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The Effect of Glycemic Control on Spirometric Variables in Patients of Type 2 Diabetes Mellitus

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Abstract

Introduction: Pulmonary function tests (PFTs) is a generic term used to indicate a battery of studies or manoeuvres that may be performed using standardized equipment to measure lung function. PFTs can include simple screening spirometry, formal lung volume measurement, diffusing capacity for carbon monoxide, and arterial blood gases. These studies may collectively be referred to as a complete pulmonary function survey.

Methodology: Information was collected through a pre tested and structured proforma for each patient Qualifying patients will be undergoing detailed history, clinical examination, routine investigations like FBS, PPBS, HBA1c, fundus evaluation and spirometric evaluation using a easy one flow spirometer. Glycemic control is taken as HBA1C below 7.5 and HBA1C more than 7.5 is considered as uncontrolled sugars Diabetic patients of different durations are selected Using criteria laid down.

Results: In our study, 2(10%)patients with HBA1C <7.5 had restrictive pattern and out of 15 patients with HBA1C of more than 7.5, 10(20%) patients had restrictive pattern in group 1 where as in group 2, 6 patients with HBA1C < 7.5 had restrictive pattern and out of 26 patients with HBA1C >7.5, restrictive pattern was seen in 21 patients in group 2.

Conclusion: Spirometry is the most commonly used lung function screening study. It generally should be the clinicians first option.

Keywords: Glycemic Control; Spirometric Variables; Type 2 Diabetes Mellitus.

Introduction

"Pulmonary function tests have evolved from tools for physiological study to clinical tools widely used in assessing respiratory states during the last three decades". Apart from their use in clinical decision making, they have become a part of routine health examinations in respiratory, occupational and sports medicine and in public health screening.[1]

Pulmonary function tests (PFTs) is a generic term used to indicate a battery of studies or manoeuvres that may be performed using standardized

equipment to measure lung function. PFTs can include simple screening spirometry, formal lung volume measurement, diffusing capacity for carbon monoxide, and arterial blood gases. These studies may collectively be referred to as a complete pulmonary function survey.[2]

Before a spirogram can be meaningfully interpreted, one needs to inspect the graphic data (the volume-time curve and the flow-volume loop) to ascertain whether the study meets certain well-defined acceptability and reproducibility standards. Tests thatfail to meet these standards can provide useful information about minimum levels of lungfunction, but, in general, they should be interpreted cautiously. The interpretive Strategy usually involves establishing a pattern of abnormality (obstructive, restrictive, or mixed), grading the severity of the abnormality, and assessing trends over time. Various algorithms are available. Automated spirometry systems usually have built-in software that can generate a preliminary interpretation, especially for spirometry; however, algorithms for other pulmonary function studies are not as well established and necessitate appropriate clinical correlation and physician oversight.[3]

Computerized equipment adds a new dimension with preselected or means of reference values and interpretation algorithms. By the time most patients present clinically, conventional spirometry is abnormal and most useful and commonly employed test is the FEV 1.

Spirometry is the most commonly used lung function screening study. It generally should be the clinicians first option. With other studies being reserved for specific indications.[4] Most patients can easily perform spirometry when coached by an appropriately trained technician or other health care provider. The test can be administered in the ambulatory setting, physicians office, emergency department, or inpatient setting.

Methodology

Information was collected through prepared proforma for each patient

Sample Size: 70 diabetic subjects meeting the criteria for the present study

Inclusion Criteria

All patients presenting to OPD and patients from IPD who fulfil the inclusion criteria for the study

1. Previously diagnosed type 2 Diabetic patients
2. Type 2 Diabetes mellitus with age group of 30 – 60 years.
3. Who gives written informed consent.

