the possibility of opioid tolerance. In the urine of methadone maintenance patients the ratio of EDDP to methadone may be significantly greater than 1 albeit with considerable variation.

Consequently segmental analysis was carried out on a hair sample with the following results:

Segment cm	Methadone ng/mg	EDDP ng/mg
0–1	0.10	Not detected
1–2	0.12	Not detected
2–3	0.26	Not detected
3–4.3	0.49	Not detected
Wash	Not detected	Not detected

In the absence of detectable EDDP, these results were not conclusive for the prior consumption of methadone. Methadone contamination of hair may result from sweating, and it was noted that the room where the child was found was very hot and stuffy. Therefore it was not possible to be definitive about the prior use of methadone.

Discussion

The 'ante-mortem', hospital blood and serum samples showed that a potentially lethal amount of methadone was involved. The values for methadone blood levels in fatalities in the literature vary considerably for example from 0.28 to 3.1 mg/L, mean 0.28 in one survey (Worm et al. [1]) to a mean of 0.58 and 1.0 mg/L respectively in two other surveys (Milroy and Forrest [2] and Karch and Stephens [3]). Furthermore for methadone maintenance patients, blood levels of methadone overlap the fatal levels for non-tolerant individuals. Therefore it is important to know the degree of tolerance of an individual before any interpretation is carried out. Hair analyses may help and high relative amounts of EDDP to methadone in the urine may also give some information about prior use, notwithstanding the limitations indicated above. However, it is much less likely that a child would be tolerant than an adult who was an ex-drug abuser and participating in a methadone programme.

A small child, who may be 15–20 kg in weight, would obviously be consuming an overdose, if the adult therapeutic amount were involved, especially if it were a high dose as may be achieved during maintenance use. Although methadone displays typical opioid effects it is said to be less sedating than morphine, the benchmark opiate. Methadone also is rather slow to act when taken orally and peak plasma levels may not occur for several hours. Therefore notwithstanding the smaller body-size of a young child permitting faster circulation of the drug compared with an adult, the typical CNS depressant effects of an overdose such as drowsiness, coma, slowing of breathing and heart-rate may be slow to occur possibly contributing to further consumption due to lack of perceived effect. The concentration of methadone in the stomach contents indicated that the oral route was involved and that the ingestion had probably been at least an hour or so prior to death, perhaps reinforcing the slow action scenario. There was no obvious colour of green methadone linctus in the stomach contents.

The results of the various post-mortem samples indicated that some redistribution of methadone took place and was typical for a drug with a volume of distribution of 4–5 L/kg, that is chemically basic and quite lipophilic (Log P octanol/pH 7.4 partition coefficient is 2.1) [4].

A further issue is the possible stability of EDDP as the levels relative to methadone in blood and serum and some tissues appeared to show considerable variation. This issue is complicated by the fact that the Human Tissue Act makes it difficult to match tissue matrices when performing extractions so that there may be deviation from ideal behaviour during analysis.

Therefore caution should be applied to interpretation of post-mortem methadone and EDDP levels in these cases. If ante-mortem samples are available then these should be used in preference to the post-mortem samples. In the absence of ante-mortem samples and taking into account the relative paucity of data, the use of tissues could help minimise the drug redistribution effects in the blood.

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The correlation of blood drug concentration between manner of death and cause of death. Doxylamine

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Abstract

Doxylamine is used in the short-term treatment of insomnia, and is an antihistamine of the ethanolamine class. It is available in tablets containing 25 μg of the succinate salt, and also used in combination with decongestants and other medications to relieve sneezing, runny nose, and nasal congestion caused by the common cold. However, doxylamine is most frequently misused in criminal cases such as suicide, homicide, rape and robbery in this country.

