J Indian Acad Forensic Med. 2020 Jul-Sep; 42(3): 227-230
doi:10.5958/0974-0848.2020.00059.7

CASE REPORT

Arsenic – Not an Obsolete Homicidal Poison

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Abstract
Arsenic has been one of the heavy metals with a notorious reputation as an ideal homicidal poison, with numerous high profile cases being reported in literature. It has also been a favourite with detective fiction writers who write stories on cases involving the use of poisons. However, over a period of time the popularity of arsenic began to wane in reality as well as in fiction; and other newer and more exotic poisons emerged. In recent times, cases of such homicidal attempts with this agent have become quite scarce in literature. It is in the midst of such a scenario that a shocking case of attempted murder with an arsenic compound came to light in a major corporate hospital of Cochin, involving a Keralite male working in Bengaluru city. Suspicions of systematic poisoning with arsenic trioxide through his food over a period of several days to weeks became a certainty on the basis of his gradually deteriorating health, medical evaluation, and subsequent laboratory investigations. While the case is yet to be resolved in the legal context, medically the patient is on the road to recovery, and this paper seeks to present the clinical unfolding of a case of arsenic poisoning with almost textbook characteristics in relation to symptomatology and laboratory findings.
This disturbing case serves to demonstrate the sinister fact that some poisons just do not fade into history, and physicians must always be alert to the possibility of them still being employed by people with a criminal bent of mind.

Keywords
Arsenic; Attempted homicide; Criminal poisoning; Heavy metal

Introduction

In India, though the general perception is that heavy metal poisoning is uncommon, the truth is the converse.[1] Heavy metal poisoning is a major cause of morbidity/mortality all over the world with India being no exception. Arsenic has had an outstanding reputation as an ideal homicidal poison, especially in the West, in the Victorian era. Several murders were said to have been accomplished with the help of this heavy metal, including the shocking case of Napoleon Bonaparte, though there are conflicting reports relating to this today.[2] However of late, the popularity of arsenic as a homicidal agent had declined due to legal restrictions on its sale, availability of sophisticated methods for its detection, and also perhaps due to emergence of better homicidal poisons. Today much of the reported research work on arsenic relate to environmental contamination,[3] and reports of murders are quite rare.[4] Since 1992, only two cases of intentional arsenic poisoning have been reported in the Western literature.[5,6] Arsenic trioxide, one of the commonest salts of this metal, can be administered to a victim without arousing suspicion because it is virtually tasteless and colourless. The only problem is the relative insolubility in common food or beverage items, and hot solutions (such as coffee or soup) are required for dissolving it.[1] Also, much of the dissolved arsenic often separates out as a gritty deposit once the solution cools. But if chronic administration to a victim is successful, the symptoms produced can be mistaken even by a qualified doctor for natural causes such as neurological disease or hepatorenal afflictions, while acute poisoning may be confused with gastroenteritis or cholera.

The case being reported is a rare presentation of homicidal chronic arsenic poisoning with almost textbook characteristics that escaped suspicion for quite some time.

Case Report

A 37 year old male, an Information Technology professional working in the city of Bengaluru, developed nausea, vomiting and loose stools immediately after dinner at home, on 15 April 2019. He was admitted at a local hospital and was managed conservatively. He was symptomless for the next one month. However, the same incident repeated one month later following dinner, though this time, the symptoms took much longer to resolve. He was again admitted to hospital. In addition to the earlier features, there was tingling and numbness of both hands. After two weeks he was discharged, but the sensory neuropathy of both hands and feet persisted for a month. By the end of July 2019, he began to notice skin changes on his palms and soles in the form of flaking, accompanied by a burning sensation over the feet. He became virtually bed bound due to difficulty in walking, and also had loss of appetite. He felt progressively

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Article History
Received: 2nd April, 2020; Accepted: 13th August, 2020

weaker and had to be readmitted to the hospital.

This time, a detailed evaluation was done by the attending physician. The complete blood count showed evidence of leucopoenia and anaemia. Iron studies, folic acid and vitamin B_{12} levels were normal. ESR (erythrocyte sedimentation rate) was 15mm/hr and CRP (C-reactive protein) was 12mg/l. Renal, liver, and thyroid function tests, serum amylase and lipase, and electrolytes were all with normal ranges. ANA (antinuclear antibody) profile, C-ANCA (cytoplasmic antineutrophil cytoplasmic antibodies) and P-ANCA (perinuclear antineutrophil cytoplasmic antibodies) were also negative. Tissue transglutaminase immunoglobulin A (tTG-IgA) was assayed and showed up as negative. CECT (high-dose contrast-enhanced computed tomography) abdomen indicated peripancreatic oedema. NCV (nerve conduction velocity) revealed right deep peroneal neuropathy, primarily demyelinating in nature, with secondary axonal loss. MRI (magnetic resonance imaging) of the spine was normal. No oligoclonal bands were seen in the cerebrospinal fluid. Autoimmune encephalitis panel and paraneoplastic panel tests turned out to be negative.

