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Study of respiratory function tests in young adult male textile mill workers.

KEYWORDS

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ABSTRACT ***Background :****The textile industry has a unique place throughout the world. The industry provides cloth, one of the basic necessities of life and employment to millions of people. Byssinosis is a chronic disabling disease which does not show any characteristic physical and X-ray signs in initial stages. Taking into consideration the large number of workers involved in textile mills and high incidence of Byssinosis progressing to COPD, we thought, assessment of respiratory functions may help to identify the pulmonary dysfunction at early stages, so as to take appropriate measures to prevent disabling complications of cotton dust exposure in workers.* ***Material & Methods :*** *The present study was conducted in 242 males of Jamshri Textile mill, Solapur. 164 male workers served as cases and 78 males served as controls. Controls were totally healthy, age matched and selected from the clerical department of the mill and were not exposed to cotton dust. Subjects were in the age groups ranged from 20-39yrs. After screening all were subjected to Respiratory function test (RFT). The results were analysed using students unpaired T-test.* ***Results :*** *Young male workers showed highly significant reduction in FVC, FEVI, PEFR, FEF 0.2, FEF 25% and MVV in textile mill workers. This table shows highly significant decrease in FVC, FEVI, PEFR, FEF 0.2-1.2, FEF 25% and MVV and significant decrease in FEF 25-75% and FEF 50%. Conclusion: The present study on respiratory function in young textile mill workers showed that exposure to cotton dust is definitely an occupational hazard. Initially large airways and then small airways show obstructive changes. Management should be advised to hold a pre-employment examination of a worker to detect overall health status and especially the status of respiratory functions. A regular periodic assessment of workers in the industry should be done for the detection of respiratory dysfunction.*

Introduction : The textile industry has a unique place throughout the world. The industry provides cloth, one of the basic necessities of life and employment to millions of people.The first textile mill was established in New England in late 16th century. In 19th century, industries revolutionized a lot with advanced technologies and mechanization of processing of cotton. [1]

Due to extensive mechanization and use of chemicals, workers were exposed to different occupational hazards, such as accidents, fire, diseases due to exposure to cotton dust, disabilities due to exposure to high temperature in spinning and weaving departments, hearing impairment produced by noise pollution by the rapidly rotating machines and different skin diseases caused by exposure to industrial chemicals. Of all, the greatest health hazard was due to inhalation of cotton dust. [2]

Cotton is a natural fiber obtained from plant "Gossypium". It contains 90% cellulose and 6% moisture. Cotton was first cultivated in India as early as 2000-3000 B. C. and thus India became the homeland for cotton. [3] Then it was grown in China, Korea and now all over the world. The cotton from field is collected and fed into a machine called "Gin" which separates fibers from seeds by pneumatic suction. Then cotton is compressed into bales and sent to textile industry.

India being larger producer of cotton, many textile industries are set up in states like Gujarat, Maharashtra and Uttar Pradesh. According to recent surveys, carried in Bombay, Ahmedabad and Delhi, the incidence of Byssinosis is 7-8%(17) In Maharashtra textile industries are aggregated in Bombay,Sangli-Miraj, Ichalkaranji. [4]

In Solapur, there are two composite textile mills, 15-20 spinning mills and 3000-3200 powerlooms and handlooms. The production is mainly of chadddars and towels. The goods are famous not only in India but are exported to foreign countries also. Nearly 30,000-35000 workers are involved in these mills. [5]

Byssinosis is a chronic disabling disease which does not show any characteristic physical and X-ray signs in initial stages. Taking into consideration the large number of workers involved in textile mills of Solapur and high incidence of Byssinosis progressing to COPD, we thought, assessment of respiratory functions may help to identify the pulmonary dysfunction at early stages, so as to take appropriate measures to prevent disabling complications of cotton dust exposure in workers. [6]

Material & Methods :

The present study was conducted in 395 males of Jamshri Textile mill, Solapur. Two hundred fifty three (253) male workers served as cases and one hundred and forty two males served as controls. Controls were totally healthy, age matched and selected from the clerical department of the mill and were not exposed to cotton dust. Subjects were in the age groups ranged from 20-59yrs.

