K35 Applicability of Biochip Array Technology to the Simultaneous Screening of Drugs Associated With Driving Under the Influence of Drugs (DUID)

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After attending this presentation, attendees will better understand the application of biochip array technology to the simultaneous screening of drugs associated with DUID, which are under-reported recommendations focused on a two-tier approach of drug analysis.

This presentation will impact the forensic science community by providing results from a new biochip array that allows simultaneous determination of drugs associated with DUID and included in Tier 1 and Tier 2 under reported recommendations. Twenty immunoassays arrayed on the biochip surface allow this multi-analytical screening from a single whole blood sample. This leads to test consolidation and an increase in the screening capacity in test settings.

Biochip array technology enables the simultaneous detection of multiple analytes from a single sample. As drug impaired driving is becoming a major problem in the United States and worldwide, recommendations for the toxicological investigation of drug-impaired driving and motor vehicle fatalities were reported. These recommendations focused on a two-tier approach of drug analysis. Tier 1 consisted of the most prevalent drugs found in the United States impaired-driving population with Tier 2 drugs being less frequently encountered, with regional significance and/or beyond the routine analytical capabilities of some laboratories. Tier 1 drugs should be the minimum testing that should be completed in drugged driving casework.[1]

Competitive chemiluminescent biochip-based immunoassays were employed. Ligands were immobilized and stabilized to the biochip surface defining an array of 20 discrete test sites (15 Tier 1 assays and 5 Tier 2 assays). The signal output is inversely proportional to the concentration of the drug in the sample.

Tier 1 assays included were: Amphetamine (AMPH), Methamphetamine (MAMP), Barbiturate (BARB), Benzodiazepine Class 1 (BENZ1), Benzodiazepine Class 2 (BENZ2), Cannabinoids (THC), Cocaine/Benzoylecgonine (BZG), Hydromorphone (OPDS), Meprobamate (MPB), Methadone (MDONE), Opiates (OPIAT), Oxycodone (OXYC1 and OXYC2), Phencyclidine (PCP), and Zolpidem (ZOL). Tier 2 assays included: Buprenorphine (BUP), Dextromethorphan (DMP), Fentanyl (FENT), Tramadol (TRM), and Tricyclic Antidepressants (TCAs). The assays are semi-quantitative and applicable to both the fully automated Evidence Analyser and the semi-automated analyzer Evidence Investigator. The systems have dedicated software to process, report, and archive the data produced. The sample volume required is 60µl of whole blood (diluted one in four).

In this initial evaluation, the cut-offs of all the assays were within the values stated in the recommendations. The assays presented the following Limits Of Detection (LOD): for Tier 1 drugs — AMPH 4.35ng/mL, MAMP 2.44ng/mL, BARB 4.41ng/mL, BENZ1 0.26ng/mL, BENZ2 0.83ng/mL, THC 1.78ng/mL, BZG 1.31ng/mL, OPDS 1.37ng/mL, MPB 13.15ng/mL, MDONE 0.61ng/mL, OPIAT 0.48ng/mL, OXYC1 0.87ng/mL, OXYC2 2.22ng/mL, PCP 0.10ng/mL, and ZOL 0.45ng/mL; for Tier 2 drugs assays presented the following LODs — BUP 0.06ng/mL, DMP 0.3ng/mL, FENT 0.13ng/mL, TRM 0.53ng/mL, and TCA 1.98ng/mL. Intra-assay precision around the cut-off value for each of the assays, expressed as %CV (n=6), ranged between 5.5% and 16.3%.

In conclusion, the results indicate applicability of biochip array technology to the simultaneous screening of drugs associated with DUID and included in Tier 1 and Tier 2 drugs under reported recommendations. The 20 immunoassays arrayed on the biochip surface presented lower LODs than the recommended cut-offs in whole blood. This methodology allows for multi-analytical screening of samples, leading to test consolidation and increased screening capacity in test settings.

Reference(s):

1. Logan B.K. et al. Recommendations for toxicological investigation of drug-impaired driving and motor vehicle fatalities. *Journal of Analytical Toxicology* 2013:*37(8):552-558.*

DUID, Biochip Array, Tier 1

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