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The Relationship between Duration of Asthma and Pulmonary Function Test Parameters in Patients with Mild to Moderate Asthma

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Abstract:-

Background: The severity of bronchial asthma is determined by the frequency, duration and intensity of asthmatic attacks, activity and symptoms outside attacks and pulmonary function. Many factors including age, sex, anthropometric indices and race affect lung function parameters. Poor asthma control may also affect lung function indices of asthmatics. However, relatively little is known about the extent to which asthma duration affects lung function parameters of asthmatics in our environment. This aim of this study was to clarify the relationship between the duration of asthma and lung function parameters among patients with mild to moderate bronchial asthma in our setting.

Methods: Patients with asthma were classed into two groups; Long Duration of Asthma (LDA) with a clinical course of more than 10 years and Short Duration of Asthma (SDA) with a clinical course of 10 years or less. Lung function parameters were carried out according to the American Thoracic Society guidelines.

Results: The median duration of asthma for all the subjects was 10 (1-43).There was a statistically significant difference in the duration of asthma between the two groups, LDA group median duration of asthma was 18 (10-43) compared to SDA group of 2.5 (I-I0) (P<O.0001).There was a significant negative correlation between duration of asthma symptoms and Forced Expiratory Volume in one second (FEV_1).

Conclusion: Our finding showed an inverse relationship between the asthma duration and lung function parameters supporting the concept of asthma as a slowly progressive chronic inflammatory disease that may cause impairment of lung function.

Abstract words count-238.

Keywords:- *Asthma, Duration, Pulmonary Function Test, Relationship, Patients.*

I. INTRODUCTION

Bronchial asthma is a chronic disease with a growing health concern globally. It affects almost 300 million people worldwide with an expected increase of prevalence to 400 million by 2025.[1] It poses a substantial and unacceptable health and economic burden.[2]

Airway inflammation is generally accepted as a central mechanism in the pathogenesis of bronchial asthma. Inflammatory changes have been described even in distal airways and pulmonary parenchymal. [3]Airway inflammation in asthma is brought about by the invasion of the airway by mast cells, lymphocytes, eosinophils among others that lead to the of release potent mediators, including growth factors leading to structural changes in the bronchial airways walls[4] and increased airway smooth muscles contractility. The severity of asthma is determined by the frequency, duration, and intensity of the asthmatic attacks, activity and symptoms outside attacks and pulmonary function.

A finding by Sutcliffe et a1[5] showed that increased Nicotinamide Adenine Dinucleotide Phosphate Oxidase 4 (Nox4) over expression mediates intrinsic airway smooth muscle hyper-contractility in asthma resulting in airway remodelling process, deterioration in lung function and irreversible airways obstruction.[6,7]

Some of these changes occur early in the course of the disease process, [8] the airways of adult patients who have had asthma for years could likely have impaired lung function. A study by Brown[9] showed that the presence of persistent obstruction in asthmatics was more closely related to the duration of asthma than to age.

Another study by Robert et a1[10] revealed that asthma duration is associated with reduced lung functions, higher methacholine responsiveness, more asthma symptoms and increased use of reliever medications. These studies were all carried out in Western countries.

Many factors including age, sex[11] anthropometric indices and race [12]affect lung function parameters. Poor asthma control[13] also affect the lung function of asthmatics.

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However, not much is known about the extent asthma duration affects lung function parameters of asthmatics in our environment. Hence, this study was aimed at clarifying the relationship between the duration of asthma and pulmonary function in our environment.

II. PATIENTS AND METHODS

A. Study Design

It is a cross-sectional study, conducted at the OAUTH Ile-lfe, South West Nigeria from July 2009-January 2011. The Ethical Clearance Committee of OAUTH approved the study and informed consent was obtained from all the patients.

B. Study subjects

A total of sixty five subjects within the age range of 16 to 55 year took part in the study. All study subjects attended regular out-patients clinics and had a clinical diagnosis of asthma with a reversibility of FEV_I of at least 15% or 200mI. Subjects with acute severe asthma or acute exacerbation in the prior four weeks were not included in the study.

