



The Egyptian Society of Chest Diseases and Tuberculosis
Egyptian Journal of Chest Diseases and Tuberculosis

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CASE REPORT

Chronic arsenicosis with varied pulmonary involvement – A case series



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Received 8 November 2014; accepted 26 November 2014

Available online 19 December 2014

KEYWORDS

Chronic arsenicosis;
Bronchiectasis;
Chronic obstructive
pulmonary disease

Abstract Arsenic is an element which occurs naturally in the earth's crust and in small quantities in rock, soil, water and air. Chronic arsenic toxicity produces various dermal and systemic manifestations including cancer. It may also cause different pulmonary diseases. Here, we have described a case series of three chronic arsenicosis patients having varied pulmonary involvements ranging from bronchiectasis to chronic obstructive pulmonary diseases. They all had classic raindrop pigmentations with one patient developing squamous cell carcinoma. Pulmonary manifestations were severe with more cutaneous manifestations as well as more arsenic levels in hair and nail samples of patients. Manifestations also seemed severe with increased duration of exposure and more amount of arsenic in their drinking water.

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Introduction

Arsenic is an element which occurs naturally in the earth's crust and in small quantities in rock, soil, water and air. Chronic arsenicosis has been defined by the WHO working group 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 involvement of internal organs' [1]. Chronic arsenic toxicity produces various dermal and systemic manifestations including cancer [2]. It may also cause different pulmonary

diseases most probably by inflammation, rather than direct toxicity [3]. Here, we have described a case series of three patients with unique skin and pulmonary manifestations.

Case series

Case 1

A 25 year old female, a housewife, presented with hyperpigmented lesions all over the body, along with progressive shortness of breath and cough. She had multiple, patchy, hyperkeratotic lesions all over her body, predominantly on palms and the plantar aspect of the feet since the past 10 years. She suffered from respiratory distress off and on for about 6 months, which was increasing gradually, along with cough,

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Peer review under responsibility of The Egyptian Society of Chest Diseases and Tuberculosis.

<http://dx.doi.org/10.1016/j.ejcdt.2014.11.031>

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mucopurulent sputum production and generalized weakness. Chest X ray showed bilateral ground glass opacity. Non-contrast CT scan of the thorax revealed scattered bronchiectasis and patchy alveolitis. Echocardiography showed early cor pulmonale. Pulmonary function test revealed obstructive pattern without bronchodilator reversibility. Serum angiotensin converting enzyme level was 58.6 U/L, which was within normal limits. Fiberoptic bronchoscopy was done and bronchoalveolar lavage (BAL) fluid was analyzed for cell count, cell type, gram staining, ZN stain and BACTEC culture for mycobacteria. All parameters were within normal limits. BAL fluid was also estimated for the arsenic level, which showed the arsenic content in the fluid was 0.02 µg/g.

Case 2

A 35 year-old male, farmer, presented with raindrop hyperpigmentation for the last 15 years, mostly concentrated on chest, abdomen, upper and lower extremities and which were increasing in number associated with occasional itching. On examination, multiple, raised keratosis (> 2–5 mm), localized or patchy pigmentation and leukomelanosis in which the hypopigmented macules take a spotty, white appearance were evident. From, last 4 years, he experienced dyspnoea and weakness along with anorexia and erectile dysfunction. The dyspnea was initially noticed only during exertion. However, it eventually became noticeable with progressively less exertion or even at rest. There was chronic cough, characterized by the insidious onset of sputum production, which occurred in the morning. Chest X ray showed increased radiolucency of the lung and air trapping and the pulmonary function test, on the other hand, revealed an obstructive pattern with FEV1/FVC result < 70%. He had no history of smoking and was diagnosed as having chronic obstructive pulmonary disease (COPD) along with chronic arsenicosis.

Case 3

A 40 year old male, porter, presented with multiple different-sized hypo and hyperpigmented lesions all over the body. A large 5 cm × 2 cm, oval shaped hypopigmented ulcer with irregular margin and rolled-out edges was present just below his left shoulder region and above the left axilla. Biopsy report from that area showed the presence of tissue lined by keratinised stratified squamous epithelium with focal thinning. Dermal appendages were reduced and replaced by collagen. The report concluded the presence of squamous cell carcinoma. The hyperpigmentation appeared in a finely freckled, “raindrop” pattern that is particularly pronounced on the trunk and extremities and was symmetrically distributed bilaterally. He also complained of worsening dyspnoea for the last 5 years

and a history of acute exacerbations 2 times in the last 2 years with subsequent hospital admissions. Chest X-ray and pulmonary function tests confirmed the presence of COPD and he was being treated for the same with an inhaled bronchodilator and steroids.

