

## Case Report

### Chronic Arsenic Poisoning

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#### Abstract

Chronic Arsenic Toxicity may have varied clinical presentations ranging from non-cancerous manifestations to malignancy of skin and different internal organs. Dermal lesions such as hyper pigmentation and hyperkeratosis, predominantly over palms and soles are diagnostic of Chronic Arsenicosis.

We report two cases from a family living in Sukkur who presented with classical skin lesions described in Chronic Arsenicosis. The urine, nail and hair samples of these patients contained markedly elevated levels of arsenic. Also the water samples from their household and the neighbouring households were found to have alarming levels of inorganic Arsenic.

#### Introduction

Chronic Arsenic Poisoning can result from chronic exposure to high levels of Arsenic (As) in the air, food or water. However most cases result from consuming water with toxic levels of Arsenic. Arsenic toxicity impacts on the entire body but some clinical features are pathognomic e.g skin hyper pigmentation and classical hyperkeratosis of palms and soles. Clinical features of Chronic Arsenicosis are highly variable and depend on the levels and duration of As exposure as well as the degree of host susceptibility. We describe two cases in a family from Sukkur comprising of nine family members in whom Arsenic toxicity was confirmed by the presence of markedly elevated Arsenic content in their hair and nail samples.

#### Case 1:

An 18 year old carpenter, resident of Sukkur, was admitted with progressive weakness and numbness of all four limbs for 3 months. There was no urinary or faecal incontinence, headache, visual problems, memory loss or fits. This was associated with brownish, non-itchy, painless, scaly lesions over palms and soles (Fig-1). Patient had significant weight loss and was bed bound for 2 months. There were no other respiratory or gastrointestinal symptoms. The patient's mother had died a few months back and was not reported to have a similar illness. His father who was also admitted at the same time suffered from a similar illness with similar skin lesions



Brownish, scaly lesion on the sole.

and pattern of weakness. Two of his five sisters, of ages 8 and 12 respectively, had also developed similar skin lesions in the previous 2 to 3 months. Two brothers were reported to be normal. This family lived in a single room house where they had made "traditional wooden beds". They worked with wood and paints but did not use any wood preservatives.

On examination, the patient was wasted and anaemic and had grayish-brown scaly lesions over his palms and soles with hyper pigmentation on the skin of the neck and abdomen. His trunk had rain drop hypo pigmented skin lesions anteriorly. He had reduced bulk, power and tone in all limbs with absent reflexes. There was glove and stocking pattern loss of all sensations up to elbows and mid thigh. Higher mental function and cranial nerves were intact. Rest of the examination was unremarkable.

The investigations revealed haemoglobin of 10 g%, MCV 89.7 fl, ESR 55 mm/hr, normal WBC, platelets and urea, creatinine and electrolytes. LFTs showed total bilirubin 0.9 mg/dl, GGT 89 mg/dl, SGPT 103 mg/dl, alkaline phosphatase 937 mg/dl, total proteins 7.6 mg/dl, albumin 3.9 mg/dl, PT/INR normal. Chest X-ray was normal, Ultrasound showed altered texture of liver parenchyma with mild hepatomegaly. Liver biopsy showed mild hepatitis with patchy parenchymal inflammation. Nerve conduction studies showed demyelinating sensory motor neuropathy in the limbs. Pulmonary function test showed mixed restrictive and obstructive pattern.

## Case 2:

A 42 year old male, father of case 1 was admitted with similar complaints and clinical presentation with peripheral neuropathy for 4 months and similar skin lesions. Patient had history of weight loss and was bed bound for 3 months. None of his brothers or sisters had such a disease. His parents were not alive and they were reported not to have had any such disorder.

On examination, the patient was wasted and pale with grayish brown scaly lesions over palms and soles and hyper pigmentation of skin of the lower neck. He had reduced bulk, tone and power in all four limbs with absent reflexes (Fig 2). There was glove and stocking pattern loss of all sensations up to elbows and mid thigh. Higher mental function and cranial nerves were intact. He had 3 cm non-



Reduced bulk of lower limb.

tender hepatomegaly. Rest of the examination was unremarkable.

The investigations revealed a haemoglobin of 9.5 g%, MCV 90 fl, ESR 75 mm/hr, normal WBC, platelets and urea, creatinine and electrolytes. LFTs showed total bilirubin 0.5 mg/dl, GGT 140 mg/dl, SGPT 42 mg/dl, alkaline phosphatase 467 mg/dl, total proteins 6.8 g/dl, albumin 3.5 g/dl, PT/INR normal. Chest X-ray showed fibrosis of right upper zone. Ultrasound revealed altered texture of liver parenchyma with hepatomegaly. Liver biopsy showed parenchymal inflammation. Pulmonary function tests suggested a restrictive pattern.