Exclusion Criteria

1. Bronchial Asthma.
2. COPD
3. History of Pulmonary Tuberculosis.
4. History of cardiovascular disease
5. Smokers
6. ILD
7. Those not willing for the study

Information was collected through a pre tested and structured proforma for each patient

Qualifying patients will be undergoing detailed history, clinical examination, routine investigations like FBS, PPBS, HBA1c, fundus evaluation and spirometric evaluation using a easy one flow spirometer

Glycemic control is taken as HBA1C below 7.5 and HBA1C more than 7.5 is considered as uncontrolled sugars

Diabetic patients of different durations are selected Using criteria laid down

Group A: Type 2 diabetes mellitus of 5-10 year duration

Group B: Type 2 diabetes mellitus of 11-15 year duration

Results

Group 1 consisted of 21 males and 14 females whereas group 2 also had majority of males (25) than females (10) (Fig. 1)

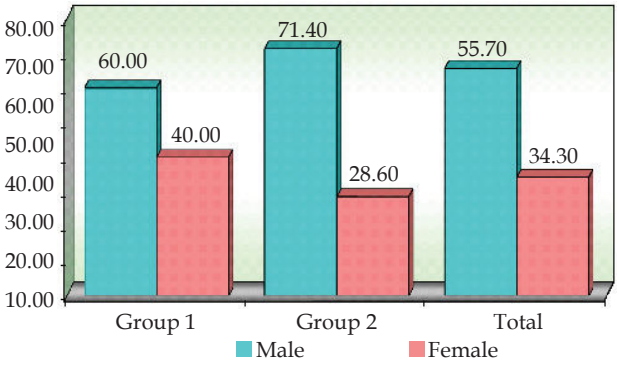

Fig. 1: Distribution of male and females in two study groups.

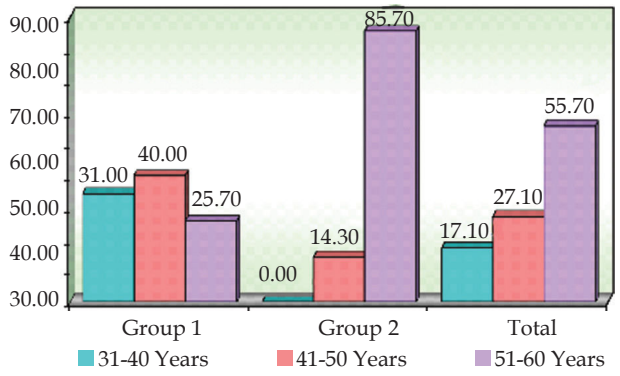

Fig. 2: Distribution of patients in two study groups by age groups.

In our study male patients were more than the female patient

Group 1 had majority of patients between age of 41- 50 years and group 2 had majority of patient between 51 to 60 years (Fig. 2).

In our study,2(10%)patients with HBA1C <7.5 had restrictive pattern and out of 15 patients with HBA1C of more than 7.5, 10(20%) patients had restrictive pattern in group 1 where as in group 2, 6 patients with HBA1C < 7.5 had restrictive pattern and out of 26 patients with HBA1C >7.5, restrictive pattern was seen in 21 patients in group2 (Table 1)

Table 1: HBA1c Vs Spirometry result in two groups.

Groups by duration	HBA1c	Spirometry result						
		Obstruction	%	Restriction	%	Normal	%	Total
Group 1	<7.50	0	0.00	2	10.00	18	90.00	20
	>=7.50	2	13.33	10	66.67	3	20.00	15
	Total	2	5.71	12	34.29	21	60.00	35
		Chi-square=17.6941 P = 0.0001*						
Group 2	<7.50	1	11.11	6	66.67	2	22.22	9
	>=7.50	4	15.38	21	80.77	1	3.85	26
	Total	5	14.29	27	77.14	3	8.57	35
		Chi-square=2.8921 P = 0.2362						

*p<0.05

Discussion

Because spirometry is an expiratory manoeuvre, it measures exhaled volume or vital capacity but does not measure residual volume, functional residual capacity (resting lung volume), or total lung capacity. Vital capacity is a simple measure of lung volume that is usually reduced in restrictive disorders; however, reduction in the vital capacity measured during spirometry should prompt measurement of lung volumes to confirm the presence or absence of a true restrictive ventilatory disorder.

