Drug screening in serum samples with the Dade Behring Viva-E™ System

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AIMS: The object of the study was the evaluation of the Emit® II Plus urine tests for the detection of drugs in serum samples. Assay parameters were to be optimised to enhance sensitivity.

METHODS: The urine tests for cannabinoids, opiates, cocaine metabolite (benzoylecgonine), amphetamines, and ecstasy were used to screen serum samples with special consideration of the substances listed in § 24a of street traffic law in Germany (THC, morphine, benzoylecgonine, amphetamine, MDMA, MDEA). In a first step additional calibration points were added in the lower concentration ranges of the calibration curves. Then, for each parameter approximately 100 positive serum samples and at least 20 drug free serum samples were measured within a few days after taking or after storage at –20°C for up to 3 years. The results were compared to those of a gas chromatography/mass spectrometry analysis. Within-run precision was determined using calibrators of a low and a high concentration and a positive serum pool (n = 20). Between-day precision was calculated measuring the same calibrators and serum pools in duplicate on 20 days. Finally – for amphetamines and ecstasy – the ratio of sample to buffer volume and the antibody amount was modified to detect low concentrations as well.

RESULTS: Using a modified cubic spline it was possible to calibrate the assays at much lower concentrations than those recommended by the manufacturer for urine samples. However, high calibrator concentrations had to be left out. Serum samples could be analysed by the Emit® II Plus urine tests for the presence of cannabinoids, opiates, benzoylecgonine, amphetamines, and ecstasy without prior sample preparation. The cut-off values could be reduced because negative serum samples had very low background absorption except for some serum samples in the amphetamine test. The coefficients of variation (CV) for within-run and between-day precision were in the following ranges: for cannabinoids between 1.4% and 5.6%, for opiates between 2.2% and 3.4%, for benzoylecgonine between 4.9% and 10.0%, for amphetamines between 1.8% and 12.0%, and for ecstasy between 3.4% and 30.6%. The Emit® II Plus urine tests adapted to low calibration levels were able to detect a high dosage or an intoxication in all cases except for amphetamines: some samples with high concentrations over 200 ng/mL amphetamine tested negative. In connection with § 24a of German street traffic law the following cut-off values for driving under the influence of drugs are recommended: 1 ng/mL THC, 10 ng/mL morphine, 75 ng/mL benzoylecgonine, and 25 ng/mL amphetamine, MDMA or MDEA, respectively. Cannabinoids, morphine and benzoylecgonine were found in nearly all of the samples which contained concentrations in the range of the recommended cut-off values. For amphetamine and ecstasy the tests were not sensitive enough. After changing the ratio of sample to buffer volume and the antibody amount for the amphetamine and ecstasy tests the sensitivity increased.

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CONCLUSIONS: Serum samples can be analysed by the Emit® II Plus urine tests without prior sample preparation if they are measured within a few days after taking or had been stored deep frozen prior to analysis. How far the cut-off values can be lowered in comparison to the urine application depends on the requirements of the laboratory. If a confirmation of potentially positive samples is obligatory – as it is in forensic cases – very low cut-off values can be used. For ecstasy and amphetamines a special optimisation of assay parameters enhances sensitivity for serum samples.

KEYWORDS: *Viva-E, Emit II Plus, Serum, Amphetamines, Benzoylecgonine, Ecstasy, Opiates, Cannabinoids*

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