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Original Research Article

FEV1/FVC and FEV1/SVC ratios in the diagnosis of chronic obstructive pulmonary diseases

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Abstract

Half a million people die every year due to COPD in India, about over 4 times the number in USA & Europe. Asthma is one of the most common chronic diseases worldwide with an estimated 300 million affected individuals. The subjects recruited directly from the department of pulmonary medicine based on the inclusion and exclusion criteria. Minimum 60 subjects needed for the study. The parameters of lung volumes (SVC, FVC, FEV1, FEV1/FVC%, FEV1/SVC%) recorded by ATS standardized MEDISOFT® spirometry. FEV1/SVC diagnosed obstruction in 36 out of 38 patients (94.74%) compared to FEV1/FVC which diagnosed obstruction in 27 out of 38 patients (71.05%) with statistical significance (p= 0.009). The discrepancy is 23.69%.

Keywords: FEV1/FVC, FEV1/SVC ratios, chronic obstructive pulmonary diseases

Introduction

Spirometry is the most commonly used tool for evaluation of respiratory disorders, especially obstructive airway diseases. Chronic obstructive pulmonary diseases (COPD) and Bronchial asthma (BA) are the common obstructive airway diseases causing major health problems worldwide. Half a million people die every year due to COPD in India, about over 4 times the number in USA & Europe. Asthma is one of the most common chronic diseases worldwide with an estimated 300 million affected individuals [1, 2].

FEV1/FVC (Tiffeneau index) is an important ratio, for diagnosing COPD & BA, as recommended by GOLD & GINA respectively.

Currently there is a debate that the use of FEV1/FVC alone leads to underdiagnosis of obstructive airway diseases. In normal individuals forced vital capacity is equal to slow vital capacity. In patients with airway obstruction slow vital capacity is greater than forced vital capacity due to dynamic airway collapse during forced exhalation leading to air trapping & lung hyperinflation. Slow vital capacity (SVC) avoids dynamic airway compression and gives

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more appropriate airway status. In 2005, ATS/ERS recommended the best of FVC or SVC maneuver to determine VC. This statement is accepted by GOLD 2014 guidelines [3, 4].
FEV1/FVC is usually used alone in our routine practice, which could lead to high chances of missing cases. Barros *et al*. [5] conducted a study in Europe, which concluded that FEV1/SVC ratio (566 individuals) detected the presence of airway obstruction in more individuals than did the FEV1/FVC ratio (476 individuals). Rasheed *et al*. [6] conducted a study in U.S.A, which concluded that FEV1/FVC ratio by spirometry was falsely normal in 17% of patients with known OAD (Asthma and COPD). These patients were correctly identified as having obstructive airway disease by low FEV1/SVC.
At present, we have a very few studies worldwide and also in India to validate this index (FEV1/SVC) for diagnosing airway obstruction. Hence this study conducted to substantiate the amount of discordance with FEV1/FVC & FEV1/SVC ratios in the diagnosis of airway obstruction and also to identify the prevalence of missed patients while using both the ratios.

Methodology

Sources of data

Patients with COPD presenting to the department of pulmonary.

Research design

Cross sectional study design.

Sampling techniques

Convenient sampling technique.

Sample

Total sample consisted of 79 subjects which includes 38 COPD patients.

Inclusion criteria

- Age group between 12-80 years.
- Both males and females.
- Patients with high index of clinical suspicion of COPD.
- Patients willing to give written informed consent to participate in the study.

Exclusion criteria

- Test performances that do not meet ATS criteria during the procedure.
- Patients with chronic lung diseases other than COPD, ASTHMA.

Methods of data collection

- The subjects recruited directly from the department of pulmonary medicine based on the inclusion and exclusion criteria.
- Minimum 60 subjects needed for the study.
- The parameters of lung volumes (SVC, FVC, FEV1, FEV1/FVC%, FEV1/SVC%) recorded by ATS standardized MEDISOFT® spirometry.
- The parameters analyzed descriptively.
- The comparison of obtained data between the ratios analyzed separately.

ISSN 2515-8260 Volume 09, Issue 06, 2022

Statistical method

- The data collected entered in Microsoft excel file. Then the data analysed using SPSS software version 21.
- All categorical variables expressed as frequencies and percentage.
- All continuous variables expressed as mean ± standard deviation or median, interquartile range.
- Mann Whitney U test applied for comparing two independent variables.
- $p<0.05$ considered as statistically significant.

Results

Table 1: Age Distribution of COPD Patients Studied

Age in years	No of patients	%
40-49	4	10.53%
50-59	17	44.74%
60-70	17	44.74%
Total	38	100.00%

Highest number of patients were found in age group 50-70 years (34 patients) which constituted 89.48% of patients followed by the age group of 40-49 (4 patients) which constituted 10.53%.

