Editorial

A study to compare the pulmonary function test in non-asthmatic allergic and non-asthmatic non-allergic (Apparently Healthy) children- in age group 6-12 years

Tikkas R[1], Ramteke S.[2], ChakravartyP.[3], Dave L.[4], Srivastava J.[5]

[1]Dr. Rajesh Tikkas, Associate Professor, [2]Dr. Sharmila Ramteke, Assistant Professor, [3]Dr. Pushpendra Chakravarty, Resident Doctor, Department of Pediatrics, [4]Dr. Lokendra Dave, Professor and Head, Department of TB Chest, [5]Dr. Jyotsna Srivastava, Professor and Head, Department of Pediatrics, all authors are affiliated with Gandhi Medical College, Bhopal, MP, India

Corresponding Author: Dr Sharmila Ramteke, Assistant Professor, Department of Pediatrics, Gandhi Medical College, Bhopal, M.P., E-mail:sharmi.ramteke@gmail.com

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Abstract

Aims & Objective: To compare Pulmonary Function Test in Non-Asthmatic Allergic and Non-Asthmatic Non-Allergic children. **Background:** Many studies have shown that Allergic children are prone to develop Asthma or may have subclinical symptoms of asthma. By comparing pulmonary function test in Allergic children and Non-Allergic children we tried to find out impact of allergy on pulmonary function. We compared the pulmonary functions in the healthy Allergicand Non-Asthmatic children. **Method:** This is cross sectional observational case-control study. All 75 children who were selected randomly, in pediatric Out Patient Department (OPD) undergone Burlingtonent Clinical Questionnaire scoring system, for the clinical assessment of possibility/probability of Allergy (score more than 8). Then, all were evaluated through pulmonary function test by Spirometry. Data of Premedication and Post medication Pulmonary Function parameters were collected and have been compared in relation to Allergic and Non-Allergic possibility. Result were expressed as Mean± SD (standard deviation) and p value was calculated with student paired 't' test and unpaired 't' test. **Results:** In our study, statistically significant difference ($p<0.01$) was found in Pre-bronchodilator Pulmonary Function parameters (%FVC & %FEF25-75) among possible Allergic & possible Non-Allergic group of children, which, however, was non-significant in post bronchodilator Pulmonary function test. On comparing the pre and post medication pulmonary function test parameters (% FEV1, % FVC, % FEV1/FVC, % FEF 25-75, % PEFR(SPIROMETRY), there was statistically significant ($p<0.01$) positive increment in all these individual lung spirometry parameters in possible Allergic group and not in healthy control group. Although the spirometric parameters did not fulfill the criteria of Asthma, but small airway function parameters were abnormal among possible allergic children. **Conclusion:** There is some correlation between clinical suspicion of Allergy and changes in lung parameters in Pulmonary Function Test, which may favoroccurrence of future lung disease and the potential of reversibility in allergic groups by appropriate therapeutic guidance.

Keywords: Allergy, Burlingtonent Clinical Allergy Questionnaire, Pulmonary Function Test

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Introduction

Allergic disorders are major health problems worldwide and their incidence is increasing day by day. There are many studies done in past which shows that one variety of Allergic disorder is mostly associated with other system's allergic manifestations, as is also reflected in the concept of united airway disease[1]. Nasal symptoms have been reported to occur in 28-78% Asthmatics while 17-38% of children with Allergic Rhinitis (AR) have coexistent Asthma [2]. Incidence of these allergies has been increasing worldwide over the recent years. Prevalence is 10-30% in different parts of world according to World Allergy Organization report. [3]. Recent survey carried out in India shows that 20-30% of population suffer from Allergic Rhinitis and 15% pediatric population suffer from Asthma alone. In India, AR is considered to be a trivial and mild disease, despite the fact that symptoms of rhinitis were present

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in 75% of asthmatic children and 80% of Asthmatic adult [2].

All Allergic children are prone to develop Asthma or may initially have subclinical symptoms. Overt asthma can easily be diagnosed on the basis of history and pulmonary function test. Many children may also develop subclinical or asymptomatic atopy, allergy and Asthma, which could not be easily detected by history alone. However, the possibility of having Allergy in these children can be traced by history and performing questionnaire based examination. Burlingtonent Clinical Questionnaire Scoring System [4] for Allergy is one of them, which was used in present study. In this study, by comparing pulmonary function test in Allergic children and Non-Allergic children, we have tried to find out significance and applicability of pulmonary function test in Allergic children to diagnose early asthma. Present study is an effort to find out the difference and change in pulmonary function and bronchodilator response in the Non-Allergic healthy controls and Allergic Non-Asthmatic children.

