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Spirometric Evaluation of Chronic Dyspnea in Department of TB & Chest, Rajendra Institute of Medical Sciences, Ranchi, India

Medical Science

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ABSTRACT

Background: The decision of prescribing bronchodilators cannot be empirically justified until a specific diagnosis is made. Additional Investigations should be used in cases where spirometry is contraindicated or PFT findings are inconclusive chronic dyspnea is a frequent observation in medical practice. It is defined as shortness of breath lasting longer than one month. Spirometry for pulmonary function testing (PFT) provides a stepwise algorithmic approach to establish an accurate diagnosis for the cause and is of great help in preventing over-diagnosis or under-diagnosis of common respiratory diseases. The aim of the present study was to study the role of spirometry in evaluating patients of chronic dyspnea and to classify findings into obstructive/restrictive/mixed patterns. To further analyze the study population categorized by age groups and sex based on various spirometric variables, make a specific diagnosis and then study the pattern and bronchodilator response in cases.

Methods: 200 adult patients, who visited the T.B. and Chest OPD of RIMS, Ranchi with features of chronic dyspnea, were included in the study. A detailed clinical history, clinical examination and spirometry were done in all patients included. A repeat Post-bronchodilator spirometry was performed in those showing an abnormal pattern. Study population was categorized into three age groups and frequency of male/female noted. Obstructive/restrictive/mixed patterns were identified in different age groups and specific diagnosis was made using additional investigations where required. Response to bronchodilator was recorded. Overall pattern, distribution and disease association with age was studied.

Results: Most symptomatic patients including both sexes were in the middle age group (56 males & 38 females), followed by older (>60yrs) age group (72 males vs 20 females). 66.5% Subjects whose spirometric findings were abnormal were subjected to a post-bronchodilator spirometry. There was a statistically significant improvement ($p<0.05$) in the lung volumes (FEV1 %, FEV3 %), forced vital capacity (FVC %) and expiratory flow (FEF25-75 %) after bronchodilator administration. Obstructive pattern was more frequent in middle age group (39/75) whereas a restrictive pathology was commoner in older age group (20/33). COPD (45) & Asthma (44) were the most common specific diagnosis. Restrictive lung disease due to Lung parenchymal damage (21) and Pleural and chest wall deformity (13) was frequently observed in older subjects.

Conclusion: Pulmonary function testing by Spirometry must be performed in all possible cases to classify the etiology and make a specific diagnosis of common clinical conditions like Asthma or COPD. Not all symptomatic cases show spirometric abnormalities. Prevalence of Obstructive lung disease is higher in middle age group whereas Restrictive lung disorders increase with increasing age.

KEYWORDS:

Spirometry, chronic dyspnea,FEV1-forced expiratory volume in 1 sec,Asthma,COPD

INTRODUCTION

Chronic dyspnea is one of the common complaints in patients presenting to TB & Chest clinic or pulmonary medicine OPDs. Chronic dyspnea is defined as a subjective experience of breathing discomfort that consists of qualitatively distinct sensation that vary in intensity and lasts longer than a month.[1,2] The cause of dyspnea cannot be solely determined by patient's complaints or clinical impression, so it needs some objective tests in addition to clinical evaluation.

Pulmonary Function Testing, also known as Spirometry, is a powerful tool for Respiratory care physicians to diagnose and manage respiratory problems. Spirometry provides a stepwise algorithmic approach to distinguish between obstructive and restrictive lung disorders and a detailed study can help in establishing an accurate diagnosis for the cause of chronic dyspnea.[3] besides, a comprehensive spirometric study in symptomatic individuals can help in ruling out an over-diagnosis of common respiratory disease like asthma.[4]

