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Original Research Paper

Physiology

COMPARING THE EFFICACY OF FEV1 VERSUS FEV1/FVC(%) IN PREDICTION OF MILD ASTHMA

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ABSTRACT Among India's 1.31 billion people, about 6% of children and 2% of adults have asthma. Asthma poses greater public health challenges for most countries regardless of their economic status

We conducted a retrospective study in a tertiary care hospital in Dibrugarh, Assam to compare the efficacy of FEV1 alone versus FEVI/FVC in predicting asthma in a newly suspected case using RMS-HELIO 702 spirometry device.FEV1 is considered single best measure of pulmonary function for assessing severity. Baseline FEV1, duration of the disease and FEV1 variability, significantly influence a decline in lung function (FEV1) in patients with bronchial asthma.

KEYWORDS : FEV_1, FEV_1/FVC, spirometry, mild bronchial asthma.

INTRODUCTION

Among India's 1.31 billion people, about 6% of children and 2% of adults have asthma. Asthma poses greater public health challenges for most countries regardless of their economic status. Although the prevalence is observed to be high in developed countries, it is more fatal in the developing countries accounting for nearly 80% of asthma deaths worldwide.[1]

Asthma is a common long-term inflammatory disease of the airways of the lungs.It is characterized by variable and recurring symptoms, reversible airflow obstruction, and easily triggered bronchospasms. It is defined by the Global Initiative for Asthma as "a chronic inflammatory disorder of the airways in which many cells and cellular elements play a role. The chronic inflammation is associated with airway hyper-responsiveness that leads to recurrent episodes of wheezing, breathlessness, chest tightness and coughing particularly at night or in the early morning. These episodes are usually associated with widespread but variable airflow obstruction within the lung that is often reversible either spontaneously or with treatment".[2]

The most common parameters measured in spirometry are Vital capacity (VC), Forced vital capacity (FVC), Forced expiratory volume (FEV) at timed intervals of 0.5, 1.0 (FEV_1), 2.0, and 3.0 seconds, forced expiratory flow 25–75% (FEF 25–75) and maximal voluntary ventilation (MVV), also known as Maximum breathing capacity. FVC is the most basic maneuver in spirometry tests. The ratio of FEV_1 to FVC in healthy adults this should be approximately 70–80% (declining with age).[3]In obstructive diseases (asthma) FEV_1 is diminished because of increased airway resistance to expiratory flow; the FVC may be decreased as well, due to the premature closure of airway in expiration, just not in the same proportion as FEV_1. This generates a reduced value (<80%, often ~45%).

We conducted a retrospective study in a tertiary care hospital in Dibrugarh ,Assam to compare the efficacy of FEV1 alone versus FEV_1/FVC in predicting asthma in a newly suspected case. 50 mild asthma patients, diagnosed in physiology department by spirometry were included.

METHODS

We conducted a retrospective study on 50 male cases of mild asthma diagnosed by spirometry in a period of 6 months from January 2020 to June 2020 in Physiology department of tertiary care center in Assam.

Ethical Clearance

Before commencing the study, necessary permission and approval from ethics committee was obtained from the Institutional Ethics Committee (Human), Assam Medical College and Hospital. Informed written consents were taken from all patients.

Statistics

The statistical analysis of data was performed using the computer program, Statistical Package for Social Sciences (SPSS for Windows, version 20.0. Chicago, SPSS Inc.) and Microsoft Excel 2010.Spirometry data was tested for normal distribution. We used paired -tests to compare the differences between baseline lung function and predicted values or differences between FEV_1 and FEV_1/FVC of each subject. We report the findings as mean (±SD) when normally distributed or as median and 95% confidence limit if nonnormally distributed. Statistical significance was set at $p < 0.05$.

Spirometry was assisted by certified technicians. We assessed the sensitivity of spirometric indices to detect airway obstruction in male asthma patients in age group of 30- 40 yrs. with standardized height and weight.

RMS-HELIOS 702 is an electronic device used to measure FEV_1, FEV_1% and FEV1/FVC %. Subject's anthropometric parameters are fed into the device. Procedure was performed in sitting position. Before doing the procedure, procedure was explained and a practical demonstration was given. Results are displayed in a small screen of the machine, which can be printed on a thermal paper pressing the print button.

FEV_1/FVC > 75% and FEV_1 > 80% was taken as cut off limit for diagnosis of mild asthma cases.

INCLUSION CRITERIA:

(I) Age group: 30-40 years
(ii) Clinical features of mild bronchial asthma-as per GINA guidelines
(iii) Male subjects with standardized height and weight were included.
(iv) Patients willing to give written informed consent to participate in the study.

