G39 Erroneous Diagnosis of Cadmium Poisoning Based on Postmortem Toxicology

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The goal of this presentation is to investigate the interpretation of cadmium levels in postmortem blood specimens.

This presentation will impact the forensic science community by demontrating how the observed evaluation of elevated levels of cadmium in postmortem specimens may lead to an interpretation of accidental or intentional poisoning for what is actually a poorly described artifact of cadmium pharmacokinetics. Lack of knowledge of this artifact can lead to various effects ranging from unnecessary exhumations to civil and criminal legal cases.

In 2004, county coroner (County A) in Pennsylvania ordered a heavy metal screen on an autopsy case to investigate a case of suspected poisoning. The only analyte that was abnormal was markedly elevated cadmium. Suspicion of either accidental or intentional poisoning caused the coroner to order 26 additional postmortem heavy metal studies as well as an exhumation. A comparative population study of cadmium levels was performed on a representative living population in the same community, along with a postmortem study of a similar autopsy population. These studies confirmed that the observed elevations of cadmium were postmortem artifact.

The laboratory results of cadmium were compared for the following study groups: (1) twenty seven (27) cases of postmortem cadmium analysis performed for the Coroner of County A as part of his investigation of possible poisoning, (2) nine (9) analyses of a separate autopsy population in a nearby county (County B) that has a similar demographics and incidence of possible industrial cadmium exposure, and (3) forty seven (47) analyses of a living out-patient population at the major medical center in County A.

The average measured cadmium values were as follows:

- Coroner's cases of County A - 110µg/L
- Coroner's cases of County B - 66.6µg/L
- Control (Out patients County A) - 1.5µg/L

Applying a t-test to these results reveals no significant difference between the two autopsy populations. The difference between the postmortem studies in County A and the living control population of the county is significant to a p-value of 0.003.

Cadmium is a well described human toxic agent. Almost one hundred years of research based on industrial exposures has allowed precise and extensive knowledge of toxicology of the compound. Cadmium is associated with renal and pulmonary toxicity and is considered to have carcinogenic effects. Chronic environmental exposure in Japan, in the 1950's, led to the development of *itai-itai* disease. Normal ranges for cadmium are from 0.3- 1.2µg/L in non-smokers to 0.6-3.9µg/L in the smoking population. The 1991 OSHA standard for cadmium defines a blood cadmium value of 5.0µg/L as an action limit for exposed workers. Despite its chronic toxicity, cases of acute poisoning due to cadmium are exceedingly rare and occur mostly in the context of acute fume inhalation in industry or suicidal ingestions. Even in these cases measured blood cadmium levels rarely exceed 30µg/L. Thus all the evidence suggests that the observed, massive elevation of postmortem cadmium was an artifact. This has been described only once before in the medical literature, in an environmental journal. It is mostly likely due to a postmortem disassociation of cadmium from its *in vivo* transport protein metallothionein.

Forensic practice relies heavily on the interpretation of postmortem chemistry values for the determination of cause and manner of death. Although this can often be a straight forward process, it requires knowledge of numerous artifacts. In the case at hand, an erroneous interpretation of these cadmium values could have easily led to considerations of either intentional or accidental poisonings.

In this particular part of the country, cadmium is still used in industrial processes and the possibility of environmental contamination was considered. A well controlled and efficient population study confirmed that the observed values were a postmortem artifact.

Cadmiun, Artifact, Postmortem

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