On the basis of clinical presentation and the fact that multiple members of different age groups and sex were affected in the same family, we suspected chronic arsenic poisoning in this family. Therefore water samples from the tube well in the house, as well as from two other neighboring households were collected and sent to Pakistan Council for Scientific and Industrial Research (PCSIR), along with hair, nail and urine samples of both the patients

for determination of arsenic levels.

Normal Arsenic content in drinking water should be < 50 ug/L as reported by Guha Mazumder et al.<sup>2</sup> whereas Arsenic levels in the samples collected were as follows;

<b>Patient's house</b>	<b>1286.68 ug/</b>
Neighbour 1	231.37 ug/L
Neighbour 2	233.06 ug/L

Arsenic levels in urine, hair and nail samples from case 1 and 2 were:

Samples	Arsenic Levels		
	Case 1	Case 2	Normal*
Urine**	31 ug/L	16 ug/L	10-50 ug/L
Hair	38.15 mg/kg	42.7 mg/kg	0.02-0.2 mg/kg
Nails	31.18 mg/kg	71.16 mg/kg	0.02-0.5 mg/kg

\*(Ref. 9,10).

\*\*Urine samples were sent some 2 weeks after removal from exposure to As laden water.

During their 22 days stay in the hospital they were given symptomatic treatment and were advised to use alternate sources of water for consumption. The two cases were also notified to the relevant health authorities of the provincial and federal government.

## Discussion

High levels of Arsenic in the subsoil water has been reported from all over the world and globally many areas with high As content have been identified by the WHO. These include areas surrounded by The Great Ganga Basin in India where 25% of the wells have been found to high As content, as reported by WHO.<sup>1</sup>

Chronic Arsenic Poisoning leaves an imprint on all organs of the body in particular affecting the skin and the peripheral nerves. A variety of cutaneous manifestations have been described ranging from rain drop pigmentation or hypo pigmented lesions on the trunk and extremities, mild to severe diffused hyper pigmentation or melanosis. A very typical hyperkeratosis of palms and soles sometimes extending to dorsum of the hands is considered to be pathognomic of Chronic Arsenicosis.<sup>2</sup> The duration of patients exposure to Arsenic and onset of symptoms does not follow a particular time frame. Various durations for the development of clinical signs after the exposure to high levels of Arsenic have been described and can be as short as less than 1 year.<sup>3</sup> Hyper pigmentation was reported to occur after 6 months by Rattner et al with hyper keratosis occurring about 3 years after exposure to 4.75 mg / day of As.<sup>4</sup> The skin lesions in our patients were advanced lesions and the entire palms and soles appeared

to be horny and wart-like. This hyper keratosis was not confined to the pressure points or points of friction as seen in the farmers. In addition they also had other classical features of Arsenicosis<sup>2</sup> such as sensori-motor peripheral neuropathy, anaemia, hepatic injury with some excess of iron deposition in the liver despite normal serum ferritin levels.

The gastrointestinal symptoms, leucopenia, and hepatic and urinary injury are predominant in the initial phase of subacute arsenic poisoning. Peripheral neuropathy is the most frequent manifestation after the initial phase. The biomethylation of arsenic decreases in a dose rate-dependent manner.<sup>5</sup>

Urine is the major route of As excretion and an average background concentration of As in urine is generally less than 10ug/L in Europe<sup>6</sup> and around 50ug/L in Japan.<sup>7</sup> The half time of inorganic As in humans is about 4 days. Urine samples of both our patients were found to have As levels in excess of 10ug/L even though these samples were delayed well over 2 weeks after removal from As exposure.

In people with no known exposure to As, the concentration of As in hair is generally 0.02 - 0.2 mg/kg<sup>8</sup> whereas normal As values in nails appear to range from 0.02 - 0.5 mg/kg.<sup>9</sup> Both our patients had markedly raised As levels in their hair and nail samples.

Although various chelating agents such as dimercaprol, DMSA (2,3-dimercaptosuccinic acid) and DMPS (2,3-dimercapto-propane sulfonic acid) have been described to increase survival when administered after acute As poisoning but the efficacy of these agents decline in proportion to the length of time that has elapsed after acute As exposure.

Though efficacy of specific chelation therapy for patients suffering from chronic arsenicosis has not yet been fully substantiated, supportive treatment could help in reducing many symptoms of the patients. Good nutritious diet, containing high protein content, as well as the drinking of arsenic free water has been found to reduce symptom

score. The various clinical manifestations like chronic bronchitis, anaemia and dyspepsia should be treated symptomatically.

Chronic arsenic poisoning is the most serious health risk for the ~2 million people drinking groundwater without treatment, followed by malfunctions in children's development through excessive manganese uptake.<sup>10</sup>

The fact that chronic arsenic toxicity can result in serious morbidity and mortality, including malignancies of skin and internal organs, we suggest that the issue of toxic levels of As in sub-soil water used for human consumption should be addressed on a priority basis. An urgent survey of drinking water samples should be conducted in various parts of the country as a preventive measure for preserving public health.

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