Original Article

IMPACT OF OBJECTIVE AIRFLOW MEASUREMENT ON ASSESSMENT OF ASTHMA SEVERITY AND TREATMENT APPROPRIATENESS

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Abstract

Current asthma treatment is directed by severity of symptoms and lung function. In Malaysia, spirometry is not widely available and therefore not used in most medical consultations. In 163 asthmatic patients [mean (95% CI) age: 41 (38-44) yrs; 29% male; 32% Malays, 32% Chinese, 34% Indians] who were being followed up in a State Hospital medical outpatient clinic and a large urban-based health clinic, we studied the effect on Global Initiative for Asthma (GINA) disease severity classification and the appropriateness of currently prescribed treatment when forced expiratory volume in one second (FEV_1) was considered together with symptom severity. We showed that 52% of the patients were upgraded to a higher severity classification and 71% of the patients were 'under-treated'. If based on 'symptoms alone' to assess severity, 39% of the patients were still 'under-treated'. We concluded that the disease severity in many asthmatic patients might have been underestimated and therefore not adequately treated, because spirometry was not available or used to assess asthma severity. The use of spirometry should be advocated more widely among clinicians treating asthma in Malaysia.
Keywords: Asthma severity, spirometry, symptoms, Malaysia, under-treatment

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Introduction

Current recommendation for asthma treatment is based on a step-wise approach according to severity of symptoms and lung function.[1] While symptoms often correlate with the calibre of airways and therefore provide a reliable reflection of airflow limitation, many patients may not adequately appreciate their level of symptom severity.[1,2] The lack of appreciation either occurring deliberately (i.e. patients settle for a certain degree of disability) or as a result of impaired perception of breathlessness compromises the level of care that can be provided by the physician to the patient, and may contribute to an increase in asthma morbidity and mortality.[3]

Forced Expiratory Volume in One Second (FEV_1) provided by spirometry is the gold standard for measurement of airflow obstruction, and is a principal component for assessing asthma severity in national and international asthma management guidelines.[1,4]

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However, unlike Peak Expiratory Flow Rate (PEFR) commonly obtained by a portable Wright's meter, it is not readily available in most clinics or hospitals due to technical or cost reasons. Although useful as a tool to measure airflow limitation, PEFR measurement lacks the reliability and reproducibility of spirometric measurement and may underestimate the severity of underlying airflow limitation.[5] Nevertheless, PEFR measurement correlates relatively well with FEV_1 and under most circumstances, information derived from these two measurements can be used interchangeably.[1,6] Despite these tools to objectively measure airflow limitations, many physicians still frequently rely on patient's symptoms alone to decide disease severity and treatment strategy.

To investigate how asthma severity classification can be affected when assessment is based on 'symptoms alone', compared to 'symptoms plus FEV_1', we studied in asthmatic patients followed up in our state hospital outpatient clinic and a large community health clinic on (1) how the classification of their asthma severity changed when FEV_1 were considered together with symptom severity, and on (2) how currently prescribed treatment corresponded to the level of asthma severity based on 'symptoms alone' and 'symptoms plus FEV_1' respectively.

Methods

Patients

Over a period of 13 months (from August 2001 to December 2002), asthmatic patients between the age of 12 and 70 years old who were being followed-up in the medical outpatient clinic of an 800-bed state government hospital, and in a large health clinic located next to the hospital, were recruited. Excluded were patients who were current cigarette smokers or those who had previously smoked more than 10 pack years. This was considered necessary in order to avoid recruiting patients with chronic obstructive pulmonary disease. Patients who had asthma exacerbations in the past 6 weeks were re-scheduled for a later study visit.

