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Fatal Cesium Chloride Toxicity After Alternative Cancer Treatment

Daniel Sessions, MD,[1] Kennon Heard, MD,[1,2] and Michael Kosnett, MD[3]

Abstract

Background: Cesium chloride (CsCl) is sold as a treatment for several types of cancers. The purported mechanism of action is alkalinization of relatively acidic neoplastic cells. The efficacy of CsCl has not been demonstrated in controlled experiments. Oral and intravenous CsCl use has been associated with seizures, cardiotoxicity, syncope, and death. Although intratumoral treatment with various antineoplastic agents is described, no cases of intratumoral cancer treatment with CsCl have been found in the medical literature. The case described here appears to be of the first reported patient with CsCl toxicity secondary to subcutaneous exposure after attempted intratumoral injection.

Case Details: A 61-year-old woman presented in cardiac arrest 20 hours after injecting 9 mL of an oral CsCl preparation around a mass in her breast. She had been taking the CsCl orally for approximately 1 year to treat her breast mass. The patient had a headache and nausea for several hours after injection and then experienced ventricular tachycardia arrest at home. She received advanced cardiac life support care and multiple antiarrhythmic medications and underwent electrical cardioversion early in the course of the arrest. After stabilization, her electrocardiogram revealed QT interval prolongation to >700 milliseconds. Upon discovery of her CsCl exposure, she was treated with Prussian blue. Her initial whole blood cesium level was 100,000 μg/L (reference range <10 μg/L). Her QT prolongation resolved after several days, but she experienced no meaningful post-arrest neurologic recovery and died at home less than a week after exposure.

Discussion: CsCl is sold as an alternative treatment for cancer. There is no demonstrable efficacy, and clear evidence shows life-threatening toxicity. Reported here is a case of fatal CsCl toxicity after attempted intratumoral injection.

Introduction

A national survey conducted in 2007 by the National Institutes of Health showed that 38% of adults and 12% of children in the United States were treated with complementary and alternative medicine (CAM). Americans spent $33.9 billion out of pocket on CAM visits, products, and classes.[1] Cesium chloride (CsCl) is sold as an alternative treatment for several types of cancers. Its proponents often recommend a regimen of CsCl; selenium; and high doses of vitamin A, vitamin C, zinc, and amygdalin.[2] Its purported mechanism of action is alkalinization of relatively acidic neoplastic cells.[2–5] The efficacy of CsCl in treating cancer has never been demonstrated in controlled trials. However, many case reports describe CsCl toxicity.[6,7] Cardiotoxicity, including QT prolongation, monomorphic ventricular tachycardia, and torsade de pointes have been reported. Other reported toxicities include seizure, syncope, hypokalemia, hypomagnesemia, and chronic diarrhea. These toxicities have been reported with oral and intravenous CsCl use.[8] Although intratumoral treatment with various antineoplastic agents is described,[9] a review of the medical literature identified no cases of intratumoral cancer treatment with CsCI. This report describes a case of CsCl toxicity secondary to subcutaneous exposure after attempted intratumoral injection.

Case Report

A 61-year-old woman presented to a local emergency department after a witnessed arrest at home. Per her family, she reported headache, nausea, and "not feeling well" since the previous evening. She suddenly collapsed the next afternoon. She received bystander cardiopulmonary resuscitation before presentation in the emergency department. Her

[1]Rocky Mountain Poison and Drug Center, Denver Health, Denver, CO.
[2]Department of Emergency Medicine, University of Colorado School of Medicine, Aurora, CO.
[3]Division of Clinical Pharmacology & Toxicology, Department of Medicine, University of Colorado Denver, Denver, CO.

initial cardiac rhythm was polymorphic ventricular tachycardia, according to evaluation by emergency medical services. On scene and at initial presentation she was treated with standard advanced cardiac life support. Spontaneous circulation returned in the emergency department, without electrical cardioversion. The patient was intubated; cooled; and treated with lidocaine, magnesium, and amiodarone before transfer to another hospital with an intensive care unit. During her transfer, she sustained multiple episodes of ventricular tachycardia that necessitated one treatment with electrical cardioversion.

