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Evaluation of Serum Biomarkers to Assess Health Status in Urban Traffic Police Personnel

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Abstract

Traffic police personnel face multiple occupational hazards as they are continuously exposed to vehicular emissions and work in a noisy, polluted environment. The objective of the present study is to explore the impact of air pollution on health of traffic police, by evaluation of serum biomarkers.

The study population included 200 traffic police who worked outdoor on roads with heavy flow of vehicles and who were exposed to pollutants. 50 age and sex matched healthy subjects who worked indoor were considered as controls. Further, the traffic police group was subdivided into 4 groups based on the number of years of their exposure to urban pollutants. Group I included subjects with less than 5 years of exposure, Group II 6 to 10 years, Group III 11 to 20 years and group IV more than 20 years.

Biochemical parameters like glucose, cholesterol, bilirubin and other markers of liver function and renal function were estimated in fasting blood samples using spectrophotometric methods. 37% of the traffic police were pre-diabetic and 10% were diabetic. Hypercholesterolemia in police strongly suggest the risk of cardiovascular diseases. Significantly elevated total bilirubin, direct and indirect bilirubin levels in police indicate the prevalence of sub clinical jaundice. Further, increased serum transaminases demonstrate mild hepatocellular damage. Albumin globulin ratio decreased with the increase in duration of exposure to pollution within the police sub groups. Markedly high urea may be a sign of renal dysfunction in police personnel. Uric acid, the latest marker of pre-diabetes and insulin resistance, increased steadily from group I to IV along with glucose. The current study emphasizes the need for regular health checkups and create awareness regarding early diagnosis of organ dysfunction by investigation of biomarkers in police personnel.

Keywords: *Traffic Police, Air pollution Liver function tests, Renal function tests, Diabetes mellitus*

Introduction

Police personnel, the law enforcement authority of the society, are always under stress as they deal with unique shock situations and psycho social stressors [1]. Traffic police on an average work almost eight hours per day. In addition to various stressors, they are exposed to various chemical pollutants like lead, sulfur dioxide, carbon monoxide, manganese, methanol which can cause biochemical alterations in blood cells, lungs, detoxifying organ like liver[2]. Urbanization, increased automobile usage and traffic noise not only affects physical and mental health but may be a key factor in pathogenesis of several diseases[3]. Though recruitment of police is based on physical fitness, regular health checkups are seldom done throughout their career. Majority of studies on policemen, are on decreased lung function and increased respiratory morbidity due to vehicular emissions rich in benzene and other aromatic hydrocarbons[4]. To date most studies have focused on risk factors related to work environment in developed countries. Data are scarce for developing country like India where diabetes burden is very high and air pollution is on a rise. Hence, the

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aim of the present study is to assess the health status of police by estimation of various biochemical markers in the blood that would determine the subclinical organ dysfunction.

Materials and Method

The study population included 200 traffic police who worked outdoor on roads with heavy flow of vehicles, and who were exposed to pollutants. 50 age and sex matched healthy subjects who worked indoor were considered as controls. Further, the traffic police group was subdivided into 4 groups based on the number of years of their exposure to urban pollutants. Group I included subjects with less than 5 years of exposure, Group II 6 to 10 years, Group III 11 to 20 years and group IV more than 20 years of exposure to pollutants. Habitual smokers, alcoholics and subjects with systemic illness were excluded from the study. Informed consent was collected from all the participants along with a standardized questionnaire on food habits and personal details.

Fasting blood sample was collected in fluoride vacutainer for glucose estimation and rest in plain vacutainer for the estimation of biomarkers to assess liver and kidney functions. Analysis was carried out immediately in Cobas 6000 chemistry analyzer using spectrophotometric methods [5,6]. Data was analyzed statistically using student t test and intergroup comparison was done by ANOVA followed by post hoc Tukey's multiple comparison. The difference of $p < 0.05$ was considered significant.

