

## Validity of pulmonary function test measured by spirometry in silicosis patients classified according to international labor organization classification: A retrospective study

Deepak UG<sup>1</sup>, Abdul Azeez AM<sup>2\*</sup>

<sup>1,2</sup>Assistant Professor, <sup>1</sup>Dept. of Pulmonary Medicine, <sup>2</sup>Dept. of Medicine, <sup>1</sup>Rajiv Gandhi Institute of Chest Diseases, Bengaluru, Karnataka, <sup>2</sup>Kodagu Institute of Medical Sciences, Karnataka, India

\*Corresponding Author: Abdul Azeez AM

Email: deepakug17@gmail.com

### Abstract

**Background:** Silicosis is one of the common occupational disease affecting mainly developing countries like India, an estimated 2.34 million people die each year from work-related accidents and diseases. Silicosis leads to Obstructive and restrictive pattern of lung disease that will lead to decreased lung function.

**Methodology:** In this study we classified patients of silicosis with the help of chest X-ray according to International Labor Organization classification (ILO) classification, 2011 and pulmonary functional capacity of these patients was measured by spirometry to assess the effect of silicosis on pulmonary functional capacity.

**Results:** The mean FEV1 change from grade 1 to grade C of ILO classification is 54.9%. The mean FVC change was 33.24% and the mean FEV1/FVC change was 34.64%.

**Conclusions:** The ILO classification of Pneumoconiosis to assess the severity of silicosis by chest X-ray is a very important tool since its grading of X-rays correlate with pulmonary functional status of silicosis patients.

**Keywords:** ILO; Silicosis; Spirometry.

### Introduction

Occupational diseases make an important contribution to the global burden of disease. Work-related morbidity and mortality not only results in suffering and hardship for the worker and his/her family, but also it adds to the overall cost to society through lost productivity and increased use of medical and welfare services. The cost to society has been estimated at 2-14% of the gross national product in different studies in different countries [1].

An estimated 2.34 million people die each year from work-related accidents and diseases. Of these, an estimated 2.02 million people die from a wide range of work-related diseases [2].

Silicosis is functionally characterized by obstructive ventilation defects, often accompanied by restrictive abnormalities and reduced diffusing capacity. Since COPD and silicosis often coexist, it is difficult to attribute the clinical grade of breathlessness to either of the one condition [3-4]. However, the identification and quantification of this excess dyspnoea is of pivotal value to the recognition of a clinically important occupational lung disease.

Spirometry is a method of assessing lung function by measuring the volume of air that the patient can expel from the lungs after a maximal inspiration [5]. The pulmonary function tests have opened a new era towards scientific approach in diagnosis, prognosis and management of pulmonary disorders by the early recognition of their alteration in Pneumoconiosis workers who are constantly exposed to Silica dust and to institute protective and preventive measures to minimize the hazards of exposure to polluted environment.

The present study was done to observe the effect of occupational exposure of silica on pulmonary functional status (Spirometry) in silicosis patients.

### Materials and Methods

**Study Design:** The present study was conducted from July 2013 to September 2014 at Kamla Nehru Chest Hospital, Dr. S. N. Medical College, Jodhpur, a tertiary care center for respiratory diseases in western part of Rajasthan, India. Ethical clearance was taken from Dr. S.N. Medical College Ethical committee for human research to conduct the study.

**Study Population:** 109 patients, who were attending out-patient department and/or occupational disease compensation was selected. The diagnosis of silicosis was based on a relevant occupational history involving significant exposure to silica-containing dust, and radiographic changes consistent with silicosis.

Conventional Chest X-ray with postero-anterior view of the chest was taken and were read independently and in random order by an experienced Chest physician and a radiologist, who were not aware of the exposure or clinical status of the subjects to which the films belonged.

**Data Collection and Analysis:** Each patient was given a questionnaire regarding their demographic data & clinical symptoms. The clinical records and radiographic findings of the study population were reviewed. For the radiographic abnormalities, the chest X-ray films were classified according to the International Labour Organisation Classification of Radiographs of Pneumoconioses, 2011. Each patient confirmed with silicosis undergoes Spirometry test to assess the pulmonary functional statuses of silicosis patients.

