K35 Demonstrating the Need for Complete Testing Methods When Screening for Novel Psychoactive Substances (NPS)

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After attending this presentation, attendees will understand the need to consider the metabolism of known, infrequently detected compounds when screening for NPS.

This presentation will impact the forensic science community by increasing awareness that complete analytical testing profiles must be used when interpreting data regarding NPS. Sample data from two case samples will be used to demonstrate this point.

NPS use has been a main focus of forensic and clinical toxicology for the past several years. The Department of Defense (DoD) and its Drug Demand and Reduction Program (DDRP) have utilized surveillance testing to keep pace with emerging drug trends in service member urine samples. The Armed Forces Medical Examiner System (AFMES) Division of Forensic Toxicology uses Liquid Chromatography/quadrupole Time-of-Flight/Mass Spectrometry (LC/qTOF/MS) for a portion of their surveillance testing, as well as for select human performance and postmortem casework.

Toxicology analysis is often directed based on initial screening results and case history. Initial screens are typically based on enzyme immunoassay and Gas Chromatography/Mass Spectrometry (GC/MS) techniques. These approaches, while powerful, have known limitations in scope. New immunoassay kits are often unable to stay current with NPS trends. GC/MS screening methods may not yield satisfactory performance for compounds that are thermally labile or have poor volatility. New instrumentation, including LC/qTOF, is important in addressing the limitations of routine toxicology screening techniques and was used to investigate potential NPS detection in the following cases.

Case 1: Urine from a routine human performance case was screened by an alkaline GC/MS method. Ethcathinone (N-ethylcathinone), cathinone, cathine, phentermine, and trace amounts of diethylpropion were presumptively identified. An unidentified cathinone-related peak was also observed in the GC/MS chromatogram. LC/qTOF was used to confirm the previous findings, as well as propose reduced metabolites for ethcathinone and diethylpropion.

Diethylpropion (diethylcathinone, amfepramone) is a Schedule IV anorectic not commonly observed in DoD samples. Known metabolites include reductions and N-dealkylations (ethcathinone, cathinone). Inclusion of diethylpropion to screening techniques and NPS panels, particularly ones including cathinones, is vital to accurately interpret ethcathinone detection as a result of diethylpropion and not illicit NPS use.

Case 2: Hospital urine from a postmortem case was screened using a routine alkaline GC/MS method. Lamotrigine and a large, unidentified peak were detected. The unknown mass spectrum resembled a phenethylamine and was suspected as a possible NPS. Lamotrigine was confirmed by GC/MS. Midazolam and 1-hydroxymidazolam were also confirmed by GC/MS as a result of routine immunoassay screening. LC/qTOF was used to investigate the suspected NPS.

Labetalol was detected by LC/qTOF in addition to the previous case findings. Labetalol is an antihypertensive with mixed α- and β-adrenergic receptor antagonist activity. It is not commonly detected in DoD samples. After further review of the LC/qTOF data, the potential NPS was proposed as 3-Amino-1-Phenylbutane (APB), a previously reported labetalol metabolite and isomer of methamphetamine. Both the GC/MS library and LC/qTOF databases were updated using a certified reference standard for future casework.

The cases described in this presentation serve as a reminder that positive detections of "designer drugs" and suspected NPS cannot be interpreted in a vacuum; complete analytical profiles must be available to the laboratory. In certain cases, detection of these compounds may be due to metabolism from infrequently encountered, legitimately used prescription medications. Expanded testing methods, such as LC/qTOF and regularly updated GC/MS libraries, greatly aid in properly assessing NPS-related positives.

NPS, QTOF, Screening