The Evaluation Asthma Control and its Predictors in Patients Attending a Tertiary Clinic in Lagos, Nigeria

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Abstract

Background: There is a high rate of poorly controlled asthma in Nigeria. The determination of the level of asthma control and associated factors in asthma patients attending clinics is important so as to identify those patients at risk of exacerbations. The objective of this study is to evaluate the level of asthma control of patients attending respiratory clinic in Lagos using the Asthma Control Test (ACT) and pre-forced expiratory volume in first second (PREFEV1).

Methodology: This was a cross-sectional descriptive study. The ACT questionnaire and PREFEV1 were used to assess asthma control of patients attending a tertiary pulmonary clinics in Lagos. Two hundred patients were recruited over the period of one year between 2016 and 2017.

Results: The participants comprised of 96 (48.0%) females and 104 (52.0%) males with mean and standard deviation (SD) of 40.57± 15.86 years. The mean score with standard deviation of the ACT score was 18.64 ±4.64. Half of the participants had good asthma control (>20) based on the ACT score. The mean pre FEV1 was 2.14 ±0.93 for 200 participants and the post FEV1 of 189 was 2.25± 0.91. Only76 (37.5%) participants had normal FEV1. About one third of the participants 60(30%) had obstructive ventilatory pattern, 9(5%) had restrictive ventilatory pattern, 73(37%) had mixed ventilator pattern and 58(29%) had normal ventilatory pattern. Allergic rhinitis was reported in 99 (49.5%) and likelihood of GERD in 63 (31.5%).There was a significant positive relationship between the ACT and FEV1 and a significant negative relationship between the GSAS score and ACT (p= <0.0001 and p=<0.0001 respectively).

Conclusion: The level of asthma control using ACT questionnaire was average among asthma patients attending the clinic. However, the use of pre FEV1 which is an objective tool for assessing asthma control was significantly lower among these patients. The use of Lung function test should be employed in respiratory clinics for objective assessment of patients' asthma control in other to achieve the goals of asthma treatment.

Keywords: Asthma; Asthma Control; Spirometry; Asthma Control Test; PREFEV1; Reversibility.

Introduction

Asthma is a chronic inflammatory condition that affects about 300 million people worldwide. It is associated with airway hyper-responsiveness which results in recurrent episodes of wheeze, chest tightness and breathlessness. The world-wide prevalence of asthma is estimated to range from 1- 18%[1]. In Nigeria, the prevalence of asthma in is increasing and it is estimated that about 10% of Nigerian adults (About 16 million) may have

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asthma[2]. There is also a high rate of poorly controlled asthma in Nigeria and these imply that asthma poses a substantial burden on the individuals and on the healthcare system[3,4]. The determination of the level of asthma control and associated factors in asthma patients attending clinics is important so as to identify those patients at risk of exacerbations who may benefit from close monitoring and medication adjustments and also provide opportunities to address the factors associated with poor control. We therefore aimed to assess the level of asthma control and the determinants in patients attending a tertiary clinic in Lagos.

Methods

This is a descriptive cross-sectional study that was conducted among asthma patients attending an out-patient respiratory clinic of the Lagos University Teaching Hospital (LUTH), Idi Araba Lagos Nigeria. This clinic is a referral center in Lagos and attends to about 22-25 patients per week of which about 10 are managed for asthma. Ethical approval was obtained from the Health Research Ethics Committee of LUTH. Written informed consent was obtained from all patients that participated in the study. All those who met the inclusion criteria and provided informed consent were recruited.

A proforma was used to obtain information for each participant by direct questioning and also by review of the case notes. The information obtained included socio-demographic parameters such as age, gender, level of education, occupation, ethnicity(Yoruba, Ibo and Hausa for ease of categorization), asthma history, history of exacerbations, history of rhinitis, medication use and tobacco smoking history (Never smoked, current smoker and ex-smoker).Asthma control was assessed using the ACT and the Mini AQLQ. The adult version of the ACT is a validated simple five-item questionnaire that assesses interference of asthma with activities, symptoms of shortness of breath, nocturnal symptoms, use of rescue medication, and patient's self-assessment of symptoms in the preceding 4 weeks. Each item is scored 1-5, and total ACT scores ranges from 5-20. A score of ≥ 20 defines "well-controlled" asthma, and a score of < 20 defines uncontrolled asthma[15,6].

