Journal of Pakistan Association of Dermatologists 2008; **18**: 202-206.

Original Article

Association between anemia and grading of arsenicosis

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Abstract Chronic arsenic toxicity has been recognized as a typical form of arsenicosis which is defined by the experts of International Health Organization as a chronic health condition arising from prolonged ingestion of arsenic above the safe dose for at least six months, usually manifested by characteristic skin lesions of melanosis and keratosis, occurring alone or in combination, with or without the involvement of internal organs The present study evidences that the occurrence of skin manifestation varies form pigmentary changes, progressing to keratosis and even may lead to malignancy. The findings obtained obviously illustrate interlink between dynamics of severity of anemia and the promotion of the viable development of dermatological grading of arsenicosis.

Key words
Arsenicosis, anemia

Introduction

The toxicity of arsenic compounds depends on many factors, such as the chemical and physical form of the compound, route of administration, dose and duration of exposure and time elapsed after exposure, dietary level of the interacting elements, nutritional status, age and sex of the exposed individuals.[1,2] In Bangladesh the important determinants of this toxicity have been precisely studied which include arsenic contents of ground water, duration of exposure and nutritional status of the individual, body mechanism, immune response of the individual and other unknown predisposing factors. Considerably high levels of arsenic content ranging from 0.10 mg/l to 1.0 mg/l or even more were detected in ground water of various parts of the country.[3] According to the WHO more than 1.0 mg/l of arsenic in drinking water is hazardous to health and may create a disastrous situation. Clinical expression of chronic arsenicosis is delayed in well-nourished persons. Methylation is the major detoxification process for arsenic in the body.[3,4] The clinical manifestations due to chronic arsenicosis develop after a latent period of six months to two years or more depending on the amount of arsenic intake. Melanosis, leukomelanosis and palmoplantar hyperkeratosis usually manifest early. If exposure continues skin lesions increase in severity and the patients may develop systemic involvement and cancers.[5] Since a dose-response relationship has been observed between exposure to

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Table 1 Different grades of arsenicosis

Grade I Mild	*Grade II Moderate*	*Grade III. Severe*
• Diffuse melanosis. • Suspicious spotty depigmentation/pigmentation over trunk /limbs. • Mild diffuse thickening of palms and soles.	• Definite spotty pigmentation/depigmentation on the trunk and limbs, bilaterally distributed. • Severe diffuse thickening (with/without wart-like nodules of the palms and soles).	• Definite spotty pigmentation/depigmentation as above with few blotchy pigmented/depigmented macular patches over trunk or limbs. • Pigmentation involving the undersurface of tongue and/or buccal mucosa. • Larger nodules over thickened palms and soles occasionally over dorsal aspect of hands and feet • Diffuse verrucous lesions of the soles with cracks and fissures and keratotic horns over palms/soles.

arsenic and the frequency of dermal lesions, peripheral vascular disorder and skin cancer,[6,7,8] so there could be a positive association between severity and duration of skin lesions and subsequently the occurrence of systemic involvement in patients mostly malnourished and exposed to high level of arsenic in drinking water for long periods and already developed skin lesions for some years.[9,10] The purpose of this study has therefore been to find out the association of anemia with arsenicosis and assess its correlation with different grades of the malady.

Patients and methods

This non-randomized, case study was conducted in the Department of Dermatology and Venereology, Bangabandhu Sheikh Mujib Medical University (BSMMU) during the period of one year (November, 2006 to November, 2007). A total of 50 arsenicosis out-patients fulfilling the inclusion criteria were selected. Patients of any age and either sex, all races and ethnic group with history of consumption of arsenic-contaminated water for more than six months, all established cases of arsenicosis either by clinical or by laboratory, were included in the study. Patients suffering from other systemic illnesses were excluded. A detailed history and clinical examination were carried out. Clinical parameters included dermatological features and the grading, whereas laboratory investigations included Hb% and severity of the anemia were recorded according the age and sex of the patients. A system was developed for assessing the grading of arsenicosis on the basis of type, density and extent of distribution of the lesions (**Table 1**). Colorimetric method was used to detect the Hb% level.

Data obtained from the above mentioned parameters were compiled and expressed as mean±SD. The statistical analysis was done

between different groups of age and sex of arsenicosis patients by Chi square test. The relationship between hemoglobin levels, age of suffering with dermatological grading of arsenicosis by biserial correlation was done.

