DETERMINING EFFICACY OF SALBUTAMOL IN RESTRICTIVE SPIROMETRY

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ABSTRACT

Of different parameters of spirometry, FEV_1 (forced expiratory volume in first second), FVC (forced vital capacity), FEV_1/FVC ratio and PEFR (peak expiratory flow rate) are chosen which provide information about the lung function in restrictive lung disease. The objective of this study was to determine the efficacy of salbutamol on the basis of improvement in spirometry parameters.

A descriptive cross sectional study was conducted at NMCTH for a period of 3 months. A total of 50 patients who presented with symptoms of respiratory disease in medicine outpatient department (OPD) in which spirometry was performed were selected. Of the 50 patients, 25 with restrictive pattern were selected as cases and remaining 25 with normal pattern on the basis of spirometry were selected as control. After taking informed consent, spirometry parameter were measured before and after salbutamol inhalation. Data was collected from medicine department, pulmonary function test (PFT) unit. All the data were entered in statistical package for social sciences (SPSS version 20) and FEV_1, FVC, FEV_1/FVC and PEFR were analyzed.

There was significant difference ($p<0.05$) in spirometry parameters (i.e. FEV_1, FVC, PEFR) when after salbutamol therapy was compared from before therapy. However, there was no statistical difference in percentage change in spirometry parameter (%FEV_1 change, %FVC change, %FEV_1/FVC change and %PEFR change) between cases and control groups.

Thus, salbutamol was not efficacious and did not produce effective bronchodilation in patient with restrictive pattern spirometry.

KEYWORDS

Bronchodilation, restrictive pattern, salbutamol, spirometry

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INTRODUCTION

Salbutamol, a bronchodilator and one of the essential medicine in WHO's list, is marketed by several names such as albuterol, ventolin, asthalin, etc. This drug is used in management of pulmonary diseases.[1] Such diseases can be classified as obstructive, restrictive or combined pattern and is assessed by spirometry. Spirometry is a physiological test that is used for screening of respiratory health in the same way as blood pressure provide information about general cardiovascular health.[2] A good respiratory health is interpreted as normal on the basis of normal spirometry parameters like forced expiratory volume in first second (FEV_1), forced vital capacity (FVC), ratio of FEV_1/FVC and peak expiratory flow rate (PEFR).[3-4] Restrictive lung diseases are defined as inability to get air into the lung. It is best defined as a reduction in total lung capacity (TLC) but is suspected when the FVC is low and the ratio of FEV_1/FVC is normal.[4-5] Restrictive lung diseases can be produced by a number of defects: increased elastic recoil (interstitial lung disease), respiratory muscle weakness (myesthnia gravis), mechanical restrictions (pleural effusion) and poor effort.[6] Spirometry being the most widely available is used for pulmonary function test (PFT). It takes only 15-20 minutes, carries no risks and provide information about obstructive and restrictive pattern.[7] According to American Thoracic Society guidelines, the diagnosis of obstructive and restrictive ventilatory defects should be made using the basic measurements of spirometry.[8] Patient with restrictive lung diseases have reduced FEV_1 and reduced FVC but the FEV_1/FVC ratio remains normal.[4] This can be assessed by spirometry parameters like FEV_1, FVC, FEV_1/FVC ratio and PEFR. These variable were taken into consideration because of the fact that they determine the pattern of obstruction in pulmonary disease.[9-10] Patients were subjected to bronchodilator reversibility test,[11] it is percentage improvement in FEV_1, FVC or both from baseline following bronchodilator administration.[12] Percentage changes in spirometry parameters were used to observe efficacy of salbutamol.[13-14]

MATERIALS AND METHODS

A descriptive cross sectional study was conducted in Department of Medicine, NMCTH from 20th August 2016 to 20th November 2016. Informed consent was taken from all the patients. Ethical approval was taken from the Research and Ethical Sub Committee (RESC) of NMCTH. Confidentiality and anonymity of the patients was assured and maintained.

A total of 50 patients who presented with symptoms of respiratory disease in medicine outpatient department (OPD) in which spirometry was performed were selected. Of the 50 patients, 25 of them with restrictive pattern were selected as cases and remaining 25 patients had respiratory symptoms but no airway diseases were selected as control. The spirometer used was SCHILLER SP-26C. A qualified pulmonary technologist performed spirometry in patients referred from outpatient department (OPD). The patients were instructed and were asked to perform spirometry at least three times to observe FEV_1, FVC, FEV_1/FVC ratio and PEFR. The best values were considered for analysis. After completion of spirometry, the same patient was given salbutamol 1ml (5mg) mixed with 2ml of normal saline via nebulizer. Spirometry was repeated in the same patient.

