Spirometric evaluation of pulmonary function tests in clinically diagnosed patients of bronchial asthma

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ABSTRACT

The present study was undertaken to assess the difference between the normal predicted value and observed value of pulmonary function test (PFT) amongst the asthmatic patients and also to compare the aforesaid observed values between male and female asthmatic patients. Clinically diagnosed cases (male 62, female 75) of bronchial asthma attending medical out patient department of Nepal Medical College Teaching Hospital were assessed. All the pulmonary parameters showed significantly less observed values than the normal predicted values except PEFR in female and FVC in male asthmatic patients. Hence, PEFR in female and FVC in male asthmatic patients might not be considered as a valid parameter to indicate bronchial asthma. Present study also revealed that all the pulmonary variables were significantly higher in males than in females.

Keywords: Pulmonary function test, bronchial asthma, spirometry.

INTRODUCTION

The National Heart, Lung and Blood Institute defines asthma as a common chronic disorder of the airways characterized by variable and recurring symptoms, airflow obstruction, bronchial hyper responsiveness (bronchospasm), and an underlying inflammation.[1] It results in episodic bronchospasm and wheezing resulting in significant morbidity and mortality. Epidemiological studies indicate its increasing prevalence. Asthma affects a total of 300 million people worldwide.[2] In a previous hospital based evaluation in T.U. Teaching Hospital, Nepal, in 1994, proportion of bronchial asthma was 0.4% (45 cases out of 11190) of total hospital admission and 1.0% of admissions in intensive care unit.[3] In contrast to chronic obstructive pulmonary disease and chronic bronchitis, the airway inflammation of asthma is reversible and can affect people at any age.

Pulmonary function test (PFT), is a non invasive test, used to detect air flow limitation and/or lung volume restriction. Assessment of ventilatory function is an important investigation because, smoking, pollution related lung diseases (eg. COPD) and occupational pulmonary diseases are more widespread and generally more disabling than any other group of occupational health hazards. Early detection of functional impairment and its appropriate treatment will help to reduce morbidity and mortality due to these diseases. Furthermore, repeated testing makes it possible to trace and quantify the course of the illness and the effects of therapeutic interventions. [4] For achieving a better asthma management, spirometric evaluation of ventilatory function plays a critical role in the diagnosis, differentiation and management of respiratory illness such as asthma, chronic obstructive pulmonary disease and restrictive lung disorders.[5,6]

Reports revealed reduction of pulmonary flow parameter values in the asthma group at all points.[7] Most spirometric indices were reduced in association with current wheeze and a history of asthma. Whereas Mean values for all spirometric parameters for asthmatic adolescents, apart from forced expiratory volume in the first second of expiration (FEV_1,) and forced vital capacity (FVC), were in the normal range, which showed that FEV_1, and FEV_1/FVC were considered as an essential tool for diagnosing asthma.[8] It was found that even peak expiratory flow rate (PEFR) variability was low in asthmatic patient than in normal.[9] Similarly it was found that FEV_1, and PEFR were less than 80% of the predicted values.[10] In contrast, a study concluded that maximum voluntary ventilation (MVV)/ FEV_1, are abnormally low in many asthmatic subjects and can consider as a good parameter for predicting asthama.[11] Thus, in spirometric results bronchial provocation remains an essential tool for diagnosing asthma.

MATERIALS AND METHODS

Clinically diagnosed consecutive cases of bronchial asthma attending medical OPD of NMCTH, undergoing pulmonary function test during 9th April 2009 to 4th December 2009, were enrolled in this study as patient population. All patients showed reversibility after inhalation of salbutamol (2.5 gm) which confirms the clinical diagnosis of bronchial asthma. They were ensured that nothing restricted the normal chest