Discussion

In West Bengal, a state of India, a large population is exposed to arsenic contamination which is acquired from drinking water, and which results in consequent escalation in the number of chronic arsenicosis cases [4]. While WHO permissible limit of arsenic in ground water is known to be 0.01 mg/L, it has been reported that in 8 districts of West Bengal covering an area of about 34,000 km² with a population of about 30 million, the arsenic content is much higher than the WHO limit. It may be noted here that the Bureau of Indian Standards (BIS) has also revised the limit of arsenic in drinking water from 0.05 to 0.01 mg/L (5–1 ppb) since 2003 [5].

For a case to be called chronic arsenicosis, two major criteria are to be met (a) the presence of pigmentary and keratotic skin lesions, and (b) evidence of exposure to elevated levels of arsenic established by a history of intake of arsenic contaminated water, or by arsenic concentration in hair or nails [2]. Both nails and hairs provide circumstantial evidence of arsenic exposure within the preceding 9 months [2].

Skin lesions have long been known to be hallmark signs of chronic arsenic exposure. Hyperpigmentation and keratotic lesions are the most common health effects found in populations exposed to arsenic-contaminated drinking water [4]. Non-healing ulcers may also develop which could progress to malignancies [4]. In our case series, the skin manifestations were non-malignant in two cases and malignant in the third case. The hallmarks of non-malignant manifestations were dermal changes concomitantly characterized by increased pigmentation and hardening of the skin, that is a combination of melanosis and keratosis.

There were spotted or “raindrop pigmentation” present in all three patients along with varied levels of hyperkeratotic changes.

An epidemiological study from Chile first suggested an association with non-malignant respiratory changes [6] which was confirmed in West Bengal by a cross-sectional survey [7]. While an obstructive pattern was the predominant change observed, restrictive pattern was also noted in a few. COPD accounted for the largest group of patients, followed by interstitial lung disease, malignancies and bronchiectasis [3]. In our case series, one patient suffered from bronchiectasis and remaining two from COPD. In another study, it was found that persons with arsenicosis skin lesions have a 10-fold higher rate of bronchiectasis [8]. The arsenic content in nail, hair and

Table 1 Patients' characteristics and arsenic levels.

Patient	Residence (West Bengal) districts	Age (yrs)/Sex	Arsenic concentration in drinking water (mg/L)	Duration of water intake (yrs)	Arsenic level (µg/g)	
					Hair	Nail
1	24 Pg (N)	25/F	0.06	25	1.34	1.93
2	Murshidabad	32/M	0.13	10	1.57	5.18
3	24 Pg (S)	40/M	0.26	20	4.19	8.07

drinking water samples from the patients along with the duration of consumption of that drinking water (Table 1) are in accordance with the fact that increasing degree of arsenic poisoning is directly correlated with worsening of lung function. Thus, lung manifestations are more evident in those drinking water with a higher arsenic content, and those with a worse clinical and cutaneous symptoms [3]. All parameters of respiratory function were worse with a worsening degree of arsenic poisoning.

The cause behind pulmonary involvement is probably inflammatory. Increased activation of pulmonary macrophages as well as increased production of inflammatory mediators (like tumor necrosis factor alpha, interleukin-1, LDH, etc.) may be implicated for such manifestations [9].

All the three patients consumed drinking water from a tube-well source for several years (Table 1) and had a family history of similar skin manifestations. There were some epidemiological studies on lung involvement in arsenicosis patients [3,10] but the case series with different cutaneous and pulmonary manifestations showing clearly that the positive correlation of increased manifestations with an increased duration as well as increased arsenic content of drinking water is scarce in the literature and seemed to be interesting for medical fraternity.

No treatment of proven benefit is currently available to treat chronic arsenic toxicity, most are supportive therapy. Thus, the provision of safe drinking water is a priority to prevent these types of cutaneous along with pulmonary manifestations. We have counseled the patients regarding the danger of drinking arsenic-rich water and asked them to consume safe drinking water as well as to come for regular check-up for their diseases.

Contributions

AP: Identified the case and drafted the article. SS: Collected and assembled the clinical data, SBT and SKT: Reviewed the article.

Conflict of interest

The authors declare that there is no conflict of interest.

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