Material and Method

This was a hospital based observational study which was conducted at Department of Pediatrics Gandhi Medical College and Associated Kamala Nehru Hospital Bhopal during March 2013 - October 2014. Institutional ethical clearance was taken. Total 75 children, in 6-12 years age group, were randomly selected in OPD and written informed consent was obtained from parents/ guardian. Children having any subacute or chronic cardiorespiratory/ chest wall disease/ infectious disease including pulmonary TB were excluded.Burlingtonent Clinical Questionnaire scoring system was performed, for the clinical assessment of possibility of Allergy. Children with score>8 were considered as possible/ probable Allergic and score <8 as possible Non-Allergic.

Burlingtonent Clinical Questionnaire scoring system [4] is developed in west Burlington Iowa for assessment of Allergy with the help of 15 questions that enquires about clinical symptoms and categorizes children into 4 categories: Score <8- Allergy is unlikely; Score 8-12- Allergy is Possible; Score 13-20- Allergy is Probable; Score >20- Allergy is very likely

For ease of analysis, all patients in group 2,3,4 above are clubbed together as possible allergic group. And group 1 patients were taken as control group. Among total 75 participants 48% (36) children were found to have score >8, who were possible Allergic patients and possible Non-Allergic healthy subjects were52 %(39) having score <8.

Further, all of them hadundergone pulmonary function testing with help of RMS Helios 401 spirometry and the collected data were analyzed and there comparative interpretation was done by appropriate statistical scientific methods.

Observations

Percentage distribution of age groups among possible allergic and non allergic children are almost equal. In age group 6-9 years, total 15 out of 32 study candidates, whereas in 10-12 years age group, 21 out of 43 study subjects were possible allergic children. Male proportion was 23 children out of 41 male study subjects, whereas among female, 13 out of 34 patients were found possibly allergic. In possible allergic group, an ODD's ratio of male children being allergic as compared to female was 2.044 with Confidence Interval 0.81-5.29. Observations for study and their statistical interpretation is being tabulated here (table 1 to4) for ease of understanding.

Table-1: Comparison of Mean prebronchodilator spirometric values of possible Allergic and possible Non-Allergic children group (score<8)

Pulmonary function parameters pre bronchodilatation	Possible Non-allergic children (n=39)		Possible allergic children (n=36)		p value
	Mean	± SD	Mean	± SD	
% Fev1	102.4	15.3	98.2	15.7	0.26
% FVC	**106.6**	**10.1**	**102.0**	**10.1**	**0.03 significant**
% FEV1/FVC	96.2	10.6	96.3	11.6	0.999
% FEF 25-75	**77.3**	**17.3**	**67.9**	**19.2**	**0.034 significant**
% PEFR (SPIROMETRY)	90.2	20.1	88.7	15.5	0.81

Our study observation [TABLE 1] shows different lung parameters in possible Allergic and possible Non-Allergic children before medication. Statistically significant difference was observed in %FVC, %FEF25 -75 among possible Allergic and possible Non-Allergic children group

Table-2: Comparison of Mean post bronchodilatation spirometric values of possible Allergic (score>8) and possible Non-Allergic children(score<8)

Pulmonary function parameters post bronchodilators	Non allergic group (n=39)		Possible allergic group (n=36)		p value
	MEAN	± SD	MEAN	± SD	
% FEV1	104.0	14.5	107.2	16.8	0.422
% FVC	107.3	12.1	107.8	11.4	0.707
% FEV1/FVC	94.8	10.9	99.4	9.2	0.088 Significant
% FEF 25-75	77.6	21.0	77.3	15.4	0.81
% PEFR (SPIROMETRY)	88.1	22.5	95.4	13.4	0.106

This reflects post bronchodilator medication spirometric parameters in both groups. There was no statistical significant difference between possible Allergic & possible Non-Allergic groups.

Table-3: Comparison of Mean pre and post bronchodilator pulmonary function parameters of possible non-allergic children (score<8)

Pulmonary function parameters	Possible Non-allergic group (n=39) prebronchodilator		Possible non-allergic group(n=39) postbronchodilator		p value
	MEAN	±SD	MEAN	±SD	
% FEV1	102.4	15.3	104.0	14.5	0.670 NS
% FVC	**106.6**	**10.1**	107.3	12.1	0.707 NS
% FEV1/FVC	96.2	10.6	94.8	10.9	0.222 NS
% FEF 25-75	**77.3**	**17.3**	77.6	21.0	0.913 NS
% PEFR (SPIROMETRY)	90.2	20.1	88.1	22.5	0.509 NS

Table-4: Comparison of Mean pre and post medication pulmonary function parameters of possible allergic children (score>8)

