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ORIGINAL ARTICLE

STUDY OF WBC COUNT AND ITS ASSOCIATION WITH BLOOD PRESSURE IN PETROL PUMP FILLING WORKERS OF BARABANKI CITY, UTTAR PRADESH

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ABSTRACT:

Background: People with high risk of exposure to petroleum products like benzene include petrol pump workers, gasoline, rubber, printing and refinery workers. Petrol pump workers are exposed to many toxic chemicals like benzene which has carcinogenic effects. Human exposure to benzene has significant adverse health effects with the risk of developing haematological abnormalities including leukaemia, aplastic anaemia, lymphomas, etc. The main purpose of this study was to examine the effects of chronic inhalation of petrol fumes on white cell count s in a population of male petrol filling workers occupationally exposed to the solvents in petrol and air pollutants for short and long durations. **Materials and method:** Experimental group consisted 30 adult male volunteers of age group 30-40 years working in petrol pump stations for more than 8 years in Uttar Pradesh. Control group consisted of 30 male adults of same age group who didn't have the history of exposure to petroleum products. Blood samples were collected and analysed for total leucocyte count [TLC], platelet count and haemoglobin [HB] concentrations. **Result:** The experimental group showed significant change in WBC count when compared with control group (Lymphocyte counts were significantly lower; monocytes and granulocytes were higher in experimental group) and mean arterial pressure was high in experimental group. There were no significant changes in platelet count among study and control groups. **Conclusion:** Long term exposure to petrol fumes has deleterious effects on human haematopoietic system leading to bone marrow depression, decreased lymphocyte count and there is increase in mean arterial pressure due to adverse effect of pollutants.

Key Words: Agranulocyte, Benzene, Granulocyte, Haematotoxicity, Petrol pump workers.

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INTRODUCTION:

Petrol is an integral ingredient of modern industrial world. Benzene is important ingredient of petrol. In India, 2-5% of benzene is added to petrol.[1] Chronic exposure has been reported to result in bone marrow depression, aplasia and leukaemia, cardiac abnormalities, heart attack, and other cancers of the lung, brain and stomach. Fuel (petrol and diesel) filling station attendants are exposed to a mixture of hydrocarbons in fuel vapours during dispensing fuel and to the gases from vehicular exhaust. [2] Benzene (BZ) could be considered to be the most hazardous; xylene and toluene have toxicities in line with other aromatics of lower/different concern compared to BZ .The volatile nature of petrol products makes them readily available in the atmosphere any time it is dispensed, especially at petrol filling stations and depots.[3]

Many of the harmful effects seen after exposure to gasoline are due to the individual chemicals in the gasoline mixture, such as benzene, lead, and oxygenates. Breathing small amounts of gasoline vapors can lead to nose and throat irritation, headaches, dizziness, nausea, vomiting, confusion, and breathing difficulties. Some effects of skin contact with gasoline include rash, redness, and swelling. Allergic reactions (hypersensitivity) have been reported but these are rare occurrence. The adverse health effects of gasoline exposure may be primarily related to impairment of the haemopoietic system with bone marrow depression.[4]

A complete blood count has been recognized as an easy

and readily available screening tool for assessing the haematoxicity of benzene.[5,6]

An elevated WBC count is a marker of infection and/or inflammation. White blood cell may also play a role in vascular injury and atherogenesis. WBC-derived macrophages and other phagocytes contribute to endothelial dysfunction, development of atherosclerotic plaque rupture and thrombosis. [7]Inflammation may also contribute to increasing microvascular capillary resistance, initiation of platelet aggregation, and increased catecholamine levels. Chronic or low-grade inflammation has been shown to be a potential risk factor for hypertension.

The main aim of this study is to find the effects of benzene on granulocyte and agranulocyte count in male petrol pump workers, and educate and motivate them to use personal protective measures for prevention of benzene toxicity. With respect to the relationship between WBC count and hypertension, association between elevated WBC count and incident hypertension in a predominantly with the risk ratio of hypertension being directly related in a dose-dependant manner to increasing tertiles of WBC count.[7] This association appeared to be independent of smoking and other cardiovascular risk factors. There is association between WBC count and increased incidence of hypertension with 'high normal' WBC count.

MATERIALS AND METHODS:

The present study includes a total of consisted 30 adult male volunteers of age group 30-40 years working in petrol pump stations for more than 5 years for >10 hours/day in Barabanki city, Uttar Pradesh. Control group consisted of 30 male adults of same age group who didn't have the history of exposure to petroleum products. All members were non smokers and were no using any tobacco products. This is to exclude the exacerbating factors of effect of smoking. Person with history of present or past illness {Hypertension, Diabetes}, acute infection and individuals on medication affecting blood cell count were excluded from the study. A detailed questionnaire requesting information on life time occupational and environmental exposure history, medical history and tobacco smoking were collected using a pre-structured proforma. A brief physical and general examination was carried out and relevant data (age, sex, height, weight and smoker or non smoker) were collected. Four millilitres of blood were collected by standard vene-puncture method from all the subjects. The blood was dispensed into EDTA bottle to give a concentration of 1–5 mg/mL. The samples were transported to the haematology laboratory within one hour of collection, using field ice boxes for maintaining a temperature. Samples were analysed within one hour of collection. Systolic and diastolic blood pressure (SBP and DBP, respectively) were measured in the right arm, using a standard mercury sphygmomanometer after 5 minutes of rest in each subject.

RESULTS:

The demographic variables including age, weight, height and BMI of subjects under experimental and control group is given in table no 1. All haematological parameters including RBC, TLC, absolute lymphocyte count and platelet count are given in table no 2.