This paper reviewed cases investigated by the National Institute of Scientific Investigation in which postmortem toxicological studies indicated the presence of doxylamine over the period from 2005 to April 2007 to examine the role of the drug in these deaths. A total of 117 consecutive cases were studied, including 26 in which death was attributed to doxylamine toxicity only, 26 combined drug toxicity, 14 to drowning, 13 to suffocation, and 13 to hanging. There was a considerable overlap in the postmortem blood doxylamine concentrations among the groups. Concentrations ranged from 0.83 μg to 204.6 μg/L (mean: 24.63 μg/L) in cases where death was attributed to doxylamine toxicity; 0.08 μg to 137.9 μg/L (mean: 17.83 μg/L) in cases of combined drug toxicity; 0.08 μg to 12.4 μg/L (mean: 3.11 μg/L) in cases of drowning; 0.06 μg to 19.24 μg/L (mean: 3.72 μg/L) in cases of suffocation; and 0.4 μg to 19.84 μg/L (mean: 5.74 μg/L) in cases of hanging. The concentration of doxylamine detected indicated that it may not be possible to establish a lethal doxylamine range because some deaths occurred at doxylamine concentrations below the previously reported lethal range. Determining the cause of death and manner of death in doxylamine-positive cases necessitates correlations with toxicological analyses, medical reports, police report, autopsy protocols and investigative findings.

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Determination of drugs in "Alternative Biological Matrices"

Christine Moore

Abstract

With technological advances in extraction methods, immunoassay screening and instrumental techniques, interest in testing biological matrices other than urine, blood and serum has increased dramatically over the last few years. Almost every biological matrix can be tested in some way and provides unique information over other fluids and tissues.

The increasing utility of immunoassay screening procedures, specifically ELISA, in forensic laboratories provides two major benefits: 1) biological background is washed away, enhancing the sensitivity of the assays and 2) automated instrumentation has allowed an increase in the number and type of specimens which can be processed on a routine basis. Finally, the availability and affordability of bench-top liquid chromatographic systems with tandem mass spectrometric detection systems (LC-MS/MS) has allowed confirmatory methods to be reliably implemented.

Application	Standard matrix	Alternative matrices	Advantages	Disadvantages
Workplace	Urine	Oral fluid	Rapid, easy, observed collection. Difficult to adulterate. Extensive drug profile	Dry mouth. Specimen volume.
		Hair	Difficult to adulterate. Extensive drug profile. Long window of detection. Drug stability; easy storage	External contamination. Colour bias.
		Sweat	Observed collection Drug stability; easy storage. Observed collection. Easy to collect (patch).	Specific applications. Collection takes 24 h.
Post-mortem toxicology	Blood, liver, and urine	Hair	Unlimited specimen. May provide drug history.	Contamination.
		Vitreous humor	Easy collection. Protected from putrefaction.	Specimen volume.
		Bone marrow, bone, and teeth	Skeletonized remains.	Post-mortem only.
		Brain Nails	Greater drug stability; less putrefaction.	Specimen amount; area of sampling.
Fetal drug exposure	Urine	Meconium	Long window of detection.	Heterogeneous sample.
		Amniotic fluid	High sample volume.	Labour intensive analysis.
		Breast milk	Wide drug profile.	Difficult to collect.
		Maternal hair	Long window of detection.	Difficult to collect.
		Neonatal hair		High lipid content. External contamination. Small sample size.
Criminal justice				
1. DFSA	Blood, urine	Hair	May provide drug history.	Single dose may not be detected.
2.Parole-probation	Urine	Sweat Oral fluid	Drug use over time can be monitored. Rapid routine collections.	Parolees may remove patches.
3. DUID	Urine/ blood	Oral fluid	Easy to collect at roadside. Free drug circulation; correlation with impairment? Free drug circulation; correlation with impairment?	Insufficient data at this time, but studies are on-going (NRS; DRUID).
4. Child custody	Urine	Hair	Environmental drug exposure.	
5. Drug court	Urine	Oral fluid	Gender independent observed collection.	

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50 years of forensic toxicology

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Abstract

The body of a 1 month-old male was found in a rucksack. Drug paraphernalia was found at the parents' address. Heroin and 'Distalgesic' were also found there. Table 1 illustrates the drugs detected from the deceased.

Table 1

Sample	Alcohol result (mg/100 ml)	Drugs detected
Preserved heart blood	15	Free morphine 2. 1 µ1 µg/ml Total morphine 3.7 µg/ml Paracetamol c. 140 µg/ml 6-MAM and codeine detected Insufficient sample for further testing
Unpreserved urine	42	Positive immunoassay tests for opiate drugs and free morphine but insufficient sample for further testing
Thigh muscle	Not analysed	Free morphine c. 2. 5 µg/g Total morphine c. 3.1 µg/g Paracetamol c. 131 µg/g Propoxyphene c. 3. 1 µ1µg/g
Stomach content	Not analysed	Morphine c. 40 µg in total Very low levels of paracetamol and propoxyphene