K70 A Comparison of Cannabinoid Concentrations in Central and Peripheral Postmortem Blood Samples

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Learning Overview: The goal of this presentation is to provide toxicological evidence that demonstrates the limitations of interpreting postmortem cannabinoid concentrations in blood.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing data demonstrating the variability of cannabinoid concentrations in blood collected from central and peripheral sites in medicolegal death cases.

Introduction: Variable concentrations of Delta-9-Tetrahydrocannabinol (THC) and its metabolites, 11-OH-Tetrahydrocannabinol (OH-THC) and Delta-9-Carboxy-Tetrahydrocannabinol (THCC), have been reported when comparing postmortem specimens collected at different times during the postmortem interval and from different sites in the body. This is the first study to compare central and peripheral blood cannabinoid concentrations in blood collected at the same time in a larger number of cases.

Methods: Central blood (identified as heart, chest, inferior vena cava, or subclavian) and peripheral blood (identified as femoral or peripheral) were collected during routine postmortem examinations. Peripheral blood was initially screened for cannabinoids using Enzyme-Linked Immuno-Sorbent Assay (ELISA) (cutoff concentration, 10ng/mL). Presumptive positive cases were subjected to confirmatory testing by Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS) for both peripheral and central blood samples. Additionally, antemortem samples were tested, when available. LC/MS/MS cut-off concentrations and Upper Limits Of Linearity (ULOL) were THC (0.5, 50ng/mL), OH-THC (1.0, 100ng/mL) and THCC (5.0, 500ng/mL). The ratio of the peripheral to central concentration of each analyte was determined for those analytes within the linear range of the assay. Additionally, a linear regression analysis between peripheral and central cannabinoid concentrations was performed. Analytes quantitating below the cutoff and greater than the ULOL were not included in the calculations.

Results: A total of 62, 65, and 39 pairs of blood samples were compared for THC, THCC, and OH-THC, respectively. As expected, the highest mean (3.16) and median (1.57) peripheral to heart blood ratio was for THC although the range was large (0.30–30) as reflected by a standard deviation of 4.91. The less lipophilic metabolites had ratios much closer to unity: THCC (mean 1.06, median 0.95, SD 0.61, range 0.28–4.05); OH THC (mean 1.14, median 0.96, SD 0.55, range 0.51–3.18).

Linear regression analysis (r-squared) for peripheral vs. central THC, THCC, and OH-THC were 0.1943, 0.7443, and 0.9382, respectively. However, if the three highest concentrations of OH-THC (>20ng/mL) were deleted from the analysis, the r-squared value for this analyte fell to 0.4891. Additionally, there were five cases for which antemortem hospital blood samples were collected. The results for these cases are summarized in the table below:

Case	Date / Time	Blood	THC	THCC	OH-THC
1	11/17/2017 10:06	Antemortem	16	160	7.1
	11/18/2017 8:30	Central	18	100	5.4
	11/18/2017 8:30	Peripheral	>50	95	7
2	2/9/2018 14:30	Antemortem	0.94	7.5	ND
	2/10/2018 8:29	Peripheral	6.1	<5.0	ND
3	4/9/2018 21:35	Antemortem	26	94	7.3
	4/10/2018 10:50	Central	20	64	4.7
4	5/20/2018 unk	Antemortem	26	31	4.2
	5/21/2018 10:00	Central	12	40	6
	5/21/2018 10:00	Peripheral	11	23	3.3
5	7/3/2018 22:44	Antemortem	0.67	8.6	ND
	7/5/2018 9:45	Central	1.0	10	ND
	7/4/2018 18:10	Peripheral	3.9	6.2	ND

Conclusions: Postmortem peripheral blood THC concentrations exceeded central blood concentrations in 80% of cases studied. Additionally, in three out of four cases where antemortem blood was collected the day prior to peripheral blood, peripheral blood THC concentrations exceeded antemortem THC concentrations. Cannabinoid concentrations in postmortem blood can be subject to significant variability, and THC concentrations, in particular, should not be interpreted as if they were antemortem blood specimens.

Cannabinoid, Postmortem, Variability