Post-mortem Drug Analysis of Plaque Samples in Seven Intoxication Cases

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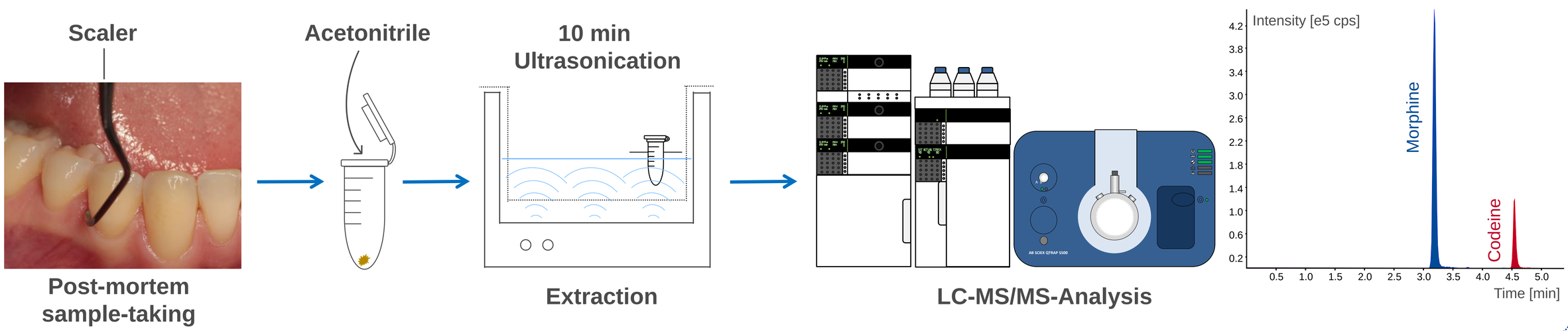
Objective

Non-mineralized dental biofilm (plaque) as material for drug analysis might extend the spectrum of common biological matrices (e.g. blood, urine, hair) used in forensic toxicology, especially in post-mortem drug analysis. So far, the retention of extraneous substances in plaque has been investigated only sparsely. Hence, post-mortem plaque samples from seven intoxication cases were analyzed for illicit and medicinal drugs using liquid chromatography-tandem mass spectrometry (LC-MS/MS). Since opioids show a high prevalence in intoxications, findings for morphine and codeine (also metabolites of street heroin) in plaque are highlighted here. The results were compared to those of routinely analyzed hair and body fluid (femoral blood, urine) samples.

Methods



Results & Discussion

	Table 1	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7
	Dried mass plaque sample [mg]	1.6	6.3	1.0	2.4	4.4	1.0	0.76
Morphine	Femoral blood [ng/mL]	310	54	1,200	1,500	×	×	×
	Urine	✓	✓	✓	n.a.	×	×	×
	Hair (proximal-distal) [pg/mg]	n.a.	870 – 680	170 – 240	190 – 180	520 – 740	× – ~ 86	×
	Plaque [pg/mg]	43	~ 490	1,400	~ 8,100	~ 5.8	14	90
Codeine	Femoral blood [ng/mL]	21	~ 2.4	130	×	×	×	×
	Urine	×	✓	✓	n.a.	×	×	×
	Hair (proximal-distal) [pg/mg]	n.a.	240 – 140	×	×	140 – 140	×	×
	Plaque [pg/mg]	290	44	400	~ 2.8	×	×	×

Table 1: Results Case 1 – 7, ✓ = detected (not quantified), × = not detected, n.a. = not analyzed, ~ = approximately (extrapolated)

Findings

Morphine:

- Plaque samples ✓: 7/7
- Concentration range: ~ 5.8 to ~ 8,100 pg/mg
- Median value: 90 pg/mg

In two cases (5 and 6) morphine has not been detected in the investigated body fluids (femoral blood and urine) but in hair and plaque. In case 7 morphine has been exclusively found in the plaque sample. In cases 1 – 4 morphine has been detected in all investigated matrices (body fluids, hair and plaque).

Codeine:

- Plaque samples ✓: 4/7
- Concentration range: ~ 2.8 to 400 pg/mg
- Median value: 167 pg/mg

Codeine has been exclusively found in plaque and in no other material in case 4. In case 1 codeine has been only found in femoral blood and in the plaque sample (no hair available in this case). In case 2 all investigated materials and in case 3 all samples except for the hair sample were positive for codeine.

Case History

Cases 1 – 3: A heroin overdose led to death. High concentrations of morphine and codeine in femoral blood, as proof for a recent uptake of heroin, were also reflected in the investigated plaque sample.

Case 4: A morphine overdose was fatal and led to high morphine concentrations in femoral blood as well as in plaque. Additionally, hair analysis proved a regular morphine uptake over a sustained period of time.

Case 5 and 6: Heroin use was not fatal but a regular, non-recent use has been reported. Consistently, morphine and codeine were not found in body fluids but in hair, which represents a larger window of detection than body fluids. In both cases morphine was detected in plaque as well.

Case 7: A history of heroin addiction has been reported, but neither morphine nor codeine were found in any routinely investigated material. Hence, morphine findings in plaque served as the only analytical evidence for a possible heroin uptake.

Conclusions

The results show that opiates are retained in plaque and can be detected using the here-presented method. Compared to other matrices (especially body fluids), plaque may offer a larger window of detection as demonstrated in three of seven cases. In one case morphine was exclusively found in plaque confirming an uptake of opiates that would have been missed by the routinely analyzed matrices. Therefore, plaque might be a suitable additional alternative matrix in forensic toxicology, especially if other material is not available (e.g. in case of burning).

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