Further history revealed that the patient had a 1-year history of a right breast mass but had not seen a physician. She had no formal diagnosis of breast carcinoma. Per her family, she had no history of any cardiovascular disease. She was taking several supplements, including oral selenium and CsCl, for approximately 1 year to treat the breast lump. She was also taking potassium, vitamin D, silymarin, and folic acid supplements, as well as a multivitamin. The evening before presentation, upon advice from a nutritionist, her husband injected approximately 9 mL of an oral CsCl preparation (concentration unknown) into and around the lump. Her nausea, headache, and malaise began immediately thereafter.

On arrival to the intensive care unit, her initial vital signs included a heart rate of 58 beats per minute and blood pressure of 110/61 mm Hg. Her physical examination was remarkable for a 14 cm by 6 cm right breast mass with surrounding ecchymosis and blebs. She also had matted right axillary lymphadenopathy. She was nonverbal, displayed a disconjugate gaze, and responded to painful stimulation with decorticate posturing. Her initial electrocardiogram (ECG) showed sinus bradycardia at 45 beats per minute and QT prolongation with a corrected QT interval of 620 milliseconds. Her initial sodium level was 114 mEq/L and initial potassium level was 2.7 mEq/L. She was treated with 150 mg of amiodarone, 2 g of magnesium, and rapid correction of hyponatremia and hypokalemia. However, repeat ECG on hospital day 2 showed a corrected QT interval of 694 milliseconds despite these measures. Serum, plasma, and urine cesium levels were drawn on hospital day 2. A serum selenium level was drawn on hospital day 5. She was treated with Prussian blue, 1 mg, by mouth 3 times daily beginning on hospital day 2. Debridement of the right breast was recommended to decrease the patient's exposure to cesium. However, her family declined because of her previously stated wish to receive no surgical treatment.

She remained in sinus rhythm through the remainder of her course except for a brief episode of paroxysmal atrial fibrillation on hospital day 3 that resolved with metoprolol, 5 mg intravenously. Her corrected QT interval decreased to the normal range on hospital day 3. Unfortunately, the patient demonstrated no meaningful cortical activity after stabilization. She was discharged to hospice care on hospital day 7 with a diagnosis of neurovegetative state, anoxic encephalopathy, and breast cancer. She died 3 days after discharge at her home.

Reference laboratory results were available several weeks later. The patient's initial whole blood cesium level was 100,000 μg/L (reference range <10 μg/L). Her plasma cesium level was 27,000 μg/L (reference range <10 μg/L); her urine cesium level, 270,000 μg/L (reference range <20 μg/L); and her serum selenium level, 163 μg/L (reference range, 23–190 μg/L).

Discussion

This report describes CsCl cardiotoxicity from subcutaneous administration after attempted intratumoral injection. The patient sustained multiple episodes of ventricular tachycardia, likely from QT prolongation from injected CsCl. The patient was made further susceptible to QT prolongation by hypokalemia. Long-term oral CsCl and selenium intake also probably contributed. CsCl causes QT prolongation and arrhythmia via its blockade of potassium rectifier channels on atrial and ventricular myocytes.[10] Blockade of these potassium channels results in prolongation of phase 4 of the cardiac action potential, causing a prolonged QT. Likewise, blockade of these channels produces early afterdepolarizations, which can lead to arrhythmias, including torsade de pointes.[11]

Although debridement of the patient's injection site was recommended to decrease her exposure to CsCl, it is unclear that it would have changed her course significantly. Her wound lacked clear margins, she was already exhibiting severe toxicity, and there are no similar cases for comparison. Prussian blue was recommended because it has been demonstrated to increase the elimination of radioactive and nonradioactive cesium.[8] However, no post-treatment levels were available to assess for increased elimination.

A Google search for cesium and cancer treatment on August 29, 2012, returned 167,000 results. Of the first 10 results, 8 proclaimed that CsCl was an effective treatment for multiple types of cancer with limited adverse effects. None of these 8 sites reported ventricular dysrhythmia or death as an adverse effect. Two of the first 10 results (1 from the American Cancer Society's Complementary and Alternative Medicine page) discussed the lack of evidence supporting the efficacy of CsCl, as well as the risk of arrhythmia, syncope, and death associated with its use. This unfortunate case demonstrates the danger of CsCl use. Further cases will probably arise given the misconceptions about its safety and efficacy and its ready availability.

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Address correspondence to:
Daniel Sessions, MD
Rocky Mountain Poison and Drug Center
Denver Health
990 Bannock Street
Denver, CO 80204

E-mail: dsessi1@gmail.com