Table 1: Demographic variables of study and control group

Variables	Study group (n=30)	Control group (n=30)
Haemoglobin (g/dl)	11.01± 0.05	13.01± 0.73
Age (years)	34.5	36.8
Weight (kg)	62.5	63.9
Height (cm)	172.06	171.07
BMI	20.91	21.84

Table 2: Haematological parameters

Parameters	Study group	Control group
RBC (millions/mm^3)	4.27±0.481	5.13±0.421
TLC (thousands/ mm^3)	8244.1±1290.3	7018.6±1391.2
Absolute monocyte count($\times 10^3$/mm^3)	0.51±0.2	0.43±0.1
Absolute lymphocyte count($\times 10^3$/mm^3)	2.24±0.4	2.61±0.2
Absolute granulocyte count($\times 10^3$/mm^3)	4.28±0.9	4.18±0.6
Platelet count(lakhs/ mm^3)	2.78±0.71	2.71±0.5

Table 3: Mean arterial pressure and B.P in both groups

Variable (mm Hg)	Study group	Control group
Mean arterial pressure	93.51± 2.3	89.41±2.8
Systolic B.P (SBP)	127.92±5.2	115.8±4.5
Diastolic B.P (DBP)	76.2±3.1	75.93±2.7
Pulse rate	83.01±4.2	80.86±4.6

The study group showed significant increase in Total leukocyte count when compared with control group; Lymphocyte counts were significantly lower; monocytes and granulocytes were higher in experimental group and mean arterial pressure was high in experimenal group. There were no significant changes in platelet count among study and control groups. Pulse rate and mean arterial pressure in both groups is given in table no. 3. A linear relationship between elevated WBC count and higher SBP was found, with particularly high WBC count among subjects with SBP 127±5.2 mmHg when compared to control group.

DISCUSSION:

Hypertension is a major global health problem and public-health challenge, demanding a vast proportion of health care resources directly and indirectly because of its high and increasing prevalence and the concomitant risks of cardiovascular and kidney disease, disability-adjusted life-years and mortality. Various risk factors have been implicated in the development of hypertension, some of which include genetic, environmental, psychosocial, and inflammatory factors.[8,9] Links between inflammation and hypertension have been suggested in the past however, most of these studies have been cross-sectional in design, making it difficult to understand whether inflammation, chronic or mild, with an increase in the inflammatory markers, is a cause or an effect of high blood pressure. With respect to the relationship between WBC count and hypertension, one population-based study found an association between elevated WBC count and incident hypertension in petrol pump workers having exposure to benzene, with the risk ratio of hypertension being directly related to WBC count.[10]

Our study was conducted among petrol pump workers as they are more likely to get affected by the toxic effects of benzene. Chronic inhalation of petrol fumes may cause toxic effect on haematological, respiratory and neurological systems.[11] Benzene is reported to produce haematological changes ranging from pancytopenia to total bone marrow aplasia through its myelotoxic action.[12] The study group showed that there was significant reduction in RBC count and Hb concentration. Decrease in Hb concentration could be due to decrease in RBC (or) impaired biosynthesis of haeme in bone marrow. Decreased Hb and RBC could also be attributed to insufficiency of protein synthesis that mainly induces decrease of essential amino acid synthesis incorporated in Hb production.[13] Toxic constituents of crude oil such as benzene are reported to be activated in bone marrow and cytotoxic effects are mediated through disturbance in DNA function. The resultant bone marrow depression is characterised by inadequate production of RBC and other formed elements.[14]

Individuals with a high normal SBP were more likely to be having increased WBC count. This association persisted after adjustment for age, gender, smoking status and BMI. Other studies have also shown an association between WBC count and hypertension. In the first National Health and Nutrition Examination Survey (NHANES I) Epidemiologic Follow-up Study (NHFS), Gillum and Mussolino showed that increased WBC count was associated with an increased incidence of hypertension in white men, and possibly older white and black women. [15] However, no positive association between increased WBC count and the incidence of hypertension was seen in black men. In a matched case–control study, Friedman et al. reported a 40% increase in the risk of hypertension in the whole cohort comparing the highest to the lowest quartile of WBC count. [16] However, little is known about the association of

inflammation and blood pressure within the normotensive range.

Recently, it has been suggested that immune mechanisms may play a role in the development of some forms of hypertension. Studies conducted by Wierda & Iron (1982) stated that the benzene and its metabolites (quinone & catechol) are immunotoxic and results in potent B cell suppression as well as block in B cell differentiation and maturation.[17] Singh D et al (2013) had shown significant decrease in eosinophil count when duration of benzene exposure >15 years.[18]

In contrast, studies conducted by Qu Q et al (2002) and Hameed F et al. (2009) reported decrease in WBC and other cell types in benzene exposed workers.[19,20]

Further studies investigating such an association in large population and involving other racial groups, as well as looking for evidence of a drop in the WBC count with reduction in blood pressure by nonpharmacological as well as pharmacological means, are probably required. Also, relevant would be the exploration of other 'noninflammatory, noninfective' causes of leukocytosis, corticosteroid therapies, haematological malignancies and their role, if any, in the pathogenesis of hypertension. It is also difficult to predict if treatments aimed at reducing inflammation and WBC count would be beneficial in blood pressure.[21]

CONCLUSION:

Long term exposure to petrol fumes has deleterious effects on human haematopoietic system leading to bone marrow depression. We observed a significant reduction in RBC count, Hb concentration and lymphocyte count which are significantly correlated with raised mean arterial pressure.

In conclusion, our study shows that increasing SBP even within the normotensive range is associated with an increased WBC count.

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