EXCLUSION CRITERIA:

1. Asthmatic patients with moderate or severe asthma according to GINA guidelines
2. Smokers

3. Diseases that present like asthma: COPD, cardiac diseases,
4. Tuberculosis
5. Chronic illnesses: HIV, Hepatitis
6. Auto immune disorders: Churgh-Strauss Syndrome
7. Subjects with contraindication for PFT, such as

(a) Hemoptysis of unknown origin
(b) Pneumothorax
(C) Unstable angina pectoris
(d) Recent MI
(e) Aortic aneurism
(f) Recent abdominal, thoracic or ocular surgeries
(g) Patients with history of syncope associated with forced exhalation

3. RESULTS

We inspected spirometry data from 50 male patients the age composition was 30- 40 years. The mean age was 34.5years; the mean height was 168.5 cm and weight 70.4 kg. There was no significant difference in the anthropometric data among the cases included in study.

Table 1 presents the FEV 1 percentage of asthmatic patients. 38% cases had FEV_1 (predicted percentage) 80-84%, 26% cases had 85-88%, 22% cases had 89-92%, 10 % cases had 93-96% and 4 % cases were above 96%.

Table 2 presents the FEV_1/FVC spirometry indices of asthmatic cases.

60 % cases had FEV1/ FVC (%) 71-74%, 36% cases had 75-78% ,32% cases had 79-82%, 18 % cases had 83-86% and 4 % cases were 86-89%

FEV_1 (PREDICTED %)	NUMBER OF CASES	% OF CASES
80-84	19	38
85-88	13	26
89-92	11	22
93-96	5	10
>96	2	4

FEV_1/FVC (%)	NUMBER OF CASES	% OF CASES
71-74	3	60
75-78	18	36
79-82	16	32
83-86	9	18
86-89	2	4

DISCUSSION

Asthma is a chronic inflammatory disorder of the airways in which many cells and cellular elements play a role.[4]

The chronic inflammation is associated with airway hyper-responsiveness that leads to the recurrent episodes of wheezing, breathlessness, chest tightness and coughing, particularly at night or in the early morning. These episodes are usually associated with widespread but variable airflow obstruction within the lung that is often reversible either spontaneously or with treatment.[4]

The symptom pattern maybe seasonal, perennial or perennial with seasonal exacerbations[5]. These exacerbations commonly affect the functional status of the patient. This was determined by using Sherwood Jones Index.[6]

Spirometry is done to determine the site and severity of airway obstruction. Pulmonary function test (PFT), is a non-invasive test, used to detect the airflow limitation and/or lung volume restriction. It is an important investigation because early detection of functional impairment and its appropriate treatment will help to reduce morbidity and mortality related to the disease.[7]

Typically, asthmatics show an obstructive pattern along with impaired FVC, FEV_1 and FEV_1/FVC RATIO.[6]

FEV_1 is the single best measure of pulmonary function for assessing severity. Baseline FEV_1, duration of the disease and FEV_1 variability, significantly influence a decline in lung function (FEV_1) in patients with bronchial asthma.[7]

In Ivory Coast, 41% of the physicians studied by Ngom et al[8] were not using spirometry as they were totally unaware of the usefulness of FEV measurements in making a diagnosis of asthma in both pediatric and adult patients. In a related study conducted in Southeast Nigeria with the aim of assessing appropriate treatment of asthma by medical practitioners, Ayuk et al[9] reported that only 34% of doctors in their study population used any lung function measures to make a diagnosis of asthma while none made use of spirometry.

In this study, an attempt was made to study the pulmonary function test of patients with mild bronchial asthma. This study aims to compare efficacy of two parameters calculated by spirometry i.e. FEV_1versus FEV_1/FVC (%)

Panhuysen et al, in their study of 25 - year follow - up data on adults from a Dutch asthma clinic, found that more than 75 percent of the patients had FEV_1 values below 90 percent of the predicted values at the final examination[10].

Lebecque et al. in their study of 100 asthmatic children aged 6–17 years showed that FEF25–75% was more sensitive than either FEV_1 or FEV_1/FVC [11]. Similar results were found in the study by McFadden et al [12].In our study we found that 38 % cases had FEV_1 between 80-84, 4 % cases had FEV_1 >96% and mean FEV_1 86.66 $\pm$4.85 while 60% cases had FEV_1/FVC 71-74, 4% cases had 86-89 % and mean FEV_1/FVC 78.21 $\pm$3.44.

We came to a conclusion that FEV_1/FVC is a better parameter for prediction of mild asthma.

However, on statistical analysis no significant difference was found. ($p > 0.05$)

CONCLUSION

We would like to conclude that although there is no statistical difference in values of FEV_1 versus FEV_1/FVC in diagnosis of mild asthma but 60% of the cases were diagnosed with FEV_1/FVC parameter. We would like recommend more widespread use of spirometry along with the history and clinical examination in diagnosis of obstructive lung diseases in India. This will eventually decrease the monetary burden for diagnosis of asthma.

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