



Selected Topics: Toxicology

A CASE OF ACCIDENTAL MERCURY INTOXICATION

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Abstract—Background: Mercury poisoning is an uncommon diagnosis in the United States, but it is a differential diagnosis that physicians should consider because it can lead to potentially fatal complications if untreated. Due to the nonspecific presentation of mercury poisoning, which includes symptoms such as fever, nausea, vomiting, and abdominal pain, misdiagnosis may occur unless a proper history is taken. **Case Report:** In the present case, a white female patient was misdiagnosed repeatedly with a viral illness and sent home from the local hospital. The patient presented with a diffuse full-body rash, fever, myalgias, headache, peripheral neuropathy, oral paresthesias, and tender cervical posterior lymphadenopathy. After obtaining a thorough history, it was discovered that the patient and her family were exposed to mercury through a spill of elemental mercury in their home. Blood mercury levels in the patient were 170 ng/mL. The patient was treated with a course of dimercaprol. Her symptoms improved and she was discharged on hospital day 5. **Why Should an Emergency Physician Be Aware of This?:** Ultimately, mercury poisoning is a treatable condition, but if exposure continues and the pa-

tient is not treated, it may lead to complications such as severe pneumonitis, renal tubular necrosis, and neurological dysfunction. In some instances, neurological symptoms may persist even if the source of exposure is removed. For these reasons, recognition and prompt treatment after a suspected exposure is important. © 2018 Elsevier Inc. All rights reserved.

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INTRODUCTION

Mercury is a toxic heavy metal that exists in multiple forms and has been used historically for many applications, including dental amalgams and gold mining. Human exposure occurs primarily through the consumption of contaminated fish or through environmental exposure from coal burning (1). Other sources of exposure, although more rare, include exposure to mercury vapor after a mercury spill or a broken thermometer. The elemental form of mercury is the only metal that is a liquid at ambient temperature, which allows it to vaporize easily if agitated (2). Mercury vapor is particularly hazardous because it is colorless and odorless and, once inhaled, it is absorbed easily (3). Studies have shown that approximately 74% of the inhaled mercury vapor is absorbed through the lungs and then distributed readily throughout the body (3). The absorbed mercury is highly lipophilic, allowing it to cross the blood–brain and placental barriers (1).

Informed Consent: All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. Written informed consent was unable to be obtained from the patient as she was lost to follow-up after discharge. The manuscript has been written so that no identifiable data or photographs are provided. The use of laboratory findings and photographs from this patient was reviewed and approved by the Mercer University Institutional Review Board.

Clinical presentation of mercury poisoning varies greatly among patients; however, acrodynia has been described as a common condition associated with mercury toxicity (4). Patients may present with extremity pain, irritability, skin involvement, sweating, fever, anorexia, hypertension, and tachycardia (5,6). Other documented signs and symptoms of mercury toxicity include tremors, nausea, vomiting, and diarrhea. Fortunately, mercury poisoning is a treatable condition. The most common therapy utilizes administration of a chelating agent such as dimercaprol or succimer. With chelation therapy, symptoms of mercury poisoning may resolve quickly. However, if mercury poisoning is left untreated, it may lead to complications such as severe pneumonitis, renal tubular necrosis, and neurological dysfunction (1).

CASE REPORT

A 32-year old white woman presented to the Emergency Department (ED) after a known exposure to elemental mercury. Her 15-year-old daughter brought home a vial of elemental mercury from the home of a friend. The friend's home was a rental house owned by a dentist who was storing elemental mercury in the basement for use in dental amalgams. The 15-year-old and her two sisters brought the mercury to their house without the patient's knowledge. They were playing with the liquid and they accidentally spilled it onto the carpet. The spill was cleaned by vacuuming the mercury with the household vacuum cleaner. The patient then unknowingly used the same vacuum cleaner to vacuum the floors throughout the rest of the house. The subsequent use of the contaminated vacuum cleaner may have facilitated the vaporization of the vacuumed liquid mercury and resulted in exposure of the patient to mercury vapor.

The patient and her children developed nonspecific symptoms including fever, headache, myalgias, dyspnea, and rash. They initially visited a local hospital on multiple occasions, but they were discharged with a diagnosis of a viral illness. Approximately 6 days after the exposure occurred, the patient learned that mercury had been brought into the home and the Centers for Disease Control and Prevention (CDC) was contacted immediately. The family began driving to the CDC, but CDC personnel advised them to stop at the nearest hospital, which was our medical center. When the family arrived at the ED, local physicians contacted the CDC and the Georgia Poison Control Center to obtain a treatment protocol.

Here, we present the case of the 32-year old patient, as the patient's children were treated separately in the children's hospital associated with our facility. At presentation, the patient was febrile, with a temperature of 38.9°C; tachycardic, with a pulse rate of 122 beats/min;

and tachypneic, with a respiratory rate of 22 breaths/min. She had a flat, erythematous, blanching confluent rash covering her arms and legs bilaterally, as well as her chest, abdomen, and back (Figure 1). Additionally, she complained of a headache, myalgias, peripheral neuropathy, oral paresthesia, and tender, posterior cervical lymphadenopathy.

