



## Pathology/Biology Section - 2016

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### H76 Using Enzyme-Multiplied Immunoassay Technique (EMIT) Analysis of Vitreous Humor to Identify Heroin Use at Autopsy

Brandi C. McCleskey\*, University of Alabama at Birmingham, 619 19th Street, S, Birmingham, AL 35249; C. Andrew Robinson, Jr., PhD, University of Alabama, Laboratory Medicine Division, Dept of Pathology, Birmingham, AL 35233-7331; and Daniel W. Dye, MD, Jefferson County Coroner/Medical Examiner Office, 1515 6th Avenue, S, Rm 220, Birmingham, AL 35233

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After attending this presentation, attendees will be aware of the potential utility of vitreous humor screening for 6-Acetylmorphine (6-AM) in cases of suspected heroin use with negative urine and/or blood screens for 6-AM and opiates.

This presentation will impact the forensic science community by stressing the importance of scene investigation and knowledge of circumstances surrounding death for proper analysis of specimens collected during postmortem examination.

Deaths due to the toxic effects of heroin have risen more than 286% in the past decade. The rise in use of heroin among most demographic groups is likely contributed to by the insurgence of opioid painkiller misuse and addiction.<sup>1</sup> Medical examiner offices are faced with cases in which heroin use is suspected given scene investigation findings and eyewitness accounts of activities prior to death. Toxicological evidence is often utilized to support the physical and postmortem findings; however, given the many factors that affect the breakdown of heroin *in vivo*, screening tests for heroin's unique metabolite 6-AM or opiates in blood or urine may be negative, leading to a possible misdiagnosis.

Utilizing detection methods to identify 6-AM is often useful for the forensic pathologist in determining cause of death and, in some cases, is supportive of time of survival after lethal injection of heroin.<sup>2</sup> Vitreous humor is a readily available biologic specimen in most forensic postmortem examinations. Heroin is metabolized via deacetylation to 6-AM, which undergoes further esterase conversion to morphine. This metabolism occurs quickly in the blood where esterase activity is high. The lipophilicity of heroin makes its transfer across the vitreous-blood barrier favorable where it is rapidly metabolized to 6-AM in the vitreous humor. Furthermore, the window of detection for 6-AM is extended due to the minimal esterase activity present in the vitreous. Vitreous levels of 6-AM likely indicate recent exposure to heroin prior to death even in the absence of blood and urine 6-AM detection.

Five cases from the Jefferson County Coroner/Medical Examiner Office in 2014 were identified in which the decedent was suspected of using heroin, given the history and scene investigation findings prior to death, but postmortem urine drug screens were negative for opiates and 6-AM. The vitreous humor was then screened for 6-AM using EMIT and 6-AM was subsequently detected in four to five cases (80%). In all five cases, morphine was detected and quantified in the blood. These combined results supported the scene investigation and physical findings of the postmortem examination, including needle tracks and puncture sites, consistent with heroin toxicity.

Negative toxicology is often a finding in delayed death cases and complicates the cause-of-death designation. The prolonged window of detection of 6-AM in the vitreous humor may allow further analytical evidence of heroin use and toxicity. Although advanced methods have been evaluated in the literature for vitreous humor opiate testing, the common and relatively simple method of EMIT typically utilized for urine drug screening can also provide an additional screening method using vitreous humor in selected cases.<sup>3</sup>

#### Reference(s):

1. Substance Abuse and Mental Health Services Administration, Results from the 2012 National Survey on Drug Use and Health: Summary of National Findings, *NSDUH Series H-46*, HHS Publication No. (SMA) 13-4795. Rockville, MD: Substance Abuse and Mental Health Services Administration, 2013.
2. Rees K.A., Pounder D.J., Osselton M.D. Distribution of opiates in femoral blood and vitreous humour in heroin/morphine-related deaths. *Forensic Sci Int* 2013;226(1-3):152-9.
3. Peres M.D., Pelicao F.S., Caleffi B., De Martinis B.S. Simultaneous quantification of cocaine, amphetamines, opiates and cannabinoids in vitreous humor. *J Anal Toxicol* 2014;38(1):39-45.

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#### Heroin, Vitreous, Autopsy