Other pulmonary function methodology is required to formally measure total lung capacity, which is derived from the addition of functional residual capacity (FRC) to inspiratory capacity obtained from spirornetry. FRC is usually measured by a gas dilution technique or body plethysmography. Gas dilution techniques are based on a simple principle, are widely used, and provide a good measurement of all air in the lungs that communicates with the airways. A limitation of this technique is that it does not measure air in non communicating bullae, and therefore it can underestimate total lung capacity, especially in patients with severe emphysema.[5]

After the FRC is measured by any of these techniques, measurement of lung sub divisions (inspiratory capacity, expiratory reserve volume, vital capacity ensues. Ideally while the patient is still on the mouth piece. From these volumes and capacities, the residual volume and total lung capacity can be calculated.[6]

The American Thoracic Society has gone to great lengths to standard and publish detailed recommendations regarding spirometry, lung volumes, and diffusing capacity.[24,32] These guidelines include the selection of equipment, important technical considerations for variability, and standardization between laboratories for the manoeuvre.

A number of spirometry standards have been developed over the years. The American Thoracic Society standardization guidelines for acceptability and reproducibility criteria are shown in Box 3. A well-trained pulmonary function technician usually

coaches the patient through the session until the demonstrated reproducibility of key parameters suggests the results represent the best possible measure of lung function at that time.

Studies from a healthy population indicate that parameters of lung function, such as FEV_1 or FVC, are affected most significantly by standing height, age, gender, race, and, to a lesser extent, weight. If we assume that lung function has a normal Gaussian distribution, then a wide range of values may be considered normal. Because there is no absolute cut-off point for what is normal in biologic systems, an arbitrary statistical approach is widely used to define the lowest 5% of the population as abnormal. Over the years, many regression equations have been generated by several investigators using different methodologies to study variety of populations. The recommendation is for clinical laboratories to choose a published reference standard that is most similar to the typical patient population at a given institution as well as the testing methods used. The most commonly used standards are those of Morris and colleagues, Crapo and colleagues. Knudson and Colleagues.and the National Health and Nutrition Examination Survey (NHANES III). These reference standards are based on a cohort of normal subjects of similar age, height, and race, with normal being defined as persons without a history of smoking or disease that can affect lung function.[7,8]

Many approaches have been developed to determine the normal range of spirometry. These approaches have included using a fixed percentage of predicted (75%) and a fixed FEV1-to-FVC ratio, (<0.70). both of these approaches have no statistical basis and are not recommended.

The American Thoracic Society recommends using the concept of lower limit of normal by identifying the lowest 5% of a population, or patients that fall outside the limits of 1 .645 standard deviations from the mean.[2] This aloe may be calculated by multiplying 1.645 times the standard error of estimate (1.645 SEE).

Weight is less important as a predictor of lung function. Obese patients might have abnormal spirometry (decrease in FVC) based on the diaphragms ability to displace the intraabdomina1 fat. Body weight has little impact on intrathoracic volume.[9]

Race plays an important role in determining normal lung function has been recognized that persons of different races for any given height and age have proportionately different lung volumes. Specifically, based on anthropometric differences, the lung function for African Americans is systematically lower compared with whites. The American Thoracic Society recommends a 12% correction for African Americans for FEV_1- FVC, and total lung capacity. The FEV_1 to-FVC ratio in African Americans may be slightly higher compared with whites. A 7% correction for lower values is recommended for FRC and residual volume. However, race-specific reference standards are preferred.[10]

Conclusion

In our study out of 15 patients with HBA1c of more than 7.5, 12 patients had restrictive pattern in group 1 where as in group 2 out of 26 patients with HBA1c more than 7.5, restrictive pattern was seen in 21 patients.

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