

Sources, Symptoms, and Signs of Arsenic Poisoning

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Arsenic poisoning continues to be a serious medical problem that may easily be overlooked or misdiagnosed. The broad constellation of symptoms and signs in arsenic poisoning, along with changing sources of this toxin, contributes to misdiagnosis. A re-examination of current potential sources was carried out. Sources were determined in 17 of 20 documented cases of arsenic poisoning. Fourteen cases resulted from ingestion of a single, commonly available, arsenic-containing ant killer. In contrast to earlier reports, this survey found that agricultural and industrial sources were relatively uncommon.

A peculiar posturing of the hand is commonly seen in the early stages of arsenic poisoning prior to the development of Mee's lines or palmar hyperkeratosis. An illustrative case is reported that resulted from intermittent self-administration of an arsenic-containing ant killer in order to maintain a state of chronic invalidism.

Many years have passed since the sources for arsenic intoxication were investigated.¹ Prior to World War II arsenic poisoning was fairly common. At that time the widespread use of medicinal arsenic gave rise to inadvertent overdosing and provided a ready source of arsenic for attempted homicides. Arsenic poisoning also resulted from the widespread application of arsenic-containing insecticides to grain, fruits, and vegetables. Current medical uses of arsenic are few. Agricultural applications are limited to additives for livestock and poultry rations. Potential industrial exposure

to arsenic, however, has heightened concern that arsenic poisoning may again be on the rise.²⁻⁴ The possible changing epidemiology prompted a re-examination of this potentially avoidable health hazard.

Survey of Arsenic Poisonings

A case investigation was carried out using postmortem laboratory results from death certificates (2 cases) and results of clinical laboratory analyses (18 cases) from the Minnesota State Board of Health. The survey covered the period from 1976 through 1979.

Twenty instances of elevated arsenic levels for different individuals were recorded for the four-year period under study. Follow-up inquiries to the referring physicians, patients, families, and local police revealed an identifiable source in 17 cases.

Table 1 summarizes the sources of arsenic and

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Table 1. Documented Causes of Arsenic Poisonings*

	Accident	Suicide	Homicide	Malingering	Total No. (%)
Terro Ant Killer	6**	5	2	1	14 (82)
Laboratory arsenic compound		2			2 (12)
Commercial insecticide	1				1 (6)
Total	7	7	2	1	17 (100)

*Source of arsenic could not be determined in three cases of poisoning
 **Five of these were children

motivations underlying the poisoning cases. For an additional three cases, a source could not be determined. Of the 20 subjects, 14 were male and 6 were female. Fourteen of the 17 explainable cases (82 percent) were caused by Terro Ant Killer. Self-administration of arsenic by childhood accident or as an adult suicide attempt represented the most common type of ingestion.

One case stands out. This was the first of three arsenic poisonings to present at the Minneapolis Veterans Administration Medical Center. This case was representative of the subsequent survey results in that Terro Ant Killer proved to be the source of arsenic. In addition, this case was particularly interesting because the patient was willfully self-administering arsenic for the purpose of creating and maintaining a state of chronic invalidism.

Case Report

A 57-year-old unemployed man was first admitted to the Minneapolis VA Medical Center in April 1977, with initial complaints and findings including severe abdominal cramping, diarrhea, and pancytopenia. After the gastrointestinal complaints resolved, severe acroparesthesias and gait difficulty appeared. Serial examinations revealed progressively more peripheral neuropathy. Urine analysis for arsenic revealed a strikingly elevated level (3,600 mg/L, normal value < .015 mg/L). Dimercaprol treatment was begun. Efforts to determine the source of the arsenic poisoning were inconclusive. The patient denied any knowledge of exposure to arsenic. He stated that he was "separated" from his wife, although they continued to occupy the same house, living on different floors.

The wife continued to cook for both of them. Medical personnel and the local police were unable to establish a source or definite motive. Following a prolonged rehabilitation effort, the patient was discharged and returned home.

The patient was readmitted seven additional times over the next three years for recurrent but less severe arsenic poisoning. Typically, when his gait was returning to normal, he would again succumb to a bout of arsenic poisoning. Additional episodes occurred while he was away on pass from the hospital, with documented elevations of urine arsenic levels on return to the hospital. With permission of the patient and his wife, the home was thoroughly searched for arsenic, which resulted in the discovery of a partially used bottle of Terro Ant Killer. The search also found medical texts with underlined descriptions of arsenic poisoning. In addition, a sensationalized and annotated article was found describing the arsenic poisoning of Clare Booth Luce while she was ambassador to Italy. Multiple artifacts and volumes relating to the occult were also noted.

Subsequent psychiatric and psychological evaluations suggested that the patient was highly intelligent, depressed, narcissistic, and hysteroid. He revealed, after several years of interviews, his conviction that he could communicate with his deceased mother through involuntary writing. The patient reported that this psychical automatism of his hand also allowed communication with a number of other deceased persons who would provide him with advice and counseling. Paranoid tendencies were expressed. He was certain that he was being spied on through one-way mirrors and hidden microphones. He was diagnosed as having a narrowly confined delusional system that had

escaped detection for years because of marked defensiveness.

