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Effect of Exposure to Cement Dust among the Workers: An Evaluation of Health Related Complications

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Abstract

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BACKGROUND: Cement contains various types of chemicals in addition to lime and silica, and such chemicals cause different health complications and pathogenesis in addition to respiratory disorders. The most important occupational hazards for cement workers are allergy and complication related to respiratory system.

AIM: The current study was performed by analysing the questionnaire distributed among the workers and also by the sputum collected from them to study the general health conditions and other life activities.

METHODS: Sputum samples were assayed for cytological analysis by Hematoxylin and Eosin staining.

RESULTS: In this study, it was observed that majority of these workers suffered from different types of respiratory complications, such as a cough, asthma and lung infections. In addition to this, few subjects showed allergy and other complication like hypertension, diabetes and backache. Moreover, cytological analysis of the sputum was made, and it was observed that majority of the subjects showed severe inflammation.

CONCLUSION: Based on these finding, we concluded that long-term cement dust exposure and inhalation causes respiratory complications due to epithelial tissue damage and that can lead to secondary complications as well.

Introduction

Environmental and occupational pollution has always been a major cause of morbidity and mortality. The incidence of the occupational disease is constantly increasing throughout the world, especially in developing countries due to the lack of proper quality control documentation and the practical approach towards this mammoth problem.

The smoke and dust produced by some industries cause various types of pathogenesis. The unhygienic exposure of the smoke and dust are linked with an increased risk of chronic obstructive pulmonary diseases [1]. In this vista, cement workers may also be exposed to numerous types of

occupational hazards, and these materials are the major culprits in mortality and morbidity.

Cement dust of portland contains various types of metal oxides including calcium oxide, silicon oxide, aluminium trioxide, ferric oxide, magnesium oxide, sand and other impurities [2]. Respiratory problems with high prevalence and varying degrees of airway obstruction about portland cement exposure have been reported by earlier investigators [3] [4] [5]. In a related study, it has been reported that the cement industry workers, who are directly exposed to the dust for longer durations, suffer from more shortness of breath, as compared to the workers who take precautionary measures [6] [7].

In this scenario, the study was performed, based on the distributed questionnaire and the collected sputum from the concerned cement dust

exposed workers to evaluate the chronic respiratory complications or changes in lung function. Results of the study concluded that most of the subjects suffer from inflammation of the respiratory epithelial cells and other respiratory related complications including an asthma and productive cough.

Material and Methods

The study was conducted on cement dust exposed workers, and fifty subjects were included in this study which was especially subjected to cement dust exposure. Only the workers with minimum of more than three years' exposure were included in this study. 20 samples from the normal healthy population, who did not have any smoking history and exposure of cement particle, were considered as control groups in the study. A questionnaire was used to inquire about the symptoms of respiratory such as a productive cough, asthma, lung infection, allergy and other health-related issues. A sputum sample was collected from each subject in 50 ml plastic jars with tight lids. The jars were transported to the laboratory in proper transportation boxes at earliest and stored at 4°C till further investigations. The smears were prepared from each sputum sample on glass slides and were fixed with methanol. The slides were analysed after Hematoxylin and Eosin staining through light microscopy. Briefly, the slide with smear was immersed in the filtered Hematoxylin and was rinsed with the help of running tap water. The same slides were then immersed in eosin and again rinsed with running tap water. Running tap water removes the excess Hematoxylin or Eosin. Dehydration of section was made via ascending alcohol solutions. Mounting of the slide was done with DPX and slides were observed using a light microscope to evaluate the cellular alterations.

Results

From the distributed questionnaire and the collected sputum from the concerned workers, we obtained with following information detailed here.

A total of 50 Subjects were included in the study; the age distribution among the subjects showed that 20 cases (40 %) were in the age group between 20-30 years, 17 cases (34%) were in the age group 31-40 years, and 13 cases (26%) were in the age group between 41-50 years (Figure 1).

Nowadays smoking and tobacco chewing is very common among workers during working hours and is a major cause of health hazard. In this study, it

was observed that cement workers are allowed to smoke and tobacco chewing during work.

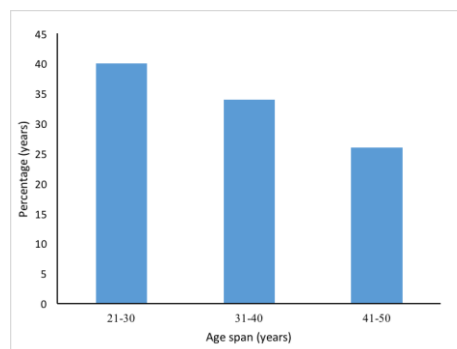


Figure 1: Analysis of the age distribution among the workers

It was found that more than 50% of workers had either smoking or tobacco chewing habits. Furthermore, it was observed that 23 subjects (46%) were smokers, 3 cases (6%) were chewing tobacco, and 2 subjects (4%) were having both smoking and chewing habits. In addition to this, 22 persons (44%) were not having either tobacco chewing or smoking habits (Figure 2).

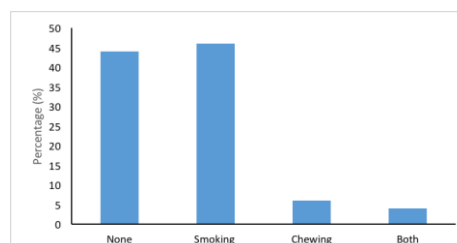


Figure 2: Distribution of subjects according to tobacco chewing and smoking habits

It was observed that most of the workers were in this sector were more than three years of work experience. It was obvious to study the general health conditions among these workers. It was studied that 5 persons (10% subjects) showed a productive cough, 7 workers (14%) were having the complication of asthma, 7 individuals (14%) were having lungs infection. Moreover, 1 person (2%) showed allergy and 11 (22%) were suffering from other complication including hypertension, diabetes and back pain (Figure 3). It was further analysed that the health conditions of these workers were not so severe before joining this cement industry.

