The Asthma Control Test and its relationship with lung function parameters

J Jumbo, B O Adeniyi, P O Ikuabe, and G E Erhabor

Abstract

The Asthma Control Test (ACT) is a validated, simple, and inexpensive instrument to assess control among patients with bronchial asthma. However, its relationship with lung function parameters is yet to be demonstrated among Nigerian asthma patients.

Our study aimed at assessing asthma control using ACT scores and determining its relationship with lung function parameters among persons with asthma in a university respiratory clinic.

The cross-sectional study included 65 patients with bronchial asthma who underwent routine check-ups in respiratory clinics at the Obafemi Awolowo University Teaching Hospital Complex (OAUTHC), Ile-Ife, Nigeria between October 2009 and January 2011. The ACT was administered to assess for asthma control. Lung function testing was done using the guidelines of the American Thoracic Society (ATS).

The mean pre-bronchodilator FEV_1 (forced expiratory volume in 1 second) was 1.97±0.87L and mean ACT score was 18.2+4.28; 24 (37%) of the study subjects had well-controlled asthma. The ACT scores were weakly correlated with percentage of predicted, FEV_1(r=0.220, p=<0.078) and PEF (peak expiratory flow), (r=0.168,p=0.18).

In this study, most of the patients had poor asthma control and lung function parameters correlated poorly with ACT scores. It is important that the ACT complements other physiological measures of assessing asthma control in our environment.

Introduction

Bronchial asthma is a worldwide disease which affects all ages, sexes, and racial groups. It affects 300 million people globally with an expected increase of prevalence to 400 million by the year 2025.[1] It poses substantial and unacceptable health and economic burdens.[2]

International guidelines indicate that the primary goal of asthma management is to obtain control and reduce the risk of exacerbation.[3] Asthma control refers to the control of disease manifestations both in terms of symptoms and laboratory investigations.[4]

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Poor assessment of asthma control is a major cause of suboptimal asthma management worldwide so the focus is now shifting to an assessment and treatment approach based on control. The Gaining Optimal Asthma Control (GOAL) study[5] has suggested that asthma control is a feasible outcome and is associated with marked improvement in quality of life and substantial reduction in morbidity.

While there is no comprehensive tool to identify and define asthma control, several instruments have been developed, tested, and validated over the last few years for their reliability and reproducibility to measure control.[6–10] These tools include the Asthma Therapy Assessment Questionnaire (ATAQ),[6,7] the Juniper Asthma Control Questionnaire (ACQ),[8] the Asthma Control Scoring System (ACSS),[9] and the Asthma Control Test (ACT).[10] The ACT was developed by Nathan and colleagues in 2004 and is a trademark of the US company Quality Metric. It is a validated, reproducible, and reliable tool in assessing asthma control.

Studies conducted in Canada, Europe, Asia-Pacific, and South Africa[11–15] suggest that substantial cases of asthma are not well controlled. A study carried out by Adeyeye et al[16] in Lagos, Nigeria has also corroborated these findings.

Traditionally, asthma is assessed using spirometry as a measure of lung function. This provides an objective and reproducible measure of ventilatory function and provides complementary information not provided by other outcome variables. However, its correlations with symptoms or disease-specific measures of quality of life is weak.[7] In addition, it is unclear how spirometry relates with ACT as a complimentary measure in the assessment of asthma.There is paucity of research work assessing control using ACT and its relationship with lung function parameters among asthmatics in Nigeria. Our study was aimed at assessing asthma control using a validated ACT among Nigerian asthmatics and investigating how it relates and complements lung function parameters.

Patients and methods

This cross-sectional analytical study was carried out in the medical clinics/wards of Obafemi Awolowo University Teaching Hospitals Complex (OAUTHC).

A total of 65 patients aged between 16 and 55 years who had spirometric evidence of asthma (as defined by a bronchodilator reversibility test with change in FEV_1 (forced expiratory volume in 1 second) >15% and/or

200 ml, 20 minutes after inhalation of 400 microgram of β-agonist (salbutamol))[17] were included.In addition, only those without an acute exacerbation of asthma in the preceding 4 weeks were included in the sample.

All asthma patients who had co-morbid conditions such as hypertensive heart failure and chronic obstructive pulmonary disease (COPD), patients with acute severe asthma, and with an unconfirmed diagnosis of asthma, were excluded. A Medical Research Council (MRC) questionnaire was used to record socio-demographic data and symptom profile from each patient and the data obtained were summarised.

Asthma control was assessed by self-reported asthma control questionnaires, the ACT. This is a five-item questionnaire that assesses interference with activity, shortness of breath, nocturnal symptoms, rescue medication use, and self-rating of asthma control. Each item is scored using a 1–5 scale and then scores are totalled (total score 5–25). A score of 20 or higher was found to be the most discriminating cut-off to define well-controlled asthma and a score lower than 15 was identified as the most discriminating cut-off to define poorly controlled asthma.[10]

Lung function tests were performed according to the American Thoracic Society guidelines[17] as follows:

- Peak expiratory flow (PEF) was measured using a mini Wright peak flow meter after due explanation of the procedure and accompanying demonstration. The best of three satisfactory readings was recorded.
- Forced expiratory volume in 1 second, FEV_1.
- Forced vital capacity (FVC) was measured using a standardised spirometer: Micro Medical Ltd, USA.

