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Association Between Six Minute Walk Test And Dlco In Patients With Interstitial Lung Disease."- A Cross Sectional Study

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Abstract

Background: Interstitial lung disease (ILD) refers to a heterogeneous collection of lung disorders that are gathered together because they share clinical, radiographic, and pathologic features. ILD.is also referred to as diffuse parenchymal lung disease (DPLD). After diagnosing ILD we assess patient by HRCT (High resolution computed tomography) thorax, Spirometry, DLCO(Diffuse lung capacity of carbon monoxide), 6mwt. Often these parameters may not show co-relation between themselves. These are used to assess progression of the disease.

Aim: Association between six minute walk test and DLCO in patients with interstitial lung disease.

Objective:

1. Co-relation of 6 minute walk test with DLCO.
2. Co-relation of 6 minute walk test with HRCT THORAX(Warrick score).
3. Co-relation of 6 minute walk test with spirometry(FVC).

Materials and Methods: This study was done at a tertiary care centre in Bareilly City, of state Uttar Pradesh (INDIA) in this study all consecutive patients who were diagnosed with Interstitial Lung Disease on clinico-radiological basis, were registered and evaluated. A total of 57 patients were taken in the study. 6 MINUTE WALK TEST, HRCT thorax, DLCO and spirometry was done for patient assessment.

Results: A total of 57 patients were taken in the study. The most common diagnosis was Idiopathic Pulmonary fibrosis (IPF) (16) followed by Connected Tissue Disorder associated Interstitial Lung Disease (CTD-ILD) (12). In our study, 78.94% study population desaturated during 6MWT. There is significant association between 6MWT and DLCO the p-value is less than 0.05. There is insignificant association between 6MWT and spirometry p-value is more than 0.05. There is insignificant association between 6MWT and HRCT thorax the p-value is more than 0.05.

Conclusion: There is insignificant correlation between 6MWT and FVC, therefore only FVC is not sufficient for the functional assessment of the disease. There is best correlation between 6MWT and DLCO as both the tests are for the functional assessment of the disease at physiological level. Therefore in resource limited settings where DLCO is not available 6MWT can be used as the best tool for functional assessment of the disease.

Keywords: SIX MINUTE WALK TEST, DLCO and INTERSTITIAL LUNG DISEASE

Introduction

Patients with interstitial lung diseases (ILD), also called diffuse parenchymal lung diseases (DPLD), generally presents with breathlessness due to impaired gaseous exchange as a consequence of widespread

inflammation and/or fibrosis of the alveolar walls[1,2]. ILD frequently presents with dyspnea on exertion, diffuse bilateral infiltrates on chest imaging, and restriction with diffusion impairment on physiologic testing.[1-2]

Specific diagnosis is grounded upon a complete history and vigilant physical examination, as well as assessment of laboratory data, physiologic studies, radiography, and in specific cases, pathologic tissue obtained from lung biopsy. Multidisciplinaryreview(MDD) is a significant part of the process and can have a important impact on diagnostic and controlling decisions.[3]

The American Thoracic Society (ATS)/European Respiratory Society (ERS) consensus panel classification system on idiopathic interstitial pneumonias (IIPs) has been a cornerstone in the field of interstitial lung diseases (ILDs). Initially published in 2002, it underwent updates in 2013 and 2018, primarily with a focus on improving the diagnosis and management of idiopathic pulmonary fibrosis (IPF). This classification system encompasses radiographic, histopathologic, and clinical characteristics to categorize various forms of ILDs, providing a structured approach for diagnosis and treatment decisions. Through these updates, the ATS/ERS panel aims to refine and enhance the understanding and management of ILDs, particularly IPF, to improve patient outcomes and quality of life.[4,5,6]

An overview of ILD classification (Data from ATS/ERS classification, 2018.)[7]