Data collection

In a single study visit, data on socio-demographic details and asthma-related variables were collected using a standard questionnaire. Specifically included in the questionnaire were frequency of asthma day and night symptoms, requirement for rescue short-acting β_2-agonist in the past 1 month, asthma exacerbation episodes in the past 12 months, and degree of restriction of daily activities, if any. Current anti-asthma medication was also recorded. Forced Expiratory Volume on One Second (FEV_1) data collected was post-bronchodilator and corrected to Asian values [Vitalograph (UK) 2120 Spirotrac IV]. Patients who had asthma 'since birth' were considered to have onset of asthma at the age of 3 years old for the purpose of standardisation. They were likely asthmatics whose onset of asthma was before the age of three. This study was part of a larger study that was approved by our local university Research and Ethics Committee (IMU018/2002 and IMU020/2002).

Classification of asthma severity according to 'symptoms alone' and 'symptoms plus FEV_1'

We adopted the approach by Liard R et al[7] based on Global Initiative for Asthma (GINA) [1]. Using this approach, the asthma severity was classified into intermittent (Step 1), mild persistent (Step 2), moderate persistent (Step 3) and severe persistent (Step 4), based on symptom and FEV_1. For the purpose of this study, the asthma severity was classified according to 'symptoms alone', and according to 'symptoms and FEV_1'. The assignment of classification first started with whether patient had 'intermittent asthma'. If not, the patient was then assigned to the appropriate severity group in a downward manner i.e. from severe persistent, to moderate persistent, and to finally mild persistent [6]. The details are outlined in Table 1.

Classification of level of currently prescribed anti-asthma treatment

In the same manner, the level of current anti-asthma treatment was stratified according to GINA classification [1] of Step 1 (for intermittent disease), Step 2 (for mild persistent disease), Step 3 (for moderate persistent disease), and Step 4 (for severe persistent disease). The details are outlined in Table 1. These treatment steps were compared to disease severity according to 'symptoms alone' and 'symptoms plus FEV_1' and judged as to whether patients were appropriately treated or 'under-treated'.

Statistical analysis

Descriptive analysis was performed on patient socio-demographic details, asthma-related variables and the proportion of patients whose disease severity was affected following re-classification when FEV_1 was considered. The comparisons between current treatment level and asthma disease severity according to 'symptoms alone' and 'symptoms plus FEV_1' were also performed using descriptive analysis. All computation was made using statistical package SPSS version 11.5 for Windows (Chicago, Illinois, USA).

Table 1: Global Initiative for Asthma (GINA) classification of asthma severity and the recommended medications

	Symptoms	FEV_1 or PEFR	Medications
STEP 1: Intermittent disease	Day symptoms < 1 per week Night symptoms < 2 per month Infrequent exacerbations* Daily activities not affected at all	$FEV_1 \geq 80\%$ predicted normal	Rescue SABA only
STEP 2: Mild persistent disease	Day symptoms $\geq$ 1 per week but < 1 per day Nocturnal symptoms $\geq$ 2 per month Exacerbations may affect activity and sleep* Daily activities minimally affected	$FEV_1 \geq 80\%$ predicted normal	One controller¶ medication (if ICS, the dose must be $\leq$ 500 μg a day) Plus Rescue SABA only
STEP 3: Moderate persistent disease	Daily symptoms Nocturnal symptoms > 1 per week Exacerbations have affected activity and sleep Daily activities frequently affected	FEV_1 60 to < 80% predicted normal	Two controller¶ medications or ICS > 500 μg a day Plus Rescue SABA only
STEP 4: Severe persistent disease	Daily symptoms Frequent nocturnal symptoms Frequent exacerbations Daily activities always affected	FEV_1 < 60% predicted normal	Three controller¶ medications Plus Rescue SABA only

FEV_1= Forced Expiratory Volume in One Second

SABA= Short-acting β_2-agonist

* For the purpose of classification, exacerbation rates are divided arbitrarily as none in a year for Step 1; < 2 a year for Step 1; 2 to 5 a year for Step 3, and $\geq$ 6 a year for Step 4.

¶defined as regularly used medications recommended as a disease control agent. This included ICS, theophylline, long-acting β_2-agonist and montelukast

Results

A total of 163 asthmatic patients were recruited for the study (Table 2). The mean age was 41 years and the majority of the patients were female. Ethnicity was relatively equal in the recruited population, and half earned between RM1000 and 3000 per month. Most patients had asthma early in their lives. The mean asthma duration was 17 years, indicating that most patients had chronic asthma. However the mean duration of regular inhaled corticosteroid in patients who were being prescribed was only 5 years. Overall, mean FEV_1 was relatively low at 1.67 litres and 65% predicted normal.

