Study on factors associated with post bronchodilator reversibility among patients presenting with dyspnea: An experience at a tertiary care academic hospital in Kerala

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ABSTRACT

Background: The change in FEV₁ after administration of a short-acting bronchodilator has been widely used for diagnosis of obstructive airway diseases. Many factors can influence the post bronchodilator reversibility. Aim: The aim of the present study was to estimate the presence of reversibility among the patients of obstructive airway disease and to identify the factors affecting it. Methods: Patients who presented to the department of respiratory medicine with symptoms of dyspnea were evaluated with spirometry. Spirometry and post bronchodilator reversibility (BDR) was defined as per international guidelines. SPSS 17 was used for statistical analysis and \( P < 0.05 \) was considered significant. Results: Out of 100 patients studied, 33 had BDR. Median age of the population was 58 ± 17 years. There were 72 non-smokers and 58 men. A total of 32 had chronic obstructive pulmonary disease (COPD), 56 had asthma, and 12 had normal spirometry. The median pre and post bronchodilator FEV₁ was 1.34L/Sec and 1.46 L/sec respectively. Twenty-seven of asthma (41%) and 6 of COPD (19%) had BDR (\( P = 0.05 \)). Other factors associated with BDR were smoking (\( P = 0.035 \)). There was no statistically significant correlation found between eosinophilia, gender, severity of obstruction, BMI, height, weight and age. Conclusion: The prevalence of post BDR in the study population was 33%. The factors affecting BDR were smoking status, and asthma. The study did not show any significant correlation between BDR and eosinophilia, gender, height and age.

KEY WORDS: Asthma, bronchodilator reversibility, COPD, Kerala population

INTRODUCTION

Asthma is traditionally considered a disease of the young and non-smokers. Main clinical characteristics of asthma are episodic airway obstruction and hyper-responsiveness that is reversible.¹ Chronic obstructive pulmonary disease (COPD) is a gradually progressive fixed airway obstruction that is associated with exposure to noxious gas-particles or tobacco and common in middle aged men. COPD and asthma are anatomically and physiologically two extreme categories which can be easily separated by etiology, symptoms, type of airway inflammation, response to treatment, and course of illness.² In clinical practice, COPD and asthma are difficult to distinguish just on the basis of

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physiologic findings when isolated from the context of their environmental and clinical history.\[9\] Such inability to clearly separate these conditions can be very frustrating for the treating clinician.\[14\] The clinician is often faced with two very different treatment paradigms depending on the diagnostic choice. Even in today’s era, measurement of lung function test is a key diagnostic tool in obstructive airways diseases (OADs) like asthma and COPD.\[10\] It is recommended that if airway obstruction is found in spirometry, reversibility test with short acting beta two agonists should be done.\[6,7\] This study was conducted to find out the prevalence of reversibility in OADs.

**OBJECTIVE**

The primary objective of the study was to assess the prevalence of post bronchodilator reversibility (BDR) among patients presenting to Respiratory Medicine outpatient department (OPD) with complaints of dyspnea. Secondary objective of the study was to assess the factors influencing post BDR.

**MATERIALS AND METHODS**

It was an analytical research study conducted over one year in the department of respiratory medicine, at a tertiary care academic hospital of Kerala, India.

**Inclusion criteria**

Patients who presented to the respiratory medicine department for our evaluation of dyspnea.

**Exclusion criteria**

Those with recent myocardial infarction, active respiratory tract infection, non-compensated heart failure, recent eye operation or those with cognitive impairment were excluded from the study.

**Intervention**

Spirometry with BDR testing was done for all the patients. All patients were assessed for short-term (20 mins after the test) change in lung function, usually FEV1, after inhalation of a short-acting bronchodilator drug. We used Salbutamol metered dose inhaler (100 mcg 2 puffs with spacer) for bronchodilatation.\[8\]

**Definition of bronchodilator reversibility**

Post bronchodilator FEV1: A requirement of at least a 12% baseline increase plus an additional 200 mL absolute change.\[8\]

**Statistical analysis**

Values are expressed as percentages and mean ± SD. SPSS 17 was used for statistical analysis and P of < 0.05 was considered significant. Pearson co-efficient was used to find out correlation between BDR and different variables.

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**RESULTS**

We included 100 patients who presented to us for evaluation of dyspnea. Mean age was 58 ± 17 years. There were 58 men, and out of them, 28 were smokers. All females (32) were non-smokers. A total of 66 patients had COPD and 32 had asthma, while 2 had normal spirometry. There were 33% patients with BDR. Other base line demographics and the values of pre and post bronchodilator FEV1 are shown in Table 1.

The median pre and post bronchodilator FEV1 was 1.34 L/Sec and 1.46 L/sec respectively. Twenty-seven of asthma (41%) and 6 of COPD (19%) patients had BDR (P = 0.05). Other factors associated with BDR were smoking (P = 0.03). No statistically significant correlation was found between the female gender, presence of eosinophilia, severity of obstruction, or height, weight and age [Tables 2 and 3]. BDR in the current cohort was 33%. Out of them 27 (81%) asthma and 6 (18%) had COPD. Thus, the present study showed that BDR was more common in asthmatic than in COPD patients [Table 2].