Results

As **Table 2** shows, out of 50 patients there were 37 (74%) anemics of which 24 (80%) were males and 13 (65%) were females. The mean hemoglobin level in males was 11.98±1.24 g/dL whereas the normal value was 15.5±2.5 g/dL. Similarly in females mean hemoglobin level was 10.79±1.56 g/dL whereas the normal value was 14.0±2.5 g/dL. In **Figure 1**, the sex distribution of patients with arsenicosis and duration of suffering is shown. The relationship between mean Hb level and duration of disease is represented in **Figure 2**.

Figure 3 records the distribution of anemic patients with different grades of arsenicosis. Out of 50 patients of group A, 6 (16.2%) had anemia and 4 (30.8%) had normal hemoglobin level in grade I; 14 (37.8%) had anemia and 8 (61.5%) had normal hemoglobin level in grade II and 17 (45.9%) had anemia and 1 (7.7%) had normal hemoglobin level in grade III, respectively. There was statistically significant anemia in different grading (p <0.05). **Figure 4** depicts a negative correlation of Hb level and grade of arsenicosis. That means the higher the grade of arsenicosis the lower the Hb level and vice versa. No statistically significant difference in relation of Hb with grade of arsenicosis (r= -0.262, p> 0.05) was found. **Figure 5** shows correlation of duration of suffering (year) with the grade of arsenicosis.

Table 2 Hemoglobin levels and grades of arsenicosis in anemic and non-anemic patients (n=50).

	Anemia (n=37)	*Non-anemic (n=13)*
Males	24 (80%)	6 (20%)
Females	13 (65%)	7 (35%)
Mean hemoglobin (gm/dL)		
Males	11.98±10.24	15.5±2.5
Females	10.79±10.56	14.0±2.5
Anemia with different grades of arsenicosis		
Grade I	6 (16.2%)	4 (30.8%)
Grade II	14 (37.8%)	8 (61.5%)
Grade III	17 (45.9%)	1 (7.7%)

Chi square test was done to measure the level of significance
Chi square value (after Yates correction) = 6.157, df=2, p value=0.046

Discussion

The present study aimed at investigating the association between grading of arsenicosis with hemoglobin level. This work is of extreme importance in the present perspective when arsenic contamination of ground water has emerged as the greatest concern for the nation due to its high potential risk factor to cause adverse health effects.

In the present study, 50 cases of chronic arsenicosis were included. The age of the patients ranged from 15 to 72 years having the mean value of 36.2±1.71 years of age. The demography evidenced that there were 30 males and 20 females with the male to female ratio of 1.5:1. The symptoms of anemia were observed in 37 (74%) patients. The findings are similar to that of earlier studies by Sikder *et al*.[6,7,8] who identified observed in 89.23%, 100% and 47.41% patients anemic, respectively. There was negative correlation of Hb level and grade of arsenicosis. That means the higher the grade of arsenicosis the lower the Hb level and

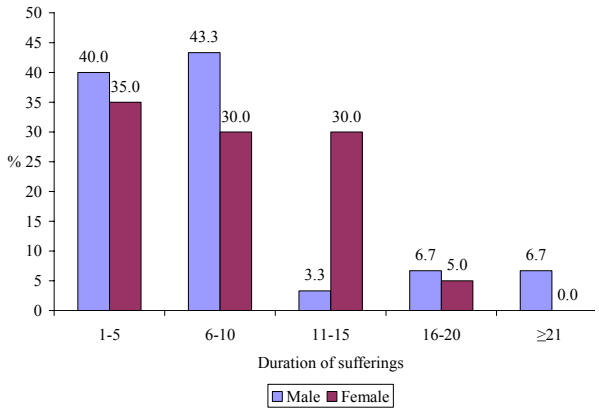

Figure 1 Sex distribution of patients with arsenicosis by duration of suffering in years (n=50).