GERD was considered as a potential confounder in this study because it occurs frequently among asthma patients and can affect asthma control. The likelihood of GERD among the participants was assessed using the gastroesophageal reflux disease symptoms assessment scale (GSAS) questionnaire (Used with Permission). The GSAS is a 15 item validated questionnaire that measures the frequency and distress of GERD associated symptoms in the preceding one week[7]. Each item is scored as YES or NO. The total number of symptoms present ranges from 0-15 with higher scores above 3 suggesting a more likelihood of GERD[8]. The participants completed the questionnaires first and the following measurements were taken.

Spirometry was performed according to the American Thoracic Society/European Respiratory Society (ATS/ERS) standards for measurement of spirometry using a Vitalogragh alpha model 6000.The predicted values of ERS/Polgar with correction for persons of African descent were used. Spirometric measures of interest were Forced Vital Capacity (FVC) and Forced expiratory Volume in the first second (FEV1). Impairment in the spirometry pattern was characterized as follows: an obstructive impairment (ratio of FEVI/FVC<0.7 or lower limit of normal (LLN) with FVC% predicted $\geq 80\%$ or FVC>LLN), a restrictive impairment (FVC% predicted <80% or LLN with FEV1/FVC $\geq$ 0.7 and LLN) or a mixed impairment (FEV1/FVC ratio <70% or LLN with FVC% predicted <80% or LLN). The level of asthma control on spirometry was based on the pre-bronchodilator FEV1% predicted following the ERS/ATS 2005 guidelines. An FEV1, of 80%predicted was categorized as normal. The post bronchodilator parameters were documented and the reversibility was assessed. The reversibility of 12% and 200L compared to the pre-bronchodilator test was considered significant[9,10].

Data was analyzed using the Statistical Software for Social Sciences (SPSS, IBM Corporation, Somers, New York, USA)® statistical software version 20.0. The numerical demographic and clinical data (e.g age) and the test scores were summarized as means and standard deviations and compared among the participants using the student's t-test or the analysis of variance (SD). Categorical variables (e.g. gender, and degree of asthma control) were summarized as frequencies (%) and compared using the chi square

tests or the Wilcoxon's rank test. Independent determinants of measures of asthma control (ACT scores, and FEVI) were evaluated using multivariate linear regression analysis (a stepwise model was used and variables with a p value of <0.2 on univariate analysis were imputed into the multivariate model.) Odds ratios was determined and a p value of <0.05 was considered significant.

Results

The questionnaires were administered to 212 asthma patients over a period of 1 year. The calculated sample size of 156 was not achieved within 6 months, so the period of recruitment was extended to one year during which 212 patients were seen. Two hundred patients were able to perform adequate pre bronchodilator Spirometry. Eleven of those who performed Spirometry were unable to perform adequate post-tests, most complained of fatigue and were uncooperative. Therefore, we included 200 participants in the analysis but analyzed 189 post tests.

Socio-demographic data

The participants comprised of 96 (48.0%) females and 104 (52.0%) males and their ages ranged from 18-70 years with a mean age in years and standard deviation (SD) of 40.57± 15.86 years. Over 50% of participants were 40 years of age and below. Males were significantly older than females (43.10±15.44 in males versus 37.8 ± 15.93 in females). Most participants had formal education but over half earned less than N100,000 per month. Only 2 participants were current smokers (1 male and one female respectively). Table 1 shows details of the socio-demographic characteristics of all participants and a comparison between males and females.

Table 1: Shows details of the socio-demographic characteristics of all participants and a comparison between males and females

CHARACTERISTICS		ALL participants (n=200)	Male(N=104) Mean+SD or Percentage	Female (N=96) Mean+SD or Percentage	Statistics
AGE (YEARS) MEAN AGE (MEAN AND SD)		40.57+15.86	43.10+15.44	37.8+15.93	t = -2.37 p= 0.02
AGE GROUPS	18-30	63(31.5)	22(21.15)	41(42.71)	
	31-40	43(21.5)	29(27.88)	14(14.58)	
	41-50	34(17.0)	20(19.23)	14(14.58)	X^2= 15.79
	51-60	32(16.0)	14(13.46)	18(18.75)	P= 0.003
	61-70	28(14.0)	19(18.27)	9(9.38)	
LEVEL OF EDUCATION (%)	PRIMARY	10(5.0)	6(5.77)	4(4.17)	
	SECONDARY	49(24.5)	31(29.81)	18(18.75)	X^2 = 4.99
	TERTIARY	140(70.0)	66(63.46)	74(77.08)	P= 0.17
	NONE	1(5.0)	1(0.96)		

