized allergen extracts for skin testing makes accurate allergy diagnosis challenging, leading to poor disease characteristics and generating unreliable epidemiological data [9].There is a time relationship between the onset of allergic rhinitis and asthma. Rhinitis often occurs before the onset of asthma [10], which is explained by the "unified airway hypothesis" [11, 12]. Many researchers have demonstrated that bronchial hyper responsiveness before the onset of asthma symptoms supports this hypothesis [13-15]. Many studies support the view that treatment of allergic rhinitis can prevent asthma attacks [16, 17]. Hence, early recognition and appropriate treatment of allergic rhinitis is necessary. The methacholine provocation test used to determine bronchialhyper responsiveness in these studies is not

available in many centers, andit is not feasible for daily clinical use. Due to the ease of operation and lackof invasiveness, the measurement of peak expiratory flow rate is one of the most commonly used measurements of bronchial hyperresponsiveness [18, 19].The ARIA (Allergic Rhinitis and its Impact on Asthma) committee has proposed new guidelines for the diagnosis of allergic rhinitis.[6] Varied definitions for allergic rhinitis make it difficult to interpret older studies. Hence, the present study primarily intended to find out the usefulness of peak expiratory flow determination as an early marker of bronchial hyper- responsiveness in children with allergic rhinitis (diagnosed by the universally accepted revised ARIA criteria).

MATERIAL AND METHODS

Study Design

Prospective observational study

Study Site

The study done in the Allergy and Asthma clinic in Department of Pediatrics at Shree Balaji Medical College and Hospital, Chennai.

Study period

December 2018 to June 2020.

Source and study population

The source of the population was all allergic rhinitis patients attending Sree Balaji Medical College, Hospital, Chennai and the target population was all rhinitis patients who fulfilled the inclusion criteria. Minimum sample size needed for adequate statistical power was considered as 94. Hence, the present study included 94 patients.

Eligibility criteria

Inclusion criteria

Children age ≥ 5 years diagnosed as allergic rhinitis as perthe ARIA

- watery anterior rhinorrhea
- Sneezing especially paroxysmal
- Nasal obstruction
- Nasal pruri
- conjunctivitis+/-
- In the absence of
- Unilateral symptoms
- Nasal obstruction without other symptoms
- Mucopurulent rhinorrhea
- Postnasal drip with thick mucus and without anteriorrhinorrhea
- Recurrent epistaxis
- Anosmia

Exclusion criteria

- Children with asthma symptoms or sign who will obviouslyhave low PEFR
- Recurrent wheeze
- Recurrent isolated cough
- Recurrent breathlessness
- Nocturnal cough
- Tightness of chest
- Generalised rhonchi
- Prolonged expiration
- Chest hyperinflation
- Children on steroids or bronchodilators
- Children with dyspnea/tachypnea of any cause which canaffect PEFR measurement.

Data Collection

All consecutive patients who fulfilled the inclusion criteria and consented to participate in the study were included in the study.

- ✓ Demographic details such as age (in years), height (in centimeters), weight (in kilograms) and Medical details (pre-morbidities) were collected and Body mass index were calculated.
- ✓ PEFR measured as per the ARIA guidelines.
- ✓ The variation in PEFR among different groups are analyzed using unpaired t test and one-way anova test.

- ✓ The change in PEFR after treatment of allergic rhinitis is determined. The difference after treatment is statistically analyzed using paired t test.

Data Processing and Statistical methods

The data was entered with an excel sheet. Data was exported to Medcalc version 19.0 for further processing. All categorical variables were expressed as percentages and the continuous variables were expressed as mean ± standard deviation. The statistical significance of mean differences was compared using unpaired t-test and one way ANOVA. All values wereconsidered significant if the *P*-value was < 0.05.

Ethical Consideration

This research was strictly fulfilling the ethical guidelines as outlined in the declaration of Helsinki. The participants signed a consent form and were assured that their participation was completely voluntary and could be terminated at any time without compromising their medical care. The study protocol was approved by the Sri Balaji Medical College InstitutionalReview Board.

RESULTS

TABLE 1: ARIA classification of the study participants

Variables	Mild IntermittentAR (N= 53)	Moderate- Severe IntermittentAR (N=06)	Mild Persistent AR (N=30)	Moderate-Severe Persistent AR (N=05)
Age	8.79±2.56	7.83±1.47	8.1±2.38	7.6±0.89
M:F	35:18	3:3	17 :13	2:3
Pulse rate	90.13±11.47	90.83±11.07	90.7±10.22	87.2±6.41
Respiratory rate	22.79±5.26	24.16±4.30	24.26±4.81	23.8±2.68
Weight	27.83±8.63	24.33±5.04	25.8±7.73	23.2±3.34
Height	129.58±15.41	124±8.83	125.1±14.52	122.4±4.97
BMI	16.1±1.15	15.63±1.21	16.12±1.08	15.4±1/.05
PEFR	222.73±73.15	160±41.83	181.16±56.36	121±12.94

Among the study participants, 56.38 % of children were belongs to the mild intermittent allergic rhinitis group and 31.91 % were mild persistent allergic rhinitis group

TABLE 2: One-Way Analysis of Variance of PEFR in ARIA groups ofchildren

PEFR	Sum of squares	df	Mean square	F	Significance
Between groups	78842.265	3	26280.755	6.227	.001
Within groups	379832.469	90	4220.361		
Total	458674.734	93			

The moderate to severe groupsof intermittent and persistent were 6.38 % and 5.31% respectively. The one way ANOVA analysis indicated that there were significant variation of PEFR among the ARIA groups.