India is a large country with people having widely variable socio-economic and cultural backgrounds. The incidence of respiratory diseases also varies from area to area. There is paucity of data available for the prevalence of various etiologies of dyspnea in the state of Jharkhand, which covers a heterogeneous geographical and socio-cultural population. While a large population is exposed to pollution from mines and industry, along with a significant population of poor socio-economic status exposed to chronic diseases with poor availability of medical facility. Pulmonary Function testing/ Spiro metry is not frequently available in majority of smaller district hospitals and it is primary care physicians who are taking care of these patients based on clinical observations. Rajendra Institute of Medical Sciences (RIMS), Ranchi which is a premier tertiary centre of Jharkhand receives patients from all corners of Jharkhand on uniform basis. The aim of the present study was to study the role of spirometry in evaluating patients of chronic dyspnea and to classify findings into obstructive/restrictive/mixed patterns. To further analyze the study population categorized by age groups and sex based on various spirometric variables, make a specific diagnosis and then study the pattern and bronchodilator response in cases.

METHODS

200 adult patients(>18 yrs), who visited the T.B. and Chest OPD of RIMS, Ranchi with features of chronic dyspnea (as defined earlier) during the period of January 2014 to December 2016, were included in the study. Patients who were contraindicated for spirometry and those who were infected and those who can't perform the test properly were excluded from the study.

A detailed clinical history, clinical examination and spirometry was done to all patients included in the study. Post bronchodilator spirometry after 4 puffs of Salbutamol (pMDI) with spacer device after 15 minutes of drug administration was done in all patients who were found abnormal in pre bronchodilator test. Obstruction was defined as FEV1`/FVC < 70%. Restriction was defined as FVC and FEV1 < 80% of the predicted with maintained FEV1/FVC ratio >70%. Post bronchodilator reversibility was defined as post bronchodilator improvement of FEV1 >200 ml and 12%.[5]

Patients were divided into three groups on the basis of age, group 1(≤ 30 Yrs), group 2 (>30Yrs to 60 Yrs) and group 3 (> 60 Yrs). Additional investigations (CXR, CECT-CHEST, HRCT-CHEST etc) were required to confirm the specific diagnosis and properly categorize the cases. Diagnostic subgroups were identified as follows –

Asthma – a history of episodic wheeze, shortness of breath, chest tightness and cough that vary over time and in intensity together with variable expiratory airflow limitation with post bronchodilator improvement in FEV1 of 12% and 200ml.[6]

Chronic obstructive pulmonary disease (COPD) –Patients who has dyspnea, chronic cough or sputum production, and/or a history of exposure to risk factors for disease with spirometry confirmation by the presence of post-bronchodilator FEV1/FVC < 0.7.[7]

Lung parenchyma damage diagnosis was done by clinical feature and radiographic appearance (X-ray chest and HRCT). Idiopathic pulmonary fibrosis(IPF) was diagnosed especially a specific chronic progressive fibrosis interstitial pneumonia of unknown cause, occurring primarily in older adults, limited to the lungs and associated with histopathological and radiological pattern of UIP, it also requires the exclusion of other forms of interstitial pneumonia and ILD associated with environmental exposure, medication or systemic disease.8 All relevant information and reports were analyzed and the final diagnosis of all the patients were made after discussion with all the co-authors.For data analysis, Ms Excel(2007) and SPSS software version 12 were used. Paired t test was used to see the significance difference in spirometric parameters before and after of the drug therapy. p value < 0.05 was considered significant for this study.

Results:

Figure 1 shows the age and sex wise distribution of the subjects in the study population. It was observed that the majority of subjects including both sexes were in the middle age group (56 males & 38 females), closely followed by older(>60 Yrs) age group which included(72 males & 20 females). Few patients were in the Younger age group (5 males & 9 females).

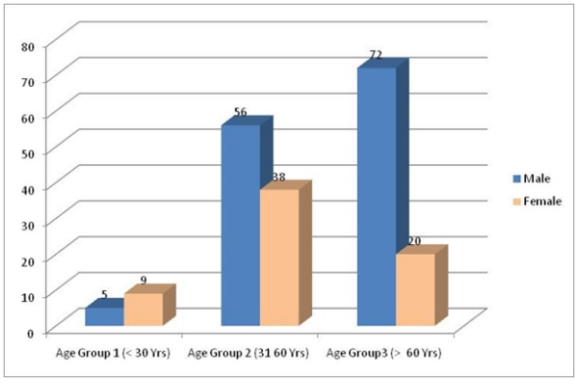

Figure -1 shows the age and sex wise distribution of the subjects in the study population.