OCCUPATION (%)				
UNEMPLOYED	6(3)	1(0.96)	5(5.21)	
STUDENTS	50(25)	18(17.31)	32(5.21)	X^2= 25.72
PROFESSIONALS	69(34.5)	37(35.58)	32(33.34)	P= 0.002
BUSINESS&SALES	47(23.5)	28(26.92)	23(23.96)	
TECHNICIANS	28(14.0)	20(19.73)	8(8.33)	
INCOME (NAIRA)				
<100,000	118(59)	58(55.77)	60(62.50)	X^2=3.64
>100,000	51(25.5)	25(24.04)	26(27.08)	P=0.16
>200,000	31(15.5)	21(20.19)	10(10.42)	
ETHNICITY				
YORUBA	100(50)	51(49.04)	49(51.09)	X^2= 3.31
IBO	93(46.5)	47(45.19)	46(47.92)	P= 0.19
HAUSA	7(3.5)	6(5.77)	1(1.04)	
SMOKING STATUS				
CURRENT SMOKER	1(5)	1(0.96)	1(1.04)	X^2= 1009
EX SMOKER	13(6.5)	12(11.54)	Nil	P= 0.06
NEVER	186(98)	91(87.50)	95(98.96)	

Footnote: p values are for comparison of characteristics between males and females

Asthma control test scores and among participants

The mean score with standard deviation of the ACT score was 18.64 +4.64. Half of the participants had good asthma control (>20) based on the ACT score.

When compared by gender, more males had good asthma control than females. (57(54.81%) for males and 43(44.79% for females) p=0.008.

Table 2: Asthma Control Test scores

Characteristic	ALL(200) Mean+SD or Percentage	Male(N=104) Mean+SD or Percentage	Female(N=96) Mean+SD or Percentage	Statistics
ACT SCORE Mean	18.64+4.63	19.53+3.81	17.68+5.23	t= -1.42 P= 0.16
Category (%)				
Controlled >20	100(50)	57(54.81)	43(44.79)	X^2= 1.62
Uncontrolled <20	100(50)	47(45.19)	53(55.21)	P= 0.08

p values are for comparison of characteristics between males and females ACT-Asthma control score.

Lung function parameters among study participants

The mean pre FEV1 was 2.14 +0.93 for 200 participants and the post FEV1 of 189 was 2.25+ 0.91. Only76 (37.5%) participants had normal FEV1. More males had normal FEV1compared to females. [46(46.0%) for males and 29 (30.21%) for females, p= 0.02]. About one third of the participants 60(30%) had obstructive ventilatory pattern, 9(5%) had restrictive ventilatory pattern, 73(37%) had mixed ventilator pattern and 58(29%) had normal ventilatory pattern. The frequency of obstructive ventilatory pattern was significantly higher in males than in females [31(29.81%) for males and 29(30.21%) for females, X^2= 7.45, P= 0.06].

History of asthma medications and associated comorbidities

Majority of the participants 139(69.5%) had been adherent with their medications. 103(51.5%) were on inhaled short acting beta 2 agonist, 14(7%) were on inhaled long acting beta 2 agonist, 20(10%) were on inhaled steroid, 27(13.5%) were on oral steroid, 136(68%) were on combination of long acting beta 2 agonist and inhaled steroid, 2(1%) were on anticholinergics and 5(2.5%) were on other medications. Eighty five percent of the participants had received some training on inhaler technique from a doctor or a pharmacist. Regarding the associated comorbidities, allergic rhinitis was reported in 99 (49.5%) of the participants and a score of at least 3 from GSAS questionnaire indicative of GERD was also reported in 63 (31.5%).

Multiple linear regression for determinants of asthma control based on the ACT Scores

The educational status, allergy history, PREFEVI, GSAS, BMI, rhinitis and inhaler training that met the criteria on univariate analysis were inputted for the ACT on the multivariate model. There was significant positive relationship between the ACT and FEV1 implying better asthma control with increasing FEV1 and a significant negative relationship between the GSAS score and ACT implying lower risk of GERD was associated with better ACT scores (p= <0.0001 and p= <0.0001 respectively). This shown in Table 3.

Table 3: Multiple linear regression analysis for act determinants.

