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STUDY OF CLINICAL PROFILE, SPIROMETRIC FUNCTION TEST, DIFFUSING CAPACITY OF CARBON MONOXIDE, 6 MINUTE WALK TEST AND CHEST X-RAY FINDINGS IN TEXTILE DYE-PRINTING WORKERS IN SURAT CITY

Respiratory Medicine

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ABSTRACT

INTRODUCTION The textile industry consists of several processes including dyeing, printing etc. and due to the exposures to various chemicals at work, these workers frequently complain of respiratory symptoms. Spirometry allows us to measure FEV1,FVC, FEV1/FVC ratio,FEF25-75%.Diffusion Capacity of Lung for Carbon Monoxide(DLCO) test indicates the diffusion of Carbon Monoxide gas across the alveolar membrane. In 6 Minute walk Test ,Pulse rate and SpO2 is measure at the start and at the end of the test. (At 0 min and at 6 min) and then fall or rise in Pulse or SpO2 is observed. **METHODOLOGY** This study included all the subjects according to the inclusion criteria(40) coming to Respiratory Medicine OPD during the study period (15 months). Data was collected and analyzed .**RESULTS** Majority of the patients were male, (50%) and smokers. Dry cough seen in – 29 patients (72.5%) & Dyspnoea on exertion in 15(37.5%) patients. Chest X-Ray was normal in – 21patients (52.5%), followed by Prominent Broncho-Vascular markings (BVM) was seen in 10(25%) patients. On Spirometry Findings, 24 (60%) patients were normal, 8 (20%) patients showed Restrictive Pattern, 6 (15%) showed Obstructive Pattern and 2 (5%) patients showed Mixed Pattern. In DLCO findings, 27 patients showed normal (67.5%) and 13 (32.5%) patients showed Decreased Pattern. **CONCLUSION** Duration of exposure to dye and smoking were significantly associated with Clinical features, reduced 6 Minute Walk distance, Abnormal Spirometry and DLCO findings. FEF25-75% was significantly decreased in most of the dye-workers in present study. As the Dyeing-workers are working in hazardous environment, there should protocols be formed for routine medical check-up at frequent interval in textile industry to detect occupation related diseases at early stage and to intervene the problem timely.

KEYWORDS

SPIROMETRIC FUNCTION TEST DIFFUSING CAPACITY OF CARBON MONOXIDE 6 MINUTE WALK TEST

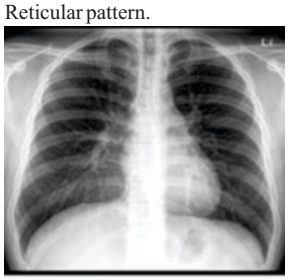
INTRODUCTION

The textile industry consists of several processes including dyeing, printing etc. and due to the exposures to various chemicals at work, these workers frequently complain of respiratory symptoms. There are many studies about the consequences of various textile dusts on the Pulmonary system, such as the effects of cotton dust [1] , flax [2], hemp [3] and wool fibres [4], but little information is available about the Pulmonary function of textile dye printing workers.[5]

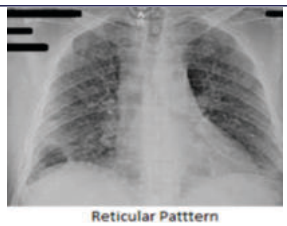
Dyeing workers have exposure to both allergens (e.g. reactive dyes) and irritants (e.g. H2S, SO2 and nitrogen oxides). A high-humidity at workplace increases the effect of these chemicals on the respiratory system as well. [5]

In 1987, Alanko, first time ever, described four cases of occupational asthma due to reactive dyes among dye powder weighting workers [6]. In 2003, a study on Carpet industry workers was done and the effect of workplace exposures on respiratory system in all units of the carpet industry was evaluated. According to this study, it was observed that dyeing workers more frequently complained of respiratory symptoms than other workers. Obstructive pattern was the most frequent pattern of Spirometry in dyeing workers [7].

We did Chest X-ray PA view among all the participants to see the effect of dyes. Some of them showed normal Chest X-ray. Some showed Prominent Broncho-Vascular Markings. And few participants showed Reticular pattern.