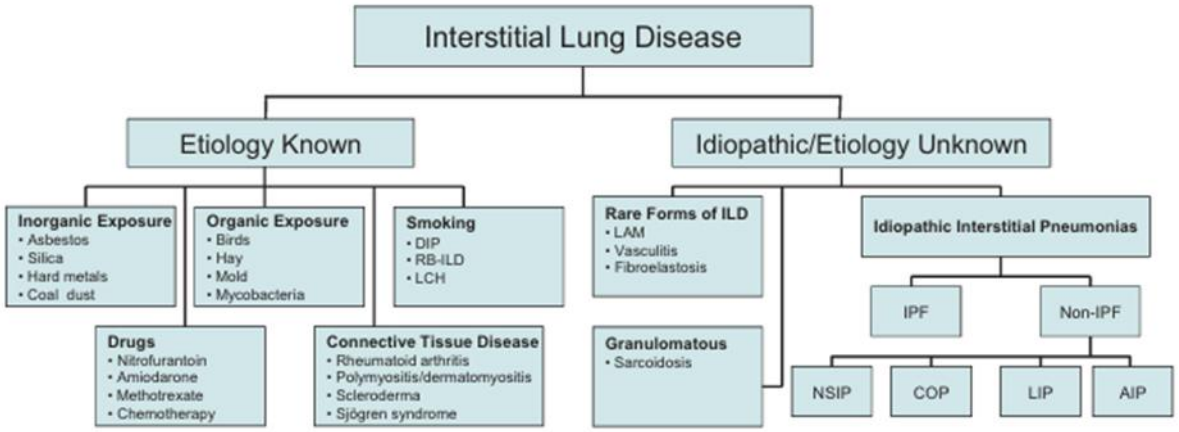

Fig 1 ; An overview of ILD classification. AIP, acute interstitial pneumonia; COP, cryptogenic organizing pneumonia; DIP, desquama tive interstitial pneumonia; IPF, idiopathic pulmonary fibrosis; LAM, lymphangioleiomyomatosis; LCH, Langerhans cell histiocytosis; LIP, lymphocytic interstitial pneumonia; NSIP, nonspecific interstitial pneu monia; PPFE, pleuroparenchymal fibroelastosis; RB-ILD, respiratory bronchiolitis interstitial lung disease. (Data from ATS/ERS classification,2

For managing ILD patient first we assess the patient by using HRCT (High resolution computed tomography) thorax, Spirometry, DLCO, 6mwt.

Broadly patients are divided into IPF and non-IPF treatment was initiated accordingly. In all these patients the tests are repeated after every 3-6months to see the response to treatment and to asses the progression of the disease accordingly we assess the need of the change in therapy and to assess the need for lung transplantation.

In non IPF patients group few may show evidences of PF-ILD[8] (Progressive fibrosing-Interstitial lung disease) which is defined as at least two of the following three criteria occurring within the past year with no alternative explanation. That is worsening respiratory symptoms, Physiological evidence of disease progression and Radiological evidence of disease progression. Here the physiological evidence of disease progression is seen by Absolute decline in FVC >5% predicted within 1 year of follow-up and Absolute decline in DLCO (corrected for Hb) >10% predicted within 1 year of follow-up. Accordingly assessment is done for the need for addition of anti-

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fibrotic to the therapy and need for lung transplantation.

In IPF patients after performing the tests in follow-up assessment is done for response to therapy. In some patient we need for change in anti-fibrotic therapy or referral for lung transplantation accordingly.

Guidelines for Listing for Lung Transplantation in ILD are Decline in FVC >10% or >5% with radiographic progression in the past 6 months, Decline in DlCO >10% in the past 6 months, Oxygen saturation <88% during a 6MWT, decline in 6MWT distance >50 meters in the past 6 months, Pulmonary hypertension, Hospitalization for a respiratory indication. .

Materials & Methods

The present cross sectional study was conducted among Patients diagnosed as ILD under inclusion criteria, in the Department of Respiratory Medicine, Rohilkhand Medical College and Hospital(RMCH), Bareilly, Uttar Pradesh, are included in the study. Duration of study was one year (1 Nov 2022- 31 Oct 2023). Study will be conducted after taking approval from Institutional Ethics Committee (IEC), RMCH, Bareilly

Sample size: The calculated sample size is 57.

