K58 Analysis of Postmortem Blood and Tissue by AccuTOF™ DART™

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After attending this presentation, the attendees will understand the potential strengths and weaknesses of the application of the AccuTOF™ DART™ system to screening of postmortem blood and tissue specimens.

The presentation will impact the forensic community by providing information about a novel technology applied to screening of postmortem blood and tissue samples.

Introduction: The innovative use of direct analysis real time (DART) coupled with time-of-flight (TOF) mass spectrometry has the potential to be of great value in the area of postmortem blood and tissue analysis. Generally, the technology applied by the AccuTOF-DART™system allows for the analysis of many samples without the need for sample preparation or solvents. Additional benefits of TOF-DART include: (1) use of limited sample size, (2) simultaneous screening and identification of a myriad of drug classes, and (3) minimal time for analysis. This system was used to analyze blood and tissue samples collected from various medical examiners' offices (Maricopa County Office of the Chief Medical Examiner, North Carolina Office of the Chief Medical Examiner, Washington State Toxicology Laboratory). The purpose of this study is to evaluate the AccuTOF-DART™system as a novel approach to expeditiously screen post- mortem toxicology samples.

Methods: More than 23 blood and tissue specimen cases were analyzed both with and without minimal sample preparation and extraction. These samples were previously analyzed by traditional postmortem techniques and collection of samples contained 32 different drugs based on the previously reported results from traditional postmortem analysis. All tissue specimens were homogenized in deionized water (1:4). Initially, blood and liver samples were extracted in n-butyl chloride, evaporated, and reconstituted in butyl acetate. As an alternative extraction and sample prepa- ration, the samples were extracted in acetonitrile, evaporated and reconsti- tuted in acetonitrile. Samples were analyzed, for the corresponding M + H ion, by AccuTOF-DART™ mass spectrometry in positive mode. TOF- DART results were compared with the results reported from previous analysis of the cases by their respective toxicology laboratory.

Results: Initial attempts with directly introducing blood and tissue specimens resulted in no detection of corresponding M+H ions from drugs of interest. It was apparent that a sample extraction or minimally a precipi- tation of proteins was necessary for detection of compounds. With TOF- DART analysis of the representative samples, the results for the solvent-extracted blood and tissues and the protein-precipitated postmortem samples were comparable. In many instances, TOF-DART analysis of a sample produced expected M+H ions for a particular drug of interest, but not for another drug, previously detected using traditional postmortem analysis. For example, amitriptyline previously quantitated at 23 mg/kg in the liver homogenate, was detected by TOF-DART; however, metaprolol and nortriptyline (reported at 25 mg/kg and 35 mg/kg, respectively) were not detected. For example methadone, was consistently detected as low at 0.18 mg/L in aortic blood and 2.1 mg/kg in liver from the same case. In contrast, benzoylecgonine, like other drugs, was undetectable by TOF-DART when it was detected by traditional methods as low as at 6.9 mg/L. This unpredictability was found to occur in both blood and tissue samples.

Conclusions: Although the AccuTOF-DART™system has the ability to detect the presence of analytes by direct analysis, current indications show that drugs are not detected in postmortem samples without extraction or protein precipitation. Even with extraction and some concentration, many drug were not detected at high or low levels in both blood and tissue samples. It has been previously reported detection of many of the drugs, such as cocaine, at lower levels when drugs spiked into blank blood or urine, but these same drugs in the more complex matrix of postmortem blood and tissue were not as readily detectable. The samples analyzed in this study are archived postmortem samples and the stability of the drugs in these particular samples was not confirmed by traditional postmortem methods after TOF- DART. The AccuTOF-DART™system is a novel approach in the analysis of compounds; however, due to the nature of many postmortem specimens it does not have the sensitivity to detect the presence of many drugs.

AccuTOF™ DART™, Postmortem, Toxicology Screening

 ** Presenting Author*