Duration of asthma was defined as the duration from the onset of symptoms resulting in the clinical diagnosis of asthma. The patients with duration of asthma of 10 years or more were classed into long duration of asthma (LDA) group while those with asthma duration less than 10 years were put into the short duration of asthma (SDA) group.[14].

C. Data Collection

Data was collected by means of interviews followed by clinical examination and spirometry function test. The procedure was explained to the patients and a modified form of the Medical Research Council (MRC) Chronic Respiratory Questionnaire[15]was used to record information on socio-demographic data, clinical features and spirometric indices of each patient. Asthma control was assessed by Asthma Control Test.[16]

Spirometry test was carried out according to the American Thoracic Society (ATS) guidelines [17]and the following were measured : Peak Expiratory Flow using Mini Wright Peak Flow meter; FEVI Forced Vital Capacity (FVC) and FEV,/FVC ratio using Standardized Spirometer, Micro Medical Ltd, USA. The percentage predicted values of each lung function parameter was calculated for each subjects was calculated by dividing the measured value over the expected for the subject's age, sex, height, weight and race.

Statistical Package for Social Sciences (SPSS) version 16.0 was used to analyse the data obtained. Chi-square analysis and T-test were used as appropriate to compare the data obtained for the two groups.

Regression analysis were performed to explore the factors that predict pulmonary function test values and specifically to determine the impact of the duration of asthma on the lung function and standardized *B* Co-efficient was used as appropriate. P values < 0.05 were considered significant.

III. RESULTS

Table I shows the clinical characteristics and asthma control of the participants. The median age of the participants was 19 (l -51) years and the median duration of asthma for all the subjects was 10 (1-43) with LDA having a median duration of 18 years (range 10-43) compared to 2.5 years (range 1-10) in the SDA group (p<0.0001).

Variable	**Total** (No-65)	**LOA** (No=33)	**SDA** (no=32)	**p-value**
Age (years)	35.4+12.0	36.7+11.9	34.09+12.04	0.39
Sex				
Males (n)%	27(41.59)	12(36.4)	15(46.9)	0.20
Females (n)%	38(58.5)	21 (63.6)	17(53.1)	
Median duration of asthma (range), years	10 (1-43)	18 (10-43)	2.5 (1-10)	0.0001
Asthma control				
WC	24 (37)	12 (36.4)	12 (37.5)	
NWC	41 (63)	21 (63.6)	20 (62.5)	0.92
ICS use prior to study (n) %	15 (23)	7 (21)	8 (25)	0.720.0001
Median age onset (range), years	19 (1-51)	12 (1-1-40)	27 (14-51)	

Table 1: Clinical characteristics and asthma control of the subjects

WC —well controlled, NWC =not well controlled, ICS —inhaled corticosteroid

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A correlation analysis was performed with data from all the subjects to explore the relationship between lung functions parameters and duration asthma.

As shown in Table 2, there was a statistically significant negative correlation between the duration of asthma symptoms and FEV_1.

Pulmonary functions	Duration of Asthma	P<Value
FEV_1 Pre	r=0.439	<0.0001
FEV_1Post	r=0.352	0.004
FVC pre	r=O.379	0.002
FVC Post	r=O.48	0.730
FEVI/FVC Pre	r=0.290	0.019
FEV/FVC Post	r=0.316	0.010
PEF pre	r=-O.186	0.39
PEF Post	r=-O.220	0.078

Table 2: Relationship between asthma duration and pulmonary functions
r: Pearson's correlation, Pre-bronchodilator, Post-bronchodilator

The pulmonary function parameters are presented on Table 3 below.
The LDA group had worse pulmonary function values (percentage predicted FEVI FEVI/FVC and reversibility) compared to the SDA group.

