K16 Evaluating the Significance of Variation of Drug Concentrations in Antemortem and Postmortem Blood and Tissue Samples

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Upon viewing this presentation, attendees will be able to examine the postmortem changes in blood drug concentrations over time. This will aid them in determining the role such factors as postmortem interval, storage conditions and biochemical transformations have on the interpretive value of quantitative data.

This is the first known comprehensive study of its kind in humans where samples are analyzed starting from the antemortem phase and followed through the postmortem phase. This presentation will impact the forensic science community by providing information that will aid in the process of relating antemortem to postmortem drug concentrations.

Postmortem (PM) forensic toxicology seeks to determine what role, if any, drugs or poisons played in causing or contributing to death. Drug related deaths can encompass everything from overdoses to non-compliance with prescription medications to drug-drug interactions. In situations where chemical substances may have played a role in a death, it is necessary to first identify which drug(s) are present, and then to determine the concentration(s) in blood and, sometimes, in tissues from the deceased. Proper scientific interpretation of postmortem drug concentrations may be critical in the correct assessment of the cause of death. To date there is no definitive way to correlate PM toxicological results with antemortem (AM) drug concen- trations because the accurate relationship between PM drug concentrations to perimortem concentrations has yet to be established. The main reason for the hindrance is a phenomenon known as postmortem redistribution (PMR).

Put quite simply PMR is the name given for the movement of chemicals and drugs within the body after death. While living processes (including absorption, distribution, metabolism and excretion) have ceased, decompo- sition processes have begun. It is in-part, the decomposition processes (including autolysis), which allow for the release of drugs from their stored depots in tissues. The extent of redistribution may vary based upon a number of factors including: postmortem interval, sampling site (i.e. peripheral vs. central), environmental factors (i.e., temperature, humidity, etc.) and subsequent microbial activity present as a result of the aforementioned. Additionally, the chemical properties of drugs (and drug classes) play a significant role in their ability to redistribute. Some drug classes have a higher propensity than others to be sequestered in living tissues and subsequently released and redistributed after death.

This two part comprehensive study first examined the differences in AM and PM drug concentrations in blood and serum. AM samples collected from area hospitals were analyzed with the related PM samples obtained from the Miami-Dade County Medical Examiner's Office located in Miami, Fl. Multiple cases were collected, analyzed and evaluated both individually and collectively. Secondly, a study to establish of the stability of drugs within the preserved PM samples was conducted. The PM samples were analyzed at multiple time points to determine the pattern of drug concentration changes. The results of each individual case were evaluated, and the cumulative data were examined for evidence of trends or patterns.

All of the samples were maintained and analyzed solely on the grounds of the Miami-Dade County Medical Examiner's Office. The majority of the samples were stored in a walk-in refrigerator (7ºC), while some additional PM samples were frozen (-85º) upon receipt. Both liquid-liquid and solid- phase extraction techniques were utilized to produce specimens analyzed on such instruments as: GC/MS, GC/NPD and GC/ECD.

To date, PM concentrations of alprazolam, diphenhydramine, and methadone all show a decline of ≥ 20% over a two month period. When the same drugs are used to examine the differences between AM to PM drug concentrations, almost invariably the AM concentrations are significantly (≥ 50%) lower than the PM.

The data generated here will help establish a correlation between PM and AM drug concentrations. In the future this information will help guide PM interpretation and give enhanced credibility to the field of PM toxicology as a whole.

Toxicology, Postmortem Redistribution, Postmortem Release

 ** Presenting Author*