EVALUATION OF POST-BRONCHODILATOR REVERSIBILITY IN PATIENT WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE AND ASTHMA

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ABSTRACT

Obstructive lung disease is a group of disorders comprising Chronic Obstructive Pulmonary Disease (COPD) and asthma. It is one of the most common causes of morbidity and mortality worldwide. COPD is a preventable and treatable disease characterized by persistent respiratory symptoms and airflow limitation, whereas asthma is reversible episodes of recurrent wheezing, cough, breathlessness, and chest tightness. It is sometimes difficult to distinguish COPD from asthma when COPD patients present with significant post-bronchodilator reversibility. Spirometry is the gold standard test to diagnose obstructive airway disease. We carried out a hospital-based cross-sectional study in Nepal Medical College Teaching Hospital from January 2018 to December 2018. One hundred and ninety eight patients who met the inclusion criteria underwent spirometry. Basal and post-bronchodilator FEV1, FVC, FEV1/FVC, and reversibility of FEV1 were measured. The majority of the patients enrolled in the study were males (n=100). The mean age of the patients was 49.3±17.0 years. Most of the patients were above 60 years of age (n=68). Clinical diagnosis of asthma was made in 113 (57%) and COPD in 85 (43%) patients. Post-bronchodilator reversibility was observed in 48 (42%) asthmatic and 19 (22%) COPD patients. Post-bronchodilator reversibility was statistically significant in asthmatic patients (p=0.032). Post-bronchodilator reversibility was observed in COPD patients as well. Therefore, post-bronchodilator reversibility alone may have a limited role in differentiating COPD from bronchial asthma. However, spirometry is mandatory to diagnose a patient with obstructive lung disease.

KEYWORDS

Asthma, COPD, obstructive airway disease, post-bronchodilator reversibility, spirometry, Nepal

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INTRODUCTION

Asthma and COPD are obstructive airway diseases, resulting in airway narrowing due to inflammation and bronchoconstriction.[1] Obstructive airway diseases are one of the most common causes of morbidity and mortality worldwide.[2] The incidence of and mortality due to obstructive airway diseases are increasing globally, thus a greater understanding of the characteristics and management of these diseases is needed.[3]

The Global Initiative for Asthma (GINA) defines asthma as a heterogeneous condition, usually characterized by chronic airway inflammation. It is defined by the history of respiratory symptoms such as wheeze, shortness of breath, chest tightness, and cough that vary over time and intensity, together with variable expiratory airflow limitation.[4] Asthma is one of the most common chronic respiratory diseases and is a major public health issue globally, affecting people of all ages, genders, and ethnicities.[5]

The Global Initiative for Chronic Obstructive Lung Disease (GOLD) defines COPD as a common, preventable, and treatable disease state characterized by persistent respiratory symptoms and airflow limitation due to airway and alveolar abnormalities usually caused by significant exposure to noxious particles or gases and influenced by host factors including abnormal lung development.[6] COPD is currently the fourth leading cause of death in the world.[7]

As reported by Imaoka *et al*[8] and Jindal[9], in 1961, Orie *et al* reported that there are patients who have manifestations of both asthma and COPD. This theory is known as the "Dutch hypothesis". This hypothesis states a considerable overlap between asthmatic and COPD patients in terms of airway responsiveness, airflow obstruction, and pulmonary symptoms.[5] However, Ried *et al* suggested that asthma and COPD are fundamentally different diseases where asthma is largely due to allergic phenomenon and COPD is due to smoking-related inflammation and damage, and this theory is known as the "British hypothesis".[10]

Patients with COPD were traditionally believed to have irreversible airway obstruction.[11] However, recent studies have demonstrated that many patients with COPD exhibit post bronchodilator reversibility, making it difficult to distinguish from asthma.[12] A study conducted by Tashkin *et al*[13] had reported substantial post bronchodilator reversibility in COPD patients who did not have other features of asthma. Some literatures label these with features of both the conditions as asthma-COPD overlap syndrome.[8] The incidence and prevalence of the syndrome are largely unknown, some small studies have demonstrated a prevalence of 2.1-26.1% in different countries.[14]

Spirometry is a gold standard test to diagnose obstructive and restrictive lung disease.[15,16] When initial spirometry shows an obstructive pattern, 'reversibility' testing is done to see whether the airway obstruction is reversible or not.[17] Traditionally, 'reversibility' testing was used as a valuable tool in differentiating asthma and COPD.[18] However, more recent studies do not support the use of 'reversibility' testing alone in differentiating these two conditions.[1,17] The study aims to observe the post-bronchodilator reversibility in clinically diagnosed case of asthma and COPD.

