Development of a Metabolite-based LC-MS^n Screening Procedure for Detection of Drugs of Abuse and Their Metabolites in Urine

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Abstract

Aims: For a broad screening procedure, immunoassays and several chromatographic methods are in use. For completion of the authors' new metabolite-based LC-MS^n screening (Wissenbach et al., PMID: 21079926), the detectability of drugs of abuse and their metabolites within the new LC-MS^n screening approach was studied and the corresponding data added to the LC-MS^n library.

Methods: The library was built up with MS² and MS³ wideband spectra using a Thermo Fisher (TF) LXQ linear ion trap with electrospray ionization in the positive mode and full scan information-dependent acquisition. Metabolite spectra were recorded after protein precipitation of urine from rats after administration of the corresponding drugs for toxicological diagnostic reasons. After identification, the metabolite spectra were added to the library. Recovery, process efficiency, matrix effects, and limits of detection for selected drugs of abuse were determined using spiked human urine. Automatic data evaluation was performed using TF ToxID and Genebio SmileMS software (Wissenbach et al., PMID: 21079926).

Results and Discussion: After protein precipitation of the rat urine samples, the studied drugs of abuse and their phase I and II metabolites could be detected after sufficient LC separation. The data of the corresponding drugs and of the identified metabolites were added to the LC-MS^n library. This consists now of data of over 800 parent compounds, including over 80 drugs of abuse, and of over 2,000 metabolites and artifacts, among which over 300 were formed by drugs of abuse. The validation data were acceptable, so that the LC-MS^n screening was suitable for urine screening for over 80 amphetamines, designer drugs, synthetic cannabinoids, cocaine, opioids. This was confirmed by a study comparing the LC-MS results with those obtained using routine GC-MS screening (Maurer et al., 2007). THC-COOH and buprenorphine could only be detected in concentrations above 400 µg/l and 100 µg/l respectively.

In the meantime, this study was published as original paper:
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