Pulmonary function parameters	Possible allergic group (n=36) prebronchodilator		Possible allergic group (n=36) postbronchodilator		p value
	MEAN	± SD	MEAN	± SD	
% FEV1	98.2	15.7	107.2	16.8	<0.001 significant
% FVC	**102.0**	**10.1**	107.8	11.4	<0.001 significant
% FEV1/FVC	96.3	11.6	99.4	9.2	0.004 significant
% FEF 25-75	**67.9**	**19.2**	77.3	15.4	<0.001 significant
% PEFR (SPIROMETRY)	88.7	15.5	95.4	13.4	<0.001 significant

As shown in [table 3 & 4] various parameters [% FEV1, % FVC, % FEV1/FVC, % FEF 25-75, % PEFR(Spirometry), improved after medication in possible Allergic group which was statistically significant (p value < 0.001) while in possible Non-Allergic group it was insignificant.

Discussion

Lombardi C et al [5] studied that through a specific questionnaire, we can suspect Allergic Asthma among adolescent age group. The questionnaire was administered to a group of adolescents after a diagnosis of Allergic Asthma. The diagnosis was based on history, clinical examination, pulmonary function tests and Allergy tests. They found positive correlation between clinical questionnaire outcome and diagnosis of asthma in adolescents. Allergic rhinitis is the most common of all the atopic disorders, it is most commonly associated with Asthma[6,7,8].

In our study and in a study done by Choudhary P et al [9] study population was classified according to Burlingtonent Clinical Questionnaire Scoring System. Chaudhary P et al found 75 % Allergic children in their study population. Whereas in our study 48% children are found to have possible/ probable allergic manifestation.

Our study observation [TABLE 1] shows different lung parameters in possible Allergic and possible Non-Allergic children before medication. Statistically significant difference was observed in %FVC, %FEF25 -75 among possible Allergic and possible Non-Allergic children group, Which was comparatively less in possible Allergic children and this particular findings reflects that these children are prone to compromised pulmonary function as far as small airways function and forced vital capacity is concerned which is in favor of early stage of mixed lung disorders.

In [TABLE 2] reflects post bronchodilator medication spirometric parameters in both groups. There was no statistical significant difference between possible Allergic & possible Non-Allergic groups. However, there was increment in two pulmonary function parameters (%FVC & %FEF25-75) after medication reflecting post medication bronchodilatation.

As shown in [TABLE 3 & 4] various parameters [% FEV1, % FVC, % FEV1/FVC, % FEF 25-75, % PEFR(Spirometry), improved after medication in possible Allergic group which was statistically significant (p value < 0.001) while in possible Non-Allergic group it was insignificant.

Gildea and McCarthy [10] stated that FVC is a measure of lung volume and is usually reduced in restrictive disorders. It may also be reduced due to severe airflow obstruction and air trapping. In our study, we found abnormal and statistically significantly different FVC among possible allergic group of children.

Cochrane et al [11] stated that % FEF 25 – 75; a sensitive parameter may be useful for long term studies in individuals when onset of obstructive disease is suspected. However, as per the Knudson et al [12], it was not recommended for routine assessment of the bronchodilator response due to intra-individual variability. In present study, possible allergic children show statistically significant difference in pre and post bronchodilator values of FEF 25-75 parameter.

Bronchial hyper responsiveness may be seen in children with Allergic rhinitis. This could represent coexistent but unrecognized Asthma. This is clear from observation table 1 to 4 in present study that spirometric function are little abnormal or different in possible allergic age group with an obvious significant post bronchodilator response. And hence, they may be future candidates for possible future obstructive airway disease.

A link between Allergic rhinitis and Asthma is evident from epidemiologic, pathophysiologic, and clinical studies. Eggleston PA et al [13] found that inflammatory processes of the upper airway might alter the responsiveness of the lower airway.

Samoliński B et al [14] showed Dysfunction of the upper and lower airways frequently coexists, and they appear to share key elements of pathogenesis. The effective management of Allergic rhinitis relieves symptoms of Asthma. Chhabra SK et al [15, 16] Bavvek et al [17] Ciprandi G et al[18] also demonstrated AR and Asthma may be associated, and bronchial hyperreactivity is quite common in Allergic Rhinitis children.

In present study, there was a limitation that we have only done a cross sectional observational study and no linkage between present allergic patients getting converted into asthma could be established, but looking at the existing evidences available in literature, as discussed, it can be recommended that children with possible allergic manifestation are at high risk to develop future bronchial asthma and they should be guided by preventive management as early as possible. Questionnaire based evaluation may help clinicians to find possibility of allergy.

Conclusions

There is correlation between clinical suspicion of Allergy and changes in lung parameters in spirometry test, which favors' possibility of future disease of lung and the potential of reversibilityof lung functions in allergic group of patients, by timely intervention and preventive management we can avoid or properly manage future asthma in this group of children .