The subjects having previous major illnesses, respiratory diseases, smoking habits were excluded from the study. Screening of each subject was done with following proforma. Occupational History was taken as duration of Service in a particular department , number of hours/day, H/o change of job or transfer to other department.

After screening all were subjected to Respiratory function test (RFT).All the recordings were done in the period from Oct 1998 to Jan 1998 at an average temperature of 28 degree C, between 11 am. to 2 pm. The instrument used was 'Medspiror', a computerized pneumotachometer (manufactured by Med. System Pvt. Ltd. Chandigarh). [7] The instrument fulfilled the criteria/conditions for performance and reproducibility laid by American Thoracic Society (ATS).

The procedure was explained in detail so that subject gets complete understanding and trials were given after the demonstration of forced expiratory manoeuvre and maximum voluntary ventilation. All were tested in sitting position. Three trials were given and maximum reading was taken for observation. Standard data and standard regression equations in the software of the microprocessor, predicted values of respiratory

Volume : 6 | Issue : 12 | December : 2016 | ISSN - 2249-555X | IF : 3.919 | IC Value : 79.96

function parameters were calculated by the instrument and were corrected to BTPS by the instrument itself. Each subject was asked to perform following two manoeuvres. Forced expiratory manoeuvre. Subject was asked to take maximum inspiration and then blow into the mouthpiece without interruption as hard, fast and completely as possible. Maximum Voluntary Ventilation Manoeuvre subject was asked to respire (inspiration and expiration) as rapidly and deeply as possible, for 10 seconds in the mouthpiece of instrument. With these two manoeuvre actual values of all RFT parameters were recorded in instrument. Out of following ten nine were recorded with first manoeuvre and the last by second manoeuvre. These parameters are , FVC, FEV 1,PEFR , FEF ,FEVI/FVC ,MVV .

For each subject a printed sheet of actual, predicted, and percent predicted values of all respiratory function parameter was taken. Instrument was reused with a new, disposable mouth-piece to next subject.

The results were then subjected to statistical analysis to find out, their statistical significance according to age groups and duration of exposure. The parameters taken in our study can be explained with the help of forced expiratory spirogram and flow volume curve. The results were analysed using students unpaired T-test.

Results :

Table No 1 Number of subjects in different age groups were as follows.

Age Group (yrs)	No. of Textile mill workers	No of controls
20-29	52	24
30-39	112	54
Total	**164**	**78**

Table No. 2 Comparison of RFT values between textile mill workers and control in the age group 20-29 yrs.

RFT Parameter	Textile Mill Worker n=52	Control n=24	S.E.	'P' Value
	Mean SD	Mean SD		
FVC	1.88 0.56	2.71 0.44	0.14	**<0.01
FEVI	1.87 0.48	2.68 0.43	0.12	**<0.01
FEVI/FVC%	99 4.92	99 2.36	1.19	--
PEFR	6 2.14	7.9 1.29	0.53	**<0.01
FEF 25-75%	4.43 1.63	4.64 1.03	0.4060	<0.2
FEF 0.2-1.2	4.7 2.24	6.5 1.16	0.55	**<0.01
FEF 25%	5.5 2.32	7 1.27	0.56	**<0.01
FEF 50%	4.87 1.82	5.01 1.05	0.44	<0.2
FEF 75%	3.37 1.11	3.29 0.93	0.28	<0.2
MVV	106 18.6	121 27	5.76	**<0.01

The table shows highly significant reduction in FVC, FEVI, PEFR, FEF0.2, FEF 25% and MVV in textile mill workers.

Table : 3 Comparison of RFT values between textile mill workers and control Age group 30-39 yrs.

