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Original Article

A cross-sectional observational study on the effect of usage of chronic arsenic contamination of ground water among residents of Pathalkudwa Mohalla in Ranchi district as reported in a tertiary care centre in Jharkhand

Masuma P Bhengra, Anand Kumar, Prabhat Kumar, Pradeep Kumar, Shyam Sundar Chaudhary

Department of Skin, VD & Leprosy, RIMS, Bariatu, Ranchi

Abstract

Objectives To study the clinical features of chronic arsenicosis on usage of arsenic contaminated ground water among the residents of Pathalkudwa mohalla, Ranchi district.

Material and Methods A cross-sectional observational study was done on 39 patients, all residents from Pathalkudwa mohalla, Ranchi, clinically suspected of arsenic toxicity attending the department of dermatology of a tertiary care centre over a period of one year. Arsenic levels estimation was done in drinking water, urine, hair and nails. Cutaneous markers like hyperpigmentation over trunk, palmoplantar keratosis and Aldrich's Mees lines were included. Non-residents of Pathalkudwa mohalla were excluded from the study.

Results Among of 39 cases affected by arsenic contamination, 20 (51.3%) cases were females and 19 (48.7%) were males. Most of the women were housewives by occupation followed by office job persons and students. Among various clinical features, tingling and numbness of extremities (84%) were the most common complaint followed by weakness (79%) and pain abdomen (74%). Palmoplantar keratosis (90%) was seen in majority of patients followed by raindrop pigmentation (48%), diffuse hyperpigmentation (28%) and Aldrich Mee's lines (3%). No signs of cutaneous malignancy was seen in any of the patient.

Conclusion Hyperkeratosis of palms and soles and skin hyperpigmentation were the most common cutaneous manifestations of chronic arsenicosis.

Key words
Arsenicosis, palmo-plantar hyperkeratosis, raindrop pigmentation.

Introduction

Arsenic is one of the most toxic metals derived from the natural environment. It is present in ground water all over the world. The major cause of arsenic toxicity in humans is from contamination of drinking water from natural geological sources rather than from industrial or agro-chemical pollution.[1]

Arsenicosis has been defined by the WHO as a "chronic health condition arising from prolonged ingestion (not less than 6 months) of arsenic above a safe dose, usually manifested by characteristic skin lesions, with or without

Address for correspondence
Dr. Masuma P Bhengra C/o Dr. Ajit Kumar Tirkey,
Opp Shashi Vihar, Cheshire Home Road
P.O Bariatu, Ranchi 834009 (JHARKHAND), India
Ph: 09973803393
Email: dr.masuma@gmail.com

involvement of internal organs".[2,3] According to the WHO guidelines, the maximum permissible limit of arsenic in drinking water is 0.01 mg/L; so any water sample containing arsenic of concentration more than 0.01 mg/L is to be considered positive.[4]

Chronic arsenic toxicity may develop insidiously after 6 months to 2 years or more depending upon the intake of arsenic-contaminated water or exposure.[5]

Symptoms of arsenic toxicity are highly variable. Initially there may be metallic taste, dry mouth, difficulty in swallowing, nausea, dehydration, colicky abdominal pain, generalized weakness followed by muscular pain and numbness in hands and feet.

Chronic arsenicosis may have varied clinical presentations ranging from non-cancerous manifestations to malignancy of skin and different internal organs. Cutaneous changes like hyperpigmentation and hyperkeratosis, predominantly seen over palms and soles are hallmark of chronic arsenicosis. The major consequence of chronic arsenicosis is malignancy:[6] Bowen's disease, basal cell carcinoma and squamous cell carcinoma may be seen in association with neglected cases of arsenicosis.[7,8]

Arsenic poisoning can be diagnosed through estimating the levels of arsenic in samples of drinking water, urine, hair and nails.

The present study from aimed to observe the various clinical features of chronic arsenicosis on usage of arsenic contaminated ground water among the residents of Pathalkudwa mohalla, Ranchi district.

Methods

A cross-sectional observational study was done on 39 patients clinically suspected of chronic arsenicosis attending the department of dermatology of a tertiary care centre in over a period of one year. All patients were the residents of Pathalkudwa mohalla, Ranchi. Patients of all age group were included. Non-resident of Pathalkudwa mohalla were excluded from the study group. Proper clinical history was taken. The details of their residence, occupation, source of drinking water, duration of exposure, diet, hobbies (gardening), any drug intake for psoriasis or asthma were recorded. Routine investigations with proper systemic evaluation were done in all patients. As tubewells were main the source of drinking water, water samples from all 150 households were collected and tested through the Merk field test kit®. Atomic absorption spectrometry was used to estimate arsenic levels in urine, hair and nails.