The minimum sample size of the study will be calculated

By applying formula

$N = (Z_{1 - alpha/2})^2 P(1-P)/d^2$

Reference article is taken from (6)

Inclusion Criteria:

1. Diagnosed cases of ILD
2. Patients above 18 years of age

Exclusion Critera

1. Sputum positive for AFB(active pulmonary TB)

Methodology

1. Patients presenting with the complaints of cough, dyspnea with with shadows suggestive of ILD in chest X-ray and /or on HRCT thorax are included and these patients are subjected to spirometry.
2. All those cases diagnosed as ILD are taken for study.
3. Informed written consent is taken.
4. Basic demographic data, history and symptoms along with their duration and character, are recorded. The symptoms includes respiratory, as well as non-respiratory symptoms.
5. Known Medical History or any Co-morbidities are identified and reported.
6. Domestic and Work Environment Factors are identified along with the duration of exposure to any noxious substances.
7. History of any substance abuse including smoking are elicited along with its duration of exposure or use.
8. 6 MINUTE WALKTEST is done and assessment of patients was done.
9. Sirometry and DLCO (Diffuse lung capacity of carbon monoxide) is done using computerised DLCO Machine.

Dlco Model Description

EASY ONE Pro

Device S/N – 551159

Statistical Analysis

The data will be entered in SPSS (statistical package for the social sciences) liscensed version23.0. Descriptive analysis will be done by calculating proportions, means and standard deviation. Appropriate statistical tests will be applied depending on type and distribution of data. p value <0.05 will be considered statistically significant.

Results:

The mean age of presentation was 48.5±14.9 years. Majority of the patients belonged to 40-59 years age group. In our study, 50.87% study population were males and 49.12% study population were females. Dyspnea and Cough were the most common presenting symptoms constituting up to 96.4% (n=55). GERD was seen to associated with IPF (57%, n=9), followed by CTD-ILD (25%, n=4). In our study, 24.1% study population had HTN, 5.2% study population had both HTN & DM, 17.2% study population had DM &6.9% study population had Thyroid disorder.

Table 1:diagnosis

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diagnosis		Frequency	Percent
	CTD ILD	12	21.0
	IPF	16	27.6
	NSIP	9	15.5
	HP	7	12.1
	SARCOIDOSIS	7	12.1
	CPFE	1	1.7
	LCH	2	3.5
	LAM	1	1.7
	DAH	1	1.7
	COP	1	1.7
	Total	57	100.0

In our study, maximum study participants (27.6%) were diagnosed with IPF. In our study, 78.94% study population were having desaturated 6MWT. In our study, 48.3% study population had UIP, 29.3% study population had NSIP

Table 3: Correlation of DLCO with 6mwt

DLCO GRADING		Grading of 6mwt					Total	P-VALUE
		>70%	70%-60%	59%-50%	<50%	Not done		
	>60%	0	0	0	0	0	0	
	40% TO 60%	1	8	10	8	0	27	
	<40	1	3	5	17	1	27	
	Not done	0	0	0	0	3	3	
Total		2	11	15	25	4	57	.000

DLCO >60% - there is no patient whose DLCO is more than 60%.

DLCO 40%-60% - total patients in this category were 27 out of which 37% (10) of the patients are in 59%-50% grade of 6mwt.

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DLCO <40% - total patients in this category were 27 out of which 62.9% (17) of the patients are in <50% grade of 6mwt.

The p-value is less than 0.05, hence there is significant association.

Table 4: Correlation of Warrick score with 6mwt

Graddingof Warrick score		Grading of 6mwt					Total	P-VALUE
		>70%	70%-60%	59%-50%	<50	Absent		
	<8(mild)	0	0	0	5	1	6	
	8 to 15(moderate)	2	7	6	10	1	26	.223
	>15(severe)	0	4	9	10	2	25	
Total		2	11	15	25	4	57	

The p-value is more than 0.05, hence there is insignificant association.

Correlation of FVC with 6mwt

GRADIND OF FVC		Grading of 6mwt					Total	P-VALUE
		>70%	70%-60%	59%-50%	<50	absent		
	>70%	2	5	2	3	0	12	
	60-69	0	5	5	4	0	14	.212
	50-59	0	1	6	8	0	15	
	35-49	0	0	2	8	1	11	
	<35	0	0	0	2	0	2	
	absent	0	0	0	0	3	3	
Total		2	11	15	25	4	57	

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The p-value is more than 0.05, hence there is insignificant association

Discussion

Ru Yang et al (2023)[9] in his study concluded that In ILD, 6MWT results were associated with DLCO. Therefore, the 6MWT might be a surrogate marker of pulmonary functions in clinical ILD, in our study we found that there is positive correlation between 6MWT and DLCO, as the 6mwt percentage predicted decreases the percentage of DLCO also decreased and vice-versa, which is similar to this study.