The recordings were compared before and after administration of drug in order to determine percentage change in spirometry parameters due to salbutamol. Similarly, spirometry value was compared before and after administration of drug in control group. Percentage change in spirometry value obtained was compared in between case and control. All the data were entered in SPSS version 22 and spirometry parameter were analyzed using Paired T-Test and Independent Sample T-Test. P-value less than 0.05 was considered as statistically significant.

RESULTS

Among the 25 restrictive pattern patients, 16 were females and 9 were males. Among the normal pattern individual, 17 were females and the remaining 8 were males. In our study, restrictive pattern was seen in patient with age ranging from 30-80 years so control were also selected from the same age group i.e. 30-80 years. The patient belonging to age group 60-69 years was predorminant (36%) followed by 50-59 years (24%).

There was significant change between before and after salbutamol therapy for spirometry parameters like FEV_1, FVC, PEFR ($p<0.01$) in restrictive pattern cases and control groups but there was no significant change in FEV_1/FVC ratio.

Table 1: Paired T test applied for spirometry parameter in restrictive lung disease cases.

Spirometry parameter	Mean	Std. Deviation	p value
FEV_1 before	69.84	11.908	<0.05
FEV_1 after	75.20	11.180	
FVC before	65.00	11.800	<0.05
FVC after	69.00	11.195	
FEV_1/FVC before	101.84	9.994	0.329
FEV_1/FVC after	103.08	8.113	
PEF before	78.88	22.683	<0.05
PEF after	86.24	20.401	

Table 2: Paired T test applied for spirometry parameter in control group.

Spirometry parameter	Mean	Std. Deviation	p value
FEV_1 before	117.84	30.061	<0.05
FEV_1 after	126.92	32.346	
FVC before	107.4	19.498	<0.05
FVC after	116.32	22.017	
FEV_1/FVC before	103.16	9.715	0.537
FEV_1/FVC after	102.6	8.803	
PEF before	115	23.862	<0.05
PEF after	125.52	25.975	

However, there was no significant change in spirometry parameters in between restrictive pattern cases and control groups.

Table 3: Independent Sample T Test applied for percentage change for spirometry parameter in case and control

Spirometry parameter		Mean	Std. Deviation	p value
% FEV_1 change	Case	8.32	7.192	0.741
	Control	7.68	6.395	
% FVC change	Case	7.04	7.877	0.547
	Control	8.20	5.408	
% FEV_1/FVC change	Case	1.52	6.584	0.242
	Control	-.36	4.434	
% PEF change	Case	11.48	15.883	0.612
	Control	9.56	10.100	

DISCUSSION

Both chronic obstructive lung disease and restrictive lung disease are important cause of morbidity and mortality in US.[15-16] Restrictive lung disease can have a variety of aetiology including disease such as muscle weakness, congestive heart disease, interstial lung disease, diabetes mellitus and obesity, all of which can be associated with increased limitation and morbidity.[17-21] In addition, respiratory symptoms such as chronic cough or sputum production may have their own significant morbidities.[22-23]

Neopane *et al* in 2006 [24] stated that spirometry is a very useful diagnostic tool for preliminary diagnosis of respiratory disease that includes restrictive lung disease as well. The study also stated that the prevalence of restrictive lung disease was 3.1%.

Salbutamol is a β_2 agonist that cause bronchodilation. This bronchodilation improve airflow limitation in obstructive lung disease.[25] In our study, bronchodilation was also seen in patients with restrictive pattern spirometry. The bronchodilation produced significant change in spirometry parameter like FEV_1, FVC, PEFR but no significant change in FEV_1 to FVC ratio. Increase in these parameters are predictors of bronchodilator response.[26-29] Similar result was found for control group.

Salbutamol although efficacious, did not produce significant change in bronchodilation when restrictive pattern spirometry cases were compared with that of normal pattern. Although, in a study conducted by Hegeward M *et al*, bronchodilator testing can be omitted in patients with normal spirometry as they have low probability of positive response.[30] Since restrictive spirometry also did not show a positive response This could lead us to a conclusion that salbutamol is not efficacious and cannot produce significant bronchodilation in patients with restrictive lung disease and therefore is not useful.

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