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Development of an LC-MS/MS approach for screening and identification of benzodiazepines, z-drugs, antidepressants, neuroleptics, PDE-5 inhibitors, opioids, and new synthetic drugs in human hair and urine samples

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Abstract

Aims: In forensic toxicology hair and urine analysis play a role in monitoring abstinence or to show consumer behavior. Detection of a substance in hair of post-mortem cases indicates a previous intake so that blood concentrations of habit-forming drugs can more accurately be interpreted in case of fatal poisonings. The aim of this study was to establish an LC-MS/MS multi-analyte approach for fast target screening and reliable identification of 146 analytes (benzodiazepines, z-drugs, antidepressants, neuroleptics, PDE-5 inhibitors, opioids, and new synthetic drugs) in hair and urine. The method is based on an approach for serum, plasma, whole blood, post mortem blood, liver tissue and gastric contents (TIAFT, Hamamatsu 2012).

Methods: Samples spiked with the corresponding drugs (20 mg pulverized hair, 0.01-2.5 ng/mg; 1 mL urine, 0.00075-2 mg/L) were extracted at pH 4 and 10 with an ether/ethyl acetate mixture (1:1 v/v) after enzymatic cleavage. Extracts were analyzed by LC-MS/MS (Shimadzu LC 20; C18; AB 3200 Q-TRAP, ESI+). For screening and identification, a scheduled MRM method was developed with 438 transitions and EPI scans for library search. Limits of detection (LOD), selectivity, matrix effects and extraction efficiencies/ recovery were determined.

Results and Discussion: In spiked hair samples, LODs ranged from 0.01-1.0 ng/mg, in spiked urine samples, from 0.00075-0.8 mg/L. Selectivity problems could not be observed, but matrix effects became apparent for atropine, bupropion, clozapine, flurazepam, ketamine, olanzapine and reboxetine in both, hair (70-201 %) and urine (69-220 %). Extraction efficiencies/ recovery ranged from 70-120 % in hair and from 72-122 % in urine.

Conclusion: The presented LC-MS/MS approach as part of a universal multi-analyte concept was applicable for screening and identification of 146 analytes in hair and urine samples with respect to the analyte specific LOD, but matrix effects for the above mentioned analytes, leading to false negative results at concentrations near the LOD, have to be considered.

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