Original Article

Chronic Arsenic Toxicity from Drinking Well Water in a Rural Area

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ABSTRACT

Background: Drinking water is the most important cause of poisoning in the world. Iran is one of the countries with arsenic-contaminated water upper limit of normal. In this study, we decided to determine the effects of chronic arsenic poisoning on demographic, clinical and laboratory features of people.

Methods: This descriptive-sectional study carried out on all people resided in Shahidabad Village, Qazvin Province in 2015. All of them were evaluated in terms of demographic features, blood pressure, diabetes, dermatologic, and neurologic lesions, and fasting blood sugar. People with exclusion criteria were excluded. The data were analyzed by SPSS software and descriptive statistics.

Results: Out of 400 subjects, 278 (69.5%) females and 122 (30.5%) males), 88 (22%) people had positive urine test for arsenic and 312 (78%) subjects had negative urine test. The mean age of them was 48.9 ±16.6 yr. The mean age and duration of residence in the region in arsenic positive group were significantly higher than arsenic negative group (P<0.05). Blood pressure, history of diabetes, dermatologic and neurologic lesions, and fasting blood sugar had no significant differences between two groups.

Conclusion: Although there were no significant differences between two groups in terms of many clinical and laboratory findings but the prevalence of 22% of poisoning with arsenic in the selected population reveals the necessity of screening, preventive measures and appropriate treatments in people exposed to arsenic contamination.

Keywords: Arsenate, Arsenic, Complications, Poisoning, Prevalence.

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INTRODUCTION

Arsenic is a metalloid naturally found in the earth as 20th available element. It is toxic for human in form of arsenate and arsenite. Human may be exposed to arsenic from air, food, or water. Water may be contaminated from pesticide remains, precipitants of inorganic compounds, and chemical compound contained arsenic. Arsenic contaminated drinking water is now the most common cause of arsenic poisoning in the world. More than 30 countries have reported arsenic contaminated water [1]. It has involved more than 150 million people in the world, of which 45 million are living in Asia. Arsenic poisoning may result in dermatologic manifestations, peripheral vascular diseases, hypertension, diabetes, and neuropathy [2, 3]. Arsenic does not change the color or taste of water. Therefore, its identification is difficult without lab tests [4]. Arsenic contaminated water is reported from Bangladesh, Kambuj, China, India, Japan, Myanmar, Nepal, Pakistan, Thailand, Vietnam, and Iran in Asia [5]. Drinking water contained higher than 50 micrograms per liter of arsenic for at least one year is produced many toxic manifestations called arsenicosis [6-8]. Arsenic contaminated water has been reported from some parts of Iran, particularly in western regions [9]. Drinking water of 25% of rural areas in a northwest province containing higher than permissible level of arsenic is reported [8-10].

Arsenic poisoning may manifest by skin lesions as hyperkeratosis and hypo- or hyperpigmentation. Moreover, its association with cardiovascular diseases, cerebrovascular accidents, chronic

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hypertension, diabetes, and neuropathies is suggested [11-13].

A rural area (Shahidabad Village) near Avaj Town in Qazvin Province, Iran was reported to have higher than permissible level of arsenic in their drinking water supplied from a sub-ground well. The present study was designed to assess the health effects of arsenic contaminated water among inhabitants in this area to identify possible symptomatic patients and treat them if needed.

MATERIALS AND METHODS

The present study was conducted in a rural area (Shahidabad Village) near Avaj Town in Qazvin Province, Iran in 2015. The village had about 1200 residents. They were recruited for clinical examination, taking urine sample for arsenic detection and blood sample for analysis of fasting blood sugar (FBS) with contribution of the local health department. Four hundred thirty people responded and attended in the department for participation in the study. All of them provided informed consent for participation in the study.

The study was approved by local Ethical Committee of the Research Department of Qazvin University of Medical Sciences. The exclusion criteria were age less than 18, duration of residence in the area less than one year, and use of water other than the main well of the area. Demographic data of the participants were gathered. The studied individuals were examined for signs and symptoms of skin lesions and peripheral neuropathy and their systolic and diastolic blood pressure were measured. Their urine samples were sent to a lab to determine arsenic presence using spectrometry method. The blood samples were used to determine FBS.

RESULTS

Four hundred people including 278 (69.2%) males and 112 (30.8%) females completed the study. Totally, 22% of them had positive urine test for arsenic. The mean age of persons with positive urine test (group A) was significantly higher than others (group B), but their sex distribution was the same. In addition, mean time of residence in the area was higher in the persons with positive urine test.

22.7% of individual's in group A had high blood pressure. While only 19.2% in group B had hypertension. Moreover, 6.8% in group A had diabetes (vs. 5.8% in group B). However, mean FBS in 2 groups was not significantly different (Table 1 and 2). 4.5% in group A vs. 3.2% in group B had various skin lesions. However, no specific lesion related to arsenicosis was found. In addition, no peripheral neuropathy was noted.

Table 1. Prevalence of hypertension in the studied individuals with and without positive urine test for arsenic.

Hypertension	Positive urine test	Negative urine test	*P*-value
Yes	20 (25%)	60 (75%)	0.670
No	68 (21.25%)	252 (78.75%)	

Table 2. Prevalence of diabetes in the studied individuals with and without positive urine test for arsenic.

Diabetes	Positive urine test	Negative urine test	*P*-value
Yes	6 (25%)	18 (75%)	0.067
No	82 (21.8%)	294 (78.2%)	

DISCUSSION

The present study was conducted to evaluate toxic manifestation of arsenic exposure in a rural area with arsenic contaminated water. We found that 22% of the inhabitants have positive urine test for arsenic. Strict manifestations of arsenicosis were not found in any participant. However, prevalence of essential hypertension and diabetes were higher among individuals with positive urine test when compared to others, though the differences were statistically insignificant. The mean duration of residence was 52.6± 17.4 yr in the present study which is much higher than similar studies [14-19].

Arsenic contamination of water was associated with hypertension in an ecologic study in Iran [13]. Association between hypertension and arsenic exposure was dose related [8]. 1.5-fold higher prevalence of hypertension was showed in endemic areas of arsenic exposure [15]. We did not found significant relationship between arsenic exposure and hypertension. Nevertheless, the participant with arsenic exposure had higher though insignificant prevalence of hypertension.

We found higher but insignificant prevalence of diabetes among individuals with arsenic exposure. However, mean FBS was not different between two groups. Another study has suggested 2.5-fold higher prevalence of diabetes in arsenic exposure [16]. Some studies also suggested the relationship

between arsenic exposure and prevalence of diabetes [13, 19]. The relationship also has suggested in studies conducted in industrial exposure of arsenic [20-22].

Dermatologic and neurologic manifestations of arsenicosis are appreciated. Hyperkeratosis was found in 6.5% of persons with arsenic exposure [12]. Another study reported hyperkeratosis and hyperpigmentation in arsenic exposure [23]. Arsenic related subclinical and overt neuropathy is also confirmed [24]. However, we did not found dermatologic or neurologic findings attributable to arsenic exposure in the current study.

CONCLUSION

About one-fifth of the arsenic exposed residents of a rural area showed lab evidence of arsenic toxicity. They did not have strict signs of arsenicosis. However, they showed higher prevalence of clinical hypertension and diabetes, though the findings were statistically insignificant.

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