Figure 1: Arsenic trioxide powder

The patient was diagnosed and managed as a possible case of Guillain–Barré syndrome (GBS) for five days with intravenous immunoglobulin (IV-IG) and was then discharged. But he showed no improvement at all, and subsequently presented to a major corporate hospital in Cochin on 5 September 2019.

Figure 2: Hyperkeratosis of skin over the palm of left hand

Figure 3: Hyperkeratosis of skin over the sole of left foot

Meanwhile he began to develop suspicion that his wife was somehow responsible for his problems as they had been experiencing serious marital problems for quite some time. The patient felt that his symptoms appeared to manifest only when he had food from his home. Subsequently he searched the entire house meticulously for the source of the poison and happened upon a bottle with white powder (Figure 1) among the kitchen waste. This white powder was tested in a laboratory in Bengaluru, and was identified as arsenic trioxide. The first author performed a detailed physical examination and recorded severe hyperkeratosis of palms and soles (Figure 2 and 3). The patient then consulted with the third author and got his blood

sample tested for arsenic. The toxicology report revealed high level of arsenic (63.36 mcg/L) confirming the diagnosis as chronic arsenic poisoning. He was started on chelation therapy with a combination of dimercaprol (British Anti Lewisite or BAL) and D-penicillamine following which his condition improved significantly (Figure 4). As there was no further exposure, his overall condition improved with supportive treatment. Meanwhile the patient made a complaint of deliberate poisoning against his wife to the police, which is currently being pursued.

Figure 4: Healing of the sole of left foot, following chelation therapy

Discussion

In the case being reported, attending physicians suspected various ailments as being responsible for the patient's deteriorating condition, until finally it began to dawn on the victim himself that he was being poisoned.

The usual fatal dose of arsenic trioxide is 200-300 mg; and the lethal dose following acute ingestion is 1-3 mg/kg.[1] However survival has been reported in an adult following ingestion of 54 grams of arsenic trioxide.[7] The amount of arsenic consumed was not able to be estimated in the present case. A blood level of less than 10 mcg/L is generally considered normal. In this case, the blood level was 63.36 mcg/L and the classical clinical features of chronic arsenic poisoning as mentioned in the literature[1] were clearly evident, such as hyperkeratosis of palms and soles, anorexia, weight loss, periodic diarrhoea, etc. There was also polyneuropathy mimicking GBS which has been a frequently confounding condition in the differential diagnosis.[8]

While many physicians today consider arsenic poisoning to be relatively uncommon in the form of accidental nature, leave alone homicidal, this case shows that the notorious Victorian poison is still very much around. A fact that has also been reinforced by some other reported cases.[9] Diagnosis is often tricky, but a high index of suspicion can enable this to be done with certainty, with the help of methodologies such as ICP-MS (inductively coupled plasma mass spectrometry) and ICP-AES (inductively coupled plasma atomic emission spectrometry) that are considered to be among the best methods for heavy metal analysis today.[10] In this case, ICP-MS was used, both on the suspicious white powder, as well as the blood sample, and helped to clinch the diagnosis. Hair samples were not tested for arsenic as there is much controversy today about its actual efficacy in arriving at the right diagnosis, because of confounding factors such as environmental exposure.[11] Urine screening for heavy metals is subject to high incidence of false positives/negatives.[12]

While treatment of chronic arsenic poisoning is best accomplished with chelation therapy utilising DMSA (dimercapto succinic acid), or DMPS (dimercapto propane sulfonic acid), in India BAL (British anti lewisite or dimercaprol) is usually employed because the former are not easily available. In the case being reported, a combination of BAL and D-penicillamine was used, as this is more effective.[13]

Conclusion

Arsenic is a heavy metal with a notorious reputation. Even though numerous cases have been reported in the past, its popularity has waned in recent years. But as this case report demonstrates, it has never really disappeared from the scene. The case highlights the importance of a high degree of suspicion every clinician must have when dealing with unusual presentations in daily practice.

Ethical clearance: A prior approval was obtained from the Institutional Ethics Committee

Conflict of interest: None to declare

Source of funding: None to declare

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