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Original Research Article

Evaluation of Forced Vital Capacity (Fvc) and Slow Vital Capacity (Svc) in Suspected Patients of Obstructive Airway Disease Visiting Tertiary Care Hospital In Southern Bihar

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Abstract

Background: Forced expiratory volume in 1 second (FEV1) to forced vital capacity ratio (FVC) is being used to diagnose the obstructive lung diseases. Forced manoeuvre (FVC) or relaxed/slow manoeuvre (SVC) can be used to determine vital capacity (VC). In healthy individuals the difference between SVC and FVC (SVC-FVC) is minimal whereas in the presence of airway obstruction this difference will become significant. The present study was done with the objective to detect and compare the airway obstruction by determining the FEV1/FVC and FEV1/ SVC ratios.

Methods: This was a prospective cross-sectional study done at Narayan medical college and hospital Sasaram Bihar during the period from January 2022 to June 2022 among the patients presenting with symptoms of obstructive airway disease. The sample comprised of 350 patients who underwent spirometry according to standard of ATS/ERS guidelines. As per the criteria, the patients are classified into four groups, by spirometry.

Results: The analysis of FEV1/FVC revealed the presence of airway obstruction in 130 (37%) individuals compared to 165 (46%) individuals by the analysis of Fev1/SVC ratio. In the obstruction and mixed groups, the difference in vital capacity SVC – FVC is statistically superior ($p<0.05$) when compared to normal and restriction groups.

Conclusions: The FEV1/SVC ratio detected the presence of airway obstruction in more individuals than did FEV1/FVC ratio and hence FEV1/SVC considered as more reliable factor in the detection of obstructive airway diseases.

Introduction

Chronic obstructive pulmonary disease is defined by GOLD (Global Initiative for chronic obstructive lung disease) as “a common, preventable & treatable disease

that is characterized by persistent respiratory symptoms & airflow limitations that is due to airway and/or alveolar abnormalities usually caused by significant exposure to noxious particles or gases [1]."

Chronic obstructive pulmonary disease is one of the main causes of disability & mortality at present [2]. In India prevalence of chronic obstructive pulmonary disease ranging between 6.5% and 7.7% in rural and 9.9% in urban India [3]. It is predicted to become the 3rd leading cause of death worldwide in 2030 by WHO [3]. The most common respiratory symptoms include dyspnea, cough &/or sputum production. These symptoms may be under reported by patients.

The chronic airflow limitation characteristic of chronic obstructive pulmonary disease is caused by a mixture of small airways disease (obstructive bronchitis) & parenchymal destruction (emphysema) [1].

Risk factors for chronic obstructive pulmonary disease are male sex, age more than 45 years, cigarette smokers, & history of occupational exposure to organic & inorganic dust, fumes of biomass fuel, chemical agents.

GOLD CLASSIFICATION [4] :

The staging was done using GOLD criteria (2010)

GOLD STAGE	COPD SEVERITY	FEV1/FVC Ratio	FEV1 Range
I	Mild	<0.70	>80% of normal
II	Moderate	<0.70	50%-79% of normal
III	Severe	<0.70	30%-49% of normal
IV	Very Severe	<0.70	<30% of normal or <50% of normal with chronic respiratory failure

Spirometry is ideally essential for the diagnosis of chronic obstructive pulmonary disease. spirometry measurement of post bronchodilator forced expiratory Volume in 1sec (FEV_1) to forced vital capacity ratio (FEV1/FVC) is essential for establishing the diagnosis, assessment of severity (staging) in chronic obstructive pulmonary diseases.[5] Normal values are approximately 80% and in obstructive lung disease the ratio was reduced to less than 80% of predicted [5].

Vital capacity can be determined by a forced manoeuvre (FVC) or relaxed /slow manoeuvre (SVC). When a FVC manoeuvre is performed ,there will be dynamic airway compression and airway collapse leading to air-trapping and reduced in amount of air expelled out by forced manoeuvre, whereas in SVC manoeuvre there will be less intra thoracic pressure .Hence large volume of air can be mobilised [6].

So, FVC volume will be less due to the dynamic compression and SVC volume will be more for the same patient. As a result more patients with obstructive airway disease can be diagnosed with SVC manoeuvre.

In healthy individuals the difference between SVC and FVC is minimal or practically zero; whereas in the presence of airway obstruction this difference will become significant.

Thus, the analysis of airway obstruction by FEV1/FVC which is being commonly used may result in under diagnosis of airway obstruction. [7]

Aim and Objectives

To measure FEV1/FVC and FEV1/SVC ratio among suspected patients of obstructive airway diseases.

Material and methods:

Study design and setting: Institution

based Cross sectional observational study.

Sample size: 350 patients**.**

Duration of study: 6 months.

Place of study: Narayan medical college and hospital jamuhar, sasaram.

Inclusion Criteria: Patients with symptoms of obstructive airway disease like wheeze, shortness of breath and cough.

Exclusion Criteria[8]: Those patients who will have a history of taking medications for above mentioned symptoms in the past.

- Patients who will have contraindications for performing spirometry.
- Patients with evidence of cardiac illness.
- Those who refused to give informed written consent.