The patient was admitted for treatment by the Internal Medicine team and daily chest x-ray studies were performed to evaluate for pneumonitis; no significant acute findings were present during the hospital stay. Twenty-four-hour urine and blood mercury levels were measured. The patient's 24-h urine mercury level prior to chelation therapy was 91.4 $\mu\text{g/L}$. The U.S. Federal Biological Exposure Index, which is the concentration that indicates exposure to mercury, is 50 $\mu\text{g/L}$ urine (1,7,8). Treatment is recommended when 24-h urine mercury levels are 100 $\mu\text{g/L}$ or greater in a patient who is symptomatic (8). The initial blood mercury level on admission was 170 ng/mL. Blood levels of mercury above 100 ng/mL indicate a diagnosis of mercury poisoning. Levels as low as 5 ng/mL are considered an unhealthy exposure, and levels of 30–40 ng/mL can have harmful effects on the brain and kidneys (7). Our team also ordered a daily complete blood count with differential in addition to a comprehensive metabolic panel, including serum creatinine to evaluate renal function. The patient's white blood cell count was low (Table 1), similar to that shown in



Figure 1. The patient presented with a flat, erythematous rash that covered her arms, legs, chest, abdomen, and back. The patient's right arm is shown here.

Table 1. Clinical Parameters of Patient During Hospital Admission

	Hospital Day 1	Hospital Day 2	Hospital Day 3	Hospital Day 4
Blood mercury (ng/mL)	170	–	–	127
White blood cells (10^9 cells/L)	3.49	2.8	3.91	4.24
Creatinine (mg/dL)	0.75	0.67	0.68	0.67
eGFR (mL/min)	106	116	116	116
Blood CO ₂ (mmol/L)	22	23	25	27

eGFR = estimated glomerular filtration rate.

Patient was admitted on Hospital Day 1 and discharged on Hospital Day 5.

animals exposed experimentally and in children exposed prenatally to mercury (9,10). The patient's serum creatinine was within normal limits but was slightly higher at the time of admission than at the time of discharge (Table 1). Likewise, the patient's estimated glomerular filtration rate (eGFR) was slightly lower at the time of admission than at the time of discharge (Table 1). Interestingly, the patient's blood levels of CO₂ appeared to be low at the time of admission but returned to normal at the time of discharge (Table 1). The changes in serum creatinine, eGFR, and CO₂ suggest a temporary, mild impairment of renal function. Blood cultures and a viral respiratory panel were also performed to rule out potential infectious causes of the patient's symptoms. The results for these two panels were negative.

The CDC recommended succimer (10 mg/kg by mouth [p.o.] three times a day [t.i.d.]) for 5 days, followed by succimer (10 mg/kg p.o. b.i.d.) for 14 days. The patient received succimer on hospital day 1, but she was switched to dimercaprol on hospital day 2 because the supply of succimer at the hospital was limited due to her children also being treated with the same medication in the children's unit of the hospital. In addition, the patients were admitted on a Friday afternoon and the hospital was unable to order additional supplies over the weekend. Dimercaprol (5 mg/kg) was administered to the patient on hospital day 2, followed by a 2.5-mg/kg intramuscular injection every 12 h for 10 days. After the first treatment, the patient became afebrile and her tachycardia and tachypnea resolved. Other symptoms, including peripheral neuropathy and myalgias, resolved by the second day of admission, and at the time of discharge, the rash had resolved completely. The patient's blood mercury levels were 127 ng/mL at the time of discharge. Other clinical parameters normalized after treatment. The home of the patient was found to be contaminated heavily with mercury and thus, the CDC sealed the home for decontamination. Consequently, the patient was discharged to the home of her mother. After discharge, the patient continued to return as an outpatient to

complete the recommended course of dimercaprol injections. The patient has been lost to follow-up so it is not known if she has had recurrence or persistence of symptoms.

DISCUSSION

Although it is uncommon for patients to present with mercury poisoning, providers should be aware of the condition and consider it as a differential diagnosis when appropriate. It is important to prevent misdiagnosis, as there are effective treatments available, including dimercaprol, penicillamine, and succimer. Removal of the source of exposure should be an initial step in care, followed by chelation and supportive therapy (6). The current case is an example of how a patient with mercury poisoning can be misdiagnosed due to the rarity of the condition and the nonspecific nature of the symptoms. In this case, treatment was delayed due to misdiagnosis with a viral infection on multiple occasions at a local hospital. Mercury poisoning has reportedly been misdiagnosed in at least one other documented case where a patient was diagnosed mistakenly with avian influenza (6). Taking a thorough history is critical in such cases, as patients can experience a flu-like illness in the first few days after exposure to mercury (6). Early recognition and prompt treatment of mercury poisoning is especially important because severe complications may occur if left untreated. Furthermore, potentially reversible complications, including nephrotic syndrome and neurological symptoms, may persist even after the source of exposure is removed, again supporting the need for early recognition and treatment (1,6).

WHY SHOULD AN EMERGENCY PHYSICIAN BE AWARE OF THIS?

Early recognition and prompt treatment of mercury poisoning is especially important because severe complications may occur if it is left untreated. Furthermore, potentially reversible complications including

nephrotic syndrome and neurological symptoms may persist even after the source of exposure is removed, again supporting the need for early recognition and treatment.

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