



## K4 Carfentanil-Induced Fatalities: A Case Series

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The goal of this presentation is to investigate several fatalities associated with carfentanil and to provide a template for medical examiner offices to monitor "designer" opioid deaths through standardized toxicological screening.

This presentation will impact the forensic science community by providing novel carfentanil toxicity levels, considering that the human biological effects of the illicit opioid are unknown.<sup>1</sup>

Carfentanil is a  $\mu$ -opioid receptor agonist that induces respiratory compromise and central nervous system depression. Its potency is 10,000 times greater than morphine.<sup>2</sup> Used as an elephant tranquilizer, the schedule II drug has concealed itself within the street drug market in North America. Fatalities continue to climb, considering there has been only one published instance of human exposure to an illicitly manufactured version of carfentanil with a successful medical outcome.<sup>3</sup>

This case series will investigate 17 fatal intoxications involving carfentanil, considering the postmortem findings, autopsy results, and toxicological screenings.

A retrospective review of 2,807 deaths was conducted through the Oakland County Medical Examiner's Office database to investigate all potential deaths of carfentanil use. Every public carfentanil-related death in Oakland County, MI, over a six-month period is included in this study. Postmortem specimens for toxicology measurement were extracted from the matrix source of the femoral artery, except for instances of heart blood when no femoral blood was present. Each decedent received a volatile screen through a fentanyl enzyme-linked immune absorbance assay test kit. With a positive confirmation of a fentanyl metabolite, an expanded postmortem, forensic, quantitative blood test was ordered through the National Medical Services Laboratories (NMS Labs). Carfentanil spectra was matched through a spectral library and measured through Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS). A standardized case review form was used to characterize each carfentanil-positive death. All available medical and legal history was reviewed to interpret the death.

Sixty-one percent of the decedents were below the age of 35 years. Other than two females, every decedent was male. The cause of death deemed by the medical examiner was drug abuse ( $n=0$ ), drug intoxication ( $n=6$ ), and drug overdose ( $n=1$ ). The manner of death was undeterminable in 16 of the cases, with one exception of suicide by overdose. Only five of the decedents had pre-existing medical conditions that could be speculated as contributory to cause of death. The rest of the decedents were otherwise healthy individuals with no anatomical evidence of trauma or pre-existing disease. Eight of the decedents underwent endotracheal intubation and six were administered naloxone. Five cases were found with a syringe in hand or within arm's reach. Of 11 chronic substance users, seven either actively abused heroin or used within the past six months per family members and friends. Four presented with biventricular hypertrophy and three possessed left ventricle myocardium hypertrophy. The mean combined lung weight was 1,536 grams. Every case possessed moderate to severe pulmonary edema, with remarkable pulmonary congestion. As reported by NMS Labs, every case presented with a unique panel of drugs with a mean carfentanil concentration of 0.384ng/mL. It was previously suggested that 20 micrograms of carfentanil could induce death, although the concentrations reported in the bloodstream at time of death were as low as 10ng/mL.<sup>4</sup> Five cases were found to have 6-monoacetylmorphine, with a mean concentration of 17.66ng/mL. U-4700 was found in conjunction with carfentanil in three instances.

There has been only one other study which provided results from a comprehensive and sensitive screening method, through Ultra High-Performance Liquid Chromatography (UHPLC) -Ion Trap-MSn, to identify carfentanil.<sup>5</sup> That study only provided detection results, without quantification values. The methods presented in the current study could be employed as a template for other medical examiner offices, as LC/MS/MS can reduce toxicological discrepancies between cases and detect low concentrations.

Hopefully, the cases presented in this study will provide a foundation for further studies examining carfentanil's toxicological characteristics. Future studies are warranted to investigate the epidemiological trends of this perilous opioid.

### Reference(s):

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### Carfentanil, Postmortem Concentration, Overdoses