

Chronic Arsenic Poisoning Leading to Skin Malignancy in a Community

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Abstract

To elucidate the etiology of skin malignancy in people in a hamlet in India, where many people experienced skin lesions that transformed into malignancy, a cross-sectional survey of the inhabitants was performed documenting skin lesions, and drinking water and blood were assessed for arsenic levels. Arsenic in the blood of affected patients was high and was determined to be the cause of malignancy.

Aim: To elucidate the etiology of skin malignancy in people in the hamlet of Kiradalli, Yadgir District, Karnataka State, India, where many people experienced skin lesions that transformed into malignancy. **Methods:** A cross-sectional survey of the inhabitants of Kiradalli was performed by trained and supervised paramedics. Skin lesions were documented. Lesions with a high suspicion of malignancy underwent biopsy. Drinking water was analyzed at the Cochin University of Science and Technology for arsenic content. Blood of affected patients was sent for arsenic level estimation and compared to normal levels. The media and social activists were involved to highlight this community health issue to help provide an alternative source of water and to provide rehabilitation. **Results:** Forty-six people were found to have skin changes suspicious for arsenic keratosis. Ten cases of epidermal malignancy were noted. A prevalence of 2.38% for epidermal neoplasm and 10.9% for arsenic keratosis was documented. The arsenic level of the water was 0.483 mg/L—much higher than the permitted level. Arsenic in the blood of affected patients was high.

Conclusion: Arsenic in the drinking water as a cause of skin cancer was established. The primary preventative measure to halt the development of new lesions was to provide safe drinking water for residents. The secondary preventative measure was to improve the prognosis of patients with malignant lesions by early diagnosis and treatment.

Clinical Skin Cancer, Vol. ■, No. ■, ■-■ © 2016 Elsevier Inc. All rights reserved.

Keywords: Arsenic, Community, Keratosis, Skin cancer, Water

Introduction

Malignant lesions of the skin include squamous-cell carcinoma, basal-cell carcinoma, and malignant melanoma. Isolated skin cancers are common. However, skin cancer affecting a large number of people within a particular community is rare. Unlike communicable diseases of infectious origin, in which a large part of the population of a particular area may be simultaneously affected, noncommunicable diseases like skin cancers do not exhibit high rates of prevalence. The etiology of cancers is often unknown and multifactorial. Only rarely can a cause be attributed to a single factor.

Skin lesions that turned malignant occurred frequently in people living in the hamlet of Kiradalli, Yadgir District, Karnataka State, India. It was suspected that there could be a common etiologic factor responsible for this transformation. Skin lesions were identified as arsenic-related keratosis; this led us to think that arsenic could be the cause of these lesions. A review of the literature indicated that no other study and documentation have been performed elsewhere in India, except one report from West Bengal¹ and few isolated places like Bombay.

Arsenic is a human carcinogen and skin pathogen.² Contamination is caused by arsenic from natural geologic sources such as ground water, and may also occur from mining and other industrial processes.³ In these places, high arsenic content is found in drinking water. Chronic arsenic ingestion leads to precancerous lesions with the potential to develop into invasive epidermal neoplasms. According to the World Health Organization (WHO), the maximum permissible limit of arsenic in drinking water is 0.01 mg/L.⁴ Levels of > 0.01 mg/L of arsenic in water are associated with arsenic-related keratosis and skin malignancy.

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Submitted: Dec 15, 2015; Accepted: May 5, 2016

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Arsenic Poisoning Leading to Skin Malignancy

Figure 1 Arsenic Keratosis on Back of Hand



Here we aim to show how a previously unsuspected cause of a disease that affected an entire community was found by keen observation, out-of-the-box thinking, and active participation. Our efforts led to the detection of the cause of the skin malignancies. Root-cause identification helped us implement action-oriented programs that aimed to lower the incidence of the disease. All of this was achievable because a surgeon made a choice to become what Atul Gawande calls a positive deviant.⁵

The aims of our study were to find the cause of the outbreak of skin lesions leading to malignancy in Kiradalli, and to survey all the inhabitants of Kiradalli for skin lesions, diagnose skin malignancies, and treat them accordingly.

Patients and Methods

A survey of skin lesions was done in Kiradalli. We noted the number of people with skin lesions. Their places of dwelling were visited by a group of medical personnel for clinical examination. Residents outside Kiradalli were excluded from this study because no cases were reported among them. The skin of subjects who volunteered for examination was examined, irrespective of the subjects' gender and age. A case was defined as 1 or more nodules or characteristic skin thickening on the palms and soles. Lesion ulceration and growth were documented. Among all the skin lesions, those with a high suspicion of malignant transformation underwent biopsy. Histopathologically proven epidermal neoplasms underwent definitive surgery. Ground water samples from bore wells, hand pumps, and draw wells in Kiradalli were sent to the Cochin University of Science and Technology for analysis of arsenic levels in water. The arsenic levels were compared to the permissible arsenic levels in water described by WHO. The blood of patients with proven malignancy was also assessed for arsenic levels. Arsenic levels in the blood of these patients were compared with normal blood arsenic levels as corroborative evidence.

Results

According to data available from the district surveillance unit, the total population of Kiradalli is 628. Of these 628 inhabitants, 420 consented to examination. Among these 420, 46 were found to have skin changes suspicious for arsenic keratosis (Figure 1). Of these 46, 15 had signs clinically suspicious for malignancy and were asked to undergo a biopsy at our institute. Ten patients turned out to have malignancy: there were 6 cases of squamous-cell carcinoma and 4

Figure 2 Arsenic Keratosis on Palms



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