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The Effect of Cement Dust Exposure on Hematological and Cytogenetic Studies of Cement Workers

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ABSTRACT

The study measured haematological and cytogentic parameters in workers occupationally exposed to cement dust in order to test the hypothesis that cement dust exposure may perturb these functions. Assessments of haematological, and cytogentic were performed in 30 workers occupationally exposed to cement dust and 30 matched unexposed controls. The RBC level has no significant change and WBC level has a significant increased whereas Differential Leucocyte count of monocyte and basophils significantly decreased in the cement workers, while there was no significant difference in the neutrophils. Eosinophils and lymphocytes showed significantly increased in cement workers. The platelet count, MCV, RDW, PCT, PDW, MCH, MCHC were significantly decreased. The Hgb content and PCV were significantly increased. TB, DB and IB were not statistically significant. In the cytogentic analysis, the chromosomal aberration was not found in control group as well as cement worker. These results suggest that occupationally exposure to cement dust may perturb haemopoietic while preserving the genotoxic.

Keywords: Cement dust; Occupational exposure; Hematological hazards; Cytogenetic.

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INTRODUCTION

Toxic effects of air–borne pollutants on humans include damage to eyes, respiratory and nervous systems, and a number of teratogenic, carcinogenic and mutagenic effects. Genetic damage when present in the cells of the germline may be expressed many generations after the primary induction of the genetic change -the mutation. The findings of a recent study in India also suggest that cement dust exposure caused haematologic and cytogenetic damage in cement factory workers. Though inflammatory responses resulting from workplace exposures are usually observed in specific target organs, such as the lungs, skin and liver and if persistent, may progress to fibrosis, granulomatous diseases and even cancer [2]. Air pollution is a significant factor in morbidity and mortality within industrial societies. Hazardous substances are distributed widely in ecosystems due to diverse human activities such as energy usage, industrial enterprises, agriculture, etc. The human haemopoietic system is extremely sensitive to some environmental influences because of the rapid synthesis and destruction demands. Human population is prone to exposure to substances that are genotoxic since some of the pollutants are carcinogens and mutagens with a capacity to affect both the structural integrity of DNA and the fidelity of its biological expression [3].

For many centuries polluted air has been considered to be a hazard to health, and concern has been mounting during the last few decades about the possible deleterious effects of the introduction of an increasing numbers of exobiotic substances into the environmental and that many of these compounds can chemically alter DNA which in-turn can lead to deleterious consequences (Jakobsson et al. 1997). The present study was aimed at evaluating and predicting the risk of haematological and cytogentic abnormalities in subjects exposed to cement dust.

MATERIAL AND METHODS

A total of thirty eligible subjects were selected among the workers of a cement factory situated at Coimbatore. They had been exposed to cement dust for 15 years. An unexposed group consisted of 30 workers who were matched by socio-economic class and age with the exposed group. Hematological parameters, 2ml of blood was drawn and placed in bottles containing NaEDTA. Quantitative buffy coat (QBC) machine capillary tubes were used to draw blood from the bottles, mixed by rubbing and spun at 2000 rpm for five minutes. 5ml Heparinised blood samples were collected under aseptic condition from control group and cement dust workers. This was carried out using the method described by Moorhead [12] with lymphocyte cultures. Results are expressed as mean±SD. Statistical analysis was carried out using the unpaired student t- test.

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RESULTS

Table 1: Hematological parameters of cement dust exposed and unexposed subjects. Results are expressed as Mean±SD.

Parameters	Control groups	Cement worker	t-values
RBC [M/UL]	4.8±0.68	4.5±0.1	0.69ns
WBC [K/UL]	8.05±1.35	20.14±2.03	1.82*
NEU [%N]	52.2±0.8	49.3±1.58	1.64ns
LYM [%L]	33.3±0.7	36.46±6.99	2.63*
MON [%M]	9.04±0.3	7.48±1.6	2.56*
EOS [%E]	4.10±0.14	6.01±4.13	2.35*
BASO [%B]	1.31±0.01	0.73±0.26	1.98*
HEB [g/dL]	15.45±0.34	13.3±1.64	1.49*
PLT [K/UL]	241.1±17.2	321.7±42.7	11.05**
PCV [%]	45.1±0.6	39.32±13.95	s 3.16**
MCV [FL]	81.8±10.4	94.9±11.5	4.31**
MPV[FL]	6.9±4.0	10.5±1.11	2.33**
RDW[%]	15.46±0.3	20.6±1.4	3.32**
PCT[%]	5.9±0.02	8.9±0.14	5.34**
PDW[10 GSD]	16.9±0.7	17.07±1.28	2.78**
MCH [Pg]	27.7±3.9	32.6±0.1	1.52*
MCHC	33.8±0.8	38.3±0.3	1.31*

