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Investigation of Biochemical and Hematological Parameters of Workers Exposed to Arsenic

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Abstract

Arsenic is a naturally occurring element widely distributed in the earth's crust and its toxicity is a global health problem affecting many millions of people. Contamination is caused by arsenic from natural geological sources leaching into aquifers, contaminating drinking water and may also occur from mining and other industrial processes. In this study, it was aimed to assess retrospectively the biochemical and hematological markers of workers who exposed to arsenic and referred to our hospital for periodical examination.

102 subjects who had exposed to arsenic and referred to Ankara Occupational Diseases Hospital for periodical examination were included in this study. 206 people who had not exposed to arsenic were included as control group. Arsenic exposure was determined by detecting its level in spot urine sample with Agilent's 7700 Series ICP-MS device. Biochemical parameters, whole blood analysis and sedimentation measurement were analyzed by Konelab Prime 60i, Beckman Coulter LH780 and Alifax device, respectively.

While there was not a significant difference between arsenic exposed workers and control group in the levels of aspartate aminotranspherase (AST), alanine aminotranspherase (ALT), erithrocyte (RBC), hemoglobin (HGB), hemotocrit (HCT), leukocytes (WBC), thrombocyte (PLT), C-reactive protein (CRP) ve sedimentation rates (p values; 0.403, 0.191, 0.064, 0.760, 0.068, 0.967,0.499, 0.892, 0.604, respectively), there was a significant difference in creatinine and blood urea nitrogen levels (p values; <0.001, 0.000, respectively).

Since there was a statistically significant difference between control and arsenic exposured group in terms of urea and creatinine, renal functions should be followed in arsenic exposed subjects. Moreover, it is very important to perform preventing strategies against arsenic in workplaces.

.***Key words—***Arsenic, biochemical parameters, hematological parameters.

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I. INTRODUCTION

Arsenic is a naturally occurring element widely distributed in the earth's crust. Arsenic appears in Group 5 (V) of the periodic table and it is classified chemically as a metalloid, having both properties of a metal and a nonmetal; however, it is frequently referred to as a metal (1). In the environment, arsenic is combined with oxygen, chlorine, and sulfur to form inorganic arsenic compounds. Arsenic in animals and plants combines with carbon and hydrogen to form organic arsenic compounds (2).

Arsenic compounds are used in the structures of pesticides, herbicides, detergent and dye pigments, industries of leather and paper, production of ceramics, glass making and tyre. The major cause of human arsenic toxicity is from contamination of drinking water (3).

Arsenic enters the human body through ingestion, inhalation, or skin absorption. Most ingested and inhalated arsenic is well absorbed through the gastrointestinal tract and lung into the blood stream. 95% of the ingested trivalent arsenic is absorbed from the gastrointestinal tract. It is distributed in a large number of organs including the lungs, liver, kidney, and skin (4). Therefore, its primer toxic effects are on skin, liver, gastrointestinal, respiratory and neural systems. While the inhalation of high level of arsenic vapor might cause irritation in trachea and lung, its exposure through the digestive system might cause death. The result of low concentration of arsenic exposure might lead to not only nausea, vomiting, colicky abdominal pain, profuse watery diarrhoea, exuviation, but also decrease in the production of erythrocytes and leukocytes.

Occupational sources of arsenic to human workers include vineyards, ceramics, glass making, smelting and refining of metallic ores, during production and use of arsenic containing agricultural products like pesticides and herbicides. IARC (International Agency for Research on Cancer) has conducted that there is sufficient evidence that inorganic arsenic compounds are skin and lung carcinogens in humans, therefore it cites sufficient evidence of a relationship between exposure to arsenic and human cancer and the IARC classification of arsenic is Group 1 (carcinogenic to humans) (2).

The aim of this study is to assess retrospectively the biochemical and hematological markers of workers who had exposed to arsenic and referred to our hospital for periodical examination.

II. MATERIALS AND METHODS

This study comprised 102 workers who presented to Ankara Occupational Diseases Hospital for periodical examination that had exposed to arsenic. 206 people who had not exposed to arsenic were stated as control group. The mean age of workers were 38.94±5.82. Arsenic exposure was determined by detecting its level in spot urine sample with Agilent's 7700 Series ICP-MS device. When aspartate aminotranspherase (AST), alanine aminotranspherase (ALT), urea, creatinine, C-reactive protein (CRP) were analyzed by Konelab Prime 60i, whole blood analysis and sedimentation measurement were analyzed by Beckman Coulter LH780 and Alifax device, respectively.

Statistical analysis

Analysis of normality of the continuous variables was performed with the Kolmogorov-Smirnov test. Data were expressed as mean±Standard Deviation (SD), unless indicated otherwise. Significance between two groups was determined by unpaired Student's t test for continuous variables and by chi-square test for discrete variables. Pearson's correlation coefficients were used to evaluate the relationships between variables. Linear regression

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analyses were used. P values <0.05 were considered significant. Statistical analysis was performed using the SPSS software package (SPSS 16.0; SPSS Inc., Chicago, IL, USA).

