Oral

[O25-3] O25-3: Drug abuse

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[O25-3-4] Direct and rapid analysis of drugs in serum by probe electrospray ionization tandem mass spectrometry (PESI/MS/MS)

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Background

To execute screening and/or quantification of drugs in biological fluids using mass spectrometric techniques, time-consuming sample preparation and method validation are mandatory. Since probe electrospray ionization (PESI) enables us to directly analyze target compounds in biological specimens without tedious sample preparation, we applied PESI with combination of MS/MS to direct analysis for drugs in serum.

Methods

A tandem mass spectrometer LCMS-8040 equipped with a PESI source (Shimadzu Corporation, Kyoto, Japan) was used. The cycle time of probe movement (CPM), ionization time, and the prove movement speed were 300 msec, 150 msec, and 300 mm/sec, respectively. Selected reaction monitoring (SRM) mode was used for analysis. Ten-fold diluted serum sample was applied on a sample plate (Shimadzu). A small sample cup, which was invented in our laboratory, with 50% aqueous ethanol solution was set on top of the sample, and PESI/MS/MS was executed. Authentic standards of 37 drugs including 14 drugs of abuse, 11 hypnotics and 2 metabolites, 7 antidepressants, 1 anticonvulsant, and 2 antipsychotics were used for quantitative method validation. For screening analysis of 161 drugs, scheduled-SRM mode was applied.

Results

Our invented sample cup successfully acted as the ethanol supply to the probe tip, resulting in direct detection of drugs in serum. Method validation demonstrated sufficient results: linearity of the calibration curves (R^2) were 0.983-0.999, and the calculated LOD and LOQ values ranged between 0.12-0.49 and 0.33-1.5 ng/mL, respectively. Quantitative analysis for 37 drugs were completed within 19 sec. We also succeeded in expanding the method to wide screening of 161 drugs, where total measuring time was 1 min 22 sec. For practicality evaluation, postmortem serum samples obtained from autopsies were analyzed by the method and successfully detected zolpidem and synthetic cannabinoids. The qualitative and quantitative results were also confirmed by liquid chromatography-quadrupole time-of-flight mass spectrometry (LC/Q-TOFMS).

Conclusions

PESI/MS/MS achieved high sensitive and ultra-fast analytical method for drugs in serum without tedious sample preparation. This technique will be expanded to on-site drug screening during autopsy or rapid quantification of drugs for therapeutic drug monitoring in the near future.