When FEV_1 was considered together with symptoms for assessment of asthma severity, 48% of the patients remained unchanged in their severity classification. 52% of the patients were upgraded to a higher severity classification. Of these patients, 26% were upgraded by 1 step, 20% by 2 steps, and 6% by 3 steps (Figure 1).

When comparing current treatment level with GINA severity classification based on 'symptom alone', 61% of the patients were appropriately treated and 39% of the patients were 'under-treated. Of the patients who were 'under-treated', 28% were 'under-treated' by 1 step, 10% by 2 steps, and 1% by 3 steps (Figure 2).

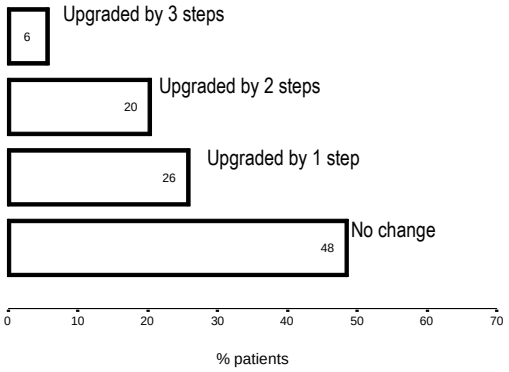
When comparing current treatment level with GINA severity classification based on 'symptoms plus FEV1', Proportion of patients appropriately treated was reduced to 29% and those 'under-treated' increased to 71%. Of the patients who were 'under-treated', 33% were 'under-treated' by 1 step, 29% by 2 steps, and 9% by 3 steps.

Table 2: Socio-demographic and asthma-related variables of patients (n=163)

Variables	Mean (or %)	95% CI
Age, yrs	41	38-44
male	29.3%	-
Ethnicity		
Malays	32.7%	-
Chinese	32.7%	-
Indians	34.6%	-
Total family income, RM* per month		
<1000	30.5%	-
1000-3000	50.0%	-
3001-5000	16.5%	-
>5000	3.0%	-
Age at onset of asthma, yrs	24	21-26
Asthma duration, yrs	17	15-19
Duration of ICS use, yrs¶	5	4-6
FEV_1, litres	1.67	1.57-1.78
FEV_1, % predicted normal	65.2%	62.3-68.1

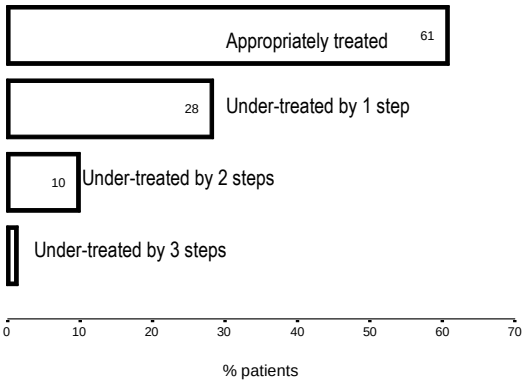
CI=confidence interval; * indicate Malaysian Ringgit; ¶ 38 patients did not received regular inhaled corticosteroids (ICS) treatment

Figure 1: Percentage of patients upgraded or remained the same in GINA classification of asthma severity from using 'symptoms alone' criteria to using 'symptoms plus FEV_1 % predicted normal' criteria.



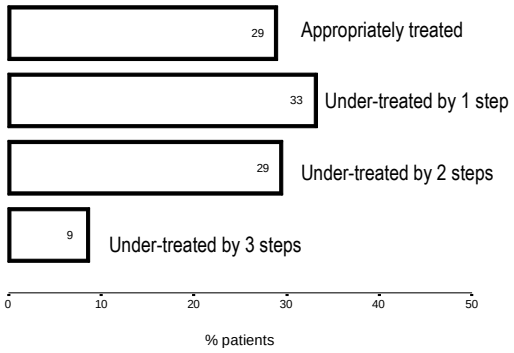
GINA= Global Initiative for Asthma; FEV_1= Forced Expiratory Volume in One Second.

