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Letter to Editor

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In Heroin-Related Fatalities, Testing for 6-Acetylmorphine in Vitreous Humor Seems to Be of Higher Sensitivity than in Blood or Urine

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To the Editor:

Abuse of heroin (diamorphine) and heroin-related deaths remain a problem of concern in many countries. In cases of fatal intoxication, the confirmation of heroin abuse as a contributory factor to death frequently depends on evidence obtained from the examination of postmortem reports, police reports and witness statement. Nevertheless, the detection of the specific metabolite of heroin, 6-acetylmorphine (6-AM), is the best marker of recent heroin intake in postmortem samples as a consequence of the rapid metabolism of heroin. However, esterase-mediated conversion of 6-AM to morphine occurs quickly in blood (half-life of 6-AM in blood: 6 to 25 min), and consequently, 6-AM can usually be detected in this matrix for <3 hours postexposure (1). Being a major route of elimination and having limited esterase activity and high concentrations, urine is generally thought to be the best specimen for 6-AM detection (2, 3). However, in postmortem situations, vitreous humor (VH) is also of interest. VH resistance to putrefactive change coupled with the lack of esterase activity results in greater 6-AM stability, a longer half-life and extended detection time window (4–7).

In postmortem situations, blood, urine and VH are variably available depending on putrefaction status of the corpse and circumstances of death. When blood and VH are both available, several reports highlighted that 6-AM was more favorably detected in VH than in blood (4–9). When urine is also available, Pragst et al. reported that urine is superior to VH for postmortem detection of 6-AM (2). In our routine forensic practice, we experienced 6-AM detection more frequently in VH than in urine. In the literature, there is no reported 6-AM detection data after simultaneous blood, VH and urine analysis. As a consequence, we thought it would be interesting to determine sensitivity of each matrix (blood, VH and urine) in cases for which 6-AM was initially detected in at least one of them. We have retrospectively selected 57 cases analyzed between 2017 and 2019 after the exclusion of samples with demonstrated contamination, such as VH contaminated by blood, or from decomposed bodies. The 57 selected cases had (i) available blood (87% from femoral origin) sampled in NaF-containing tubes, VH and urine samples and (ii) positive qualitative detection of 6-AM in at least one of these postmortem samples using LC–MS-MS (LOD 0.5 µg/L) (10). All samples were stored at +4°C before analysis that was performed after an average of 7 days, and the 3 samples from each case were analyzed at the same time. The sensitivity of 6-AM in each biological fluid was calculated using the ratio of the number of cases with 6-AM detection in the selected biological fluid to the number of cases with 6-AM detection in at least one biological fluid.

The results from the present study, as well as from data extracted from the literature, are presented in Table I. As expected, in our study (and other previously published ones), urine exhibits a better sensitivity (70%) than blood (61%) for detecting 6-AM. VH, however, showed even greater sensitivity (93%) than urine contrasting with conclusions of Pragst et al. (2). Without VH analysis, 6-AM would have not been detected in 7 of our 57 cases. It is obvious that this study is limited and can be discussed regarding the following points: small sample size, retrospective study restricted to qualitative results, bias possibility due to stability variability in sampling tubes, storage conditions and delay between sampling and analysis. Nevertheless, from a practical point of view, this result should encourage forensic toxicologists to systematically perform 6-AM assays in VH, when available (and taking into account the potential limited volume of VH available, specifically when the laboratory procedure includes volatile analysis and biochemical testing in this matrix), in cases of heroin overdose-suspected fatality, and even if urine is available.

Table I. Sensitivity of 6-AM detection in postmortem blood, vitreous humor, urine and other matrices.

Reference	Number of cases	Case selection process	Calculated sensitivity (number of positive results)			
			Blood	Vitreous humor	Urine	Other matrices
Present study	57	6-AM detection in blood, and/or vitreous humor and/or urine	61% (35)	93% (53)	70% (40)	
2	26	6-AM detection in vitreous humor and/or urine	*na*	73% (19)	90% (26)	Cerebrospinal fluid[a]: 63% (12)
8	16	6-AM detection in blood, and/or vitreous humor	62% (10)	100% (16)	*na*	Bile[b]: 23% (3)
9	17		76% (13)	88% (15)	*na*	
6	57		37% (21)	96% (55)	*na*	
5	17		50% (6)	100% (12)	*na*	
3	25	suspected heroin-related deaths	52% (13)	100% (25)	*na*	Cerebrospinal fluid: 64% (16)
7	44		61% (27)	100% (44)	*na*	Brain: 43% (19)
4	52		17% (9)	71% (37)	*na*	

(na, not available; [a]calculated sensitivity for cerebrospinal fluid in 19 out of 26 cases; [b]calculated sensitivity for bile in 13 out of 16 cases)

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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