RFT Parameter	Textile Mill Worker n=112	Control n=54	S.E.	'P' Value
	Mean SD	Mean SD		
FVC	1.78 0.45	2.32 0.35	0.09	**<0.01
FEVI	1.75 0.39	2.28 0.34	0.08	**<0.01
FEVI/FVC%	98 6.29	984.11	1.35	--
PEFR	5.1 1.81	7 1.99	0.41	**<0.01
FEF 25-75%	3.54 1.26	4.12 1.23	0.28	<0.05
FEF 0.2-1.2	3.5 1.56	5.4 1.82	0.36	**<0.01
FEF 25%	4.5 1.77	6.22.17	0.41	**<0.01
FEF 50%	3.79 1.29	4.39 1.35	0.29	<0.05
FEF 75%	2.82 1.05	2.89 0.95	0.23	<0.2
MVV	96 18.5	111 22.4	4.36	**<0.01

This table shows highly significant decrease in FVC, FEVI, PEFR, FEF 0.2-1.2, FEF 25% and MVV and significant decrease in FEF 25-75% and FEF 50%.

Discussion :

Our study included 164 male textile mill workers and 78 age matched healthy controls. Following RFT parameters were recorded for each subject FVC, FEVI/FVC%, PEFR, FEF0.2-2.,FEF 25-75%, FEF25%, FEF50%,FEF75%, & MVV.

Our control group showed mean value or FVC as 2.22L, and of FEVI, as 2.16 L. These values appeared less as compared to values in the study of V.L.N. Raoet. al. [8] which were 3.16 lit for FVC and 2.80 for FEV1 Our values in a study by Bryan Gandevia et al 1965 (2) as for FVC it was 3.76L and for FEV1, 3 L.

Mean FEVI/FVC% in our control group was 98% .The ratio seemed more as compared to values recorded by Eugenija Zuskin et al (1975) [9] as 76% (7)

PEFR value of our control group was 7.1 L/S and the value recorded by RN. Tiwari et al [10] was 7.73 L/S. Our control group had mean value of FEF 25-75% as 4.09 L/S and of FEF 50% as 4.52 L/S EugenijaZuskin et al (1975) [9] reported a mean value 3.61 L/S for FEF while 4.18 L/S was the mean value recorded for FEF 25-75% by Roger Larson et al [11]

The decline in FVC and FEVI was attributed to action of cotton dust on respiratory airways leading to obstructive changes.

Bryan Gandevia et al (1965) [2] observed that decline in FVC and FEVI was significant in those workers who served for 1-10 yr. In our study also workers exposed for 1-10 yrs showed a highly significant decline in FEVI of 85 ml which was maximum decline than in those exposed for more than 10yr. In FEVI. They also observed highly significant decline in FEVI of 161 ml which was maximum fall than those observed in workers working for more than 10 yr. They suggested therefore that recent employees are more susceptible to the effects of exposure to cotton dust.

In one more study [12] asymptomatic textile mill workers showed significant reduction in FVC and FEV1. Symtomatic workers were excluded from the study. Our findings are in accordance with above observation. They also said that workers exposed to cotton dust are table to develop pulmonary disorders which are preceded by varying degree of decline in lung function.

Considering all observations in our study, it is obvious that FVC and FEVI reduced significantly in early age group that is in 20-39 yr. As these parameters indicate obstructive changes in lungs, it appears that recently employed workers are more susceptible and prone to develop pulmonary dysfunction.

FEF 25-75% and FEF 50% are effort independent and indicate airflow in peripheral airways where diseases of chronic airflow obstruction begin [13]. We found decrease in these two parameters in age group 30-49 yr and workers of blowing and carding section.

So decrease in FVC and FEVI along with decreased flow rates suggest involvement of large airways initially. As age advances medium and small airways appear to be affected. Higher dust content of air in blowing and carding sections probably appears to be the cause for affection of many parameters in the workers .