Results

Fasting blood glucose (FBG) level of 37% of the traffic police was in pre-diabetic range and 10% in diabetic range, which was significantly higher compared to healthy controls. Serum creatinine levels remained unaltered in police compared to normal individuals, although urea and uric acid were significantly higher than controls. Total bilirubin, direct and indirect bilirubin levels were significantly elevated in police ($p<0.01$) compared to healthy controls.68% of the traffic police had elevated conjugated bilirubin. Both the hepatic enzymes ALT and AST were also elevated in police, the increase was statistically significant. However, ALP and total proteins, albumin and globulins remained normal in the study group. Total cholesterol was significantly high in police group compared to normal. (Table1)

FBG levels in group III and group IV were significantly higher than group I with statistical significance of $p<0.001$ and $p<0.05$ respectively. Serum uric acid level steadily increased from group I to group IV. The difference between group III and group IV were highly significant ($p<0.03$). Total bilirubin and unconjugated bilirubin levels steadily increased with number of years of exposure to pollutants. Bilirubin values in Group IV was significantly higher than Group I ($p<0.05$). Further, albumin levels and A/G ratio steadily decreased from Group I to Group IV, and the difference between group I and group III &IV were statistically significant ($p<0.05$) . (Table 2)

Table 1: Comparison of serum biomarkers in normal and police personnel (Mean ± SD)

	Normal (n=100)	Police (n=200)	p value
Fasting Blood Glucose (mg %)	93 ± 3.44	107.02 ± 33.42	0.05
Urea (mg %)	17.71 ± 4.91	20.65 ± 6.14	0.01
Creatinine (mg %)	0.90 ± 0.13	0.93 ± 0.13	NS
Uric acid (mg %)	4.79 ± 0.78	5.89 ± 0.52	0.01
Total cholesterol (mg %)	156.04 ± 27.23	183.92 ± 41.2	<0.001
Total bilirubin (mg %)	0.56 ± 0.22	0.87 ± 0.5	0.01
Direct bilirubin (mg %)	0.19 ± 0.05	0.26 ± 0.11	0.01
Indirect bilirubin (mg %)	0.37 ± 0.16	0.60 ± 0.39	0.01

Cont... **Table 1: Comparison of serum biomarkers in normal and police personnel (Mean ± SD)**

Total protein (g %)	7.67 ± 0.26	7.58 ± 0.40	NS
Albumin (g %)	4.59 ± 0.14	4.4 ± 0.25	NS
Globulin (g %)	2.88 ± 0.25	2.97 ± 0.4	NS
AG Ratio	1.6 ± 0.15	1.5 ± 0.25	NS
AST(IU/L)	19.19 ± 4.42	26.94 ± 13.96	0.01
ALT(IU/L)	19.09 ± 9.67	34.69 ± 26.01	0.01
ALP (IU/L)	71.85 ± 15.52	75.13 ± 20.7	NS

n= No. of samples

Table 2: Comparison of serum biomarkers in normal and police personnel (Mean ± SD)

	Group I (n=49)	Group II (n=61)	Group III (n=48)	Group IV (n=42)
FBG (mg %)	97.95 ± 17.39	99.48 ± 14.15	125 ± 56.09**#	118.12 ±29.61*
Urea (mg %)	19.69 ± 5.15	21.33± 7.04	21.39 ± 7.06	21.66 ±5.97
Creatinine (mg %)	0.9 ± 0.12	0.95 ± 0.12	0.95 ± 0.15	0.95± 0.13
Uric acid (mg %)	5.45 ± 1.12	5.59 ± 1.08	5.37 ± 1.56	8.91 ±14.35*$
Cholesterol (mg %)	171 ± 37	181 ±34	197 ± 44**	208± 45
Total bilirubin (mg %)	0.68 ± 0.36	0.79 ± 0.33	0.83 ± 0.4	0.98± 0.61*
Direct bilirubin (mg %)	0.22 ± 0.09	0.25 ± 0.07	0.25 ± 0.10	0.29± 0.13
Indirect bilirubin (mg%)	0.45 ± 0.27	0.54 ± 0.26	0.57 ± 0.30	0.69 0.48*
Total protein (g %)	7.63 ± 0.36	7.5 ± 0.41	7.5 ± 0.44	7.66± 0.45
Albumin (g %)	4.69 ± 0.23	4.61 ± 0.21	4.46 ± 0.26*#	4.5± 0.24*
Globulin (g %)	2.93 ± 0.33	2.89 ± 0.43	3.04 ± 0.45	3.15± 0.47
AG Ratio	1.62 ± 0.2	1.62 ± 0.24	1.5 ± 0.3	1.46± 0.27*
AST (IU/L)	24.09 ± 7.59	27.23 ± 16.36	29.95 ± 17.06	31.16 ± 19.03
ALT(IU/L)	29.42 ± 19.08	34.95 ± 37.95	41 ± 26.76	41.95 ± 19.03
ALP (IU/L)	76.8 ± 17.89	70.92 ± 23.58	73.86 ± 20.56	± 25.03