Parameter	LDA (Mean +SD)	SDA (Mean +SD)	P-value
Pre FEV1	65.1+ 24.6	79.0±26.7	0.03
Post FEV1	75.1+ 25.4	87.9±25.2	0.05
Pre FVC	93.9+ 24.1	95.9±27.2	0.76
Post FVC	96.1±26.1	98.2±23.2	0.73
PreFEV1/FVC	69.4 ±14.8	82.4 ±18.2	0.002
Post FEVI/FVC	78.2 ± 23.6	89.5 ±21.2	0.05
Reversibility	17.3(12-52)	23.4(15-56)	0.04

Table 3: comparison of pulmonary function values between the LDA and SDA groups

%Pre: Percentage predicted pre-bronchodilator,
%Post: Percentage predicted post-bronchodilator

Table 4 shows the relationship between the pulmonary function parameters and asthma duration after multiple regression analysis was used to control for potentially confounding variables such as age, degree of asthma control by ACT scores and use of controller medications (ICS). As shown, duration of asthma had the highest negative impact on FEV_1 (*B*=-0.422).

Variables	Age	Asthma Duration	ACT Scores	Use of ICS
FEV_1				
B	-0.032	-0.422	0.321	0.149
Beta	-0.201	-0.318	0.236	0.080
95% CI	-0.051-0.013	-0.746-0.139	0.129-0.746	0.270-0.570
FVC				
B	-0.029	-0.401	0.306	0.071
Beta	-0.34	-0.379	0.269	0.035
95% CI	-0.051-0.008	-0.766-0.077	0.173-0.838	0.289-0.549
FEV1/FVC				
B	-0.241	-3.776	0.379	0.359
Beta	0.164	-0.236	0.157	0.173
95% CI	0.398-0.016	-7.839-0.288	0.646-0.904	0.653-0.912

Table 4: Multiple linear regression of variables by pulmonary function values

IV. DISCUSSION

Evidence abound suggest that inflammation of the airways in bronchial asthma leads to abnormal pulmonary function test.[6-9] Some longitudinal studies have shown that patients with asthma have an increased rate of decline in lung function compared with the general population.[18-21] However, pathophysiological factors that lead to the rapid decline in lung function of patients with asthma are not clearly understood. Chronic inflammation of the lungs brought about by asthma which results in restructuring of the airways has been proposed as a factor that could account for the rapid decline in lung function. This index study sought to clarify the relationship between asthma duration and pulmonary function indices among bronchial asthmatics in a developing country.

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The results of our study suggest that the degree of airways obstruction is a function of the duration of asthma (Table 2). Airflow impairment was worse in the LDA group compared to the SDA group. This study seems to corroborate the findings of other studies conducted in developed countries which showed that the longer the duration of asthma, the greater the decline in lung functions due to remodelling of the bronchial wall.[19-20] Furthermore, our findings suggested that the decline in spirometric function associated with LDA were less reversible (Table 3).

Many other factors including age, level of asthma control, genetic predisposition and prior inhaled corticosteroid therapy might have contributed to the observed abnormal lung functions of our subjects. In order to control these confounding variables, a multiple linear regression analysis done showed that the duration of asthma had the highest negative impact on FEVI and FEVI/FVC (Table 4). The relationship of duration of the disease to lung function parameters persisted when regression analysis was performed to control potential confounding variables. This seems to support the hypothesis that chronic airway inflammation leads to airways narrowing and decrease in lung functions. A possible explanation for the results of this study is that even mild to moderate asthmatics have ongoing chronic airways inflammation that causes decrease airflow as shown by the pulmonary functions test.

In this present study, it is not clear whether previous inhaled corticosteroid therapy was a factor in our results. Twenty five percent of the SDA group was on inhaled corticosteroid compared to 21% of LDA but the dose, compliance or the duration of the therapy could not be confirmed.

The clinical implications of this study are as follows: 1) the measurement of pulmonary function test is important for all asthmatics and 2) the goal of asthma treatment to maintain the spirometry indices as near normal as possible should be rigidly adhered to.

