Original Research Article

CORRELATION OF PFT & HRCT FOR THE EARLY DIAGNOSIS OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE IN A TERTIARY CARE CENTRE, INDORE

Dr. Kshitiz Chourasia[1] (Consultant Respiratory Medicine) & Dr. Vinod Kumar Kurmi[2] (Assistant Professor)

Physiqure CTN Multispecialty Hospital, Sagar[1]
Department of Pulmonary Medicine, LNMC & JK Super Speciality Hospital,
Kolar Road, Bhopal, M.P.[2]
Corresponding Author: Dr. Vinod Kumar Kurmi

Abstract

Background & Methods: The aim of the study is to assess the usefulness of PFT & HRCT for early diagnosis of COPD. All the tests was perform with due permission from the Institutional Ethical Committee and informed consent from the subjects or their legal relatives. Subjects were included on the basis of their diagnosis of COPD as per GOLD guidelines. Unrelated causes of dyspnea other than COPD or its management like known cases of asthma, anemia, CHF, pulmonary embolism, ILD was excluded from the study.

Results: The lower valve of sensitivity (33.98%) and specificity (22.22%) proves that PFT method is not very effective to identify the True positive and true negative cases. The proportion of false positive and false negative is very high which shows that actual positive and negative cases identified by HRCT method is quite high then those identified initially by PFT method.

Conclusion: Patient population with COPD, the presence of emphysema, regardless of its distribution, has an impact on Physiological parameters but not on the clinical presentation of the disease. As documented in the present study, PFT have limitations as regards the measurements of airway obstruction and lung dysfunctions in Emphysema patient. HRCT is helpful for early diagnosis and quantification Pulmonary Emphysema.

Keywords: usefulness, PFT & HRCT, diagnosis & COPD.
Study Design: Observational Study.

1. Introduction

Chronic Obstructive Pulmonary Disease is the fourth leading cause of death and therefore a disease of increasing public health importance around the world. Estimations of Global Initiative for Chronic Obstructive Lung Disease (GOLD) suggest that COPD will rise to the third most common cause of death worldwide by 2020. Not only a leading cause of death, following a late diagnosis of COPD, majority of the patients experience a temporary or permanent decrease in the quality of life.[1]

In this modern era smoking rate is high among young generation, still women using chulla in homes, industrial workers working un-precautionally in industries lead to early age Chronic Obstructive Pulmonary Disease (COPD) and increase the prevalence and mortality rate of COPD. [2]

Pathological changes characteristic of COPD are found in the central and peripheral airways, lung parenchyma and pulmonary vasculature. Chronic airflow limitation is attributed to the narrowing of the small airway lumen due to morphological changes and a decrease in lung elastic recoil due to parenchyma destruction.[3,4]

At present, although pulmonary function testing (PFT) is still the accepted standard for the confirmation and clinical grading of COPD, the results can be affected by a patient's age and other health factors, and PFT is associated with a relatively large margin of error. Furthermore, PFT may be normal in some patients in whom there are already abnormalities in small-airway function (diameter < 2 mm), especially in the early stage of the disease. [5]

High-resolution computed tomography (HRCT) allows the assessment of airways as small as 1 mm in diameter and is useful for examining changes of lung tissue and airways in pulmonary diseases, including asthma and COPD. [6]

2. Material and Methods

Patients more than 20 years of age, who was admitted in Chest ward of Index Medical College, Indore with diagnosis of COPD between June 2018 to June 2019 was included in the study. Study was conducted on 300 patients from the Department of TB and CHEST at Index Medical College, Research centre and Hospital, Indore. All the tests were performed with due permission from the Institutional Ethical Committee and informed consent from the subjects or their legal relatives.

Subjects were included on the basis of their diagnosis of COPD as per GOLD guidelines and the following inclusion criteria.

Inclusion Criteria-
1. Patient more than 20 years old with history of
   - Cigarette smoking
   - Biddi smoking
   - Huka smoking
   - Chula smoking
   - Industrial workers
   - Coal mines workers
2. As per Gold guidelines, any patient who has symptom of chronic cough, sputum production or dyspnea.
3. Patient with acute episodes (as diagnosed according to criteria).

Exclusion Criteria-
1. Asthma
2. ILD
3. Congestive heart failure
4. Pulmonary embolism
5. Inability to perform spirometry.

6. Anemia

3. Result

Table 1: Distribution on Basis of Patient Age

Age Group	Frequency	Percent
21-30 Years	31	13.8
31-40 Years	77	34.2
41-50 Years	46	20.4
51-60 Years	28	12.4
61-70 Years	37	16.4
>= 71 Years	6	2.7
Total	225	100.0

The above table shows the distribution of patient according to their Age Group. The majority of patient are young between 30 to 50 years of age.

Table 2: Distribution on Basis of PFT Method Results

PFT Result	Frequency	Percent
Negative	117	52.0
Positive	108	48.0
Total	225	100.0

The above table shows the distribution of patient according to PFT Method result. The Positive and Negative cases are almost equal and near to 50% mark.

Table 3: Distribution on Basis of HRCT Method Results

HRCT Result	Frequency	Percent
Negative	72	32.0
Positive	153	68.0
Total	225	100.0

The above table shows the distribution of patient according to HRCT Method result. The Positive cases diagnosed are higher 68.0% and negative cases diagnosed are only 32.0%.

Table 4: Association between PFT Method Results and HRCT Method Results

PFT Result		HRCT Result		Total
		Negative	Positive	
Negative	Count	16	101	117
	%	22.2%	66.0%	52.0%
Positive	Count	56	52	108
	%	77.8%	34.0%	48.0%
Total	Count	72	153	225
	%	100.0%	100.0%	100.0%

CHI SQUARE VALUE = 37.615, DF = 1 P Value = 0.000 Significant Sensitivity = 33.98 %, Specificity = 22.22%, PPV = 48.15%, NPV = 13.67%

The above table shows the association of PFT outcome and HRCT outcome as positive and negative status of disease.

