Original Article

Non-obstructive patterns of spirometry among obese patients presenting with symptoms and signs of mild to moderate asthma

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Abstract

Background: Asthmatic patients typically show obstructive pattern on spirometry; with positive response to bronchodilators. However, there is paucity of data regarding presentation of obese patients with non-obstructive patterns of spirometry.

Methods: A sample of 295 known asthmatic patients (74% over-weights or obese and 26% non-obese) was selected from those attending respiratory clinic of Yastabshiron Hospital for follow up. A portable spirometer (All flow, Clement Clarke International, UK) was used for measurement of FEV1, FVC, FEV1/FVC ratio and PEF for each patient. Measurements were carried out on presentation and then 15 minutes following inhalation of 0.5 mg salbutamol using a spacer.

Results: Typical obstructive pattern was found in only 17.4% of obese patients, normal pattern in 18.3%, restrictive in 45.9% and combined pattern in 18.3%. The relation between obesity and patterns of spirometry was found to be statistically insignificant (P= 0.808). Significant proportions of all patterns showed positive reversibility tests (P= 0.000).

Conclusion: It is concluded that all patterns of spirometry are expected in obese patients with mild to moderate asthma. Reversibility tests are highly significant among asthmatic patients, irrespective to their spirometric pattern.

Key words: Obesity, Reversibility, FEV1, FVC

Spirometry is the recommended and the most widely used method for demonstrating airway obstruction in the diagnosis of asthma.[1,2] Although it is widely used in primary health care in many countries worldwide;[3] its use in the Sudan is almost restricted to outpatient departments of chest physicians. The most commonly used spirometry derived values for diagnosis of obstructive lung disease are the forced expiratory volume in one second (FEV1), the forced vital capacity (FVC) and the forced expiratory ratio (FEV1/FVC). According to these parameters, a spirometryreading shows one of four patterns: normal, obstructive, restrictive or combined (obstructive/restrictive) patterns. Normal readings vary, depending on age, sex, body size, and race. A normal pattern is diagnosed when FEV1 & FVC are ≥ 80% of predicted and FEV1/FVC ratio is > 0.7. An obstructive pattern is diagnosed when FEV1 is less than 80% of predicted and FEV1/FVC ratio is 0.7 or less whereas FVC is often normal or only mildly reduced. With a restrictive pattern, both FEV1 and FVC are less than the predicted values whereas FEV1/FVC ratio is normal. All these parameters (FEV1, FVC and FEV1/FVC ratio) are lower than predicted in a combined (obstructive and restrictive) pattern.[4,5]

Previous studies showed that the classical symptoms of wheezing, dyspnoea and cough were found in about one third of asthmatic patients.[6] In some patients, chronic cough may be the sole presenting symptom.[7] This variation in clinical presentation of asthma

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may be associated with variation in patterns of spirometry at the time of presentation.

On spirometry, asthma typically shows an obstructive pattern; however, a normal pattern may be detected in patients with mild asthma. In some patients, the only evidence of obstruction might be low values of Forced Expiratory Flow (FEF25, FEF50, FEF75 or FEF25-75), indicating obstruction within middle and small airways of the lungs. However, the FEF values are not as reproducible as FEV1.[8]

Because of the mechanical effect of obesity on the respiratory system, a restrictive pattern on spirometry is usually expected; however, there is paucity of data regarding patterns of spirometry among obese patients with asthma. The aim of this study is to determine varieties of spirometric patterns among obese patients presenting with symptoms and signs of mild to moderate asthma and to assess their responses to bronchodilators.

METHODS

This is a cross sectional study conducted in Yastabshiron Hospital, Khartoum-Sudan, during the period from November 2010 to May 2011. A total of 353 known asthmatic patients presenting with respiratory symptoms were examined. Results of 295 patients who satisfactorily completed spirometric measurements were accepted for analysis. Inclusion criteria were age 18 years or more, known asthmatic for at least one year, presenting with symptoms and signs of mild-moderate asthma according to GINA classification of clinical severity[1], and showing positive reversibility testing in previous records. Exclusion criteria were age less than 18 years, asthmatic for less than one year, presenting with symptoms and signs of severe asthma or other acute or chronic medical abnormality in addition to asthma, failure to obtain a positive reversibility testing in the past.

Each asthmatic patient was asked about date of his asthma diagnosis, current day and night symptoms, frequency of asthma attacks and type/frequency of inhalers used in treatment. Clinical examination was carried out to exclude signs of severity and presence of additional medical abnormalities. A portable all flow spirometer (Clement Clarke International, UK) was used to measure FVC, FEV_1, FEV1/FVC ratio and PEF for each patient. All data obtained by history taking; clinical examination and lung function testing were used for evaluation of clinical severity for each patient, using the GINA classification[1].Measurements were performed according to the guidelines of the American Thoracic Society[9] on presentation and then 15 minutes following inhalation of 0.5 mg salbutamol using a spacer. Positive reversibility was accepted when FEV1 improvement was greater than 12% or 200 ml.[5]

The research conforms to the ethical principles of medical research developed by the World Medical Association Declaration of Helsinki.[10] Written consents were obtained from the patients before entry into the study. Data obtained were analyzed using the Statistical Package for the Social Sciences version 16 (SPSS Inc. Chicago, IL, USA). The chi square test was used to test distribution of categorical variables. Statistical significance was accepted when P value was less than 0.05.

