Original Article

Lung function response to dust in Safai workers

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Received: 01-11-2015
Revised: 10-11-2015
Accepted: 02-12-2015

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ABSTRACT

Introduction: *Sweepers often work without proper protection and are thus exposed to harmful effects of inhaled dust.*

Objectives: *This study was undertaken to study the effect of dust on the pulmonary functions in sweepers working in PIMS, Jalandhar*

Materials & Methods: *60 sweepers were selected and 60 controls were selected for this study. Lung functions were performed using Medspiror computerized spirometer. The data was collected and statistically analysed.*

Results: *Lung functions in sweepers were significantly decreased as compared to those in controls.*

Conclusions: *Dust causes chronic inflammatory diseases in lungs and causes a decrease in the lung volumes and capacities.*

Key Words: *Dust, lung functions, spirometer, disease, vital capacity*

Introduction

Occupational lung disease is one of the major causes of respiratory morbidity and mortality especially in a developing country like India where majority of workers work without proper protection. [1] The sweepers manually collect the wastes and there is little, if any protection to workers from direct contact injury and virtually no dust control at workplaces. [2] The dust raised on sweeping consists of a complex mixture of soil, sand particles, microorganisms, spores etc. Exposure to these particles irritates the respiratory tract leading to varying degrees of respiratory symptoms and airway obstruction. [3] The present study was undertaken to observe the effect of dust inhaled during sweeping on lung function in sweepers or safai sewaks working in tertiary care hospital.

Materials & methods

The present study was undertaken in the Department of Physiology at Punjab Institute of Medical Sciences, Jalandhar. Permission to conduct the study was duly granted by the institutional ethics committee. The study was undertaken to observe the effect of dust on sweepers aged between 25-30 years. All the sweepers had been working as sweepers for more than two years. 60 sweepers were selected for study and an equal no of GDAs (General duty Attendants) were selected to act as controls. The controls were matched for age, weight and height. The procedure was explained to cases and controls in a language they could understand and informed consent was taken from both cases and controls. A brief history was taken and a clinical examination was done to rule out any respiratory or other illness. Subjects who smoked were excluded from the study. Also subjects suffering from any disease like asthma, COPD, Tuberculosis, Diabetes, and Hypertension were excluded from the study. Also subjects on treatment for chronic diseases were excluded from study. The lung functions were performed in the department of physiology using

Medspiror, computerized spirometer. The tests were performed at approximately the same time every day. The procedure was explained to the subjects. Three readings were taken in each case with an interval of 5 minutes. FVC (Forced Vital Capacity), FEV1 (forced Expiratory volume in first second), FEV1/ FVC, PEFR (Peak expiratory Flow rate) were recorded. The results for each parameter were compared between the two groups and statistically analysed using student's unpaired t test. P value of <0.05 was taken as significant.

Results

The mean height in cases was 157±7.93 cm and in controls it was 159.76±6.9 cm. Mean weight in cases and controls was 60.76±6.3 kg and 59.80±6.4 kg respectively. Similarly, the mean age in cases was 29,43±1.16 and in controls it was 29.83±0.83 years. On statistical analysis it was found that the mean values for weight, age and height were not significantly different. (Table:1) FVC in cases was 2.71±0.56 litres and in controls it was 3.27±0.52. PEFR in cases was 5.32±2.5 and in controls it was 6.27±1.94.FEV1/FVC in cases was 81.45±19.95 and in controls was 91.70±7.31. MVV in cases was 94.40±33.52 and in controls it was82.50±30.08. FEV1 was 2.25±0.84 in cases and 2.89±0.40 in controls. On comparison, FVC, FEV1, FEV1/FVC and MVV were significantly reduced in cases as compared to controls. ($p<0.05$). PEFR was decreased in cases though this decrease was not significant. (Table: 2)

Table 1: Different parameters

Parameter	Cases	Controls	P value
Height (cm)	157.26±7.93	159.26±6.9	>0.05 (NS)
Weight(kg)	60.76±6.3	59.80±6.4	>0.05 (NS)
Age(yrs)	29.83±1.16	29.83±0.83	>0.05 (NS)