Variable	Coefficient	95% confidence interval	P-value
BMI	0.065	-0.089 - 0.220	0.41
PRE FEV1	1.410	0.714 - 2.107	<0.0001
GSAS	-0.501	-0.766 - (-0.236)	<0.0001
ADHERENCE	0.458	-0.949 – 01.864	0.52
EDUCATION	-0.465	-1.523 – 0.594	0.39
RHINITIS	-0.739	-2.005 – 0.526	0.51
PREVIOUS TRAINING	0.512	-1.193 – 2.218	0.55

Footnote: There was statistically significant relationship between the ACT and FEV1 and GSAS. (p= <0.0001 and p= <0.0001 respectively).

Pre-FEV1-Prebronchodilator Forced expiratory volume in one second, BMI-Body mass index.

Discussion

This study assessed the level of asthma control in asthma patients using ACT score, and FEV1 in patients attending a tertiary care center in Nigeria.

The mean age of the study participants was 40 ± 15.86. This was similar to the mean age of 42.6 ± 5.1 of the asthma patients in a study by Ozoh et al at the same clinic in Lagos in 2011 suggesting that the average age of persons with asthma at this clinic has remained relatively stable[11]. The findings of this study showed that only half of the participants had their asthma well controlled using the ACT scores. This is similar to what was reported by Ozoh et al (43.4%) in 2012 in this same Clinic[12]. This implies that the level of asthma control among these patients attending a tertiary hospital has only slightly improved in the last 5 years despite efforts to increase asthma education and awareness among healthcare workers. Similarly, Desalu et al reported a high incidence of poor asthma control of about 69.3% in asthma patients from the clinics of 2 tertiary centers. Reasons identified were incorrect inhaler techniques, presence of comorbidities and lack of adherence to inhaled steroids[13]. Worldwide asthma is generally uncontrolled even in developed countries with better access to healthcare and adequate insurance coverage[14-16]. This has been attributed to poor patient adherence, poor inhaler technique and poor asthma education on the part of healthcare providers[5].

The participants that had good asthma control based on the pre bronchodilator FEV1≥ 80% predicted were 37.50%. This is lower compared to the 64.2% of patients with good control reported by Ozoh et al in 2012[12]. This may suggest airway remodeling as a result of chronic inflammation. However, this is similar to the findings of Adeniyi et al who reported low mean of pre FEV1 among 65 asthma patients in a cross-sectional study at a tertiary center in Ile-Ife Nigeria. This is also similar to the low mean pre FEV1 reported by Adeyeye et al in a cross-sectional study of patients with metabolic syndrome in a tertiary center in Lagos, Nigeria[18]. Twenty nine percent of the study participants had normal ventilatory pattern, 30% participants had obstructive airway and 37% had mixed ventilatory pattern. This also suggests poor asthma control among participants. The proportion for obstructive

and restrictive pattern was similar to findings from Albert et al study in the USA who reported 44% obstructive pattern and 8% restrictive pattern in asthma patients. Fourty percent of patients with obstruction had significant reversibility post bronchodilatation and this is also reflective of poor asthma control, severe asthma and possible airway remodeling.

The multivariable analysis demonstrated that comorbidities, such as GERD was independently associated with poor asthma control. The impact of comorbidities on asthma control has been reported by earlier studies[20-22]. The presence of GERD worsens asthma control by increased vagal tone from esophageal peristalsis and micro-aspiration that also occurs, thereby increasing the symptoms of asthma occurring when both conditions co-exist[21]. The presence of co-morbidities in our study may have contributed to the high frequency of poor asthma control. Identifying and treating these comorbidities had been demonstrated to lead to better asthma control[20-22].

Conclusions
The level of asthma control using ACT questionnaire was average among asthma patients attending the clinic. However, the use of pre FEV1 which is an objective tool for assessing asthma control was significantly lower among these patients. The presence of comorbidities such as GERD was independently associated with poor asthma control. The use of Lung function test should be employed in respiratory clinics for objective assessment of patients' asthma control in other to achieve the goals of asthma treatment. Identification and treating comorbidities such as GERD is also important in asthma management to improve asthma control. Future studies with a larger sample size that have adequate power to determine the level of asthma control.

Limitations
Patients were recruited from outpatient's clinics and this may have increased the prevalence of uncontrolled asthma reported in this study. Recall bias may have also influenced the responses provided by the patients with uncontrolled asthma compared to those with controlled asthma. However, this study has the merit of reporting the level of asthma control and its associated factors among patients attending tertiary care hospitals. These findings will enable tailoring targeted management interventions.

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