

Case History:

The decedent is a 52-year-old male with a longstanding history of illicit drug use. Due to his disruptive behavior at a public park, he was transported by law enforcement to a holding cell at the local jail at approximately 3 PM. He was later found to be lethargic in the same holding cell at approximately 4 PM and transported to the hospital by ambulance. The male was triaged and treated, but death was pronounced within minutes after arrival. The cause of death was ruled as multidrug intoxication and the manner of death was accident. In a civil deposition related to the law enforcement handling of the case, you are asked to opine about the discrepant cocaine and cocaethylene results in the blood samples (see Figure 1).

What is the most likely reason for cocaine and cocaethylene being positive in subclavian blood, but not detected in hospital blood?

- A. Surreptitious cocaine use while being left unobserved in the ambulance.
- B. Laboratory error.
- C. The cocaine and cocaethylene concentrations have increased in subclavian blood because of postmortem redistribution.
- D. The preservative in the hospital blood collection container is ineffective in maintaining cocaine and cocaethylene concentrations.
- E. Cocaine continued to be absorbed, distributed, metabolized, and eliminated from the time of the hospital blood collection to the time of death.

MATRIX SOURCE	RESULTS
Hospital Blood (Lavender Vial)	Ethanol: 0.155 g/100 mL Cocaine - None Detected Cocaethylene - None Detected Benzoylecgonine: 2100 ng/mL
Subclavian Blood (Gray Top Tube)	Ethanol: 0.145 g/100 mL Cocaine: 330 ng/mL Cocaethylene: 300 ng/mL Benzoylecgonine: 4800 ng/mL
Urine	Ethanol - Positive Benzoylecgonine - Positive Not Tested - Cocaine, Cocaethylene

Case courtesy of Laura Labay, Ph.D., NMS labs

A: Surreptitious cocaine use while being left unobserved for a moment in the ambulance (1.58% responses)

The possibility of this event happening is best evaluated based upon scene investigation outcome. Was the decedent in the ambulance in possession of cocaine? Was drug paraphernalia located on his person? If not, alternate explanations for the presentation of the results should be considered.

B. Laboratory error (1.93% responses)

Accredited forensic toxicology laboratories employ several analytical safeguards to ensure the accurate reporting of results. This includes screen and confirmation testing, appropriate use of quality controls, and having two different people review analytical results. Even with this, however, errors are possible. If there is concern about laboratory error, consultation with laboratory staff is required. Data re-review and repeat or additional testing are options that can be used to verify reported results.

C. The cocaine and cocaethylene concentrations have increased in subclavian blood because of postmortem redistribution (19.65% responses)

Postmortem redistribution (PMR) is a change of drug and metabolite concentrations after death. With cocaine this is a possibility, but with subclavian concentrations of 330 ng/mL for cocaine and 300 ng/mL for cocaethylene if the result differences were only due to PMR it would be expected that some amount of cocaine and cocaethylene would be detected in hospital blood.

D. The preservative in the hospital blood collection container is ineffective in maintaining cocaine and cocaethylene concentrations (Correct answer, 51.58% responses)

Different collection containers contain different additives and/or preservatives. Regarding their ability to stabilize drug concentrations, these are not necessarily equivalent or interchangeable. Hospital samples may be collected using varying container types such as lavender top tubes, blue top tubes, or serum separator tubes. It is prudent to consider the collection container types before interpreting toxicology results, maybe even more so for some drugs like cocaine.

In this case, the hospital blood was collected in a lavender vial which contains EDTA preservative while the subclavian blood was collected in a gray top tube which contains sodium fluoride preservative. Cocaine undergoes hydrolysis by plasma pseudocholinesterase to ecgonine methyl ester. This reaction rate is dependent upon variables such as drug concentration, temperature, the presence of enzyme inhibitor, and the addition of fluoride. EDTA is a chelating agent with no significant enzyme-inhibiting properties. Hence, EDTA does not prevent cocaine hydrolysis. In contrast, the use of sodium fluoride helps preserve cocaine and cocaethylene concentrations.

E. Cocaine continued to be absorbed, distributed, metabolized, and eliminated from the time of the hospital blood collection to the time of death (25.26% responses)

The time from arrival at the hospital to the time of death was minutes. Considering the pharmacokinetic parameters of cocaine, it does not stand to reason for cocaine and cocaethylene to increase from none detected to positive at the reported concentrations within minutes.

References

<https://anab.ansi.org/forensic-accreditation/abft>

<http://www.pathology.uci.edu/services/specimen-containers.asp>

Jones AW. Forensic Drug Profile: Cocaethylene. *J Anal Toxicol*. 2019 Apr 1;43(3):155-160. doi: 10.1093/jat/bkz007. PMID: 30796807.

Stewart DJ, Inaba T, Tang BK, Kalow W. Hydrolysis of cocaine in human plasma by cholinesterase. *Life Sci*. 1977 May 1;20(9):1557-63. doi: 10.1016/0024-3205(77)90448-9. PMID: 17804.