Data obtained were analysed with Statistical Package for Social Sciences (SPSS) version 16.0. Continuous variables were expressed as means ± standard deviation and categorical variables as percentages. The Chi-square test was used to determine the statistical significance of association between categorical variables while Student's t-test was used for the continuous variables. Correlations between levels of asthma control by ACT scores and lung function parameters were assessed using Pearson's linear correlation co-efficient; a p-value of <0.05 was considered significant.

Results

Socio-demographic characteristics of the patients who participated in the study are shown in Table 1. There were 38 females (58%) and 27 males (42%). Twenty (31%) of the respondents had a body mass index (BMI) greater than 24. Only 17 (26%) of the subjects were on controlled medication for asthma and 25 (38%) of the respondents had asthma disgnosed for 15 years or more.

Table 2 shows the lung function values among the respondents. The mean pre-bronchodilator FEV_1 was 1.97±0.87 L, while the post bronchodilator FEV_1 was 2.32±0.95 L. The predicted pre-bronchodilator FEV_1 was 75±25.7%. As shown, the subjects fulfilled the entry criteria of reversibility of 15% in the FEV_1 and PEF.

Figure 1 shows the distribution of the study subjects according to the level of control based on the ACT questionnaire scores. A score of ≥20 represents 'well-controlled' asthma, 15–19 denotes 'not well-controlled' asthma, while a score of 5–14 is 'poorly controlled' asthma. As shown, 24 (37%) of subjects had well-controlled asthma, while 28 (43%) and 13 (20%) had not well-controlled and poorly controlled asthma respectively.

Table 3 shows the clinical and demographic characteristics of the subjects grouped based on their ACT scores. ACT scores <20 represent 'not well controlled' and scores ≥20 denote 'well controlled' asthma. Ten (42%) of the 'well-controlled' group used controller medications com-

Variables	Frequency (n=65)	Percentage
Age (years)		
<21	8	12.3%
21–30	25	38.5%
31–40	14	21.5%
41–50	12	18.5%
51 and above	6	9.2%
Educational status		
Primary	9	13.8%
Secondary	16	24.6%
Post-secondary	40	61.6%
Gender		
Male	27	41.5%
Female	38	58.5%
Occupation		
Civil servant	23	35.4%
Traders	6	9.2%
Schooling	28	43.1%
Artisan	2	3.1%
Farming	3	4.6%
Unemployed	3	4.6%
BMI (kg/metre^2)		
<18	19	29.2%
18–25	26	40.0%
>25	20	30.8%

Table 1 Sociodemographic and health characteristics of the subjects

Variables	Pre-bronchodilator (Mean ± SD)	Post-bronchodilator (Mean ± SD)
PEF (L/min)	286.00±107.00	348±114
FEV_1 (L)	1.97±0.87	2.32±0.95
FVC (L)	2.67±1.02	2.87±0.97
FEV_1/FVC (%)	75.22±10.80	79±11.0
Reversibility FEV_1(%)		20.13±11.26
Reversibility PEF (%)		22.73±10.51
FEV_1 predicted (%)	75.0±25.7	82.0±24.3

Table 2 Lung function values for the subjects

pared with 5 (12%) of the 'not well-controlled' group that used controller medications. The difference was statistically significant (p<0.029).The relationship between the levels of asthma control and the lung function parameters of the subjects is shown in Table 4. There was no significant relationship between lung function variables and ACT scores.

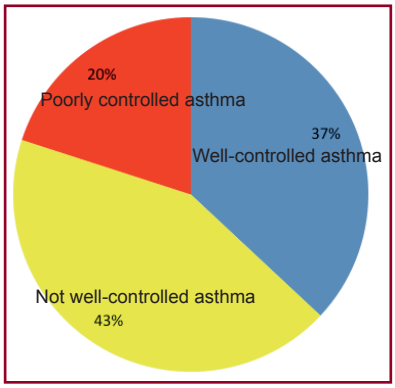

Figure 1 Distribution of study subjects according to the levels of asthma control

Discussion

This study assessed the level of asthma control using the ACT among patients with bronchial asthma in a developing country. The study also sought to determine the relation between ACT and ventilatory function parameters in clinical evaluation of persons with asthma. In this study, bronchial asthma was found to be more common among the 38 females (58%). The lung function values for the respondents showed a mean pre-bronchodilator FEV_1 of 2.29 L±1.08 and 1.75 L±0.59 for males and females respectively.

Several studies have been carried out around the world to assess asthma control using various instruments.[18–21] The ACT has been validated against specialist's rating of asthma control and spirometry[22] and quality of life.[23] The overall mean score as measured by ACT was 18.20±4.28, with only 37% of the subjects scoring 20 and above which denotes well-controlled asthma.