A normal spirometric pattern was observed in 67(33.5%) subjects. Subjects whose spirometric findings were not normal (66.5%) were subjected to a repeat spirometry after bronchodilator administration (as discussed earlier). Table-1 shows a comparison of the mean values & standard deviations of the variables in pre & post bronchodilator spirometry. P values are shown alongside in the table.

It was observed that there was a statistically significant improvement (p<0.05) in the lung volumes (FEV1 %, FEV3 %), vital capacity (FVC%) and expiratory flow(FEF25-75 %) after bronchodilator administration. As seen in table -1, the pre and post FVC% and FEV1% values showed a Mean±SD in FVC% of 66.11±20.92 and 75.91±22.52 and in FEV1% of 54.78±18.29 and 63.70±19.98 respectively. However, the result of FEV1/FVC% was not significant (p value 0.071) with a pre and post Mean±SD of 68.28±14.61 and 69.40±14.53 respectively. The pre and post FEF25-75% and FEV3% also showed a significant result (p value < 0.05) with pre and post Mean±SD in FEF25-75% of 37.71±22.33 and 47.76±25.18 and that in FEV3% of 61.66±18.42 and 70.15±81 respectively. Descriptions of spirometric variables are also discussed in Table 1.

TABLE-1 Mean and Standard deviation of spirometric parameters of patients diagnosed as abnormal in Pre & Post bronchodilator administration

Variables	Mean	no	Std deviation		p value
FVC %	Pre	66.11	133	20.92	0.000
	Post	75.91	133	22.52	
FEV_1 %	Pre	54.78	133	18.29	0.000
	Post	63.70	133	19.98	
FEV1 / FVC %	Pre	68.28	133	14.61	0.071
	Post	69.40	133	14.53	
FEF^{25-75} %	Pre	37.71	133	22.33	0.000
	Post	47.76	133	25.18	
FEV_3 %	Pre	61.66	133	18.42	0.000
	Post	70.15	133	19.81	

Spirometric variables

FEV 1% : Percentage of forced expiratory volume predicted in one second;FEV1: total volume of air a patient is able to exhale in the first second during maximal effort

FVC % : Percentage of predicted forced vital capacity; FVC : total volume of air a patient is able to exhale for the total duration of the test during maximal effort

FEV 1 /FVC ratio: the percentage of the FVC expired in one second
FEV 3 : forced expiratory volume in first three seconds
FEF 25–75% :Percentage of predicted forced expiratory flow over the middle one-half of the FVC;

FEF 25–75: the average flow from the point at which 25% of the FVC has been exhaled to the point at which 75% of the FVC has been exhaled.3

Table-2 shows the distribution of various spirometric patterns in different Age groups. In Group 1(<30 yrs), 6 (42.9%) patients had obstructive and 2 (14.3%) patients had restrictive type of lung defect whereas 6 (42.9%) patients had normal spirometry. In Group 2,middle age group, 39 (41.5%) patients had obstructive, 11 (11.7%) patients had restrictive and 9 (9.6%) patients had mixed type of defect with 35 (37.2%) patients having normal test result. In Group 3, 26 (28.3%) patients had normal spirometry with 30 (32.6%) patients having obstructive, 20 (21.7%) patients with restrictive and 16 (17.4%) patients with mixed type of defect. Overall, out of 133 patients 75 patients had obstructive, 33 patients had restrictive and 25 patients had mixed type of spirometric abnormality (Table-2).

