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Original Research Article

FEV1/FVC and FEV1/SVC ratios in the diagnosis of bronchial asthma

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Abstract

Asthmatic symptoms characteristically come and go, with a time course of hours to days, resolving spontaneously with removal from the triggering stimulus or in response to anti-asthmatic medications. Patients with asthma may remain asymptomatic for long periods of time. Report of symptoms that occur or worsen at night is a feature of asthma. 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 33 out of 41 patients (80.49%) compared to FEV1/FVC which diagnosed obstruction in 16 out of 41 patients (39.02%) with statistical significance (p=0.000). The discrepancy is 41.47%.

Keywords: FEV1/FVC, FEV1/SVC ratios, bronchial asthma

Introduction

Asthma is diagnosed before the age of seven years in approximately 75 percent of cases. Many adolescents experience a remission of childhood asthma symptoms around the time of puberty, with potential recurrence years later [1].
A pattern of respiratory symptoms that occur with exposure to triggers (e.g., allergen, exercise, viral infection) and resolve with trigger avoidance or asthma medication is typical of asthma. Some patients will report all three of the classic symptoms of asthma, while others may report only one or two [2]:

- Wheeze (high-pitched whistling sound, usually upon exhalation).
- Cough (often worse at night).
- Shortness of breath or difficulty in breathing.

Cough may be dry or productive of clear mucoid or pale-yellow sputum (made discolored by the presence of eosinophils). Asthma is a common cause of unexplained chronic cough.

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Some patients describe chest tightness, a band-like constriction, or the sensation of a heavy weight on the chest.

Asthmatic symptoms characteristically come and go, with a time course of hours to days, resolving spontaneously with removal from the triggering stimulus or in response to anti-asthmatic medications. Patients with asthma may remain asymptomatic for long periods of time. Report of symptoms that occur or worsen at night is a feature of asthma.

Respiratory symptoms triggered by cold air, exercise and exposure to allergens are suggestive of asthma [3].

Exercise-triggered symptoms typically develop 5 to 15 minutes after a brief exertion or about 15 minutes into prolonged exercise and resolve with rest over approximately 30 to 60 minutes. This time-course is distinct from simple exertional dyspnea, which typically begins shortly after the onset of exertion and abates within five minutes of stopping exercise. In asthma, exercise-induced symptoms occur more commonly and are more intense when the inhaled air is cold [4].

Allergens that commonly trigger asthmatic symptoms include dust mites, molds, furry animals, cockroaches, and pollens. The acute onset of lower respiratory tract symptoms reliably precipitated by exposure to a cat or dog is virtually pathognomonic of asthma.

Unique to asthma is the onset of cough, wheeze and/or chest tightness 30 to 120 minutes following ingestion of aspirin or any cyclooxygenase-1 inhibitor, often referred to as “aspirin-sensitive asthma” or “aspirin-exacerbated respiratory disease”, but this sensitivity occurs in only a small minority (3 to 5 percent) of asthmatic patients [5].

Personal or family history of atopy-A strong family history of asthma and allergies or a personal history of atopic diseases (e.g., atopic dermatitis, seasonal allergic rhinitis and conjunctivitis) favours a diagnosis of asthma in a patient with suggestive symptoms.

Recollection of childhood symptoms of chronic cough, nocturnal cough in the absence of respiratory infections or a childhood diagnosis of "recurrent bronchitis" or "wheezy bronchitis" favours asthma, but is also consistent with bronchiectasis [6].

Widespread, high-pitched, musical wheezes are a characteristic feature of asthma, although wheezes are not specific for asthma and are usually absent between asthma exacerbations. Wheezes are heard most commonly on expiration. Asthmatic wheeze usually involves sounds of multiple different pitches, starting and stopping at various points in the respiratory cycle and also varies in tone and duration over time.

Expiratory noises transmitted from the upper airway (e.g., larynx, pharynx) can mimic wheezing and are often described as wheezing by patients. However, these upper airway noises are typically loudest over the neck and greatly diminished over the chest in contrast to true wheezes that are typically louder over the chest [7].

Clinicians can usually distinguish the low-pitched wheezes (also called “rhonchi”) that clear with cough, a sign of increased airway secretions as may be seen in bronchitis or bronchiectasis, from the typical high-pitched expiratory wheezes of asthma.

Physical findings suggesting severe airflow obstruction in asthma include tachypnea, tachycardia, prolonged expiratory phase of respiration and a seated position with use of extended arms to support the upper chest ("tripod position"). Use of the accessory muscles of breathing (e.g., sternocleidomastoid) during inspiration and a pulsus paradoxus (greater than 12 mmHg fall in systolic blood pressure during inspiration) are usually found only during severe asthmatic attacks [8].

Methodology

Materials and Methods

MEDISOFT® computerized Spirometry.

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Sources of data

Patients with BA presenting to the department of pulmonary medicine.

Research design

Cross sectional study design.

Sampling techniques

Convenient sampling technique.

Sample

Total sample consisted of 41 BA Patients.

Inclusion criteria

- Age group between 12-80 years.
- Both males and females.
- Patients with high index of clinical suspicion of BA.
- 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.

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.

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Results

Table 1: Age Distribution of Asthma Patient Studied

Age in years	No of patients	%
10-19	4	9.76%
20-29	8	19.51%
30-39	13	31.71%
40-49	10	24.39%
50-59	4	9.76%
60-69	2	4.88%
Grand Total	41	100.00%

	N	Minimum	Maximum	Mean	Std. Deviation
Age	41	11	65	36.66	12.761

Highest number of asthma patients were found in the age group of 30-39(13 patients) which constituted 31.71% of patients followed by the age group of 40-49 (10 patients) which constituted 24.39%. Mean age was 36.66 years.

Table 2: Diagnosis of Obstruction in Patients with Asthma

Spirometry	Diagnosis of obstruction (out of 41 patients)	%
FEV1/FVC	16	39.02%
FEV1/SVC	33	80.49%

FEV1/SVC diagnosed obstruction in 33 out of 41 patients (80.49%) compared to FEV1/FVC which diagnosed obstruction in 16 out of 41 patients (39.02%) with statistical significance (p= 0.000).

Table 3: Statistical Significance

Spirometry	FEV1/FVC		FEV1/SVC		P Value*
	Median	IQR	Median	IQR	
	71.35	8.08	65.5	7.16	0.000

*Mann-Whitney U test.

Discussion

FEV1/SVC diagnosed obstruction in 33 out of 41 patients (80.49%) compared to FEV1/FVC which diagnosed obstruction in 16 out of 41 patients (39.02%) with statistical significance (p= 0.000). The discrepancy is 41.47%.

This discrepancy is greater than that observed in the study conducted by Rasheed *et al*. [9] They performed 497 spirometries. In this sample 81 patients who had normal FEV1/FVC and FEV1/SVC were excluded. 185/416 (44%) patient had asthma and 231/416 (56%) had COPD. In asthma group discordance was seen in 40/185(22%) patients.

To the best of my knowledge this is the only study I found in literature which compared FEV1/FVC and FEV1/SVC in the diagnosis of bronchial asthma [10]. The discordance in this study is 22% which is half of that observed in my study. There is a large variation in discordance between my study and his study probably due to small sample size of my study.

Conclusion

In the asthma group, FEV1/SVC diagnosed obstruction in 33 out of 41 patients (80.49%) compared to FEV1/FVC which diagnosed obstruction in 16 out of 41 patients (39.02%) with P value 0.000.

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