Skin Cancer Induced by Arsenic in the Water

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Abstract

Background: Arsenic (As) is a well-recognized poison. Exposure may be of an acute nature, leading to high concentrations and acute arsenic poisoning. Chronic exposure may lead to benign skin changes, skin cancer, and internal malignancy.

Objective: Our purpose was to study the nature, incidence, and sequelae of skin disorders in a group of Argentinean patients suffering from chronic arsenicism due to the intake of contaminated well water.

Methods: All patients who presented with chronic arsenicism at the Dermatology Department of Hospital Posadas (Buenos Aires, Argentina) during a 10-year period (1988–1998) were included in this study. The patient group comprised 9 women and 14 men, the age range was 37–72 years. Diagnosis was based on the clinical triad (keratoderma, leucoderma and epitheliomatosis). We performed clinical, laboratory, and histopathologic studies to confirm diagnosis. We screened for possible internal diseases.

Results: All patients included in this study had cutaneous lesions associated with long-term arsenic exposure. The mean age of the patients was 58.2 years. The estimated mean time of the beginning of the lesions was of 3.7 years. All patients were Argentinean from endemic areas of our country where the arsenic levels are higher than those accepted by the World Health Organization.

Conclusion: This study allows us to conclude that the relationship between arsenic and cancer is frequent and it describes the principal characteristics of this entity in our group of patients.

Sommaire

Antécédents: L’arsenic (As) est un poison bien connu. L’exposition peut être de nature aigue, conduisant à de hautes concentrations et à un empoisonnement aigu à l’arsenic. Une exposition chronique peut conduire à des changements cutanés benins, cancer de la peau et maligne interne.

Objectif: Notre but est d’étudier la nature, l’incidence, et les sequelles de maladies cutanées chez un groupe de patients argentins souffrant d’arsenicisme chronique du à l’ingestion d’eau provenant d’un puits contaminé.


Resultats: Tous les patients inclus dans cette etude avaient des lesions cutanées associees a une exposition de longue duree a l’arsenic. L’age moyen des patients etait de 58.2 ans. La moyenne etimee de la duree depuis le commencement des lesions etait de 3.7 ans. Tous les patients etaient argentins provenant de zones endemiques du pays ou les
Arsenic (As) is a well-recognized poison. Exposure may be of an acute nature, leading to high concentrations and acute arsenic poisoning. The result of acute arsenic exposure may well be circulatory collapse and death.

When arsenic exposure is chronic and occurs at a low level, clinical signs may pass unnoticed. Chronic exposure may lead to benign skin changes, skin cancer, and internal malignancy. The relationship between As and skin cancer (SC) was first reported by Hutchinson in 1887. Many authors have contributed evidence thereafter.

Arsenic keratosis, pigmentary anomalies, Bowen’s disease (BD), squamous cell carcinoma (SCC), and basal cell carcinoma (BCC) account for the majority of lesions related to chronic arsenicism. Identification of signs suggesting that a patient has had chronic arsenic exposure is important for the long-term followup, as well as the identification of the exposure source.

The most common arsenic sources for human exposures are occupational [mining--smelting, wine making, carpentry, computer manufacturing (chips), naval industry, and electroplating silver], agriculture (pesticides, germicides, herbicides, food additives, food preservatives), medicinal (Chinese herbal balls, Asiatic pills, Fowler’s solution), environmental (contaminated shellfish fed on arsenic--polluted plankton, and contaminated water of rivers or wells, naturally or by industrial remnants). Arsenic in particularly high concentrations can be found in the artesian water wells of some special areas of our country where the As levels turned out to be higher than those accepted by the World Health Organization.

Here we report the cutaneous complications arising from Argentinean water wells containing higher levels of inorganic arsenic than those allowed (World Health Organization: 0.05 ppm). Our purpose was to study the nature, incidence, and sequelae of skin disorders in a group of Argentinean patients suffering from chronic arsenicism due to the intake of contaminated well water.

Materials and Methods

All patients who presented with chronic arsenicism seen at the Dermatology Department of Hospital Posadas (Buenos Aires, Argentina) over a 10-year period (1988–1998) were included in this study. The patient group comprised 23 cases (14 men and 9 women) with an age range of 37–72 years. Diagnosis was based on the clinical triad (keratoderma, leucomelanoderma, and epitheliomatososis). Clinical, laboratory, and histopathologic studies were performed to confirm the diagnosis. Specific tests were carried out when extracutaneous malignancies were suspected.

Arsenic levels were measured in the nails and hair of all patients as far back as ten years of exposure in endemic areas. Those still living in exposure sites were also requested to bring water from the wells to measure the As level.

Results

All patients included in this study had cutaneous lesions associated with long-term arsenic exposure. The mean age of the patient group was 58.2 years; the estimated mean time of the beginning of the lesions was of 3.7 years (Table I). All were Argentinean coming from endemic areas of our country where the As levels turned out to be higher than those accepted by the World Health Organization. Signs and symptomatology appeared after a period estimated between 6 months and 14 years.

The principal skin manifestations were keratoderma found in all 23 patients (100%), leucomelanoderma in 8 cases (34.7%), SC in 22 patients (88%) (Figs. 1 and 2). Cutaneous cancers were typified as follows:

- Bowen’s disease: 6 cases (26%), 5 on the upper back, 1 on the right hand.
- Basal cell carcinoma: 21 cases (95.6%). In some patients more than one BCC was found. We classified them by their clinical appearance as follows: (1) pagetoid type: 17 lesions, all on the trunk (4 anterior, 12 posterior) and 1 in the abdominal area; (2) pigmented type: 8 lesions (4 on face, 3 on anterior trunk, and 1 on posterior trunk) (Fig. 3); (3) nodular: 3 lesions (1 on face, 1 on vulvar region, and 1 on axillary area) (Fig. 4). Histopathologically, 17 cases corresponded to the superficial type of BCC, in accordance with a clinical pattern of pagetoid aspect, 10 cordoned types, and 1 morpheaform type.
- Squamous cell carcinoma: 3 patients, 1 on sole, 1 on back of hand, and 1 on posterior trunk (Fig. 5).

There was one nonsmoker patient who developed lung carcinoma (4.3%) at 10 years.

Discussion

Arsenic, an odorless and tasteless substance, is a well-recognized poison. The effects of its chronic ingestion are teratogenic, mutagenic, and carcinogenic.