This study has a limitation because it is a hospital-based study so may not be representative of all the patients with asthma in the general population. A community-based study would have added more value to this finding.

In conclusion, our study showed that an inverse relationship exists between the asthma duration and spirometric functions. This findings support the general notion of asthma as a slow progressive chronic inflammatory disease that lead to loss of lung function.

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REFERENCES

[1.] John Rees. Global Prevalence of Asthma BMJ 2006; 332; 767-771.
[2.] Smith OH, Malore D G, Lawson K A et al. A. national estimate of the economic cost of asthma. Am J RespirCrit Care Med 1997; 156:787-771.
[3.] Sutherland E R, Martin R J, Bowler R P et al. Physiologic correlates of distal lung inflammation in asthma. J Allergy ClinImmunol 2004; 13:1046-1050.
[4.] Hamid Q. Airway remodeling in asthma. J Allergy ClinImmunol 2003; 111:1420-1421.
[5.] Sutcliffe A, HollinsF, Gomez E, et al. Increased nicotinamide adenine dinucleotide phosphate oxidase 4 overexpression mediates intrinsic airway smooth muscle hypercontractility in asthma. Am J. RespirCrit Care Med 2012;3267-3274.
[6.] Shibak K, KasaharaK, Nakajima H, Adachi M. Structural changes of the airway wall impair respiratory function even in mild asthma. Chest 2002; 122:1622-1626.
[7.] Boulet LP, TurcotteH, Turcot O, ChakirJ . Airways inflammation in airflow obstruction. Resp Med 2003;97: 739-744.
[8.] Cokugras H, Akcakaya N, Seckiñ CA, et al. Ultra structural examination of bronchial biopsy asthma Thorax 1994; 56:25-29.
[9.] Brown PJ, Greville HW, Finnicaine KE. Asthma and irreversible airflow obstruction. Thorax 1994;39: 131-136.
[10.] Robert S, Zeiger CD, Scott V and the Childhood Asthma Management Program (CAMP). J Allergy ClinImmunol 1998; 103:376-387.
[11.] Ele PU Reference values for FEVI and FVC in male adolescent and young adults of Ibo origin..EastAfr Med J 1992; 69:105-109.
[12.] Harik-Khan RI, Muller DC, Wise RA. Racial difference in lung function in African and White Children. Effect of anthropometric, socioeconomic, nutritional and environmental factors. Am J. Epidermol 2004; 160:893-900.
[13.] Mendoza MMR, Bernice OC, Guzman-Banson V, et al.Cornparative Assessment of Astma Control Test (ACT) and GINA Classification including FEVI in predicting asthma severity. Phil Heart Centre J 2007; 13: 149-154.
[14.] Cassino C, Berger KI, Goldring RM. Duration of asthma and physiological outcomes in elderly non-smokers. Am J RespirCrit Care Med 2000; 162:1423-1428.
[15.] Medical Research Council Questionnaire on Respiratory Symptoms (1986 Edition). Lancet 1987; 2(8566) : 1028.
[16.] Nathan R A, Sorkness C A, Kosinki M et al. Development of the Asthma Control Test: A survey For assessmg asthma control. J Allergy Clin Immunol 2004; 113:59-65
[17.] American Thoracic Society 1994.Standardization of spirometry. Am Rev Respir Dis 1994; 152: 1107-1136.
[18.] Lange P J, Partner J V, Schnohr P, Jensen G. A 15 years follow-up study of ventilatory function in adults with asthma. N Engl Med 1998; 339:1194-1200.

[19.] Wilson J W. Inflammation and remodeling in ageing airway. Med J Aust 2005; 183:33-34.
[20.] Bousquet J, Jeffrey P K, Busse WW et al. Asthma from bronchoconstriction to airway inflammation And remodeling. Am J Respir Cri Care Med 2000; 161:1720- 1745.
[21.] Payne D N R, Rogers AV, Adelroth et al. Early thickening of the reticular membrane in children with difficult asthma. Am J RespirCrit Care Med 2003; 167:78-82.