Barney Thomas Jesudason Isaac et al(2015)[10] in his concluded that Symptom, PFT's and exercises testing had good correlation with HRCT. DLCO corrected % of predicted correlated best with HRCT. Similarly in our study we have found good correlation between 6MWT and DLCO but poor correlation with HRCT thorax.

Shanmugapriya K. et al (2022)[11] in his study Associations between six-minute walk test with lung diffusion capacity for carbons monoxide in chronic respiratory disease concluded that There was no statistical significance between age, gender, smoking and ILD patterns. Spirometer and diffusion capacity indices co-relate best with NSIP pattern of ILD in our study. In a resourceslimited setting, clinical and radiological assessment of ILD with six-minute walking distance and spirometry should or need not be supplemented by DLCO for severity assessment. 6MWT is a simple and reliable objective tool in the functional assessment of ILD irrespective of the pattern. Smoking and UIP Pattern of ILD did not correlate whereas spirometer and diffusion capacity indices co –relate best with NSIP Pattern of ILD in our study. In addition, in a resource limited setting, clinical and radiological assessment of ILD with six-minute walk test and spirometry should or need not be supplemented by DLCO for severity assessment. Similarly, in our study for the severity assessment of the disease patients should be evaluated with DLCO as the functional assessment of the lung is best assessed by DLCO but we have seen that 6MWT and DLCO correlates best with each other, so in a resource limited setting DLCO can be replaced with 6MWT.

Dilip Shankar Phansalkar et al (2022)[12] in his study Scoringsof Interstitial Lung Disease by High-Resolution Computed Tomography(HCRT) and its Correlation with Functional Parameters concluded that There was a significant negative correlation of total HRCT-ILD scores (warrick's score) with Forced vital capacity [FVC], Forced expiratory volume in the first second [FeV1], Diffusing capacity of the lungs for carbon monoxide [DLCO] and 6-minute walk tests showing deterioration in functional parameters as the severity score increases. In our study there are some similarities as well as some contrasts compared with this study, the similarities are there is significant positive correlation between 6MWT and DLCO, In contrast there is insignificant correlation between 6MWT and FVC.

Marco Mura Et al (2006)[13] in his study Functional Predictors of Exertional Dyspnea, 6-min Walking Distance and HRCT Fibrosis Score in Idiopathic Pulmonary Fibrosis concluded that PFTs and lung volumes in particular are closely related to the HRCT score, a measure of the extentsof IPF. Score and 6-MWD to PFTs is limited, due to the complexity of mechanisms leading to exercise limitation in IPF. Therefore dyspnea and exercise performance are largely independent indices and should be followed together with PFTs and HRCT score in order to better assess the status and progress of IPF's. Similarly in my study there in good correlation between 6mwt and DLCO, insignificant correlation between 6MWT and HRCT thorax.

Rana Fessi et al(2018)[14] in his study High-resolution computed tomography fibrosis score and spirometry in interstitial lung disease concluded that HRCT fibrosis severity degree and extend correlate with PFT particularly with restrictive pulmonary dysfunction. In contrast in our study there is insignificant correlation between warrick's score and 6mwt.

Conclusion:

There is correlation between 6MWT and DLCO as both the tests are for the functional assessment of the disease at physiological level. For the severity assessment of the disease patient should be evaluated with DLCO as functional assessment of the lungs is estimated by DLCO, but we have seen that 6MWT and DLCO correlate best with each other, therefore in a resource limited setting where DLCO cannot be done for severity assessment, 6MWT can be used in place of DLCO. HRCT thorax is the best Non-invasive investigation for the diagnosis of interstitial lung

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disease. There is insignificant correlation between 6MWT and HRCT thorax severity grading in acute diseases like acute exacerbation of ILD, acute HP and early ILDs. There is significant correlation between HRCT thorax score and 6mwt in all chronic ILDs. There is significant negative correlation between HRCT thorax grading and FVC in all the chronic ILDs.

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