He continued to express a strong desire to clarify the circumstances surrounding his recurrent arsenic poisoning. An amobarbital (Amytal Sodium) interview was conducted in an attempt to overcome the patient's substantial resistance. Under Amytal he revealed that he had first administered arsenic to himself in 1947. He had proved to be an unsuccessful college teacher and had attempted suicide by ingesting arsenic. The poisoning had made him mildly ill and had given rise to some mild disturbance of his legs. To him this was sufficient to justify retirement in a face-saving way. He lived with his mother until her death. Following his mother's death, he married his mother's best friend and continued in a similarly dependent relationship with his wife.

During a routine visit to a Veterans Administration clinic, a well-intentioned house officer suggested vocational counseling and a return to work. This suggestion, combined with the patient's chronic feelings of inadequacy, resulted in emotional turmoil. Subsequently, he began intermittent self-administration of arsenic to maintain a state of chronic invalidism. He also revealed while under Amytal that he had a large supply of Terro Ant Killer hidden, and that he typically would mix it with beer to make it more palatable. Because of his expressed belief that he might well continue to poison himself, he was transferred to a long-term Veterans Administration neuropsychiatric facility for treatment and self-protection.

This case represents an instance of intermittent self-administration of an arsenic-containing pesticide. The patient, who had a narrowly focused psychosis, used this means to cope with a world he perceived to be overly demanding and threatening.

Discussion

Both acute and chronic arsenic poisoning causes multisystem disease that imitates many other diseases. It may often be overlooked in the initial differential diagnosis.⁴ The clinical manifestations depend on the rate of arsenic ingestion. Acute arsenic poisoning is characterized by burning and dryness of the oral cavity, esophagus, and stomach. Nausea, protracted vomiting, abdominal pain, and diarrhea occur. Occasionally restlessness, vertigo, muscle spasm, and delirium or coma

may occur. In the most severe form, urine retention, shock, and death are seen.

Chronic arsenic intoxication is manifested by malaise and fatigue. Skin findings include increased pigmentation and hyperkeratosis of the palms and soles. Transverse white lines in the nail beds (Mee's lines) appear approximately six weeks following intoxication. Peripheral neuropathy with prominent muscle atrophy is also a late finding in severe arsenic poisoning. Severe hematological abnormalities including pancytopenia are associated with arsenic intoxications.⁵

A neurological finding that occurs earlier but has received very little attention is an unusual posturing of the hands. A waxy immobility of the hands is brought about by intense dysesthesias in the hands and feet. The painful sensory symptoms and hand immobility are consistently seen in severe arsenic poisoning. In addition to the sensory complaints, the hands and feet may be slightly erythematous and edematous. Intense acrodysesthesias are not specific for arsenic poisoning, as they may occasionally be seen in other disorders such as acute Guillain-Barré syndrome.

Treatment of acute arsenic poisoning consists of fluid replacement during the initial gastrointestinal illness. Dimercaprol remains the treatment of choice. This chelating agent has proved most effective when administered within hours of the intoxication but may also be of use in chronic intoxication.^{1,3,6,7}

The present survey found that the greatest number of documented arsenic poisonings resulted from a single, readily available ant insecticide. Existing literature, however, points mainly to environmental, industrial, and medicinal origins for arsenic intoxication.

Arsenic has a diffuse natural distribution in soil and water. Natural sources of environmental release, such as volcanoes and hot springs, are also recognized as important.⁴ An outbreak of arsenic poisoning in a New England community was traced to arsenic contamination of approximately one third of the area's 2,000 wells. Naturally occurring arsenic in the bedrock was found to be the source. Arsenic is also a component of insecticides, herbicides, and rodenticides.^{1,6,8} It is an additive in the rations of poultry, cattle, and swine. Arsenic is present in fresco, tempera, watercolor, and oil paints, in fire salts, in cosmetics, and in bootlegged whiskey.⁴

Much attention has been given to industry as a potential source of arsenic exposure.²⁻⁴ Industrial sources of arsenic include nonferrous smelting and coal-fired power plants using arsenic-rich coal.⁹ Use of geothermal and fossil fuel energy sources high in arsenic content may increase the frequency of arsine exposure.¹⁰ Medicinal arsenic was commonly administered in the earlier part of this century in the treatment of syphilis and parasitic infections, but it has largely been replaced by less toxic substances.⁷ Its present clinical use is primarily confined to the treatment of certain protozoan diseases.⁴

Although a variety of potential sources exist, the present survey found that more than 80 percent of the poisoning cases with identified sources resulted from a readily available commercial ant insecticide (Terro Ant Killer). This agent was most prominent in the cases of childhood accidental exposure. As compared with earlier reviews,^{1,5} the results of the present survey suggest that arsenic use with homicidal intent and from accidental exposure to industrial sources is relatively rare. On the other hand, arsenic poisonings from ant

insecticide are surprisingly high. As a result of the findings of this survey, a question exists whether the benefits of ant killers containing arsenic are sufficient to justify the substantial morbidity and mortality associated with their use.

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