**Group I versus Group III , Group IV $p<0.001$

*Group I versus Group IV $p<0.05$

Group II versus Group III

$ Group III versus Group IV $p<0.03$

Discussion

Traffic police face multiple occupational hazards, which not only impact mental health but also increases physical health risks. Results of the present study showed that 37% of police personnel were pre-diabetic and 10 % were diabetic, the prevalence of which was much higher than the normal population. This was in accordance with the earlier studies done on police personnel of Saudi community[7]. A cohort study demonstrated that occupational stress was an independent predictor of diabetes mellitus [8]. Further, FBG was significantly

high in police personnel with long term exposure to air pollutants. A positive correlation between serum cortisol and blood glucose was seen in police[9]. Insulin resistance, increased consumption of high carbohydrate, low fiber diet, obesity and lack of physical exercise might have led to increase FBG in police personnel [10].Most recent Chinese study showed that exposure to sulfur dioxide, nitric oxide, ozone the major air pollutants increased the prevalence of diabetes mellitus and also was associated with high fasting glucose level[11]. Though creatinine, the renal function marker did not alter significantly in police personnel compared to normal population, other markers like urea and uric acid elevated significantly with the increase in the number of years of exposure to pollutants. Recent articles not only consider uric acid as a potential risk factor of diabetes mellitus, hypertension and CVD but also a marker of pre-diabetes [12,13]. Police in Group IV and Group V with high FBG also showed hyperuricemia which highlights the fact that renal clearance of uric acid is reduced with insulin resistance .Physical activity and exercise the protectors of cardiovascular diseases are considerably lower in police personnel [14]. One of the earlier reports on morbidity profile of police personnel showed prevalence of hypertension, dyslipidemia and cardiovascular diseases [15], which is justified by hypercholesterolemia observed in approximately 30% of the study group, with a steady increase from group I to IV. Several studies observed hypercholesterolemia in people who worked in night shifts. Regular consumption of saturated fat rich diet from restaurants would have led to hypercholesterolemia [16]. Occupational stress was demonstrated to be a risk factor for non- alcoholic fatty liver disease (NAFLD) among Chinese policemen [17]. Elevated total bilirubin, both direct and indirect bilirubin in police corroborate with the findings of other workers. Moreover, increased use of automobiles and exposure to diesel exhausts may mediate pathogenesis of NAFLD, inflammation and oxidative stress in police. Urinary 8OHdG, most sensitive marker of DNA damage was markedly elevated in traffic police exposed to vehicular exhausts, with concomitant increase in mutated cytochrome P450 and glutathione S transferase, enzymes known to play a significant role in detoxification of xenobiotics [18]. The other proposed mechanisms by which occupational stress affect liver function include cytokine related inflammation and activation of hypothalamic pituitary adrenal axis [19]. Present study observed a steady rise in serum transaminases ALT and AST in police with the number of years of exposure to pollutants. A steady decline in serum albumin may signify a decrease in synthetic function of the liver, in addition to its possible degradation by oxidants. The increase in globulins may be secondary to subclinical inflammatory response to pollutants.

On the whole, the current study emphasizes the need to arrange regular health checkups and create awareness regarding benefits of life style modifications and early diagnosis of organ dysfunction by investigations of biomarkers in police personnel. Further, to minimize the adverse effects of vehicular exhaust, preventive strategies should to be adopted by traffic police.

Conflicts of Interest: None

Source of Funding: Self

Ethical Clearance: The study was approved by Institutional Ethical Committee.

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