The basic mechanisms suggested for airway affection due to cotton dust inhalation are after inhalation of cotton dust, it is phagocytosed by pulmonary macrophages which induce neutrophils to release leukotrienes, platelet activating factor (PAFAcether) and mast cells to release Histamine. All these cause bronchoconstriction and are responsible for the symptoms [14]. Constant irritation by cotton dust causes some nonspecific respiratory irritation leading to hypersecretion of

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mucus, forming mucus plugs causing obstruction of airways. [15/21] Smooth muscle hypertrophy and mucus gland hyperplasia is a constant finding in Byssinotic lungs [3].

In 20-29 yr age group are FVC, FEVI, PEFR, FEF 0.2-1.2, FEF 25% and MVV were decreased significantly. In 30-39 yr age group in addition to above parameters FEF 25-75% and FEF 50% were also declined.

The present study on respiratory function in textile mill workers showed that. Exposure to cotton dust is definitely an occupational hazard. Initially large airways and then small airways show obstructive changes. Effect of aging on pulmonary functions was more pronounced in textile workers.

Jamshri Textile mill has already taken preventive measures like exhaust ventilation, artificial humidification and use of enclosed machinery at working place. The following suggestions can further minimize the hazards of cotton dust inhalation in the mill. Management should be advised to hold a pre-employment examination of a worker to detect overall health status and especially the status of respiratory functions. A regular periodic assessment of workers in the industry should be done for the detection of respiratory dysfunction. Workers should be advised to use masks while working in any section of the cotton mill. Transfer to a less dusty department should be advised if the worker shows pulmonary dysfunction.

References:

1. BermardinoRamazzini, 'Occupational Health Practice' second edition, 1981, page no. 415.
2. Bryan Gandevia and James Milne, 'Ventilatory capacity changes and exposure to cotton dust and their relevance to Byssinosis in Australia.,Brit. J. Industr. Med. 1965 22-295-303
3. C. Ed. wards, J. Macarthey, G. Rooke, and F Ward.'The Pathology of lung in Byssinotics' Tharox 1975, 30, 612-622
4. David C. Christaini, Ting-Ting Ye, Ellen, A. Tisen, 'Pulmanory function among cotton textile workers', Chest 1994, 105/6, 1713-21
5. David Fishwick, Angela M. Fletcher, C. Anthony C. Pickering Robert MCL. Niven, E. Brian Faragher. 'Lung function in Lancashire cotton and manmade fibre spinning mill operatives', Occupational and Environmental Medicine 1996, 53, 46-50.
6. Encyclopaedia of Occupational Health and Safety, Third edition 1983 Volume-1, Page 180.
7. EugenijaZuskin. F. VALIC, D. Butkovic and A. Bouthuys.'Lung Function in textile workers', 'British Journal of Industrial medicine-1945,32,283-288.
8. V. L. Narasimha Rao and H.C. Tandon. 'A Study of dynamic lung functions in textile workers' Ind. J. PhysiolPharmac. 1979 October-December vol. 23, No. 4, 342-346
9. EugenijaZuskin; E. Neil Schachter, BozicaKanceljakTheodar J. WitekrJr; and Edward Fein.'Organic dust disease of airways', Int. Arch. Occup. Environ, Health (1993) 65-135-140
10. Rajanarayan R. Tiwari, Sanjay Zodpey, Sanjay G. Deshpande and Nayantara D. Vasudeo. 'Peak Expiratory flow rate in Handloom weavers' Indian J. Physiol. Pharmacol. 1998; 42(2): 266:270.
11. Roger K. Larson, Martin L. Barman, David W. Smith and Larry Nicol.Study of Respiratory effect of short and long-term cotton Gin Exposure. Chest (1981) 79;4 April supplement.
12. Michel Grimard, M.D., and Fraser Adams, M.P.A. 'The Respiratory health of Quebee Textile Workers. Chest (1981) April 79, 4, Supplement.
13. Murray Nadel 'Textbook of Respiratory Medicine' Second edition 1994 Volume 1 page p 803.
14. J Bernard L. Gee' 'Occupational lung diseases' First edition 1984,193-207.