TABLE 3: Comparison of variables based on genders

	Boys	Girls	*P* Value
Age in years	8.62±2.46	8.18±2.35	0.5401
BMI	16.16±1.13	15.86±1.11	0.8749
Height in cm	128.41 ±14.92	125.97±14.11	0.5094
Weight in Kg	27.32±8.21	25.86±7.83	0.7683
Pulse rate	89.91±11.34	90.43±9.94	0.3919
Respiratoryrate	23.16±4.92	23.75±5.11	0.0218
PEFR	204.64±65.42	193.10±78.23	0.0710

The study variables categorized based on the gender and compared each other to find out the existence of significant difference or not. The comparison revealed that there was no significant variationamong the

study variables based on gender. This result indicated that there were no significant difference between the genders

TABLE 4: Comparison of variables based on other classification

Variables	Runners (N=69)	Blockers (N=43)	*P* Value
Age in years	8.65±2.43	8.55 ±2.63	0.8925
M:F	42:27	21:22	NS
BMI	16.11±1.17	16.07±1.06	0.7260
Height in cm	128.62±14.70	128.16±15.82	0.8636
Weight in Kg	27.36±8.24	27.23±8.83	0.8686
Pulse rate	89.92±10.70	89.83±10.92	0.3714
Respiratory rate	22.89±4.76	23.60±5.03	0.7398
PEFR	207.31±71.65	176.51±41.55	0.0118

There were 73.40 % of study participants belongs to runners (with prominent rhinorrhoea) and 45.74 % were blockers (with prominent nose block). The study variables were compared based on this classification and found that the PEFR value was significantly lower in blockers group than runners group (P=0.0118). However, theother study variables did not show any significant difference

TABLE 5: Effect of treatment of AR on PEFR

Variable	**Pre-treatment**	**Post -treatment**	***P* value**
PEFR	200±70.27	225.05±71.23	<0.0001

The baseline PEFR was abnormal in 94 patients. These children were given treatment as per the ARIA recommendations and followed them for 2 weeks. After 2 weeks, 50 children (53.19 %) were shown significant improvement in PEFR value

DISCUSSION

On the basis of the new ARIA classification, a retrospective study in nine countries showed that intermittent rhinitis was observed in less than20% of patients, whereas patients with persistent rhinitis comprised approximately 80%. Although 25-30% of allergic rhinitis patients had mildallergic rhinitis, 60-70% had moderate-severe rhinitis[14]. In the present study,Mild allergic rhinitis was observed in 56.38% and moderate-severe allergic rhinitis was observed in the remaining children. These findings are exactly contradictory to the finding in other studies mentioned above. This is mainly because of the strict inclusion and exclusion criteria. Children with asthmatic symptoms and those who are on bronchodilators and those withdyspnoea or tachypnoea of any cause are excluded from the study[15]. Most of these children thus excluded have moderate-severe and persistent allergic rhinitis. This probably explains the predominance of mild and intermittentallergic rhinitis in the present study[16]. In the present study, there was significant (53.19%) improvement in PEFR following treatment of allergic rhinitis alone. A study demonstrated in a double-blind, placebo-controlled, parallel-group study in 50 allergic rhinitis, that treatment with fluticasone propionate partially prevents the increase in bronchial responsiveness. In a study of 205 children, 6 to 14 years old, from 6 European paediatric centres done by Moller *et al* [17], it was shown that specific immunotherapy for seasonal rhino conjunctivitis reduces the development of asthma. A birth cohort study in 120 children by Arshad *etal* [18] suggested that allergen avoidance may prevent some cases of childhood asthma. The ETAC study [19] done in 343 atopic children 65 demonstrated the usefulness of cetirizine in the prevention of asthma. In the present study, all the therapeutic modalities including allergen avoidance, cetirizine and nasal steroids were used for treating children as per the ARIA criteria. The observation of improved BHR with treatment of allergic rhinitis alone was very important as this suggests a halt in the march of the disease to overt asthma [20].

CONCLUSION

PEFR positively correlated with age, height, weight and BMI.The 6-9 years age group was predominant. PEFR is abnormal in 44% of children with allergic rhinitis. Peak expiratory flow rate declines linearly as the severity of allergic rhinitis increases. Severe persistent and severe intermittent allergic rhinitis children had significant reduction in PEFR <60% 73.40 % of study participants belongs to runners (with prominent rhinorrhoea) and PEFR value was significantly lower in blockers group than runners group. Peak expiratory flow rate increases significantly aftertreatment of allergic rhinitis alone.

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