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CASE REPORTS

Arsenic Intoxication Presenting as Peripheral Neuropathy

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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. Chronic arsenic exposure results in dermatologic manifestations prior to overt clinical neuropathy. Arsenic neuropathy causes painful paresthesias and, with higher level or continued exposure, length-dependent weakness. We are reporting two cases of chronic arsenic poisoning who presented initially as peripheral sensory motor neuropathy and skin manifestations. Arsenic poisoning was suspected because many of the other family members also developed similar symptoms simultaneously. The hair samples of these patients contained markedly elevated levels of arsenic. Also the water samples from their household and the neighboring households were found to have alarming levels of inorganic arsenic. Provision of arsenic free drinking water halt further deterioration of symptoms and there was significant improvement of their dermatological & neurological conditions.

Keywords: *Arsenic, Arsenicosis, Peripheral Neuropathy*

Introduction:

Arsenic is a metallic compound. Arsenic forms colorless, odorless, crystalline oxides. It is found in trivalent & pentavalent form. Its salts are called arsenates which is the basis of arsenic contamination of groundwater. Trivalent arsenate has greater human toxicity than pentavalent arsenate. It is one of the most potent toxins affecting GI system, neurological, renal, hepatic system, and skin. A significant level of arsenic is found in drinking water in almost all regions of Bangladesh. Reports have demonstrated that there is a large-scale problem in Bangladesh and India due to contamination of the groundwater, causing exposure to become endemic.

In these areas a high proportion of individuals (10 to 20%) examined have evidence of arsenical toxicity. Of those with toxicity, peripheral neuropathy is a common finding. Arsenic toxicity occurs both acute & chronic forms. The clinical manifestations of arsenic exposure depend on the level of exposure. High-dose exposure results in rapid onset of severe gastrointestinal disturbance (e.g., abdominal pain, vomiting, and diarrhea), as well as tachycardia, hypotension, and vasomotor collapse with possible death. In addition, CNS dysfunction may occur, which can be transient (e.g., organic psychosis, somnolence, or stupor) or prolonged (e.g., behavioral and cognitive problem).If the subject survives acute high-level exposure, the neuropathy begins to manifest within weeks and may continue to worsen for a period of weeks after removal from exposure (coasting). Sensory symptoms including painful paresthesias and numbness predominate. Burning, aching, and tingling are positive sensory phenomena that occur first in the toes and feet, but later in the fingers. Similarly, weakness follows a length-dependent pattern, starting with the feet and later involving the hands. With high-dose exposure or inadequate treatment, the weakness may progress to involve the respiratory muscles and mimic Guillain-Barré syndrome. The deep tendon reflexes are depressed or absent early in the process. Other neurological

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manifestations include headache, visual disturbances & features of encephalopathy in acute arsenic intoxication.

Chronic arsenicosis are highly variable and depend on the levels and duration of arsenic exposure as well as the degree of host susceptibility. One of the early warning signs of arsenic poisoning is a "pins and needles" sensation in hands and feet. Clinical neuropathy characterized by burning and numbness of the feet and later the hands results from continued exposure. This involves both small and large fiber sensory disturbance with resultant difficulties with proprioception, in addition to the dysesthesias. Weakness tends to be mild and limited to the most distal muscles. Recovery is related to the severity of the neuropathy at the onset of treatment. Mild cases recover completely, whereas more serve cases may have significant residua.

Case Report:

A 26-year-old farmer, normotensive , non-diabetic, right handed person hailing from Kishoregonj ,admitted in Bangabondhu Sheikh Mujib Medical University, Dhaka with the complaints of burning sensation of hands & feet for 2 months & progressive weakness of both upper & lower limbs for 20 days. He also complaints of blackish discoloration of skin all over the body more marked in the palms & soles. All other 5 family members (excluding one of his brother who lived in Chittagong) also develop hyperpigmentation of palms and soles, and tingling, numbness along with this patient. The patient and his family members gave a history of water consumption for drinking and cooking from deep bore well (using a submersible pump) for last 6 months. Before this they had used water from another arsenic free labeled deep tube well. No bladder-bowel involvement was present. Examination revealed hyperpigmentation of face, arms, legs, upper chest, and abdomen,palms and soles. Sensory motor symmetrical predominantly distal, peripheral neuropathy was present with muscle power around 4/5 in all 4 limbs, all jerks are absent. All modalities of sensation are impaired.