What this study Adds to existing Knowledge- This study adds in the existing knowledge that even if the individual or patient does not fulfill the criteria for asthma in terms of Pulmonary Function Test indices even then there is subclinical changes in PFT indices and these patients are in need of regular follow up and holistic management, so that timely interventions can be taken.

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Abbreviations

FEV1- Forced Expiratory Volume in 1 second

FVC- Forced Vital Capacity

FEF - Forced Expiratory Flow

PEFR- Peak Expiratory Flow Rate

AR- AllergicRhinitis

OPD- Outdoor Patient Department

TB- Tuberculosis

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References

1. Aria – Position Paper Journal Of Clinical Immunology 108 – Suppl-5-2001.

2. Wallace DV, Dykewicz MS, Bernstein DI, et al.Joint Task Force on Practice; American Academy of Allergy; Asthma & Immunology; American College of Allergy; Asthma and Immunology; Joint Council of Allergy, Asthma and Immunology. The diagnosis and management of rhinitis: an updated practice parameter. J Allergy Clin Immunol. 2008 Aug;122(2 Suppl):S1-84. doi: 10.1016/j.jaci.2008.06.003.

3. Pawankar R, CanonicaGw, Holgate St Et Al. World Allergy Organization White Book On Allergy 2011-2012 Executive Summary. World Allergy Organization.

4 Douglas E. Henrich, M.D. Jennifer K. Berge, M.D. Burlington Ear, Nose &Throat, P.C. West Burlington Iowa Http://Www.Burlingtonent.Com/Files/Allergy-Questionnaire.Pdf West Burlington Lowa1225 South Gear,Avenuesuite 255, West Burlington, Iowa, 52655

5. Lombardi C1, Gani F, Landi M, Boner A, CanonicaGw, Passalacqua G,Clinical and Therapeutic Aspects Of possible Allergic Asthma In Adolescents. Pediatr Allergy Immunol. 2003 Dec; 14(6):453-7.

6. Bousquet J, Van Cauwenberge P, Khaltaev N; Aria Workshop Group; World Health Organization. Allergic rhinitis and its impact on asthma. J Allergy Clin Immunol. 2001 Nov;108(5 Suppl):S147-334.

7. Grossman J. One airway, one disease. Chest. 1997 Feb;111(2 Suppl):11S-16S.

8. Passalacqua G, Ciprandi G, Canonica GW. The nose-lung interaction in allergic rhinitis and asthma: united airways disease. Curr Opin Allergy Clin Immunol. 2001 Feb;1(1):7-13.

9. Rajesh tikkas,Lokendra Dave, Priyanka Choudhary et al. A study of allergic sensitization to eight common allergens in pediatric patients with nasobronchial allergy. Journal of evolution of medical and dental sciences 2015; 4(63):11001-11007

10. Gildea TR, McCarthy K. Pulmonary Function Testing Clevland Clinic Disease management project, January ,2009, on line

11. Cochrane GM, Prieto F, Clark TJ. Intrasubject variability of maximal expiratory flow volume curve. Thorax. 1977 Apr;32(2):171-6.

12. Knudson RJ, Lebowitz MD, Holberg CJ, Burrows B. Changes in the normal maximal expiratory flow-

volume curve with growth and aging. Am Rev Respir Dis. 1983 Jun;127(6):725-34.

13. Eggleston PA. Upperairwayinflammatorydiseases and bronchial hyperresponsiveness. J Allergy Clin Immunol.1988 May;81(5Pt2):1036-41.

14. Samoliński B, Szczesnowicz-Dabrowska P. Relationship between Inflammation of Upper and Lower Respiratory Airways. Otolaryngol Pol. 2002; 56(1):49-55.

15. Chhabra SK, Gupta CK, Chhabra P, Rajpal S. Prevalence of bronchial asthma in schoolchildren in Delhi. J Asthma. 1998;35(3):291-6.

16. Chhabra SK, Anonymous, All India Coordinated Project on Aeroallergens and Human Health Report. Ministry of Environment and Forests, New Delhi; 2000.

17. Bavbek S, Saryal S, Karabiyikoglu G, Misirligil Z. Pulmonary function parameters in patients with allergic rhinitis. J Investig Allergol Clin Immunol. 2003;13(4):252-8.

18. Ciprandi G1, Ricciardolo FL, Schiavetti I, Cirillo I. possible Allergic Rhinitis Phenotypes Based on bronchial hyperreactivity to Methacholine. Am J Rhinol Allergy. 2014 Nov; 28(6):214-8. Doi: 10.2500/Ajra.2014.28.4124.

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