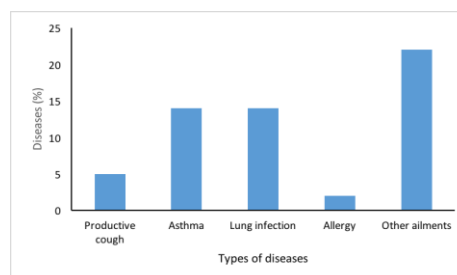


Figure 3: Study of general health conditions among the workers

All fifty sputum samples were collected in separate tight lid plastic jars with a detailed history of each subject to evaluate the alterations in cells. All the samples were performed for H&E staining. We observed 35 subjects (70%) showed severe inflammation and most of the cases were also having a long history of smoking and tobacco chewing (Figure 4).

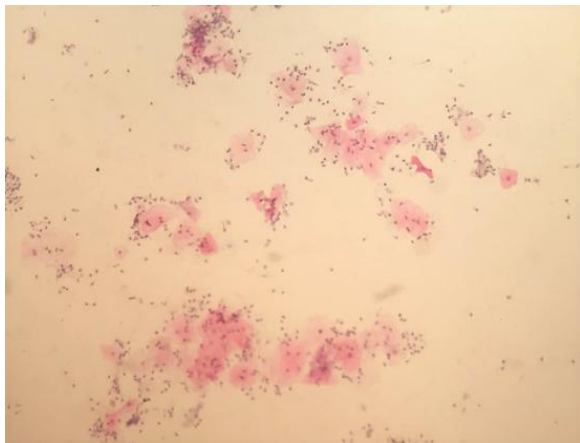


Figure 4: Severe inflammation was noted through Hematoxylin and Eosin staining (Original mag. X10)

We did not notice other types of alterations like metaplasia and dysplasia. In parallel, control samples were also run for H&E staining to compare the results with cement exposed workers. No severe inflammation was observed in the control groups (Figure 5).

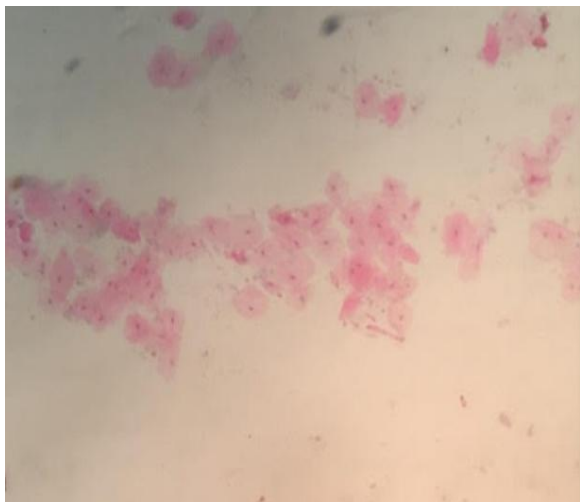


Figure 5: Less inflammatory cell was seen in control groups samples (Original mag. X10)

Discussion

Respiratory diseases associated with inhalation of airborne dust are the most vital group of

occupational diseases [8]. Previous study subjects with chronic obstructive pulmonary disease advocate that workplace exposures are powerfully linked with an increased risk of chronic obstructive pulmonary disease [9]. Chronic respiratory diseases account for a public health challenge in both industrialised as well as developing countries because of their health and economic impacts [10]. Cement is one of the most important building materials in the world [11]. Moreover, cement dust constitutes numerous materials including calcium oxide, silicon oxide, aluminium trioxide, ferric oxide, magnesium oxide, sand and other impurities [2]. The cement dust or constituents of cement causes pathogenesis of various lung diseases including chronic bronchitis, asthma, lung cancer, pneumonia and tuberculosis. The study based on workers reported that condition of the oral mucosa in cement plant workers, where clinical examination established features of mechanical trauma and oral mucosal inflammation in all workers exposed to cement dust [12]. In a previous finding based on Iran of 200 workers, increased prevalence of respiratory symptoms and reduced lung function indices were noticed post-shift [13].

In the current study, we also noticed that various types of health complication as 5 (10%) a productive cough, 7 (14%) having the complication of asthma including having shortness of breath or feeling tight in the chest, 7 (14%) were having lungs infection. Moreover, 1 (2%) subjects showed skin allergy, and 11 (22%) were other complication including hypertension, diabetes and back pain. Another study finding concluded that acute respiratory health effects among the workers are most likely due to exposure to high concentrations of irritant cement dust [14]. A study based on Malaysian population reported the association of total dust exposure and respiratory symptoms such as a cough, phlegm, chest tightness and also with lung function indices [15].

The study was performed in a cement factory based in the United Arab Emirates to assess cement dust exposure and its relationship to respiratory symptoms among workers. Result confirmed that prevalence of respiratory symptoms was higher among the exposed workers, but the difference from that of unexposed workers was statistically significant only for a cough and phlegm [16]. In the current study, it was observed that 35 subjects (70%) showed severe inflammation and most of the cases were also having a long history of smoking and tobacco chewing. We did not notice other types of alterations like metaplasia and dysplasia. Another study was made to investigate the risk of the respiratory epithelium in regards to occupational exposure to cement dust. The result of the study reported that atypia (dysplasia), squamous metaplasia, acute inflammatory infiltrated cells and chronic inflammatory infiltrated cells were detected [17].

Our finding concluded that cement particle exposure or inhalation causes respiratory

complications and its accumulation in the lung causes epithelial damage and causes inflammation.

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