Table 2: Diagnosis of Obstruction in Patients with COPD

Spirometry	Diagnosis of obstruction (out of 38 patients)	%
FEV1/FVC	25 (n=38)	65.79%
FEV1/SVC	36 (n=38)	94.74%

FEV1/SVC diagnosed obstruction in 36 out of 38 patients (94.74%) compared to FEV1/FVC which diagnosed obstruction in 27 out of 38 patients (71.05%) with P value 0.009.

Spirometry	FEV1/FVC		FEV1/SVC		P Value*
	Median	IQR	Median	IQR	
	65.0850	17.73	56.7350	22.08	0.009

*Mann-Whitney U test.

Table 3: Classification of Severity of COPD Based on Spirometry

Spirometry	Mild obstruction (n=7)	Moderate obstruction (n=22)	Severe obstruction (n=8)	Very severe obstruction (n=1)
FEV1/FVC	2(28.57%)	14(63.64%)	8(100%)	1(100%)
FEV1/SVC	6(85.71%)	21(95.45%)	8(100%)	1(100%)

The discordance is more in the mild group about 57.14% followed by moderate group 31.81%.

Discussion

FEV1/SVC diagnosed obstruction in 36 out of 38 patients (94.74%) compared to FEV1/FVC which diagnosed obstruction in 27 out of 38 patients (71.05%) with statistical significance (p= 0.009). The discrepancy is 23.69%.

This discrepancy is greater than that observed in the study conducted by Rasheed *et al.* [6]. They performed 497 spirometries. In this sample 81 patients who had normal FEV1/FVC and

ISSN 2515-8260 Volume 09, Issue 06, 2022

FEV1/SVC were excluded. 185/416 (44%) patient had asthma and 231/416 (56%) had COPD. In COPD group discordance was seen in 31/231(13%) patients.

Nathell *et al*. [7] conducted a study in Europe, to compare the diagnosis of COPD among smokers according to different international guidelines and to compare the outcome using slow vital capacity (SVC) and forced vital capacity (FVC). Totally 3,887 spirometries were performed. In this sample 10.2% (396 individuals) fulfilled the NICE COPD criteria, 14.0% (544 individuals) the GOLD COPD criteria and 21.7% (843 individuals) the ERS COPD criteria. The diagnosis according to NICE and GOLD guidelines is based on FVC and in the ERS guidelines the best value of either SVC or FVC is used. When comparing SVC and FVC for diagnosing COPD using GOLD criteria the discrepancy was 2.8%.

The discordance is more in the mild group about 57.14% followed by moderate group 31.81%. Rasheed *et al*. and Nathell *et al*. have not studied discordance according to the severity of COPD [8].

In my study, results show that FEV1/SVC ratio can help us in identifying the disease earlier than FEV1/FVC. The disease progression can be reduced by starting treatment at an earlier stage. In patients with high index of clinical suspicion of COPD, it is advisable to measure SVC and calculate FEV1/SVC along with FEV1/FVC. This helps in avoiding errors in diagnosis and missed therapy.

Conclusion

- In the COPD group, FEV1/SVC diagnosed obstruction in 36 out of 38 patients (94.74%) compared to FEV1/FVC which diagnosed obstruction in 27 out of 38 patients (71.05%) with P value 0.009.
- In the COPD group, the discordance between FEV1/FVC and FEV1/SVC is more in the mild group about 57.14% followed by moderate group 31.81%.

References

1. Sundeep Salvi, Anurag Agarwal. India needs a national COPD prevention & control program. Journal of the Association of Physicians of India, 2012 Feb, 602.
2. Global Strategy for the diagnosis, management and prevention of COPD. Global initiative for chronic obstructive lung disease (GOLD), 2014 Jan, 5-8.
3. Pocket guide for asthma management and prevention. Global initiative for asthma. 2014 Jun, 12-13.
4. Pellegrino R, Viegi G, Brusasco V, Crapo RO, Burgos F, Casaburi R, *et al*. Interpretative strategies for lung function tests. Eur Respir J. 2005;26(5):948-68. http://dx.doi.org/10.1183/09031936.05.00035205 PMid:16264058
5. Ana Raquel Gonçalves de Barros, Margarida Batista Pires, Nuno Miguel Ferreira Raposo. Importance of slow vital capacity in the detection of airway obstruction. J Bras Pneumol. 2013;39(3):317-322.
6. Rasheed A, Vasudevan V, Shahzad S, Arjomand DM, Reminick S. Underdiagnosis of obstructive disease by spirometry. Chest. 2011;140(4):691A.
7. Lennart Nathell, Madelene Nathell, Per Malmberg, Kjell Larsson. COPD diagnosis related to different guidelines and spirometry techniques. Respiratory Research. 2007;8:89.
8. Fortis S, Corazalla E, Qi Wang, Hyun J Kim. Discordance Between Forced Vital Capacity and Slow Vital Capacity in Overweight and Obese People Leads to Underdiagnosis of Obstructive Airway Disease. Am J Resp critic care med. 2014;189:A5-810.