Data was analyzed by using Pearson Chi-square test for comparison of severity of silicosis classified according to ILO classification with Spirometry results. "P value" of less than 0.05 was taken as statistically significant.

**Results**

Patients were classified according to ILO classification as simple silicosis and complicated silicosis and their pulmonary functional status was assessed by spirometry and both variables were compared for any correlation and results

obtained were as follows, the mean FEV1 change from grade 1 to grade C of ILO classification is 54.9%. The mean FVC change was 33.24% and the mean FEV1/FVC change was 34.64%. All 3 spirometry variable changes were statistically significant.

**Table 1: Distribution of patients based on spirometry and ILO classification of chest X-ray**

Spirometry	Descriptive				Robust Tests of Equality of Means
	ILO	N	Mean	Std. Deviation	
FEV1 %	1	35	91.15	8.91	Value - 28.175
	2	32	84.59	14.25	
	3	16	78.19	9.62	
	A	14	60.64	14.92	Dof - 5
	B	8	49.25	13.22	
	C	4	36.25	14.2	P Value < 0.001
	Total	109	78.32	19.33	
FVC %	1	35	93.25	6.42	Value - 8.540
	2	32	89.27	8.48	
	3	16	88.81	7.23	
	A	14	82	11.96	Dof - 5
	B	8	70.13	11.96	
	C	4	60	18.42	P Value < 0.001
	Total	109	87.1	11.95	
FEV1/FVC RATIO	1	35	97.15	7.12	Value - 12.832
	2	32	94.21	13.74	
	3	16	88.88	12.63	
	A	14	74.36	17.14	Dof - 5
	B	8	70.75	10.58	
	C	4	62.5	22.59	P value < 0.001
	Total	109	88.94	16.04	

FVC- Forced Vital Capacity

FEV1-Forced Expiratory volume at 1 second

**Discussion**

In our study the majority of patients were males (n=109) only 2 were females hence excluded from the study. Majority of patients in present study had worked in silica exposed environment between 11-30 years with mean duration of silica exposure of 20.8 years This was in conformity with earlier studies by Yeoh et al., [6], Leung et al., [7], Chierakul et al., where duration of exposure was 11-30 years in mines. Patients of silicosis were classified into simple silicosis and complicated silicosis (PMF) according to ILO Classification. 83 patients (76.2%) were having simple silicosis and remaining 26 patients (23.8%) had complicated silicosis in the present study.

Duration of exposure to silica and spirometry variables like FEV1, FVC, FEV1/FVC are negatively correlated. Those patients worked for <10 years had normal spirometry, but with increasing duration there was progressive decrease in pulmonary function test variables. These changes were statistically significant (<0.02).

Variables of pulmonary functional status like spirometry i.e., FEV1, FVC, FEV1/FVC depend on ILO classification of chest X-rays. Spirometry variables had negative correlation with ILO classification. FEV1 in grade 1 of ILO classification was 91.2±8.9% which decreased to

36.3±14.1% in grade C patients. FVC changed from 93.2±6.4% to 60±18.4% from grade 1 to grade C. Absolute FEV1/FVC changed from 97.14±7.1 to 62.5±22.6 from grade 1 to grade C according to ILO classification. In present study spirometry variables for simple silicosis patients were within normal value except the FEV1% in grade 3 of simple silicosis patients. Patients with complicated silicosis were affected more with both obstructive and restrictive pattern in spirometry. These changes were statistically significant (<0.001) and seen in other previous studies by Gocmen [8], Yang et al., [6], Law et al., [9].

**Conclusions**

Even though Silicosis is the oldest known occupational disease, the morbidity & mortality due to this disease is still very high. The ILO classification of Pneumoconiosis to assess the severity of silicosis by chest X-ray is a very important tool since its grading of x-rays correlate with pulmonary functional status of silicosis patients. Patients with silicosis develop both obstructive and restrictive pattern in spirometry as severity of silicosis increases according to ILO classification.

**Conflicts of Interest:** None declared.

**Acknowledgements:** Nil.

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<p><b>How to cite this article:</b> Deepak UG, Azeez AAM. Validity of pulmonary function test measured by spirometry in silicosis patients classified according to international labor organization classification: A retrospective study. <i>Indian J Immunol Respir Med</i> 2019;4(1):8-10.</p>
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