There was statistically significant association seen between PFT Outcome and HRCT outcome in patients ($p>0.05$), showing a difference in positive and negative count identified by two methods.

The sensitivity, specificity, Positive predictive value (PPV) and Negative predictive value (NPV) was also calculated to know the effectiveness of PFT method to identity the presence of disease at initial stage as compare to HRCT method used thereafter.

The lower valve of sensitivity (33.98%) and specificity (22.22%) proves that PFT method is not very effective to identify the True positive and true negative cases. The proportion of false positive and false negative is very high which shows that actual positive and negative cases identified by HRCT method is quite high then those identified initially by PFT method.

4. Discussion

COPD is the fourth leading cause of death around all over the world. COPD, the presence of emphysema, regardless of its distribution, has an impact on physiologic parameters but not on the clinical presentation of the disease[7]. PFT is accepted as the diagnostic test to assess airflow obstruction and classify severity of disease, based on specific cut points for FER (FEV_1/FVC <0.7 after bronchodilator) and FEV_1 (mild ≥80% predicted, moderate 50-80%, severe 30-49% predicted, very severe <30% predicted. FEV_1 normally decreases with age, and the rate of fall is an important PFT indicator of disease progression in COPD. PFT is a safe and practical procedure, and when conducted by a trained operator using a PFT that provides quality feedback. HRCT is new modality for early diagnosis of COPD, and also makes it possible to quantify the total amount of emphysema in the lungs which is important in order to precisely estimate the severity of the disease[8]. Those abilities of HRCT are important in monitoring the course of the disease and in attempts to prevent its further progression[9]. HRCT has a sensitivity of approximately 96% in diagnosing emphysema and can detect emphysematous areas as small as 0.5 cm[2.] Some authors argue that HRCT is even more effective than pulmonary function tests. As documented in the present study, lung function tests have some limitations and unable to diagnosis of COPD in young and middle

age population. Further large scale studies are needed to confirm the importance HRCT for early diagnosis of COPD and help full for decreasing morbidity and mortality[10].

In this present study (approved by IEC, Index Medical College, Indore) we included 300 patients in which 225 patients completed the study. Our study showed significant association between PFT outcome and HRCT outcome with a significant p value of less than 0.05 and HRCT easily identified the early changes of disease at initial stage as compare to PFT[11].

HRCT helps to identify positive cases in COPD groups which are not identified on PFT. The count of Negative cases reduces from Group A (53.8%) to Group D (4.3%) and count of positive cases increase from Group A (46.2%) to Group D (95.7%).

PFT is incapable to make diagnosis of COPD or more negative case in early age group 20-30 year here in PFT negative cases in Group 20-30 years is 64.5% where as in HRCT negative cases in Group 20-30 years is 48.3%.

5. Conclusion

Patient population with COPD, the presence of emphysema, regardless of its distribution, has an impact on Physiological parameters but not on the clinical presentation of the disease. As documented in the present study, PFT have limitations as regards the measurements of airway obstruction and lung dysfunctions in Emphysema patient. HRCT is helpful for early diagnosis and quantification Pulmonary Emphysema.

6. References

1. Dr David MManninoMD[a]A SoniaBuistMD – The LANCET Volume 370, Issue 9589, 1–7 September 2007, Pages 765-773- Global Burden COPD : Risk factors , Prevalence, and Future Trends.

2. Jeffery PK: Structural and inflammatory changes in COPD: a comparison with asthma. Thorax 1998; 53: 129–136.

3. Hogg JC, Chu F, Utokaparch S, Woods R, Elliott WM, Buzatu L, Cherniack RM, Rogers RM, Sciurba FC, Coxson HO, Paré PD: The nature of small-airway obstruction in chronic obstructive pulmonary disease. N Engl J Med 2004; 350: 2645–2653.

4. Chen H, Chen RC, Guan YB, Li W, Liu Q, Zeng QS. Correlation of pulmonary function indexes determined by low-dose MDCT with spirometric pulmonary function tests in subjects with chronic obstructive pulmonary disease. AJR Am J Roentgenol 2014;202(4): 711-718

5. Deveci F, Murat A, Turgut T, Altuntas¸ E, Muz MH. Airway wall thickness in subjects with COPD and healthy current smokers and healthy non-smokers: assessment with high resolution computed tomographic scanning. Respiration 2004;71(6):602-610.

6. Pauls S, Gulkin D, Feuerlein S, Muche R, Kru¨ger S, Schmidt SA, et al. Assessment of COPD severity by computed tomography: correlation with lung functional testing. Clin Imaging 2010;34(3):172-178.

7. Nakano Y, Muro S, Sakai H, Hirai T, Chin K, Tsukino M, et al. Computed tomographic measurements of airway dimensions and emphysema in smokers: correlation with lung function. Am J Respir Crit Care Med 2000;162(3 Pt 1):1102-1108.

8. Nakano Y, Wong JC, de Jong PA, Buzatu L, Nagao T, Coxson HO, et al. The prediction of small airway dimensions using computed tomography. Am J Respir Crit Care Med 2005;171(2):142-146.

9. de Jong, P. A., Müller, N. L., Paré, P. D. & Coxson, H. O. Computed tomographic imaging of the airways: relationship to structure and function. European Respiratory Journal 26, 140–152 (2005).

10. Sayiner, A. et al. Bronchiolitis in young female smokers. Respiratory Medicine 107, 732–738 (2013).

11. Hoesein, F. A. A. M. et al. CT-quantified emphysema in male heavy smokers: association with lung function decline. Thorax 66, 782–787 (2011).