



K26 Carfentanil-Related Deaths in Wayne County, Michigan: Epidemiology and Toxicology

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After attending this presentation, attendees will be able to describe the toxicological and epidemiological aspects of a series of 129 carfentanil-related fatalities in Wayne County, which includes the city of Detroit, MI.

This presentation will impact the forensic science community by providing attendees with the carfentanil concentrations observed in medicolegal death cases related to the drug in addition to the demographic information associated with the decedents, which will assist with the interpretation of drug concentrations in future carfentanil deaths.

Introduction: Carfentanil, a synthetic opioid with an analgesic potency estimated to be 10,000 times that of morphine and that is approved for veterinary use in the sedation of large animals, was analytically confirmed in blood samples from 129 death investigation cases investigated by the Wayne County Medical Examiner's Office between August 2016 and June 2017. Details of the findings in these cases are presented and discussed.

Methods: All cases presented were submitted to NMS Labs in Willow Grove, PA, for comprehensive toxicological analysis by a Liquid Chromatography/Time Of Flight/Mass Spectrometry (LC/TOF/MS) screen for approximately 250 drugs and their metabolites, which includes carfentanil and several other emerging novel opioids in an additional secondary targeted accurate mass database. Confirmatory testing for carfentanil was performed by quantitative Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS) with a quantitative reporting limit of 0.10ng/mL and limit of detection of 0.03ng/mL. Carfentanil-positive cases were reviewed for other drug findings, as well as demographic case data.

Results: Carfentanil concentrations ranged from 0.1ng/mL to 14ng/mL ($N=127$) with two cases <0.1 ng/mL. The mean and median concentrations were 0.75ng/mL and 0.44ng/mL, respectively. It was found that 87% of cases had a carfentanil concentration less than or equal to 1.0ng/mL. There were only three cases in which carfentanil was the only drug detected. In 87.6% of cases, another opioid was detected, including morphine (57%), fentanyl (43%), 6-acetyl morphine (38%), furanyl fentanyl (28%), and U-47700 (12%). Other common findings were ethanol (50%), cocaine and/or benzoylecgonine (45%), cannabinoids (31%), and alprazolam (21%). Death locations were at home (37%), at a scene (32%), or in a hospital (31%). Naloxone was detected in 78% of hospital deaths compared to 17% at home and 7.3% at a scene. Decedent demographics were mostly male (73%) and White (63.5%). Black or African American (32.5%) and other (4%) were slightly underrepresented compared to overall Wayne County demographics (52% White, 31% Black or African American, 7% Other). Total cases peaked between November 2016 and February 2017, after which there was a sharp decline in deaths related to carfentanil. In one case, an antemortem whole blood specimen was collected at the hospital approximately 14 hours prior to death. The antemortem blood and postmortem femoral blood concentration was 0.93ng/mL and 0.34ng/mL, respectively. The half-life of carfentanil in female elands was reported to average 7.7 hours.¹ This single human case appeared to have a half-life of 8.1 hours. While there are certainly caveats to this extrapolation of kinetic data, it does suggest that a one-time dose of naloxone (half-life 64 +/- 12min) would be insufficient as an antagonist. To various degrees, all of the reported cases involved police, first responders, investigators, morgue assistants, and pathologists. There was not a single incident of any adverse effects to any individual in any case involving incidental exposure to carfentanil.

Conclusions: Carfentanil was detected as an opioid of abuse in 129 cases Wayne County, MI, between August 2016 and June 2017. Although it was detected with other opioids in more than 80% of cases, it contributed to the cause of death in all cases that were considered drug-related fatalities. The decrease in the incidence of carfentanil toward the end of the reporting period suggests the possibility of new novel opioids that may be contributing to drug-related deaths.

Reference(s):

1. Alexander Cole, Adrian Mutlow, Ramiro Isaza, James W. Carpenter, David E. Koch, Robert P. Hunter, and Betsy L. Dresser. Pharmacokinetics And Pharmacodynamics of Carfentanil and Naltrexone in Female Common Eland (*Taurotragus Oryx*). *Journal of Zoo and Wildlife Medicine*. 37(3):318-326. 2006. <https://doi.org/10.1638/05-070.1>.

Carfentanil, Opioids, Fatalities