III. Results

There was not a statistically significant difference between arsenic exposed workers and control group in aspartate aminotranspherase (AST), alanine aminotranspherase (ALT), erithrocyte (RBC), hemoglobine (HGB), hemotocrit (HCT), leukocyte (WBC), thrombocyte (PLT), C-reactive protein (CRP) ve sedimentation rates (p values; 0.403, 0.191, 0.064, 0.760, 0.068, 0.967,0.499, 0.892, 0.604, respectively), while there was a statistiscally significant difference in creatinine and urea levels (p values; <0.001, 0.000 respectively)(Table 1)

TABLE 1. Comparison between worker group who exposed to arsenic and control group.

Parameters	**Workers who exposed to Arsenic<35 µg/L (n=206)**	**Workers who exposed to Arsenic>35 µg/L (n=102)**	**P values**
Arsenic (µg/L)	3.30(4.80)	54.05(447)	0.000
RBC (10^{12}/µL)	5.09±0.35	5.11±0.36	0.064
WBC (10^{9}/µL)	7.4±1.77	7.41±1.74	0.967
Hb (g/dL)	15.15±1.42	15.25±1.17	0.760
HCT (%)	44.90±3.87	45.30±3.31	0.068
PLT (10^{3}/µL)	228(284)	230(391)	0.499
ALT (U/L)	20(77)	19(63)	0.191
AST(U/L)	19(191)	20(51)	0.403
Urea (mg/dL)	12.5(15.30)	13(18)	0.000
Creatinine (mg/dL)	0.82(0.74)	0.9(094)	0.007
CRP (mg/dL)	1.35(39.70)	1.4(9.42)	0.892
Sedimentation (mm/hour)	2(14)	2(17)	0.604

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IV. DISCUSSION

Arsenic is a naturally occurring element widely distributed in the earth's crust. It has toxic effects on skin, liver, gastrointestinal, respiratory and neural systems. Also, its carcinogenicity to humans was demonstrated in several studies (1,2).

In many studies investigated hematological effects of arsenic, it was reported that arsenic led to decrease in the levels of erithrocytes and leukocytes (5,6). However, in this study, we found that there was not a statistically significant difference between control and arsenic exposed group with respect to the parameters of RBC, HGB, HCT and WBC (p values; 0.064, 0.760, 0.068, 0.967, respectively). Although some studies indicated that arsenic increased the level of hepatic enzymes as depented to the its exposure concentration (7), there was not a statistically significant difference between control and exposed group in our study (p values; 0.403, 0.19, respectively).

Some animal data have shown that exposure to inorganic arsenic gives rise to renal toxicity (8) and this finding has been corroborated in some epidemiological studies done in humans (9). In the studies related to the rats fed with arsenic-included diet, the levels of urea and creatinine were high. Compatibly with that data, we found that the concentrations of urea and creatinine were higher in subjects of arsenic exposed group than the ones in control group (p values; <0.001, 0.000). Therefore, the renal functions in workers exposed to arsenic should be investigated and followed carefully.

In conclusion, inhalation of arsenic dusts in workplace may cause more health problems than other exposure ways. Therefore, it is very important that the basic principles of occupational health and safety should be put into the practice in workplaces.

REFERENCES

[1] Meltem Bilici Başkan, Ayşegül Pala. İçme Sularında Arsenik Kirliliği : Ülkemiz Açısından bir Değerlendirme. Journal of Engineering Sciences 2009; 15(1): 69-79.
[2] http://www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=3
[3] Osweiler GD, Carson TL, Buck WB, VanGelder GA (1985) :Clinical and Diagnostic Veterinary Toxicology. 3rd Edit., Kendall-Hunt Publishing Comp, USA.
[4] Hunter, F. T., Kip, A. F., and Irvine, W. Radioactive tracer studies on arsenic injected as potassium arsenite. Hematotoxicity among Chinese workers heavily exposed to benzene. J. Pharmacol. Exp. Ther. 1942;76:207.

[5] Armstrong, C. W., Stroube, R. B., Rubio, T., and Beckett, W. S. Outbreaks of fatal arsenic poisoning caused by contaminated drinking water. Arch. Environ. Health 1984; 39: 274-79.
[6] Tözün M, Ünsal A. Benzene and Its Health Effects. Arch. Environ. Health 1989; 44: 385-90.

[7] Patlolla AK ,Todorov TI, Tchounwou PB, van der Voet G, Centeno JA. Arsenic-induced biochemical and genotoxic effects and distribution in tissues of Sprague-Dawley rats. Microchem J. 2012;105(11):101-7. Epub 2012 Sep 3.
[8] Liu J, Liu Y, Habeebu SM, et al. Chronic combined exposure to cadmium and arsenic exacerbates nephrotoxicity, particularly in metallothionein-I/II null mice. Toxicology. 2000;147:157–66.
[9] Atlanta, GA. Buchet JP, Heilier JF, Bernard A, et al. Urinary protein excretion in humans exposed to arsenic and cadmium. Int Arch Occup EnvironHealth. 2003;76:111–20.

[10] Krewski D, Snyder R, Beatty P, Granville G, Meek B, Sonawane B. Assessing the health risks of benzene: A report on the benzene state of the science workshops. Journal of Toxicology and Environmental Health 2000;61:307–38.
[11] Rizwan S, Naqshbandi A, Farooqui Z, Khan AA, Khan F. Protective effect of dietary flaxseed oil on arsenic-induced nephrotoxicity and oxidative damage in rat kidney. Food Chem Toxicol. 2014(3) ;15;68C:99-107. doi: 10.1016/j.fct.2014.03.011