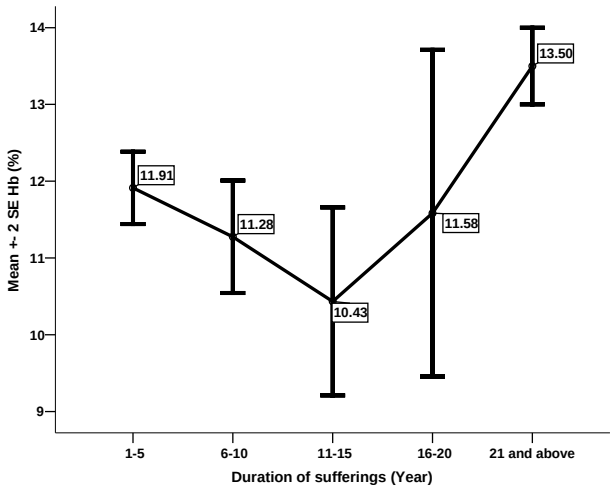

Figure 2 Mean ± 2SE of mean Hb level by duration of suffering (n=50)

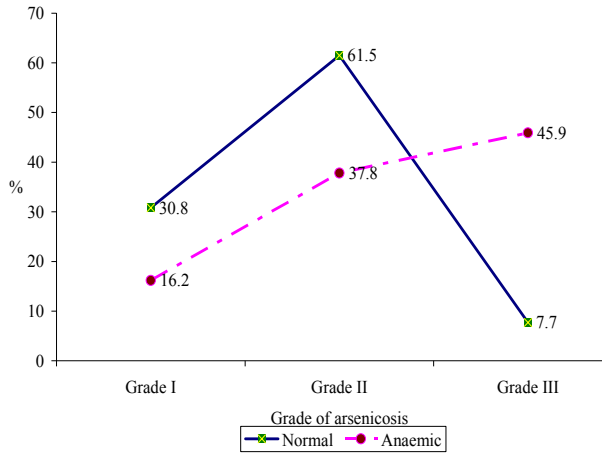

Figure 3 Distribution of anemic and normal patients by grade of arsenicosis (n=50).

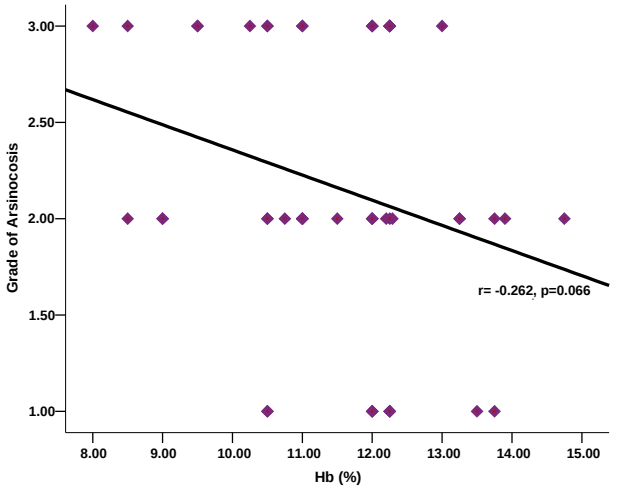

Figure 4 Correlation of Hb level with the grade of arsenicosis.

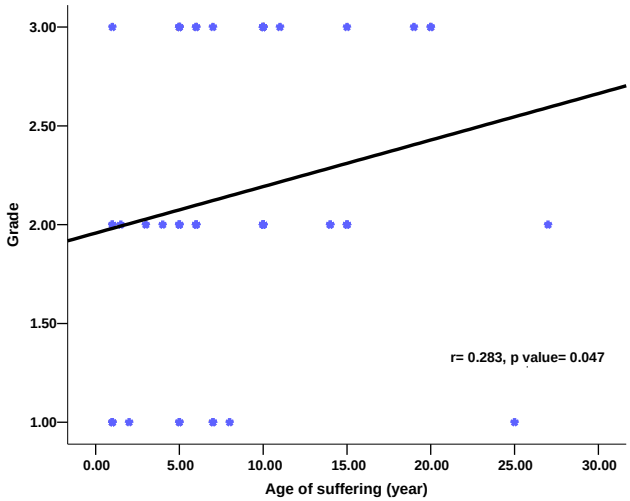

Figure 5 Correlation of age of suffering (years) with the grade of arsenicosis.

vice versa. Moreover a positive correlation was recorded between grade of arsenicosis and duration of disease and hemoglobin level (p<0.05).

Conclusion

Anemia is an important determinant in the outcome of chronic arsenicosis and by improving the hemoglobin level may retard the progression of disease.

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