We conducted the subgroup analysis of patients diagnosed as asthma and COPD separately and factors affecting BDR among them. We could not find any variable of significance in COPD group that was affecting BDR. In the asthma group, when we studied the factors associated with BDR, it was found to be more common in females compared to males with P = 0.02 [Table 3].

**DISCUSSION**

We conducted a study on the prevalence of BDR among patients presenting with dyspnea. The study was aimed to assess the prevalence of reversibility among patients who had dyspnea.

The definitions used for bronchodilator responsiveness was based on the American Thoracic Society (ATS) criteria.\[8\] The definition of asthma was based on self-reported diagnosis, attacks and medication, and the definition of COPD in this

| Character          | n Median (Percentage/Range) |
|--------------------|-----------------------------|
| Age (in years)     | 58±17                       |
| Smoking status     |                             |
| Non-smoker         | 62                          |
| Smoker             | 28                          |
| Sex                |                             |
| Male               | 58                          |
| Female             | 42                          |
| Pre bronchodilator FEV1 | 1.34±0.66                  |
| Post bronchodilator FEV1 | 1.46±0.71                  |
| FEV1/FVC ratio Pre | 0.70±0.11                   |
| FEV1/FVC ratio Post| 0.75±0.11                   |
| Percentage of reversibility | 9.5±10.2                  |
| BMI                | 25.5±4.4 kg/m²              |
| Height             | 159±12.9 cm                 |
| Weight             | 64±8.7 kg                   |
Bronchodilator reversibility

The current study showed that the prevalence of post BDR in the study population was 33%. The factors affecting BDR were (non-) smoking status of the patient and diagnosis of asthma. There were 32 patients with COPD and 66 had asthma. Eighty one percent of asthma and 18% of all COPD showed BDR. Female gender was a variable associated with BDR among asthmatics. The other factors affecting BDR in the present study and its comparison with previously published study is shown in Table 4.

Limitations

The study was conducted at a tertiary care hospital and data could not be extrapolated to the general population. The study was done on limited number of patients and is bound to have type I error. We need to remember that the percentage of reversible patients only represents the percentage at that time point, as reversibility is known to vary significantly from time to time both in asthma and COPD.

CONCLUSION

The work was conducted at Amrita Institute of Medical Sciences. The institute research board approved the study. Informed consent was taken from patients prior to inclusion.

Authors’ contribution

Conceived and designed: Mehta AA

Data collection and analysis: Divya S, Nidhi S, Tisa Pul, Richie George

Writing of the paper: Mehta AA, Aditya Ashok
Table 4: Comparison of present study with previously published studies

| Study Name   | Method of Reversibility | Reversibility Criteria                                                                 | Clinical Predictors of Reversibility |
|--------------|-------------------------|----------------------------------------------------------------------------------------|-------------------------------------|
| ECLIPSE     | 15 mins after 400 µg salbutamol | ATS/ERS: FEV1 increase ≥12% plus 200 mL                                                 | No association with age, smoking status, or cigarette pack-years |
| Lung Health | 10 min after 200 µg ipratropium    | Three criteria used: FEV1 absolute change in m, change expressed as a percentage of the pre-bronchodilator value, and change expressed as a percentage of predicted normal FEV | Gender: no association; no association with quit status (sustained quitter, intermittent quitter, and continued smoker) |
| ISOLDE      | 30 mins after 400 µg salbutamol, then 30 mins after 80 µg ipratropium | As above                                                                             | No association between absolute change in FEV1 (mL) vs smoking status, atopy, or gender |
| UPLIFT      | 60 mins after 80 µg ipratropium then 30 mins after 200 µg salbutamol | Three criteria used: 1) criteria a: FEV1 increase ≥12% plus 200 mL 2) criteria b: FEV1 increase by more than 15% over baseline 3) criteria c: ≥10% absolute increase in % predicted FEV1 | Criteria a: age (P<0.001); gender, male (P=0.001); BMI (P=0.001); present smoking status (P=0.001) Criteria c: no significant association including duration of COPD |
| NETT        | 15 mins after 116 µg salbutamol  | ATS/ERS: FEV1 increase ≥12% plus 200 mL                                                 | TLC (P=0.005); gender (11% female reversible vs 29% male reversible); P=0.002; no association with age; with pack-years or extent of emphysema on CT Asthma and non-smokers: Reversibility No association between age, gender, GOLD/GINA status, BMI or H/of Eosinophilia |
| Present Study (100) | 15 mins after 200 mcg of Salbutamol | ATS/ERS: FEV1 increase ≥12% plus 200 mL                                                 | Features of the bronchial bacterial microbiome associated with atopy, asthma, and responsiveness to inhaled corticosteroid treatment |