Mathodology:

The study sample consisted of 350 patients. All of them were made to perform spirometry according to ATLS guidelines. First, they were made to perform slow vital capacity (SVC) followed by forced vital capacity (FVC). On the basis of the results, patients were classified in to four groups:

- Normal,
- Restriction,
- Obstruction and
- Mixed groups.

The difference between SVC and FVC (SVC- FVC) was calculated in each group and compared with the other group. All the obtained data were analysed by one way ANOVA method. For statistical analysis, the level of significance was set at 0.05.

Results:

Table 1: Demographic characteristics of study population.

Group	Male	Female	Age	BMI
Normal(N=157)	70	87	48.1+\-14	24.8+\-5.3
Obstruction(N=130)	79	51	58.8+\-7.5	20.9+\-4.4
Restriction(N=40)	20	20	46.0+\-9.0	26.5+\-7.0
Mixed(N=23)	15	8	61.5+\-11	24.2+\-5.0

Table 1 presents the demographic characteristics of the study participants in four groups. Female preponderance was seen in the normal group whereas male preponderance seen in obstruction and mixed groups. In restriction group both sexes were equal in number. The mean age group and BMI were ranged between 46.0 to 61.4 and 20.9 to 26.4 respectively.

Table 2: Pulmonary function characteristics of the study participants.

Parameters	Normal	Obstruction	Restriction	Mixed
FEV1 (L)	2.05+/-0.47	1.39+/-0.53	1.49+/-0.435	0.67+/-0.12
FVC (L)	2.60+/-0.54	2.66+/-0.74	1.85+/-0.44	1.4+/-0.33
SVC (L)	2.64+/-0.52	2.89+/-1.06	1.82+/-0.48	1.60+/-0.36
FEV1/FVC (%)	0.77+/-0.054	0.58+/-0.17	0.84+/-0.079	0.48+/-0.09
FEV1/SVC (%)	0.80+/-0.059	0.53+/-0.16	0.84+/-0.65	0.42+/-0.05
SVC-FVC (ml)	13+/-114	206.06+/-111	12+/-94	178+/-102

Table 2 presents the pulmonary function parameters in the four groups. The difference between SVC and FVC was analysed in each group and found to be greater in obstruction (206.06=/-111ml) and mixed groups (178+/-102ml). In

obstruction and mixed pattern groups the SVC-FVC parameter was found to be statistically superior to that in normal and restrictive group ($p<0.05$). The analysis of FEV1/FVC ratio diagnosed the presence of airway obstruction in (37%) individuals while FEV1/FVC ratio diagnosed airway obstruction in 165 (46%) individuals. Thus there is discrepancy of 9%.

Table 3: Comparison of the differences between SVC and FVC among the pulmonary function groups under study.

Groups	Normal	Obstruction	Restriction	Mixed
Normal	N/A	P<0.05	N/S	P<0.05
Obstruction	P<0.05	N/A	P<0.05	N/S
Restriction	N/S	P<0.05	N/A	P<0.05
Mixed	P<0.05	N/S	P<0.05	N/A

To determine the relation of SVC-FVC parameter, to the type of respiratory pattern, Kruskal-Wallis test was used to reveal the existence of statistical difference ($p<0.05$) in at least one of the pulmonary function groups. For this multiple comparisons of the means for independent samples was used as shown in Table 3. In the obstruction and mixed groups, the SVC-FVC parameter, was statistically significant in normal and restricted groups ($p<0.05$). In the normal and restriction groups, SVC-FVC parameter, was statistically significant ($p<0.05$) in obstruction and mixed groups (table 3).

Discussion

A forced manoeuvre (FVC) or relaxed manoeuvre (SVC) can be used to determine vital capacity (VC). When a FVC manoeuvre is performed, there will be a dynamic airway compression and airway collapse leading to air-trapping and reduction in the amount of air expelled out by forced manoeuvre, whereas in SVC manoeuvre there will be less intra thoracic pressure hence large volume of air can be mobilised[2]. So, FVC volume will be more for the same patient when we perform slow manoeuvre.

In the present study, the analysis of FEV1/FVC ratio diagnosed the presence of airway obstruction in 130 (37%) individuals while FEV1/SVC ratio diagnosed airway obstruction in 165 (46%) individuals. Thus, there is discrepancy of 9%. This was in agreement with the findings of Barroset al [7]. In his study, the discrepancy was found to be 8.4% between the two rations. In another study by Rasheed et al, the discrepancy between the two rations of the total sample was 17% [8].

In this study, we measured the difference between SVC and FVC based on the respiratory patterns. The findings of the present study showed that the difference between SVC and FVC (SVC-FVC) was greater in obstruction and mixed group. This findings of the present study showed that the difference between SVC and FVC (SVC-FVC) was greater in obstruction and mixed group. [9] This difference describes why the FVE1/FVC ratios were higher than the FEV1/SVC ratios in the present study. This was due to the lower FVC value than SVC which has greater airway obstruction detection capability. These observations are in consistent with the findings of Chan et al [4].

In this study, statistically significant differences were observed between SVC and FVC, signifying the volumes obtained by unforced manoeuvres. Similar findings were also observed by Barros et al. [7]

Conclusion

The findings of the present study reveals that FEV1/FVC ratio detected the presence of airway obstruction in more individuals than did FEV1/FVC ratio; signifying

FEV1/SVC ratio is more reliable and sensitive pulmonary function test for detection of obstructive airway disease such as COPD.

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