TABLE 2: Different spirometric pattern distribution in different Age groups

Age groups	Spirometric Patterns				
	obstructive	restrictive	Mixed	Normal	Total
Group1, no (% in group)	6 (42.9%)	2 (14.2%)	0 (0%)	6 (42.9%)	14
Group2, no (% in group)	39 (41.5%)	11 (11.7%)	9 (9.6%)	35 (37.2%)	94
Group3, no (% in group)	30 (32.6%)	20 (21.7%)	16 (17.4%)	26 (28.3%)	92
Pattern frequency	75	33	25	67	200
Age Groups: Group 1 (≤30 yrs). Group 2 (>30 to 60 yrs). Group 3 (>60 yrs)					

Specific diagnosis of respiratory disease was made using spirometric findings, history, clinical examination and additional investigations required. Table-3 shows the distribution of various diseases in different Age groups. In Group 1, a diagnosis of Asthma was made in 6 (42.9%) patients, lung parenchymal damage in 1 (7.1%) patient and pleural and chest wall deformity in 1 (7.1%) patient. In Group 2, the diagnosis of Asthma was made in 26 (27.7%) patients, COPD in 17 (18.1%) patients, lung parenchymal damage in 8 (8.5%) patients and pleural and chest wall deformity in 4 (4.3%) patients; whereas no specific diagnosis was made in 4 (4.3%) patients. In Group 3, Asthma was diagnosed in 12 (13.0%) patients, COPD in 28 (30.4%) patients, ACOS in 1 (1.1%) patient, lung parenchymal damage in 12 (13.0%) patients, pleural and chest wall deformity in 8 (8.7%) patients and no conclusive diagnosis made in 5 (5.4%) patients. COPD was the most common diagnosis overall (45 cases), closely followed by Asthma (44 cases). in 9 cases no specific diagnosis could be made. Asthma was most frequently diagnosed in the young and middle age group whereas COPD was more frequent in the older age group. No case of COPD was seen in the young age group.

TABLE 3: Disease distribution among various Age groups

Disease	Age groups			Total No of patients
	Group1, no (% in group)	Group2, no (% in group)	Group3, no (% in group)	
Normal	6 (42.9%)	35 (37.2%)	26 (28.3%)	67
Asthma	6 (42.9%)	26 (27.7%)	12 (13.0%)	44
COPD	0 (0.0%)	17 (18.1%)	28 (30.4%)	45
ACOS	0 (0.0%)	0 (0.0%)	1 (1.1%)	1
Lung parenchymal damage	1 (7.1%)	8 (8.5%)	12 (13.0%)	21
Pleural and chest wall deformity	1 (7.1%)	4 (4.3%)	8 (8.7%)	13
No specific diagnosis made	0 (0.0%)	4 (4.3%)	5 (5.4%)	9
Total In group	14	94	92	200

Age Groups: Group 1 (≤30 yrs). Group 2 (>30 to 60 yrs). Group 3 (>60 yrs)
ACOS- Asthma COPD overlap syndrome, COPD- Chronic Obstructive Pulmonary disease

DISCUSSION

Chronic dyspnea, defined as shortness of breath lasting longer than one month can be caused due to a number of diseases both respiratory and non-respiratory. Patient's presenting complaints generally do not help in a specific diagnosis. It is recommended that In patients with chronic dyspnea, Pulmonary Function Testing should be performed to diagnose underlying cause of airflow obstruction.[1,2] Several patients presenting with chronic dyspnea may show normal spirometric findings. In such cases additional investigations should be done .

The respiratory system undergoes various anatomical, physiological and immunological changes with age leading to increased incidence of repiratory/breathing problems with age.[9] Out of the 200 subjects we studied in ranchi, It was observed that the majority of subjects including both sexes were in the middle age group, closely followed by older(>60 Yrs) age group. Males showed a relatively higher prevalence (Figure-1). Our age distribution finding was in agreement with Gumus et al(2014).[10] . A similar pattern of age and sex distribution of chronic dypnea was observed in two other Indian studies by Ningshen et al and Jadhav et al.[11,12]