Normal Chest X-ray PA view


Prominent BVM


Reticular Patttern

CLINICAL PRESENTATION

SYMPTOMS

Acute:

- Rhinorrhea
- Itching
- Skin irritation
- Eye irritation
- Dry Cough

Chronic:

- Cough with expectoration(phlegm)
- Dyspnea on exertion.
- Chest tightness.
- Dry cough.

SIGNS

- Crackles
- Rhonchi(Wheeze)
- Digital Clubbing.

Cough is the classical clinical manifestation. It is invariably present and may be the only symptoms for years. It may be persistent or intermittent and with sputum production or dry in nature. Dyspnea is regarded as a late symptom and usually indicates widespread Lung disease with extensive destruction and fibrosis.

In this study, we have performed Spirometry, DLco(Diffusion capacity of Lung for Carbon Monoxide) and 6 minute walk test to evaluate Pulmonary Function.

SPIROMETRY

Spirometry, derived from the Latin words SPIRO means to breathe and METER means to measure, is the measurement of movement of air into and out of the Lungs during breathing maneuvers[10]. Primary measurements obtained by Spirometry are Forced Expiratory Volume in one second (FEV1) and Forced Vital Capacity (FVC). Ratio of both (FEV1/FVC) is used for distinguishing obstructive airway disease and restrictive disease. Spirometry measurements are evaluated by comparison with reference values based on age, sex, height, weight and race. We have measured FEV1¬, FVC, FEV1/FVC and FEF25-75% in our study.

Diffusion capacity of Lung for Carbon Monoxide(DLCO)

DLCO is a measurement to assess the ability of the Lungs to transfer gas from inspired air to the bloodstream[9]. Carbon monoxide (CO) has a high affinity for hemoglobin and it binds with hemoglobin with the same pathway as oxygen binds to hemoglobin. That is why Carbon Monoxide (CO) is used for this purpose (affinity of CO to hemoglobin is 200-250 times that of oxygen). As oxygen uptake is limited by cardiac uptake and total body consumption, it is not preferred.

In brief, when a patient inhale CO and the hold the breath for ten-second, DLCO machin measures uptake of CO per unit time per mm of driving pressure of CO (cc of CO/sec/mm of Hg).

Classification and Severity of DLCO reduction
Normal: >75% of predicted value upto 140%
Mild Decreased: 60% to 74% of predicted value
Moderate Decreased: 40% to 59% of predicted value
Severe Decreased: <40% of predicted value

6 MINUTE WALK TEST

It is a modality for objective evaluation of functional exercise capacity. In early 1960, Balke developed a simple test to evaluate the functional capacity to measure the distance walked for the duration of 12 minute and the level of physical fitness of healthy individuals was evaluated. As 12 minute for physical exertion was cumbersome for patients of respiratory disease, the defined time was revised to 6 minutes. As compared to the other walk tests to assess the activities of daily living, the 6 Minute Walk Test is easier to administer and better tolerated[8].

Intraday variability can be seen in patients and to prevent such result, repeat test should be performed at the same time. There shouldn't any period of "warm-up". Patients should be rested for at least 10 minutes before starting the test. During this time, contraindications are sought if any, pulse, Blood pressure and Saturation of oxygen(SpO2) are measured. The time is set for 6 minute and patient is instructed to start walking from the baseline.

Post-test: After 6 minute of walk Pulse, SpO2 and Blood pressure should be measured and the distance covered in 6 minutes is calculated[8].

Many patients do not achieve the maximal capacity of 6MWT; instead, they have their own intensity of exercise so these patients are allowed to stop for rest during the test. However, because most of the daily activities are performed at sub-maximal levels of exertion, the 6MWD may better reflect the functional exercise level for daily physical activities[8].

METHODOLOGY

Study Design: This study was a Observational Cross Sectional study, performed in the department of Respiratory medicine at a tertiary care teaching institution.This study included all the subjects according to the inclusion criteria coming to Respiratory Medicine OPD during the study period (15 months).

ELIGIBILITY CRITERIA

Inclusion criteria

A patient was eligible for the study if he/she:
1. Was working in textile dye-printing industry in Surat city for minimum of 2 years and is continuously working in industry without interruptions.
2. Was willing and able to give informed consent.
3. Was older than 18 years.
4. Was able to perform Spirometry, Diffusion capacity of Lung for Carbon Monoxide (DLCO) and 6 minute walk test.
5. Not having past history of tuberculosis, Ischemic heart disease, chronic renal disease, chronic liver disease.

