

**Editor's Note:**

Welcome to Focus on Screens, a new monthly column that will address toxicology testing (both urine and blood) relating to pain medications. Each month we will present an image of an actual toxicology report, with pertinent results highlighted. Our expert toxicologists will then explain the results of the screen, why they are important, and what they mean. We hope this new column will help put toxicology screening in focus.



# Is Your Patient Using Heroin?

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## Heroin Use

The ability to identify patterns of recent heroin use from urine toxicology reports is becoming an increasingly important skill in the field of compliance monitoring. Rates of heroin use have been on the rise in recent months due to age-old factors such as low cost and wide availability. According to a survey conducted by the Centers for Disease Control and Prevention in 2009, 8.7% of respondents aged 12 years and older reported using an illicit drug in the past month.<sup>1</sup> In 2010, the government estimated that 140,000 persons aged 12 or older had used heroin for the first time within the past 12 months. This estimate was similar to the 2009 estimate (180,000) and to estimates from 2002 to 2008 (ranging from 91,000 to 118,000 per year). The average age at first use among recent initiates was 21.3 years, significantly younger than the 2009 estimate of 25.5 years.<sup>2</sup>

Additionally, recent efforts to reduce the rates of prescription drug misuse (such as the introduction of abuse-deterrent medications) have proven successful, causing some IV opioid users to replace prescription opioids with heroin. Nasal insufflation of cheaper, low-grade heroin (such as “cheese” heroin) also has become popular among the younger population and most certainly is another factor contributing to the increase in heroin use. Cheese heroin is produced by combining low-grade heroin with crushed Tylenol PM tablets containing acetaminophen and diphenhydramine.

## Pharmacology

Following administration, heroin undergoes a rapid two-step metabolic transformation into morphine (the primary metabolite of heroin). The first step of the transformation is the conversion of heroin (diacetylmorphine) into an intermediate metabolite known as 6-monoacetylmorphine (6-MAM). As the nomenclature suggests, the conversion of heroin into this intermediate metabolite involves the loss of an acetyl group. Following the formation of 6-MAM, yet another acetyl group is cleaved to form morphine. The metabolism of heroin to morphine occurs very rapidly; however, it is the production and significance of 6-MAM of which providers must be aware. The presence of 6-MAM in the urine of a patient (above standard laboratory testing cutoffs) is unequivocal proof of recent heroin use as 6-MAM does not originate from any other source.

## Toxicology

Concentrations of morphine in the urine of heroin users are significantly higher than those of 6-MAM due to the rapid conversion of 6-MAM into morphine, which is the final metabolic product. Concentrations of 6-MAM often are less than 1,000 ng/mL, whereas morphine concentrations in regular heroin users can exceed 100,000 ng/mL. In addition to morphine and 6-MAM, the urine of heroin users often will contain low concentrations (<1,000 ng/mL) of codeine, which can be traced back to the natural product used to synthesize heroin.

# LAB REPORT

Analyte Name	Result	Cut-off Unit
AMPHETAMINES	Negative	500 ng/mL
BARBITURATES	Negative	200 ng/mL
BENZODIAZEPINES	Negative	75 ng/mL
BUPRENORPHINE/METABOLITE	Negative	5 ng/mL
CANNABINOIDS	Negative	20 ng/mL
CARISOPRODOL/METABOLITE	Negative	100 ng/mL
COCAINE/METABOLITES	Negative	150 ng/mL
FENTANYL	Negative	2 ng/mL
METHADONE/METABOLITE	Negative	100 ng/mL
OPIATES	POSITIVE	50 ng/mL
Morphine	POSITIVE	50 ng/mL
Morphine, Quant	> 10,000	ng/mL
6-Monoacetylmorphine	POSITIVE	20 ng/mL
6-Monoacetylmorphine, Quant	975	ng/mL
Codeine	POSITIVE	50 ng/mL
Codeine, Quant	568	ng/mL
PROPOXYPHENE/METABOLITE	Negative	300 ng/mL
TRAMADOL/METABOLITE	Negative	200 ng/mL
ALCOHOLS	Negative	0.02 % (w/v)
ACETAMINOPHEN	Negative	10 mcg/mL
CREATININE	Normal	5 mg/dL
Creatinine, Quant	65	mg/dL
pH	Normal	
GENERAL OXIDANTS	Negative	200 mcg/mL

The presence of 6-MAM (above standard laboratory testing cutoffs) is unequivocal proof of recent heroin use.

In addition to 6-MAM, the urine of heroin users typically contains high concentrations of morphine and low concentrations of codeine. The presence of all three is the textbook pattern of recent heroin use.

**Figure 1.** Toxicology report showing recent heroin use. 6-MAM, 6-monoacetylmorphine

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### Report Interpretation

Figure 1 illustrates textbook opioid findings in the urine of a regular heroin user: a high concentration of morphine accompanied by lower concentrations of 6-MAM and codeine. Providers should have knowledge of these findings. It is important to understand that 6-MAM must be present in order to prove heroin use because the presence of only morphine and codeine also could be explained by the use of these two medications, whereas the presence of 6-MAM above standard laboratory testing cutoffs provides unequivocal proof of recent heroin use. ■

**Author's Bio:** *Joshua Gunn, PhD, is a toxicologist at AIT Laboratories, where he assists in postmortem toxicology and compliance monitoring.*



### References

1. Centers for Disease Control and Prevention. Faststats. Illegal drug use. <http://www.cdc.gov/nchs/fastats/druguse.htm>. Accessed September 28, 2011.
2. National Survey on Drug Use and Health: Summary of National Findings. Results of 2010 survey. <http://www.oas.samhsa.gov/NSDUH/2k10NSDUH/2k10Results.htm#5.5>. Accessed September 28, 2011.

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