NS=Not significant

Table 2: Lung functions

Parameter	Cases	Controls	P value
FVC(litres)	2.71±0.56	3.27±0.52	<0.05 (S)
FEV1(litres)	2.25±0.84	2.89±0.40	<0.05 (S)
FEV1/FVC	81.45±19.95	91.70±7.31	<0.05 (S)
MVV(litres)	94.40±33.52	82.50±30.08	<0.05 (S)
PEFR	5.32±2.5	6.27±1.94	>0.05(NS)

FVC= Forced Vital Capacity, FEV1= Forced Expiratory Volume in first second, MVV=Maximum Ventilation Volume, PEFR= Peak Expiratory flow Rate, S= significant, NS= Not significant

Discussion

In our study, most of the lung function parameters especially FVC, FEV1, FEV1/FVC, MVV were significantly decreased in sweepers than in controls. However, in PEFR, a significant decline in functions could not be observed. Our results match with a study on female sweepers in Nigeria which reported a reduction in all parameters of lung functions. [4] The findings are similar to those of a study done in Spain in which it was reported that FEV1, FVC, and FEV1/FVC were significantly reduced in subjects exposed to dust such as cleaners and road sweepers. This study also reported an increased incidence of symptoms of chronic bronchitis in such workers. [5]

The findings of a study done by Ajay KT et al are also similar to our study wherein they have showed a significant reduction in FVC, FEV1 and PEFR as compared to the control group. [2] They also report that with increase in duration of the exposure to dust, the lung functions tend to decrease. Another study done on female sweepers in India showed statistically significant reduction in FVC, FEV1, PEFR, FEF25-75% and FEF 200-1200 and this impairment was increased with duration of exposure to dust in sweepers. [6]

Various components of dust can access the respiratory system by inhalation and directly affect the epithelium of the airways. [7] These responses can be exacerbated by biological agents and other trace elements such as mercury, cadmium etc. that may be present in the dust. [8] The exposure to these dust particles and contaminants can cause pulmonary diseases that may have significant effect on health and quality of life. In many dust induced respiratory diseases, the immune system plays a dual role. Although activation of the immune system is necessary for removal of antigens from the airways, an inappropriate or unchecked immune response can result in severe lung disease and pathologic outcomes. Recently, many studies have focused on the suppression of the immune responses for the treatment of asthma and other pulmonary diseases. [9] COPD can be induced by long term inhalation of harmful dust particles. In COPD, patients have different respiratory symptoms and systemic outcomes but generally, there is a non infectious inflammation of the airways and lung parenchyma in COPD. [10] Airway epithelial cells act as physical barrier in the lungs and plays an important role in the immune response against dust. These cells express different receptors such as Toll like receptors (TLRs), c-type lectin receptors (cTRs) and protease activated receptors (PARs) that can be triggered by environmental allergens or microbial components. [11] Following receptor mediated signaling, epithelial cells produce pro inflammatory cytokines such as IL-6 and IL-8 in response to environmental particles. [12] This mechanism stimulates lymphocytes, dendritic cells and granulocytes resulting in acute inflammation. [13]

So, a decrease in FVC reflects restriction secondary to pulmonary and pleural fibrosis and air trapping secondary to airway obstruction which may explain a decreased FVC in the study. A decrease FEV1 may be explained by loss of lung elastic recoil pressure which reduces the force required to drive air out of the lung. This is attributed to microscopic enlargement of air spaces rather than to grossly visible emphysema. [14]

It can be safely concluded that the lung disease in sweepers are due to the deposition of airborne dust particles in airways which leads to exacerbation of immune responses of the epithelium to antigens. Such diseases may be prevented by using simple means like using long handled brooms.

It is suggested that sweepers should undergo a pre employment surveillance test and regular medical check ups thereafter. So that any decrease in lung function may be detected at an earlier stage. Also improvement in work conditions like ventilation system helps in reducing air contamination. Use of protective gear like masks is also recommended to provide additional protection. Using vacuum cleaners rather than manual broom

sweeping can also help in decreasing the morbidity. Also, spraying water over the area before sweeping will help in settling down of dust and so less dust will be inhaled. Likewise, precise tracking of critical immune cells cytokines would constitute an important step forward for the management of dust associated pulmonary diseases.

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Cite this article as: Arora R, Kaur H. Lung function response to dust in Safai workers. Int J Med and Dent Sci 2016; 5(1):1038-1041.

Source of Support: Nil
Conflict of Interest: No