We also examined one of his brother & got similar findings.Electrophysiologically, severe axonopathy was present. The arsenic level was significantly high in hair sample of both of them (33.95mg/kg, & 46.60mg/kg respectively, normal level <3.0mg/kg by atomic absorption spectrometry).Water sample of deep bore well was sent for arsenic estimation where arsenic level was found 3.53mg/l(standard limit .05 mg/l) .

Biochemical tests and haemogram , hormone profile(TSH 2.77IU/ml, ACTH 24.0pg/ml, cortisol 454nmol/l,) were normal .Treatment for arsenic poisoning for this patient and all his family members was started with oral D- penicillamine.The water source has since been changed from deep bore well to government supply arsenic free deep tube well water. After two months follow up, skin lesion had subsided in this patient as well as in all of his family members. There was mild relief from symptoms of peripheral neuropathy after two months of treatment, but complete recovery from symptoms of peripheral neuropathy has not yet occurred.

Discussion:

Peripheral neuropathy, hyperpigmentation, hyperkeratosis, exfoliative dermatitis, are the features of sub-acute or chronic arsenic intoxication[1]. Peripheral neuropathy[2] which occurs in chronic arsenic poisoning may manifest between 1 - 2 weeks after recovery from acute poisoning and is in the form of both demyelinating and distal axonopathy[1]. The symptoms of encephalopathy (headache, drowsiness, mental confusion, delirium) may also occur as part of chronic intoxication.

Arsenic exerts its toxic effect by reacting with sulphydril radicals of certain enzymes necessary for cellular metabolism. Inorganic arsenic is readily absorbed (lung and GI), sequestered in liver, spleen and kidneys. Residues persist in skin, hair, and nails for a long time. The diagnosis of arsenic poisoning depends upon the demonstration of increased level of arsenic in hair and urine[3]. Arsenic is deposited in the hair within 2 weeks of exposure and may remain fixed there for long periods. Concentration of >0.1 mg arsenic per 100 mg hair are indicative of poisoning.

Arsenic also remains within bones for long periods and is slowly excreted in the urine and faeces[3]. WHO Guidelines for drinking water published in 1999 suggested that arsenic concentration should be < 0.01 mg/litre (< 10 microgram/l.) and more than 50 microgram/l. is associated with manifestations of arsenic toxicity[4].Excretion of more than 0.1 mg arsenic per liter of urine is considered abnormal (no sea foods should have been consumed for 24 hours before collection of specimen)[5].Individuals who consume fish on regular basis, as occurs in coastal regions may have slightly or moderately elevated level of arsenic.

In our case, arsenic poisoning manifested by symptoms of peripheral sensory motor neuropathy in the form of abnormal sensations (tingling, numbness and decreased sensation), and dermatological manifestations (hyperpigmentation of palm and sole). Skin manifestations in our patient are similar to those described by Saha *et al*[6] in which arsenic in tube-well water is associated with hyperpigmentation.

Peripheral neuropathy[2] is the main feature of subacute or chronic organic poisoning and is the predominant symptom in our patient as described in literature including Hafeman *et al*[7]. Similar neuropathy due to arsenic toxicity is also described by Chuttani[1]. The possible cause of arsenic poisoning in our patient is arsenic present in deep bore well water. Symptoms of arsenic intoxication only occurred in our patient after starting of consumption of water from deep bore-well. Study conducted in Taiwan[8] showed that subjects who drank well water containing arsenic concentration > 50 microgram/l. have peripheral neuropathy evidenced by slow conduction velocity on Nerve conduction study.

Recommended treatment for acute arsenic poisoning consists of gastric lavage, vasopressor agents, fluid and electrolyte maintenance, and BAL(British anti lewisite)[9]. Maintenance of renal perfusion and exchange transfusion is required if massive haemoglobiuria occurs as in chronic poisoning. Oral succimer (DMSA & D-penicillamine[10]) vitamin supplement are also required. After change of their water source and treatment with oral D-penicillamine and supportive care, skin lesions resolved but complete recovery from peripheral neuropathy did not occur. Sensory neuropathy predominates over motor as described by Rehman *et al*[11]. Similar type of neuropathy was detected in our patients.

Conclusion:

Arsenic toxicity is a problem in Bangladesh due to contamination of ground water & many people are suffering from Arsenicosis. They manifest as different skin, GI, cardiac ,respiratory & neurological problems. These problems mostly occur due to chronic exposure to Arsenic. Neurological manifestation may be asymptomatic asymptomatic or may present with sign symptom of peripheral neuropathy. Neurophysiological evaluation may help to diagnose these cases. So early diagnosis, prevention of arsenic exposure & appropriate treatment can reduce the sign symptoms of peripheral neuropathy but complete cure can not be attained.

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