K11 Analysis of the Anticoagulant Brodifacoum in Serum After an Incident of Pesticide Poisoning

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After attending this presentation, attendees will better understand the presentation of pesticide poisoning by brodifacoum from a clinical setting as well as with the analysis of brodifacoum in biological specimens.

This presentation will impact the forensic science community by illustrating how the combination of clinical diagnostics and forensic toxicology appropriately identifies a poisoning agent.

In 2008, the Environmental Protection Agency tightened restrictions on consumer-available rodenticides due to substantial risks posed to humans. Brodifacoum, a second-generation anticoagulant rodenticide, along with bromadiolone, difenacoum, and difethialone, are no longer available in less than one pound packaging marketed to the consumer.[1] Labeled as superwarfarins, these compounds are hazardous in humans due to their long half-life anticoagulation effects which cause excessive bleeding. Commercially, brodifacoum is the most commonly used in commercial rodenticides at a concentration of 0.005% and there have been reports of accidental and intentional poisonings by brodifacoum.

A 47-year-old woman with no history of bleeding disorder developed nausea and vomiting without diarrhea after eating at a restaurant. One week later, she discovered dark blood-like urine which prompted her to go to the emergency room. She underwent an Esophagogastroduodenoscopy (EGD) during her hospitalization with no complications. Post-procedure, she developed gum bleeding and coagulation labs revealed a Prothrombin Time (PT) of >120s with an International Normalized Ratio (INR) of >9.9 and a Partial Thrombin Time (PTT) of 147.8s. PT and PTT corrected with mixing study. The patient was also found to have bleeding into the collecting system of the kidneys. She received four units of Fresh Frozen Plasma (FFP) before being transferred to another hospital for higher level care and workup. She denied any personal or family history of bleeding disorders and had multiple surgical procedures in the past without any bleeding complications. She also noted no gum bleed, epistaxis, or previous history of hematuria or hematochezia. Coagulation studies showed a decrease in vitamin K dependent factors II, VII, XI, and X of 26%, 4%, 14% and 31%, respectively. Initially her INR corrected with FFP and daily vitamin K but became elevated again two days later despite daily vitamin K. Again her INR was corrected with FFP and with an increased dose of both oral and Intravenous (IV) vitamin K. A super warfarin was suspected.

A qualitative anticoagulant poisoning panel was performed on serum that confirmed positive for brodifacoum. Other analytes in this panel include warfarin, dicumarol, diphacinone, chlorophacinone, difenacoum, and bromadiolone. The extraction of brodifacoum from serum was achieved using protein precipitation by acetonitrile after the addition of chloro-warfarin as the internal standard. Then a solvent extraction was completed using Methyl Tert-Butyl Ether (MTBE); the organic layer was dried down and reconstituted with an 80:20 mix of 0.02% ammonium hydroxide in deionized water and 0.02% ammonium hydroxide in methanol. Analysis was achieved by using High-Performance Liquid Chromatography (HPLC) separation on a BEH C18 column with negative-ion Electrospray Tandem Mass Spectrometry (LC/MS/MS) for detection. The transitions monitored for brodifacoum were 523.1>135.1 and 523.1>80.9. Values that exceeded the method cut-off of 10ng/mL were reported as positive. The response of the sample was approximately 30x that of the cut-off calibrator.

The patient denied any exposure to rat poison and did not feel anyone was trying to poison her. She denied any current suicide attempts but did state an attempt five years prior by overdosing on her antidepressants. She was cleared by psychiatry. The case was reported to the state poison control center and health department. Also the patient's local law enforcement was notified of the findings. She was cleared by the hospital's risk management department and social work department and discharged on daily vitamin K with weekly follow-ups as an outpatient for INR levels.

Reference:

1. Bradbury, S. (2008, June 24). Risk Mitigation Decision for Ten Rodenticides Retrieved from http://www2.epa.gov/rodenticides/restrictions-rodenticide-products

Brodifacoum, Pesticides, Poisoning