K47 Postmortem Analysis of Cocaine, Benzodiazepines, Opiates, and SSRIs in Hair

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The goal of this study is to compare the occurrence of drugs in hair with findings in corresponding femoral blood specimens from several medicolegal death investigations.

This presentation will impact the forensic community by explaining how hair specimens can provide a unique avenue of study in cases of severe decomposition, embalming, or chronic fetal drug exposure.

The purpose of this study was to compare the occurrence of drugs in hair with findings in corresponding femoral blood specimens from several medicolegal death investigations. Hair specimens can provide a unique avenue of study in cases of severe decomposition, embalming, or chronic fetal drug exposure. Extracts from hair can be applied to ELISA, LC-MS, and GC-MS analytical techniques for drug screening and confirmation. In the present study, hair extracts were evaluated by ELISAs according to the shown cut-off values, and also assessed by LC- MS/MS library matching. These results were compared to the drugs found in the corresponding femoral blood collected at autopsy.

ELISA cut-off values (pg/mg)

Carisoprodol	1000
Cocaine	500
Benzos	200
Fentanyl	20
Methadone	200
Opiates	200
Oxycodone	300
Tramadol	1000
Propoxyphene	200
Amphetamine	500

Parent drugs, as well as some of the metabolites, accumulate within the hair cortex as the follicle grows. This evidence of drug use is stably incorporated into the hair, and does not usually diminish with standard hygienic practices. It is possible for drugs to associate with hair indirectly through sweat and sebum secretions, as well as contact with drug powder or smoke. However, when proper external decontamination is applied in combination with the presence of biologically derived drug metabolites, issues surrounding lingering external contamination diminish.

Hair must be broken down to release the drugs trapped within the protein structures, which can often destroy drug evidence or obscure the interpretation of parent/metabolite ratios. Current methods involve the use of mechanical or harsh chemical treatments to degrade hair. Mechanical disintegration requires specialized equipment, and strongly acidic or alkaline chemical treatments can further degrade the compounds of interest. This work describes methods for analyzing the drugs in hair with minimal effort, without destroying evidence.

Ten postmortem hair specimens were chosen for evaluation, which represent a wide variety of putative cocaine, benzodiazepine, SSRI, opiate, fentanyl, and methadone combinations based on prescribed and historical drug use. The hair samples (10-20 mg) were washed, dried, and weighed before further analysis to remove external contaminants. Extracts for ELISA analysis were prepared by incubating hair specimens in phosphate buffer for 2 hours at 60ºC. These formulations were diluted 1:5 in phosphate buffer before analysis. For LC-MS/MS analysis, the specimens were immersed in a 200 mM dithiothreitol solution, supplemented with a 100 ng/mL mepivacaine internal standard. Following 2 hours incubation, the extract was diluted with a 0.2% formic acid/20% acetonitrile solution, then filtered and stored in autosampler injection vials. The yield of drugs produced by this method was sufficient to apply towards LC-MS/MS screening library and confirmation assays.

The results obtained from these methods correlated well with drugs found in femoral blood extracts, where the cause of death was usually attributed to combined drug toxicities. The presence of other drugs in hair that were not present at the time of death illustrated a history of use. Additionally, the presence of other alkaloids and adulterants were found, such as noscapine and lidocaine, which supports the evidence of illicit sources of opiates and cocaine. Such contaminants are usually found in clandestine compositions, while pharmaceutical

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companies provide cleaner preparations. These detection procedures are technically feasible and efficient methods for releasing drugs trapped within hair for the purposes of forensic toxicology analysis, which aids in describing a pharmacological history of the decedent.

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