K36 6-Monoacetylmorphine (6-MAM) Positivity: A Comparison of Two Methods

Jolene Bierly, MSFS, NMS Labs, 3701 Welsh Road, Willow Grove, PA 19090; Laura M. Labay, PhD, NMS Labs, 3701 Welsh Road, Willow Grove, PA 19090; and Barry K. Logan, PhD, NMS Labs/CFSRE, 3701 Welsh Road, Willow Grove, PA 19090*

After attending this presentation, attendees will better understand the impact of methodology and reporting limits on the ability to confirm heroin use through the detection of 6-MAM in forensic cases.

This presentation will impact the forensic science community by comparing the ability of two different methods to confirm heroin use through the evaluation of 6-MAM positivity.

With opiate use and abuse increasing, laboratories are under increased pressure to distinguish licit opiate use from illicit use; however, confirming the presence of heroin (6-diacetylmorphine) can be challenging due to the pharmacokinetics of the drug. Heroin is rapidly metabolized to 6-MAM and eventually to morphine. Confirming 6-MAM is essential to determining the presence of heroin in body fluids. Laboratory methodology and reporting limits can vary greatly in their ability to confirm and quantitate 6-MAM. This work compares the ability of a Gas Chromatography/Mass Spectrometry (GC/MS) method with a reporting limit of 10ng/mL and a Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS) method with a reporting limit of 1ng/mL to confirm and quantitate 6-MAM.

Method: Antemortem Driving Under the Influence of Drugs (DUID) and postmortem blood specimens submitted for opiate confirmation by GC/MS from April 2013 through April 2014 were reviewed. These results were compared to blood specimens submitted for opiate confirmation by LC/MS/MS from April 2014 through April 2015. Submissions in which 6-MAM confirmation was not performed for various reasons and cases that were none-detected for morphine were excluded. Percentages were rounded to the nearest whole number using conventional rounding rules. Statistical analysis was performed using student *t*-tests assuming unequal variance and that the populations were independent.

Results: A total of 14,932 cases that were submitted for opiate confirmation between April 2013 and April 2015 were included in this review. The overall 6-MAM positivity based on method increased from 15% by GC/MS to 32% by LC/MS/MS, an increase of 18% ($p < 0.05$). Submissions were also evaluated based on submission type: DUID (n=3,072) or death investigation (n=11,859). 6-MAM values ranged from 10ng/mL to 160ng/mL (mean 31ng/mL) by GC/MS confirmation and from 1ng/mL to 6,000ng/mL (mean 27ng/mL) by LC/MS/MS confirmation in DUID cases. 6-MAM positivity increased from 4% by GC/MS to 16% by LC/MS/MS, an increase of 12% ($p < 0.05$). Further investigation revealed that 87% of the DUID 6-MAM confirmations on LC/MS/MS were below 10ng/mL during this time period. Death investigation 6-MAM values ranged from 10ng/mL to 26,000ng/mL (mean 65ng/mL) on GC/MS and from 1ng/mL to 830ng/mL (mean 17ng/mL) on LC/MS/MS. 6-MAM positivity increased from 16% by GC/MS to 38% by LC/MS/MS, an increase of 22% ($p < 0.05$). In addition, 64% of the 6-MAM confirmations on the LC/MS/MS were below 10ng/mL in death investigations.

Conclusion: A comparison of these two methods demonstrated that a GC/MS method with a reporting limit of 10ng/mL could fail to confirm a large majority of heroin use in DUID and death investigation cases. In this particular review, a 6-MAM positivity rate increase of 18% was observed between the two methods.

Heroin, LC/MS/MS, GC/MS

*Presenting Author