RESULTS

Male to female ratio= 1: 1.4. Ages range from 18 to 86 years, height 144 to 188 cm, weight 42 to 125 kg and BMI 16.1 to 46.9. Mean values of these parameters are presented in table

Table 1: Characteristics of Patients in the Study Group

Parameter	Minimum	Maximum	Mean (SD)
Age	18.0	86.0	43.5 (15.3)
Height	144.0	188.0	164.3 (9.2)
Weight	42.0	125.0	78.2 (16.0)
BMI	16.1	46.9	29.0 (06.0)

Typical obstructive pattern was found in only 17.4% of obese patients, normal pattern in 18.3%, restrictive in 45.9% and combined pattern in 18.3% (table 2). The relation between patterns of spirometry and obesity was statistically insignificant. Reversibility tests were positive in 14% of those with normal pattern, 48% of those with obstructive pattern, 24% of those with restrictive pattern and 59% of those with combined pattern. This finding was found to be highly statistically significant (table 3).

Table2: Patterns of Spirometry among Obese and Non-obese asthmatic Patients in the Study Group

Pattern	Non-Obese n (%)	Obese n (%)	Total n (%)
Normal	17 (22.1%)	40 (18.3%)	57 (19.3%)
Obstructive	14 (18.2%)	38 (17.4%)	52 (17.6%)
Restrictive	35 (45.5%)	100 (45.9%)	135 (45.8%)
Combined	11 (14.3%)	40 (18.3%)	51 (17.3%)
Total	77 (100%)	218 (100%)	295 (100%)

P= 0.808

Table3: Reversibility Test in Relation to Patterns of Spirometry in the Study Group

	Reversibility test		
Pattern	Negative	Positive	Total
Normal	49 (86%)	8 (14%)	57 (100%)
Obstructive	27 (51.9%)	25 (48.1%)	52 (100%)
Restrictive	102 (75.6%)	33 (24.4%)	135 (100%)
Combined	21 (41.2%)	30 (58.8%)	51 (100%)
Total	199 (67.5%)	96 (32.5%)	295 (100%)

P= 0.000

DISCUSSION

Spirometry is the most commonly used test in assessment of ventilatory function of the lungs. It detects presence of airflow obstruction, evaluates its severity, aids in the differential diagnosis of asthma, assesses disease progression and evaluates response to treatment.[1-3] Abnormalities may appear even if the patient is asymptomatic.[11]In this study, spirometry is used for evaluation of different presentation patterrns expected in asthmatic patients. For this reason, the diagnosis of asthma in all patients participating in the study had been established, at least one year earlier, by a respiratory physician. To exclude the possibility of a wrong diagnosis, all these patients showed positive reversibility test in their records; either previously or during follow up. Confirmation of asthma diagnosis with an objective measure of lung function is essential. Many studies showed that history and clinical examination alone are not enough for asthma diagnosis or evaluation of its severity; unless augmented by lung function tests.[12,13]

The majority of patients in the study group were females. This is an expected finding because asthma in children is more prevalent in boys than in girls whereas after puberty, the disease is more common in women.[14,15] On the other hand, many studies reported more asthma symptoms[16,17] and higher frequency of routine visits[18,19] among females compared to males;however, few studies described sex difference in sensitivity to bronchodilators.[20]

The major finding in this study is that, typical obstructive pattern was found in only 17.4% of obese patients, normal pattern in 18.3% whereas 45.9% and 18.3% showed restrictive and combined patterns respectively. In addition to that, significant proportions of all these patterns showed positive reversibility

tests. These results indicate that obese patients suffering from asthma may present with non-obstructive patterns on spirometry and the diagnosis of asthma should not be excluded on a basis of that non-obstructive pattern. A possible explanation is that the vasodilatation caused by the inflammatory process within airways of asthmatics increases blood flow and makes the lungs heavier, resulting in reduction of FEV1 and FVC; on the other hand, these parameters are also reduced when complete obstruction within the small airways decreases the overall volume of air that ventilates the lungs, thus giving rise to restrictive or combined patterns. It is worth noting that, although obesity is a known cause of restrictive pattern of spirometry, only 45.9% of obese patients showed restrictive pattern and on the other hand, the relation between patterns of spirometry and obesity was found to be statistically insignificant.

When spirometric values are within normal range in patients with mild asthma, provocation tests, rather than bronchodilator studies are the usual next step for asthma diagnosis.[21] In this study, 19.3% of all patients showed normal spirometry and 14% of them had positive reversibility tests. This finding indicates that, in the symptomatic patient suspected of asthma, a bronchodilator study can be performed even if spirometry is normal. In addition to confirmation of asthma diagnosis, bronchodilator studies can relieve patients' symptoms and prevent unnecessary aggravation of patients' sufferings with the induced bronchoconstriction during the provocation techniques.

Conclusion:

In conclusion, our findings clearly demonstrate varieties of spirometric patterns among obese patients presenting with mild to moderate asthma. Significant proportions of all patterns showed positive reversibility tests, 15 minutes following the bronchodilation. It is recommended that the diagnosis of asthma should not be excluded on the basis of non-obstructive pattern on spirometry.

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