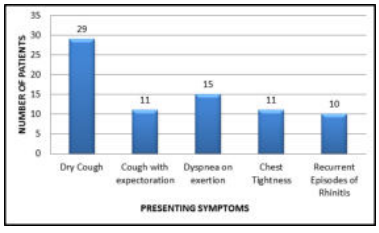
Exclusion criteria

A patient was eligible for the study if he/she:
1. Was below 18 years of age.
2. Was not willing to give consent.
3. Was having Pre-existing respiratory condition or having any chronic respiratory disease.
4. Was non compliant.
5. Was having active tuberculosis and having past history of tuberculosis, Ischemic heart disease, chronic renal disease, chronic liver disease.

OBSERVATION AND RESULTS

The present study involved 40 participants working as Textile Dye-Printing Workers in Surat City. The socio-demographic characteristics like age, sex, etc. were studied and effect of dyeing-printing on Respiratory system was studied using clinical features, Chest X-Ray finding, Spirometry Function Test, Diffusion Capacity of Lung for Carbon Monoxide(DLCO) findings and 6 Minute Walk Test.

FIGUERE no.1 – Number of patients and Presenting Clinical Features



Crackles were observed in 10 (25%) patients, Wheeze in 19 (47.5%) patients and digital clubbing in 10 (25%) patients.

In Present study, Among 40 patients, 21 (52.5%) patients showed Normal Chest X-Ray. 10 (25%) showed Prominent Broncho-Vascular Markings and 9 (22.5%) showed Reticular Pattern.

Table No. 1 : 6 Minute Walk Distance (Meters) among Textile Dye-printing workers

6 Minute Walk Distance(6MWD) (meters)	Number of Patients (n=40)	Percent (%)
≤350	6	15%
351 – 400	7	17.5%
401 – 500	10	25%
>501	17	42.5%
Mean±SD (Range)	470±102.35 (270 - 610)	
Median (IQR)	485 (375 - 565)	

Mean 6 Minute Walk Distance was 470±102.35 meters (Range: 270 – 610 meters) and median 6 MWD was 485 meters (IQR: 375 – 565 meters). Majority of patients 17(42.5%) had 6MWD > 501 meters, 10 (25%) patients had – (401 - 500 meters), 7 (17.5%) patients had – (351 - 400 meters) and 6 (15%) patients had ≤350 meters. It is shown in Table No. 1

Table No. 2: Spirometry Findings in Textile Dye-Printing workers

Spirometry Findings	Number of Patients (n=40)	Percent (%)
Normal	24	60%
Restrictive	8	20%
Obstructive	6	15%
Mixed	2	5%
Obstructive (n=6)		
Mild	4	66.7%
Moderate	2	33.3%
Severe	0	0%
Very severe	0	0%

On Spirometry Findings, 24 (60%) patients were normal, 8 (20%) patients showed Restrictive Pattern, 6 (15%) showed Obstructive Pattern and 2 (5%) patients showed Mixed Pattern. Out of 6 patients, showing Obstructive pattern, 4 (66.7%) patients showed Mild

Obstruction and 2 (33.3%) patients showed Moderate Obstruction. It is shown in Table No.2

Table No. 3: Distribution of DLCO in Patients working in Textile Dye-Printing Industry

DLCO	Number of Patients (n=40)	Percent (%)
< 40	0	0
40 – 59	6	15%
60 – 74	7	17.5%
≥75	27	67.5%
Mean±SD (Range)	76.57±15.21 (42 - 98)	
Median (IQR)	80 (67 - 86.5)	

Mean DLCO value of the patients was 76.57±15.21 (Range: 42 - 98) and median DLCO value was 80 (IQR: 67 - 86.5). Majority of the patients – 27 (67.5%) had DLCO value of ≥75 followed by 7 (17.5%) patients had DLCO value 60 – 74 and 6 (15%) patients had DLCO value of 40 – 59.