Results

In our study, all 39 patients resided in Pathalkudwa mohalla, Ranchi district. Among them, 20 (51.3%) cases were females and 19 (48.7%) were males suggested that male and females were almost equally affected. The age of presentation ranged from 3 years to 74 years with majority of cases in the third decade in age group 30-40 years. Housewives (73%) constituted most of the case population followed by office job workers (15%) and students (12%). The tubewells were the main source of drinking water; among 150 household samples, 17 household ground water samples showed the increased levels of arsenic. The arsenic level in water ranged from 0.012 mg/L to 0.917 mg/L. Arsenic level in urine was >50µg/L in almost all cases. Arsenic levels in hair was found in 67% of patients and only 3% of patients showed arsenic level in nails.

Table 1 Various clinical features of chronic arsenicosis (n=39).

Clinical features	*N (%)*
Symptoms	
Generalised weakness	29 (74)
Loss of appetite	13 (33)
Nausea	18 (46)
Metallic taste	26 (66)
Pain abdomen	31 (79)
Tingling and numbness in extremities	33 (84)
Signs	
Palmoplantar keratosis	35 (90)
Rain drop pigmentation	19 (48)
Diffuse hyperpigmentation	11 (28)
Dry skin and desquamation	9 (23)
Aldrich-mee's lines	1 (3)
Pedal oedema	10 (25)
Anaemia	18 (46)
Hepatomegaly	21 (53)

Table 1 shows the frequency of different clinical manifestations of chronic arsenicosis. Tingling and numbness of extremities (84%) were the most common complaint followed by generalized weakness (79%) and pain abdomen (74%). Palmoplantar keratosis (90%) was seen in majority of patients. It varied from small pits to diffuse punctuate warty like lesions (**Figure 1** and **2**). Pigmentary changes included raindrop pigmentation (48%) and diffuse hyperpigmentation (28%), (**Figure 3-6**). Mees' lines were noticed in one patient. No case of cutaneous malignancy was seen.

Figure 1 Dry scaly lesions with punctate keratosis on palmar aspect of both hands.

Figure 2 Scaly punctate keratotic lesions involving both plantar surfaces.

Figure 3 Hyperpigmented patches around umbilical area.

Figure 4 (a) and (b) Raindrop-like pigmentation (patches of hypopigmentation and hyperpigmentation) in the upper abdomen and lower back

Figure 5 Diffuse hyperpigmentation over left upper extremity.

Discussion

The first case of arsenic dermatosis in Jharkhand was reported in the villages of Dihari, Hajipur-Bhitta and Chanan of Sahibganj district, in December 2003–January 2004.[9] Our case study is the second to reported in Jharkhand.

In our present study, female to male ratio was 1:1.1; suggesting both genders were equally

exposed to arsenic-rich drinking water. Most of the patients were in the age group of 30-40 years which is similar to other studies.

The source of arsenic was explored and it was found that tube wells were the prime factor for generation of arsenic rich water.[10] The arsenic level in water ranged from 0.012 mg/L to 0.917 mg/L. The higher the level of arsenic in water, the earlier the symptoms appear; although studies suggest that time period of 5-20 years is usually necessary for expression of clinical manifestations.[11] In our study minimum exposure of 3 years was noted.

In our study, tingling and numbness of extremities (84%) were the most common complaint followed by generalized weakness (79%) and pain abdomen (74%), which is similar to other studies.[12]

Palmoplantar keratosis (90%) was seen in majority of patients. It varied from small pits to diffuse punctuate warty like lesions. Pigmentary changes are said to the commonest and earliest findings in arsenic patients.[13] In our study, skin pigmentation included raindrop pigmentation (48%) and diffuse hyperpigmentation (28%). Another manifestation due to arsenic deposition in keratin-rich areas is prominent transverse white lines in the fingernails called Aldrich-Mees' lines.[14] Our study showed only one patient had Mees' lines while none of the patient showed any signs of malignancy.

Conclusion

The clinical features of arsenic toxicity varies between individuals, population groups, and geographic areas. Cutaneous markers like Hyperkeratosis of palms and soles and skin hyperpigmentation are considered diagnostic of chronic As toxicity.

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