MATERIALS AND METHODS

This is a hospital based cross-sectional study performed at Nepal Medical College and Teaching Hospital from January 2018 to December 2018. COPD was defined clinically in patients who presented with persistent respiratory symptoms like cough for three months for at least two consecutive years, shortness of breath, and associated with definite risk factors. Similarly, asthma was defined clinically when patient presented with recurrent episodes of cough, wheeze, shortness of breath, chest tightness, and associated with atopy.

Patients above 15 years of age and having symptoms like cough, wheezing, shortness of breath, and chest tightness were included in the study. Patients with heart failure, bronchiectasis, interstitial lung disease, and those who did not give the consents were excluded from the study. After taking detailed history and physical examination, patients who met the inclusion criteria were included in the study and were categorized clinically into those with COPD or asthma. Spirometry was performed in all patients. Basal and post-bronchodilator FEV1, FVC, FEV1/FVC, and reversibility of FEV1 were measured. Both oral and inhaled bronchodilators were stopped 12 hours prior to the test and theophylline was stopped 24 hours prior to the test.

Post-bronchodilator spirometry was done after 15 minutes of inhalation of bronchodilator (salbutamol). The change in spirometry values after inhalation were expressed as absolute change in FEV1 in ml and in percentage. FEV1 above 80% was considered normal, significant

reversibility was characterized by change of ≥12.0% and/or 200 ml of change in FEV1; FEV1/FVC ratio less than 70.0% was considered as decreased. Chi square test was used for statistical analysis and p-value of <0.05 was considered statistically significant.

RESULTS

Among the 198 patients included in this study, majority of the patients were male (n=100, 50.5%), and the mean age of the patients was 49.3±17.0 years. Most of the patients were above 60 years of age (n=68, 34.0%). In our study, 113 (57.0%) patients were diagnosed as asthma and 85 (43.0%) patients were diagnosed as COPD.

Table 1 shows the mean age of the patients with asthma and COPD. The mean age of asthmatic patients was 38.9±13.4 years and that of COPD patients was 63.4±9.6 years. The difference between the means of age of asthmatic and COPD patients was statistically significant (p<0.001). Asthma was seen in younger age groups compared to COPD.

