Simultaneous quantification of 14 drugs of abuse from a single hair sample, using GC-MS detection

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Introduction

Hair analysis is being increasingly requested for clinical and post mortem analysis. As the growth rate in hair is fairly uniform (~1 cm/month) and once incorporated drugs are detectable for long periods a greater window of detection than for urine or blood may be found. Drugs may be incorporated into the hair through three mechanisms:

- Drugs present in the blood stream are incorporated into the hair in the follicle
- Transfer may occur from sweat into the hair
- Environmental contamination may occur through exposure to smoke or powdered drugs

Useful in post mortem cases where longer term drug history is unknown

Usual screening method is radio immunoassay (RIA), followed by GC-MS confirmation. This increases costs due to multiple tests

A single test detailed here has been devised for simultaneous extraction of a variety of drugs of abuse and metabolites in hair, useful were sample size is limited

Method

A hair sample of approximately 1 cm in diameter taken from the rear of the head was requested for analysis, then segmented into the required lengths (~1 mm)

- Washing should remove external contamination
- Calibration line prepared using a standard solution for all drugs (0, 5, 10, 50, 100, 200 ng/sample)
- Internal standard added (D200 ng/sample)
- Metabolites analysed to show ingestion of drug (and hence metabolism), presence of drugs of abuse and metabolites in hair, useful when limited sample is available
- Validation results within acceptable criteria (linearity, %CV)
- Good limits of detection for all compounds

Validation

- Detection of illicit drug use during pregnancy or during other treatment regimen
- Also picks up (in scan) nicotine, methadone, anti-depressants, anti-psychotics, ketamine...
- Good limits of detection for all compounds
- Possible uses:
  - Post mortem analysis of hair alongside other available samples may be routinely requested, or even where no other suitable sample is available
  - Clinical applications, drug use per month may be analysed for compliance with regimen
  - Detection of illicit drug use during pregnancy or during other treatment
- Dose response relationship not seen in methadone users (2) but possibly further study will show relationships for other drugs.

References


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<th>Drug</th>
<th>R² (typical)</th>
<th>QC A (ng/mg)</th>
<th>QC B (ng/mg)</th>
<th>Intraday %CV N=6</th>
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Example Calibration Lines

- y = 0.0026x + 0.0002 R² = 0.9964
- y = 0.0005x + 0.0031 R² = 0.9972
- y = 0.0057x + 0.0018 R² = 0.9984

Summary

- Simultaneous analysis and quantitation of several classes of compounds achievable
- Validation results within acceptable criteria (linearity, %CV)
- Good limits of detection for all compounds
- Possible uses:
  - Post mortem analysis of hair alongside other available samples may be routinely requested, or even where no other suitable sample is available
  - Clinical applications, drug use per month may be analysed for compliance with regimen
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Dose response relationship not seen in methadone users (2) but possibly further study will show relationships for other drugs.