K17 Analysis of Fentanyl Analogs and Common Drugs

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Learning Overview: This presentation will allow attendees to describe analytical challenges that currently face forensic toxicology sections while trying to stay current with the opioid epidemic and ever changing drugs of abuse. Further, attendees will understand the steps utilized to validate an Ultra Performance Liquid Chromatography/quadropole Time-Of-Flight (UPLC/qTOF) method according to the Scientific Working Group for Forensic Toxicology (SWGTOX) guidelines.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by illustrating the benefits and utility of toxicological analyses utilizing high resolution mass spectrometry.

The route most forensic toxicology testing laboratories implement to detect various drugs of abuse and their metabolites in blood specimens commonly includes a screening method followed by a confirmatory method of positive screening results. Due to the necessity for a greater sensitivity and level of specificity in confirmatory testing methods, instrumentation composed of Gas or Liquid Chromatography (GC or LC) capabilities coupled with Mass Spectrometry analysis (GC/MS, LC/MS, or LC/MS/MS) are the most utilized in the field of toxicology.[1]

The wide detection range and heightened sensitivity of Liquid Chromatography/quadrupole Time-Of-Flight/Mass Spectrometry (LC/qTOF/MS) makes it a worthy screening method. The increasing prevalence of fentanyl analogs since 2014 has led to the rapid scheduling of these substances and thus a need for the ability to test for the compounds in laboratories.[2,3] As recently noted, over two-thirds of overdose deaths recorded in the United States involved opioids, and locations in North America experienced sharp increases of fatalities due to carfentanil.[4] This information demonstrates the need for toxicology laboratories to stay current with drug trends. This presentation details studies to validate 11 fentanyl analogs as well as several other drugs and metabolites using LC/qTOF/MS.

Thirty-two analytes, including 11 fentanyl analogs, and various other commonly encountered drugs/metabolites were validated for analysis in antemortem and postmortem casework according to SWGTOX standards. Validation studies consisted of selectivity/specificity, analyte recovery, carryover, ionization suppression/enhancement, sensitivity, stability, and method comparison. During specificity studies, one of the fentanyl analogs, p-methyl acetyl fentanyl, could not be distinguished from fentanyl. All other analytes demonstrated acceptable selectivity and specificity. Sensitivity of the 11 fentanyl analogs was between 0.5–1.0ng/mL. All other analytes had sensitivities between 5–5,000ng/mL. Post-extraction stability was determined to be seven days. Ionization suppression was considered to be unacceptable; however, it did not impact limits of detection, as all analytes validated were able to be detected at relevant concentrations in multiple matrix samples. To demonstrate the method as fit for its intended use, ten samples, which had been previously analyzed by reference laboratories, were analyzed. Nine of the 32 analytes were detected. No false positives or negatives were identified. This method presents a screening technique for fentanyl analogs and commonly abused drugs in antemortem and postmortem whole blood using LC/qTOF with forensically relevant limits of detection.

Reference(s):

1. Marin, S.J., Hughes, J.M., Lawlor, B.G., Clark, C.J., McMillin, G.A. (2012) Rapid screening for 67 drugs and metabolites in serum or plasma by accurate-mass LC-TOF-MS. *Journal of Analytical Toxicology*, 36(7), 477-486.
2. Guerrieri, D., Kjellqvist, F., Kronstrand, R., Gréen, H. (2018) Validation and cross-reactivity data for fentanyl analogs with the immunalysis fentanyl ELISA. *Journal of Analytical Toxicology*, 43(1), 18-24.
3. Wilson, N., Mbabazi, K., Seth, P., Smith, H. IV, Davis, N.L. (2020) Drug and opioid-involved overdose deaths-United States, 2017-2018. *Morbidity and Mortality Weekly Report*, 69(12), 290-297.
4. O'Donnell, J., Gladden, M., Goldberger, B.A., Mattson, C.L., Kariisa, M. (2020) Opioid-involved overdose death with fentanyl or fentanyl analogs detected-28 states and the District of Columbia. *Morbidity and Mortality Weekly Report*, 69(10), 271-273.

LC-QTOF, Fentanyl Analogs, Validation

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