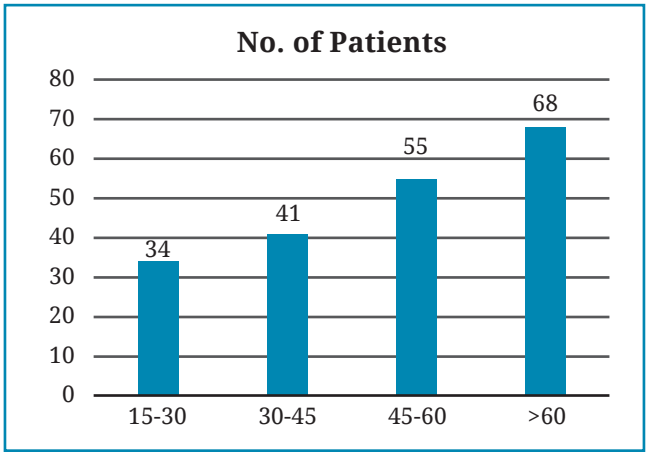

Fig 1: Age distribution of patients

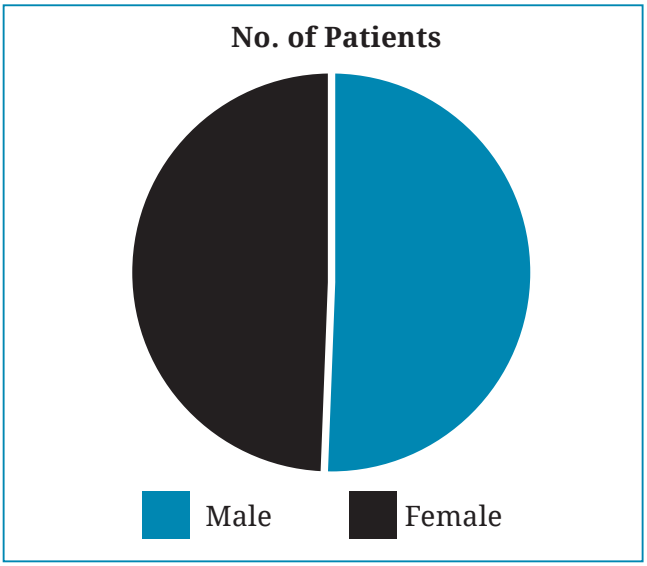

Fig. 2: Gender distribution of patients

Out of 113 clinically diagnosed asthmatic patients, post-bronchodilator reversibility was observed in 48 (42.0%) patients. Similarly, out of 85 clinically diagnosed COPD patients, post-bronchodilator reversibility was seen in 19 (22.0%) patients. Spirometry showed statistically significant post-bronchodilator reversibility in asthmatic patients compared to COPD patients.

DISCUSSION

In this study, obstructive lung disease was common in patients above 60 years of age (n=68, 34.0%). Similarly, the prevalence was more common in males (n=100, 50.5%).

In a study conducted in 395 cases of asthma and COPD by Kesten and Rebuck[19], asthma was present at a younger age when compared to COPD (48.8±1.0 vs. 65.6±0.9 years, p<0.05).

Table 1: Descriptive statistics: Mean age of patients

Diagnosis	No. of patients	Minimum age	Maximum age	Mean age	SD	p-value
Asthma	113	15	75	38.9	13.4	
COPD	85	42	80	63.4	9.6	<0.001
Total	**198**	**15**	**80**	**49.4**	**17.0**	

Table 2: Number of patients showing reversibility after bronchodilator in spirometry

Diagnosis	Reversibility		Total	P-value
	Significant	Insignificant		
Asthma	48 (42.0%)	65 (58.0%)	113	
COPD	19 (22.0%)	66 (78.0%)	85	0.032
Total	**67**	**131**	**198**	

Similarly, in our study, asthma was present in the younger age group when compared to COPD (38.9±13.4 vs 63.4±9.6 years, p<0.001). In a study conducted by Rycroft *et al*,[20] patients above 75 years of age had higher incidence of COPD.

Post-bronchodilator reversibility is a common phenomenon in asthmatic patients. In a study conducted by Janson *et al*,[18] the prevalence of post-bronchodilator reversibility in asthma and COPD was 17.3% and 18.4%, respectively. In a study conducted by Kesten and Rebuck,[19] the post-bronchodilator reversibility of FEV1 was statistically significant among the asthmatic patients (16.4±0.9 vs 10.6±0.8 L, p<0.05). In our study too, the post-bronchodilator reversibility was statistically higher amongst asthmatic patients (p<0.05). However, there were also cases where clinically diagnosed COPD patients showed post-bronchodilator reversibility. Again, some asthmatic patients did not have post-bronchodilator reversibility on spirometry. Therefore, post-bronchodilator reversibility cannot be relied upon every time in differentiating these two conditions. Chhabra[21] concluded that the reversibility test had limited utility to differentiate asthma from COPD due to a substantial overlap of the response of a bronchodilator in them.

Loss of post-bronchodilator reversibility in asthmatic patients might have been due to the chronicity, which might have led to the irreversible remodeling of the airway wall. Post-bronchodilator reversibility seen in some COPD patients might reflect asthma-COPD overlap syndrome.

This study showed that bronchodilator reversibility was common in patients with asthma than COPD. However, COPD patients also had post-bronchodilator reversibility in spirometry. Therefore, post-bronchodilator reversibility, if used as an isolated tool, has a limited value in differentiating between COPD and asthma. Rather, clinical history and physical examinations must be correlated with spirometry findings while differentiating COPD from bronchial asthma. Spirometry is still mandatory to diagnose a patient with obstructive lung disease as it can help guide the treatment.

This was a single centered, hospital-based cross-sectional study with a small sample size. Hence, the definite conclusion is difficult to draw from this study regarding the exact prevalence of post-bronchodilator reversibility in asthma and COPD patients. Post-bronchodilator reversibility was seen in 22.0% of COPD patients thus, post-bronchodilator reversibility alone might have a limited role in differentiating COPD from bronchial asthma. To confirm our findings, larger studies are warranted.

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