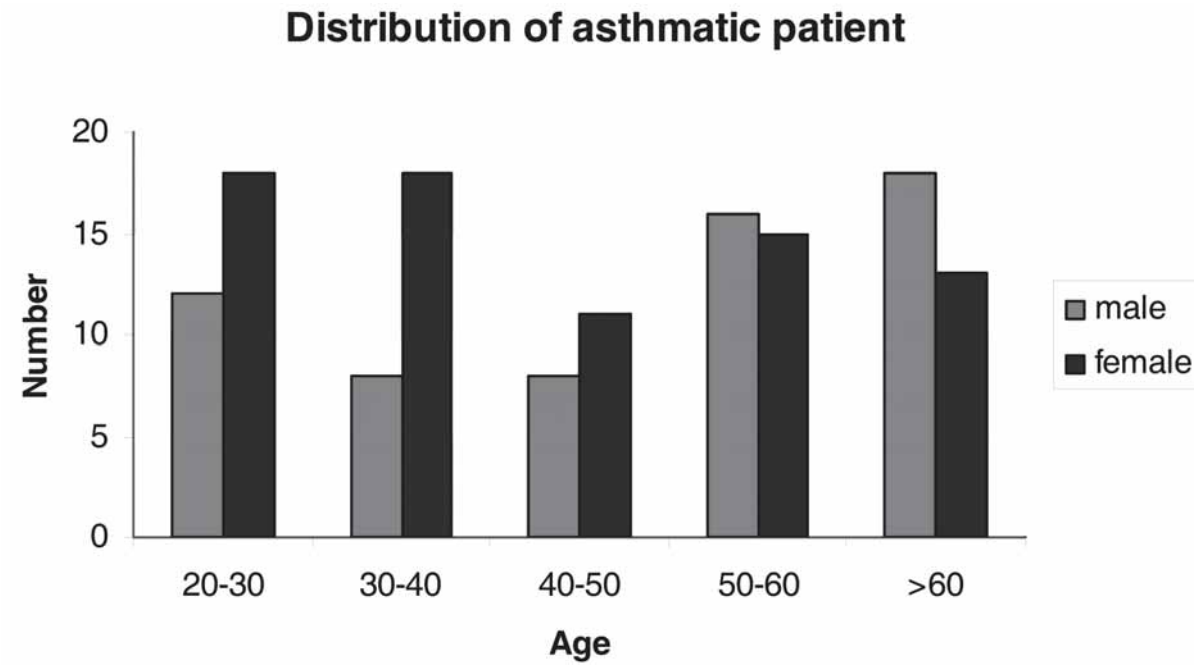

Fig. 1. Bar diagram showing distribution of asthmatic patient in different age groups

movement of air flow. They were then instructed to blow all the air into the tube as hard and as fast as they could in one long complete breath. They were explained and demonstrated until a satisfactory record was obtained. The subjects were asked to perform the PFT at least three times to observe FVC, FEV_1, FEV_1/FVC%, PEFR and the best of the three results was considered for analysis. To perform MVV test the subjects were asked to take a deep breath (maximum inspiration) and then to forceful exhale and maximally empty the lungs (maximum expiration) as fast and as strong as possible for 10 sec.

The measurement of pulmonary variables as stated above was made by computerized Spiro 232 (PULMOLAB 435, Morgan Medical Limited, England). Paired sample t test was calculated to observe the mean significant difference between dependent pulmonary variables and independent physical and anthropometric variables. All analyses were performed with the SPSS 11.5/PC statistical computing package.

RESULTS

A total of one hundred thirty seven (n=137) asthmatic patients were included in the study (male 62, female 75). The distribution of male and female in different age groups is shown in Fig 1.

Mean significant difference of pulmonary parameters with predicted value and observed values are shown in Table-1. All the pulmonary parameters showed significantly low observed value in comparison to normal predicted value except PEFR in female and FVC in male asthma patients.

DISCUSSION

Bronchial asthma is a common medical problem.[2] In our hospital based observation, it covered 2.2% of total medical admission during 2007-2009. During 9th April 2009 to 4th December 2009, there were 137 cases of clinically diagnosed bronchial asthma undergoing PFT test. It was accounted 0.8% out of total medical out patient department consultations (18,787). However, the exact proportions of bronchial asthma may be more than this data, as some of the practitioners may treat them empirically without requesting PFT tests and some poor patients may not agree to undergo PFT.

The pulmonary variables FVC, FEV_1, FEV_1/FVC%, PEFR and MVV were considered for analysis, since these parameters are mostly used by clinicians to evaluate the respiratory health and to differentiate the restrictive and obstructive airway disease. Further, most of the available literatures are also based on the analysis of these pulmonary variables for evaluating pulmonary disorder.[12,13]

The mean values of pulmonary functions were considerably less in women as compared to men. These findings may be explained by the following facts: greater development of musculo-skeletal system of the thoracico-abdominal compartments as well as that of the pulmonary tissue in men; differences in the outdoor and occupational habits; and the possible effects of repeated pregnancies in women, the latter would impair the force of contraction of the abdominal muscles which might restrict the maximal expiratory effort.[14]

Table-1: Pulmonary measurements and Mean significant difference of pulmonary variables between normal Predicted Value and Observed Value in asthmatics.

Parameters	Sex	Predicted value (Mean ± SD)	Observed value (Mean ± SD)	P value
FVC(l/sec)	Male	3.05 ± 0.73	2.90 ± 0.93	Insignificant
	Female	2.56 ± 0.40	2.09 ± 0.76	<0.001
FEV1(l/sec)	Male	2.52 ± 0.63	2.27 ± 0.97	<0.05
	Female	2.16 ± 0.37	1.84 ± 0.75	<0.001
FEV1/FVC%,	Male	82 ± 4.28	75 ± 13	<0.001
	Female	84 ± 4	86 ± 11	<0.05
PEFR(l/sec)	Male	6.52 ± 0.82	5.44 ± 2.52	<0.001
	Female	4.96 ± 0.54	4.73 ± 2.07	Insignificant
MVV(l/min.)	Male	134.8 ± 27.35	83.9 ± 40.6	<0.001
	Female	96.1 ± 15.1	69.8 ± 34.4	<0.001

Bottai *et al*[15] reported decline of pulmonary function with increased obesity which was age-independent. In other words, gains of BMI induce decrease in pulmonary function. A higher value of BMI in women might be one reason for the lower pulmonary values in them as compared to men.

The study showed significantly less observed values of all the pulmonary parameters than the normal predicted values except PEFR in female and FVC in male asthmatic patients. Hence, PEFR in female and FVC in male asthmatic patients might not be considered as a valid parameter to indicate bronchial asthma. Nevertheless, for the evaluation of the best predictor among the pulmonary parameters for the asthma, there is necessity to conduct studies in a much larger scale for different ethnic groups of Nepal.

ACKNOWLEDGEMENTS

We would like to thank Mr. Nageshwor Mandal and Ms Moni Jirel, for their secretarial assistance and cooperation. We are extremely grateful to Mr. Prem Panta, statistician/ lecturer, Dept of Community Medicine, Nepal Medical College, for the statistical analyses.

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