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PEAK EXPIRATORY FLOW RATE ASSESSMENT: AN EARLY PREDICTOR FOR ASTHMA IN CHILDREN WITH ALLERGIC RHINITIS.

Paediatrics

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ABSTRACT

Background: To use Peak Expiratory Flow Rate assessment as an early predictor for asthma in children with allergic rhinitis.
Methods: A prospective observational study was conducted in the outpatient Department of Pediatrics at Govt. Thiruvarur Medical College Hospital between July 2019 and March 2020. 75 children with allergic rhinitis satisfying the inclusion criteria were recruited for the study. The Peak Expiratory Flow Rate (PEFR) was measured by a Mini Wright Peak Flow Meter and compared with the mean value of the Indian children. The changes in PEFR after treatment for allergic rhinitis was determined.
Results: The mean expiratory flow rate expressed as percentage of expected PEFR was 78.38% in males and 84.43% in females. The peak incidence of allergic rhinitis was in 6-9 years. Of the 75 children 40(53.3%) had mild intermittent allergic rhinitis, 25(33.3%) had mild persistent allergic rhinitis, 6(8%) had moderate-severe intermittent allergic rhinitis and 4(5.3%) had moderate-severe persistent allergic rhinitis. The initial PEFR was abnormal in 34(45.3%) children. All the 34 children showed significant improvement in their follow-up PEFR (P<0.0001).
Conclusion: There was a linear co-relation between the severity of allergic rhinitis and the reduction in PEFR. As the number of cardinal symptoms increases the PEFR decreases. There was significant improvement in PEFR following treatment for allergic rhinitis.

KEYWORDS

Allergic Rhinitis, Asthma, Peak Expiratory Flow Rate, Bronchial Hyper-responsiveness.

INTRODUCTION:

Allergic Rhinitis (AR) is a common chronic disease affecting 20-30% of children. Childhood AR is associated with a three-fold increase in risk for asthma at an older age[1]. The increasing recognition over the last 50 years that AR and Asthma frequently co-exist has led to the concept that these seemingly separate disorders are manifestations of the same disease expressed to a greater or lesser extend in either the upper or the lower airways. The atopic diseases of the nose and the lungs co-exist in many children. Nasal challenge testing in asthmatics causes non-specific bronchial hyper-responsiveness and bronchial challenge testing in children with rhinitis leads to an asthmatic response with recruitment of inflammatory and pro-inflammatory mediators. This suggest that the upper and lower airway may be considered as a unique entity influenced by a common evolving inflammatory process which may be sustained and amplified by interconnected mechanisms[2]. Bronchial hyper-responsiveness to a variety of stimuli is the hallmark of asthma. This bronchial hyper-responsiveness is often seen in children with AR but without pulmonary symptoms. So early detection of children with AR and prompt treatment of the same can have a marked beneficial effect on preventing the development of asthma in future. In several studies, the methacholine challenge test was used to determine the bronchial hyper-responsiveness. This test has many practical difficulties for day-to-day use in office practice. So the measurement of PEFR has become one of the most commonly used measures to determine bronchial hyper-responsiveness. The current study aims to find the usefulness of PEFR as an early marker for bronchial hyper-responsiveness in children with AR.

Methods:

This prospective observational study was conducted between July 2019 and March 2020 in the outpatient Department of Pediatrics at Govt. Thiruvarur Medical College Hospital.

Inclusion Criteria:

Children >5 years diagnosed as Allergic Rhinitis defined by ARIA [presence of 2 or more of the following symptoms]
Watery anterior rhinorrhoea, sneezing, nasal obstruction, nasal pruritis and conjunctivitis.

Exclusion Criteria:

Children with asthma symptoms and signs, recurrent wheeze, nocturnal cough, chest tightness.

Children on steroids or bronchodilator,
Children with breathlessness which can affect PEFR measurement.

After getting informed consent 75 children satisfying the above criteria were included in the study population. The PEFR was measured by a mini Wright Peak Flow Meter and compared with the mean value of Indian children. PEFR=[(height in cm-100)5]+100. The changes in PEFR after treatment for AR was determined. The PEFR values are grouped on several parameters like age, sex, cardinal symptoms and ARIA classification. The unpaired *t* test and one-way ANOVA test were used to analyze the variations in PEFR among different groups. The paired *t* test was used to analyze the differences in PEFR after treatment. A *P* value of ≤ 0.05 was considered statistically significant.

RESULTS:

Of the 75 children with allergic rhinitis 40(53.3%) were males and 35(46.7%) were females. The male to female ratio was 1.14:1. The prevalence of allergic rhinitis was 12%. The mean flow expiratory rate expressed as percentage of expected PEFR is 78.38% in males and 84.43% in females. Using the unpaired *t* test the difference is not statistically significant (P=0.1058) Table 1.

Table 1: Gender & PEFR

Gender	No.	%	Mean % of expected PEFR
Male	40	53.3	78.38
Female	35	46.7	84.43

Two tailed P value = 0.1058

Majority of the children with allergic rhinitis were in the age group of 6-9 years. Among the different age groups the mean percentage of PEFR does not vary significantly (P=0.2) Table 2.

Table 2: Age Distribution & PEFR

Age in years	No.	Mean % of expected PEFR
6-9	46	80.4
10-13	23	81.1
≥14	06	81.8

P value by one-way ANOVA test was 0.2

Of the 75 children 40(53.3%) have mild intermittent AR, 25(33.3%) have mild persistent AR, 6(8%) have moderate-severe intermittent AR and 4(5.3%) have moderate-severe persistent AR. The number of children with low PEFR (<80% of expected) increases significantly as the severity of AR increases (P<0.0001) Table 3.