Figure 2: Percentage of patients under-treated or appropriately treated according to GINA asthma severity classification based on 'symptoms alone' criteria.



GINA= Global Initiative for Asthma

Figure 3: Percentage of patients under-treated or appropriately treated according to GINA asthma severity classification based on 'symptoms plus FEV1 % predicted normal' criteria.



GINA= Global Initiative for Asthma

Discussion

We have shown that when FEV_1 was considered together with symptoms in asthma severity assessment, more than half the patients were re-assigned to a higher grade of severity and in whom currently prescribed treatment was insufficient. We also showed that even when severity was based on symptoms alone, about two-fifth of the patients were still under-treated.

Our findings support the recommendation that lung function is crucial in the assessment of asthma severity.[1] One important reason for this recommendation is that in chronic diseases such as asthma, patients tend to downplay the severity of their symptoms, leading to under-appreciation of the true disease severity and under-treatment. As such, lung function can provide an objective assessment to the attending clinician, and ensure appropriate treatment.[1] Another important reason is the recognition of poor correlation between reported symptoms and physiologic measurements of airway calibre such as FEV_1 in many asthmatic patients.[1,2] Poor perception of symptoms in particular, increases the risk for under-treatment and possibly fatal asthma attack.[3]

Our finding that a substantial number of asthmatic patients were still under-treated based on assessment on symptoms alone, supports the findings of several large-scale regional surveys.[8-10] All these studies consistently showed that the current levels of treatment for asthma fall markedly short of goals specified in international guidelines like that of GINA[1] as evidenced by many asthmatic patients who were still suffering asthmatic symptoms and restriction of life activities.

It is important to point out that in GINA,[1] there is a provision for 'stepping down' or 'downgrading' of asthma severity classification and therefore treatment level. This is applicable if the asthma control has been stable for at least three months and by 'downgrading' of treatment level, patients are not being treated unnecessarily in terms of additional drug doses or medication types. In fact, in a separate analysis of our patients, 11% of the patients were potentially of a lower asthma severity and 5% were possibly 'over-treated' (data not shown). However it is not possible to make any conclusions about this because our data did not allow us to know about how long they had been thus well-controlled or treated.

In our study, it is unclear whether patients were previously assessed using PEFR in the clinics by the clinicians. Treatment guidelines recommend the use of PEFR as an indication of asthma severity or control.[1] It can be used like FEV_1 as a percentage of predicted normal value, or by measurement of diurnal variation as an indication of asthma severity. It has also been proposed as a 'spot-check' of asthma control using the actual or best PEFR alone,[11] or an overall assessment of asthma severity based on the lowest PEFR value recorded in the past 7 days.[12] Our study utilized FEV_1 to assess patients, and therefore cannot categorically state that the use of PEFR would provide similar conclusions. From our study design, we were also uncertain whether patients that were appropriately categorized and treated were already assessed by PEFR. Since PEFR measurement by Wright's meter is more widely available, a study based on PEFR would be more directly relevant. Nevertheless, we do not think that our results would differ greatly if PEFR were to be used instead of FEV_1 due to their fairly close correlation with each other.[1,6] To the best of our knowledge, to date there has been no published study on the impact of PEFR in re-classification of asthma severity or treatment appropriateness.

This is the first study in Malaysia to highlight the importance of FEV_1 in the assessment of asthma severity and the huge tendency to under-treat asthmatic patients if this is not considered together with the severity of symptoms. The future research on this that can to be explored include the comparison between the use of PEFR and FEV_1 in assessing asthmatic patients in Malaysia context and how they could improve on patient asthma control. For the present, use of FEV_1, or at least PEFR, to assess asthma, should be more widely advocated among all clinicians in Malaysia in the hope that asthma management can be better optimized, and asthma morbidity and mortality be reduced.

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