In our study population only 66.5% subjects showed abnormal PFT. (Table-1). 33.5% subjects with chronic dyspnea did not show any spirometric abnormality. It is possible that in such cases the cause may be non respiratory like cardiac diseases (arterial hypertension, heart valve disease, atrial fibrillation or cardiac tamponade) or psychiatric disorders(generalized anxiety disorder, depression and panic disorder) and/or other causes(obesity, hyperthyroidism, anemia, hypothy roidism).2,10 A Stepwise algorithmic approach to interpret the spirometric findings in subjects was used, as adapted by Johnson et al. 3

Patients diagnosed as abnormal, based on spirometric variables were administered a bronchodilator dose and a repeat spirometry was performed.(Table-1). A statistically significant improvement was seen in FVC %, FEV1 %, FEF 25-75 % and FEV3 % values after bronchodilator therapy. In case of an obstructive defect, an Increase in FEV 1 or FVC of > 12% and > 200 mL suggested a reversible pathology. The GOLD guidelines suggest that the presence of a post-bronchodilator forced expiratory volume in one second (FEV1) 80% of the predicted value in combination with a FEV1/forced vital capacity (FVC) 70% confirms the diagnosis of COPD. This combination of tests and effect of bronchodilator response on spirometric parameters is highly sensitive Method to diagnose COPD (Richter et al, 2008) but is less specific when differentiating between COPD & Asthma.[3,13] Post bronchodilator FEV1 / FVC ratio did not show a significant improvement (p=0.071) for obvious reasons, as both the numerator and denominator increased similarly and significantly. In 33.5 % subjects where PFT appeared normal despite clear symptoms of chronic dyspnea, additional investigations in correlation with clinical findings were required.

Based on clinical observations solely, there can be chances of overdiagnosis or underdiagnosis of Asthma/COPD. Spirometry especially with post bronchodilator re-assessment can help classifying respiratory pathology as obstructive, restrictive or mixed. As seen in table-2, Obstructive lung disease (75/133) is more common than restrictive (33/133). Obstructive pattern was more frequent in middle age group (39/75) whereas a restrictive pathology was commoner in older age group (20/33). Our findings were in agreement with large scale data studied by Mannino et al(2003).[14] Sharma and Goodwin(2006) concluded that the structural changes with age include chest wall and thoracic spine deformities which impairs the total respiratory system compliance leading to increase work of breathing. Respiratory muscle strength decreases with age and can impair effective cough, which is important for airway clearance.9 Common diseases showing a restrictive pattern are interstitial lung disease (Lung parenchymal damage) and Pleural & chest wall deformity. Bronchodilator administration usually is of little or no use in restrictive pattern but in some restrictive cases that respond to bronchodilator therapy there is a possibility of underlying obstructive diseases.[15]

The results based on pulmonary function testing showed that COPD & Asthma were the most common specific diagnosis. Whereas restrictive lung disease due to Lung parenchymal damage and Pleural and chest wall deformity was frequently observed in older subjects presenting with chronic dyspnea in our study population. Though Asthma COPD overlap syndrome (ACOS) is a infrequent finding but there should be increasing awareness among pulmonologists and primary care physicians that the diagnosis is not missed.[16] Spirometry is a valuable tool for assessing respiratory health in patients presenting with chronic dyspnea and can be helpful in differentiating the etiology of the patient's symptoms. The use of Spirometry must be encouraged in medical practice in India to prevent over-diagnosis of Asthma which has clinical symptoms similar to several other respiratory and non respiratory disorders.

CONCLUSION

Chronic dyspnea is a frequent observation in medical practice. Pulmonary function testing by Spirometry must be performed in all possible cases to classify the etiology and make a specific diagnosis of common clinical conditions like Asthma or COPD. Not all symptomatic cases show spirometric abnormalities. Prevalence of Obstructive lung disease is higher in middle age group whereas Restrictive lung disorders increase with increasing age. The decision of prescribing bronchodilators cannot be empirically justified until a specific diagnosis is made. Additional Investigations should be used in cases where spirometry is contraindicated or PFT findings are inconclusive.

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