The findings of this study showed that asthma was poorly controlled among the respondents. This study corroborated the findings of Adeyele et al[16] working in Lagos University Teaching Hospital (LUTH) who demonstrated that asthma control was poor among the study subjects.

Findings similar to this index study were reported by Mendoza et al,[22] using the ACT in a hospital-based study in The Philippines. They found that only 28% of the respondents had well-controlled asthma.

The findings of a Canadian national survey, The Reality of Asthma Control (TRAC)[12] study using the Canadian Asthma Consensus guidelines showed that only 47% of respondents had controlled asthma.

Similar observations were made in the Asthma Insight and Reality in Europe (AIRE)[13] and International Asthma Patient Insight Research (INSPIRE)[24] studies. Another study, Asthma Insight and Reality in Latin America (AIRLA)[21] survey using GINA (Global Initiative for Asthma) guidelines also corroborated the findings of this study that asthma control was poor. Overall, only 2.4% of all patients met all the GINA criteria for total asthma control.

Females appear to have lower overall ACT scores compared with males. This is consistent with the findings of Tovt-Korshynska et al[25] that in asthma, as in several chronic disease settings, females may report symptoms differently from males, being more likely to seek medical care. However, physiological explanations are also of potential importance. Non-specific bronchial hyper-

Clinical and demographic characteristics	ACT well controlled (≥20)	ACT not well controlled (≤20)	p-value
Age (years) (Mean ± SD)	36.7±12.9	34.3±10.9	0.421
Duration of asthma (years) (Mean ± SD)	10.3±7.5	12.1±10.9	0.458
Age of onset (years) (Mean ± SD)	24.6±17.4	19.4±14.2	0.19
FEV_1(L) (Mean ± SD)	2.12±0.94	1.82±0.80	0.19
Use of controller medications			
Yes n (%)	10 (42%)	5 (12%)	0.006
No n (%)	14 (58%)	36 (88%)	
Gender			
Male n (%)	11 (4%)	16 (59%)	0.591
Female n (%)	13 (34%)	25 (66%)	

Table 3 Characteristics of subjects grouped based on their ACT scores

ACT	FEV_1 Pre	FEV_1 Post	PEF Pre	PEF Post	FVC Pre	FVC Post	FEV_1/ FVC	Predicted FEV_1
Well-controlled								
r	0.131	0.150	0.148	0.129	0.155	0.100	0.105	0.093
p-value	0.30	0.234	0.238	0.306	0.219	0.429	0.404	0.460 (NS)
Not well-controlled								
r	0.188	0.178	0.076	0.077	0.225	0.234	0.067	0.167
p-value	0.133	0.156	0.546	0.543	0.071	0.060	0.596	0.183 (NS)
Poorly controlled								
r	0.072	0.086	0.060	0.043	0.077	0.151	0.002	0.107
p-value	0.569	0.778	0.637	0.734	0.151	0.230	0.989	0.398 (NS)

Table 4 Pearson's correlation between ACT and lung function parameters of the subjects

responsiveness has been reported to be more common among females than males in general population surveys.[26] However, this phenomenon needs to be further evaluated in other socio-cultural setting, and stimulates further work in ACT in diverse communities.

This study showed that only 26% of the respondents were using controller medication. This figure is lower than others reported in the work of Marks et al,[27] who found that 36% of adult asthmatics with daily symptoms and 41% with symptoms on most days were taking controller medication.

There was a significant correlation between ACT scores and use of controller medications. Subjects on controller medications appear to have a better ACT scores than respondents who are not. This finding corroborated work done by Green R J[28] in South Africa who found that asthmatics on controller medications achieved better control.

Also evaluated in this study was the relationship between ACT scores and lung function parameters. There was a poor correlation between ACT scores and lung function variables. These findings have been highlighted by several studies.[28-30] The poor correlation may be partly due to the lack of specificity of asthma symptoms and to differences in the magnitude and time course of the response to treatment.[31] Symptoms and lung function parameters represent different domains of asthma and they correlate poorly over time in individual patients,[32,33] so both need to be monitored by clinicians assessing asthma control in clinical practice.

However, a study done by Mendoza et al[22] showed a significant correlation between FEV_1 and ACT scores. This significant correlation was probably because the sample size was larger and it was a cohort prospective study which followed up subjects over time, compared with the index study which took a cross-sectional look at lung function variables and ACT scores.

Conclusion

In conclusion, the present study showed that asthma was poorly controlled among the study subjects. It also showed that lung function parameters correlate poorly with ACT scores. These findings highlight the importance of a control-based approach to management and the importance of a multi-dimensional strategy in the evaluation of persons with asthma.

This study is limited because it is a hospital-based study so may not be generally representative of asthmatics in the general population. A community-based study would have added value to the findings. There is therefore need for a large multicenter study to assess asthma control using ACT in our environment.

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