LC-MS Quantification of Acylcarnitines in Opioid-Related Deaths

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Opioid intoxications present a challenge in forensic investigations due to the development of tolerance, resulting in minimal correlations between blood concentrations and the cause of death. Acylcarnitines have emerged as potential biomarkers in various pathological conditions, including metabolic disorders, cardiovascular diseases and depression. In addition, we are hypothesizing that acylcarnitines decreases in opioid intoxications due to a prolonged hypoxic state and an increase in oxidative stress, which results in a depletion of acylcarnitine reserves. By assessing the levels of acylcarnitines in different study groups, including hangings, non-opioid intoxications, and opioid intoxications, we aim to discern potential patterns in acylcarnitines that may aid in forensic investigations of opioid intoxications.

This study, therefore, seeks to develop and validate an LC-MS method for the quantification of acylcarnitines in postmortem whole blood samples, with a particular focus on elucidating their potential association with opioid toxicity and respiratory depression. Preliminary results indicate that a simple cleanup without derivatization is sufficient to gain sensitive, selective, and reproducible LC-MS data for 14 short-, medium-, and long-chain acylcarnitines.

Prior findings have revealed significant reductions in the levels of short-, medium-, and long-chain acylcarnitines in cases of oxycodone intoxications compared to controls ($p < 0.001$), suggesting a potential link between acylcarnitines and the toxicological effects of oxycodone. Through comprehensive targeted analyses of acylcarnitine profiles in autopsy cases, we endeavor to enhance our understanding of the metabolic alterations underlying opioid-related fatalities, ultimately contributing to more accurate forensic assessments and improved public health interventions. We intend to investigate the association between acylcarnitines and respiratory depression by analyzing approximately 150 autopsy cases, encompassing hangings, non-opioid intoxications, and opioid intoxications.

We anticipate that this LC-MS method will serve as a valuable tool for examining associations involving acylcarnitines in postmortem autopsy cases, thereby contributing to a deeper understanding of forensic pathology in instances of opioid intoxication and respiratory depression.