Table 3: ARIA classification, PEFR & severity of AR

Class	>80%	60-80%	<60%	% of ab normal	Mean % of expected PEFR
Mild intermittent	30	10	0	25	88

Mild persistent	13	08	4	48	78
Severe intermittent	02	01	3	66.7	65
Severe persistent	00	01	3	100	54
Total	45	20	10	40	

P value by one-way ANOVA test is <0.0001

There were 30(40%) blockers (predominant symptom nasal block), 45(60%) runners (predominant symptom rhinorrhoea), 57(76%) had two cardinal symptoms, 15(20%) had three cardinal symptoms, 9(12%) had four cardinal symptoms and 4(5.3%) had all symptoms.

Table 4: Cardinal Symptoms

Cardinal Symptom	No.	Pvalue	Mean % of expected PEFR
Rhinorrhoea	57	0.27	82
Sneezing	70	0.70	81
Noseblock	30	0.005	77
Itching	26	0.08	76
Conjunctivitis	10	0.06	70

P value by one-way ANOVA was 0.11

Apart from nasal blockers (P=0.005) the presence of other cardinal symptoms did not affect the mean percentage of expected PEFR. Table 4.

As the number of cardinal symptoms increases the mean percentage of expected PEFR decreases (P=0.04).Table 5.

Table 5: No. Of Cardinal Symptoms & PEFR

No.ofcardinal symptoms	Mean % of expected PEFR
2	84
3	78
4	69
5	65

P value by one-way ANOVA was 0.04

Table 6: Effect Of Treatment On AR & PEFR

No.	Pre treatment	Post treatment	No.	Pre treatment	Post treatment
1	42	79	18	53	81
2	43	80	19	55	98
3	43	82	20	55	96
4	45	83	21	55	96
5	45	83	22	55	79
6	45	85	23	56	90
7	46	90	24	56	92
8	47	86	25	56	98
9	48	84	26	56	96
10	48	90	27	56	96
11	48	88	28	56	90
12	48	90	29	56	84
13	49	96	30	57	98
14	49	91	31	57	98
15	50	95	32	57	95
16	52	87	33	57	93
17	52	89	34	57	97

The initial PEFR was abnormal in 34(45.3%) children. These children were followed up after two weeks of treatment for allergic rhinitis as per ARIA protocol. All the 34 children showed significant improvement in their follow-up PEFR. The P value by paired *t* test was <0.0001 which was highly significant.

DISCUSSION:

Over the past 50 years an upsurge in allergic rhinitis has been observed throughout the world, with some symptom surveys reporting incidence rate approaching 40%. Among the pediatric out-patients the incidence of AR in our institute was 12%. This was at par with the ISAAC study[3]. The prevalence of asthma in children with allergic rhinitis was 45.3% which is similar to the prevalence of 10-40% from other studies[4-6]. The male to female ratio of allergic rhinitis in our study was 1.14:1, which co-relates with the SAPALDIA cross sectional study[7] where the gender ratio was 1.13:1. The peak age for allergic rhinitis was 6-9 years which is in unison with the study by O Connell et al.[8] where the incidence is peak at 8-10 years of age.

In the current study, the incidence of bronchial hyper-responsiveness was 45.3% which matches with the studies by Mete et al[9] and Braman et al[10]. In both the studies the methacholine challenge test was used along with spirometry. But the ease of performance has made PEFR measurement as one of the most commonly used measures for bronchial hyper-responsiveness; the present study also assert the same. Thus this current study shows children with allergic rhinitis having bronchial hyper-responsiveness have increased risk of developing asthma.

As per Pawankar R et al[11] on analysis of new ARIA classification in Asian countries 80% had persistent rhinitis 28% had intermittent rhinitis. This was contrary to our study where the intermittent rhinitis comprised of 61.3% and persistent rhinitis 38.7%. The severity of allergic rhinitis co-relates well with PEFR (P<0.0001) indicating that for classification of allergic rhinitis, ARIA guidelines should be used. The prevalence of two, three, four and five cardinal symptoms are 76%, 20%, 12% and 5.3% respectively, however it was 25.5%, 13.1%, 6.5% and 3% respectively in the study by Wang et al[12]. As the number of cardinal symptoms increases the lower is the PEFR. In the present study the commonest presenting symptom was sneezing followed by rhinorrhoea, nasal block, nasal itching and conjunctivitis. There was also a strong co-relation between the presence of nasal block and low PEFR which was similar to the observation by Krithika A.P. et al[13]. The improvement in PEFR after treatment for AR was extremely significant (P<0.0001) in unison with other studies.

CONCLUSION:

Among children with allergic rhinitis PEFR was abnormal in 45.3%. There was a linear co-relation between the severity of allergic rhinitis and the reduction in PEFR. As the number of cardinal symptoms increases, the PEFR decreases. Extremely significant improvement in PEFR occurs following treatment for allergic rhinitis.

Thus monitoring the PEFR is a simple and cost-effective bedside tool in children with allergic rhinitis for prediction of asthma in future. These children when identified and treated adequately for allergic rhinitis the future occurrence of asthma could be prevented.

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Conflict Of Interest: None

Ethical Approval: Approved by Institute Ethics Committee

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