Values are exposed by Mean ± SD, **p<0.01 - Significant at 1% level, *p<0.05 - Significant at 5% level, NS - Not significant

The haematological parameters measured are presented in table 1. The RBC of control group and cement worker were compared there was no significant change. The WBC (P<0.05) and platelet (P<0.01) were significantly higher. Differential Leucocyte count of monocyte and basophils significantly decreased in the cement workers, while there was no significant difference in the neutrophils. Eosinophils and lymphocytes showed significantly increased in cement workers. The haemoglobin concentration (P< 0.05) and packed cell volume (PCV; P< 0.01) of exposed subjects were significantly lower than in the unexposed, while the Mean corpuscular volume (MCV; P<0.01) and Mean platelet volume (MPV; P<0.01) were significantly higher in cement worker. The RDW, PDW and PCT (P<0.01) of control group and the cement worker were compared and it showed a significantly increased in cement worker. The Mean corpuscular hemoglobin and Mean corpuscular hemoglobin (MCH and MCHC; P< 0.05) were significantly higher in exposed groups.

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Table 2: Frequency Chromosomal Aberrations parameters of cement dust exposed and unexposed subjects.

S.No	Particular	No of Subjects examined	No of Metaphase counted	No of Metaphase Analysed	No of Metaphase Karyotyped	Total no of Chromosomal aberrations (Normal/Abnormal)
1	Control Group	50	30	20	4	Normal
2	Cement Worker	50	30	20	4	Normal

As shown in table 2, the Karyotype report was enclosed here with and the control group and the cement worker. There is no evidence of any structural abnormality in any of the metaphase studies. In the cytogentic analysis, the chromosomal aberration was not found in control group as well as cement worker. The metaphase karyotyped four times there is no aberrations was found in the control group and cement worker.

DISCUSSION

In the Hematological parameters, Rogers [15] reported that decrease in RBC may be due to secondary responses of an organism to irritants. [11] stated that higher in WBC than those of the unexposed group may be due to irritant cement dust lodged in the lungs. Increase in lymphocyte count and decrease in monocyte count both of which were significant. This disparity may be due to racial factors or variation in duration of exposure to cement dust [14]. Increase in Platelet counts are an indication of stress response causing RBC swelling or haemoconcentration plasmatic volume reduction [19]. A decrease in haemoglobin concentration and PCV in the blood samples of exposed group which is a sign of anaemic condition [3].

Increased MCV may be due to stimulating erythropocesis [7, 20] have shown that increased in MPV may be due to Thrombocytopenia is either impaired megakaryocytes production. High RDW levels may reflect a distruption in erythropoiesis that it may occur during some hematological disorders, such as anemia and iron deficiency [4, 10]. The increase PCT may be due to overproduction of hematopoietic regulatory elements such as colonystimulating factors, erythropoietin and thrombopoietin by the stromal cells and macrophages in the bone marrow [1, 18] have seen in increased in PDW may be due to contribute role of erythrocyte abnormalities in platelet dysfunction. Increased in MCH may be due to structural damage to RBC membranes resulting in haemolysis synthesis, stress related release of RBC from the spleen and hypoxia [17]. Studies of [8, 21] has been reported that decreased in MCHC may be due to impairment of biosynthesis of heme in bone marrow but our study reported that increased in MCHC.

In the cytogentic analysis, the chromosomal aberration was not found in control group as well as cement worker. The metaphase karyotyped four times there is no aberrations was found in the control group and cement worker. Studies of [5, 16] were stated that there was

shown previously that asbestos samples collected from an asbestos factory enhanced chromosomal aberrations in vitro using human lymphocytes. Study of [9] has stated that the leukaemia-like condition observed here was not as a result of chromosomal aberrations as indicated by the normal karyotypes of the subjects [6] emphasized that small quantities of air-bone particulate matter from polluted areas equivalent to an air – volume of about 1- 2 m^3, are capable of inducing cytogentic effects. A significant increase of chromosomal aberrations in men, environmentally and occupationally exposed to air-borne pollutants was reported [13].

CONCLUSION

In the present study and it may be concluded that in the cement factory, where the workers are exposed to cement dust has deleterious effect on the haemopoetic system while sparing in the genotoxic. The haemotoxic might be exacerbated if the exposure to this dust is not controlled. Therefore, it is advisable that mutual collaboration should be established between health officials, cement mill workers and their management to adopt technical preventive measures.

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