DISCUSSION

Distribution based on DLCO findings, Spirometry findings, 6 Minute Walk Distance, Chest X-ray findings

Parameters		In present Study
Spirometry Findings(n=40)	Normal	24(60%)
	Obstructive	6(15%)
	Restrictive	8(20%)
	Mixed	2(5%)
DLCO findings	Normal	27(67.5%)
	Mild Decrease	7(17.5%)
	Moderate Decrease	6(15%)
6 Minute Walk Distance	Mean	470±102.35
	Median (IQR)	485 (375 - 565)
Chest X-ray Findings	Normal	21(52.5%)
	Broncho-Vascular Markings	10(25%)
	Reticular Pattern	9(22.5%)

- In the Present study, besides normal Spirometric findings, 8(20%) and 6(15%) patients had Restrictive and Obstructive pattern, respectively.
- In present study, DLCO showed Mild and moderate decrease in 7(17.5%) and 6(15%) patients.
- In present study, Mean 6 Minute Walk Distance was 470±102.35.
- In present study, it showed that most patients who had reticular pattern showed either Restrictive pattern or mixed pattern and most patient showed decrease in 6 minute walk distance and abnormal Spirometry and DLCO findings. It was clinically significant.

SUMMARY

The present study was conducted in the Department of Respiratory medicine, in Tertiary Care Center. The objective is to study Clinical Profile, Spirometric Function Test, Diffusing Capacity of Lung for Carbon Monoxide, 6 Minute Walk Test and Chest X-Ray Findings in Textile Dye-Printing Workers.

1. In this study, Dry cough was observed in majority of patients – 29(72.5%) followed by Dyespnea on exertion was observed in 15(37.5%) patients.

2. Wheeze was the predominant finding in auscultation in majority of the patients – 19(47.5%), followed by Crackles and Digital clubbing, each were seen in 10(25%) of patients.

3. Chest X-Ray was normal in majority of patients – 21(52.5%), followed by Prominent Broncho-Vascular markings (BVM) was observed in 10(25%) patients. Reticular 8pattern was observed in 9(22.5%) patients, which was clinically associated with abnormal Spirometry and DLCO findings.

4. Mean 6 Minute Walk Distance was 470±102.35 meters (Range: 270 – 610 meters). Decrease in 6 Minute walk distance was clinically associated with abnormal Spirometry and DLCO findings.

5. On Spirometry Findings, 24 (60%) patients were normal, 8 (20%) patients showed Restrictive Pattern, 6 (15%) showed Obstructive Pattern and 2 (5%) patients showed Mixed Pattern. Out of 6 obstructive patients, 4 (66.7%) patients showed Mild Obstruction and 2 (33.3%) patients showed Moderate Obstruction. Abnormal Spirometry findings were observed more in male than female, more in smokers than non-smokers.

6. In present study, Mean DLCO value of the patients was 76.57±15.21 (Range: 42 - 98) and median DLCO value was 80 (IQR: 67 - 86.5). Majority of the patients – 27 (67.5%) had DLCO value of ≥75 followed by 7 (17.5%) patients had DLCO value 60 – 74 and 6 (15%) patients had DLCO value of 40 – 59. Out of 40 patients, 27 (67.5%) and 13 (32.5%) patients showed Normal and Decreased Pattern respectively in DLCO findings. Out of 13 patients with decreased DLCO value 7 (53.85%) and 6 (46.15%) patients were mild and moderate decreased grading. Abnormal DLCO findings were observed more in male than female, more in smokers than non-smokers.

CONCLUSION

Ergonomics issues are observed in majority of units engaged in textile related industry in India. Most of these units have a working environment that is unsafe and unhealthy for the workers. Textile Printing Dye-workers are constantly exposed to certain chemical dyes that have hazardous effects on health. Respiratory and Dermatological systems are frequently affected among these workers after long duration of exposure to dyes. Spirometry function test detects abnormality among the dye working even before they develop severe symptoms. In textile industry, health and welfare are given little attention, therefore, a well-formulated and implemented safety and health program that includes the training and effective supervision of workers is a necessity. The design of the machinery is to be built in a way to control the unnecessary exposure and suitable PPE should be provided to prevent the evitable hazards.

In present study, Most of the dyeing workers were immigrant from other states and males were affected more than female. Duration of exposure to dye and smoking were significantly associated with Clinical features, reduced 6 Minute Walk distance, Abnormal Spirometry and DLCO findings. FEF25-75% was significantly decreased in most of the dye-workers in present study.

As the Dyeing-workers are working in hazardous environment, there should protocols be formed for awareness program and routine medical check-up at frequent interval in textile industry to detect the health related abnormality and occupation related diseases at early stage and to intervene the problem timely to increase the prospect of cure.

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