MAYO CLINIC LABORATORIES

Test Definition: 6MAMX

6-Monoacetylmorphine, Chain of Custody, Random, Urine

Overview

Useful For

Determination of recent heroin use

Chain of custody is required when test results may be used in a court of law. Its purpose is to protect the rights of the individual contributing the specimen by documenting continuous personnel control of the specimen throughout collection, handling, and analysis, helping demonstrate that opportunities for specimen tampering were limited.

Additional Tests

Test Id	Reporting Name	Available Separately	Always Performed
COCH	Chain of Custody Processing	No	Yes
ADLTX	Adulterants Survey, CoC, U	Yes	Yes

Testing Algorithm

Testing for adulterants will be performed on all chain-of-custody urine samples per regulatory requirements.

Special Instructions

- Clinical Toxicology CPT Code Client Guidance

Method Name

Gas Chromatography Mass Spectrometry (GC-MS)

NY State Available

Yes

Specimen

Specimen Type

Urine

Ordering Guidance

This test is for situations that require the chain-of-custody process. For testing **not** requiring chain of custody, order 6MAMU / 6-Monoacetylmorphine Confirmation, Random, Urine.

Specimen Required

Supplies: Chain of Custody Kit (T282)

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Container/Tube: Chain-of-Custody Kit containing specimen containers, seals, and documentation is required.
Specimen Volume: 10 mL
Collection Instructions: Collect a random specimen without preservative in the container provided, seal, and submit with the associated documentation to satisfy the legal requirements for chain-of-custody testing.

Forms

1. Chain of Custody Request is included in the Chain-of-Custody Kit (T282).
2. If not ordering electronically, complete, print, and send a Therapeutics Test Request (T831) with the specimen.

Specimen Minimum Volume

2.1 mL

Reject Due To

Gross hemolysis	OK
Gross icterus	OK

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Urine	Refrigerated (preferred)	14 days	
	Ambient	72 hours	
	Frozen	14 days	

Clinical & Interpretive

Clinical Information

Heroin (diacetylmorphine) is a semisynthetic opiate that is closely related to morphine. It is no longer used clinically in the United States, though elsewhere it is used for rapid relief of pain.(1) Like morphine and other opiates, its relaxing and euphoric qualities make heroin a popular drug of abuse. Heroin is commonly injected intravenously, although it can be administered by other means, such as snorting, smoking, or inhaling vapors.

Heroin shares the core structure of morphine with the addition of 2 acetyl groups, which are thought to enhance its permeation into the central nervous system.(2,3) Heroin is metabolized by sequential removal of these acetyl groups: loss of the first acetyl group converts heroin into 6-monoacetylmorphine (6-MAM) and loss of the second acetyl group converts 6-MAM to morphine, the dominant metabolite of heroin.(2,3) Heroin is rarely found in urine due to its rapid metabolism. 6-MAM is a unique metabolite of heroin, and its presence is a definitive indication of recent heroin use. Like heroin, 6-MAM has a very short half-life and detection window.

Chain of custody is a record of the disposition of a specimen to document the personnel who collected, handled, and performed the analysis. When a specimen is submitted in this manner, analysis will be performed in such a way that it will withstand regular court scrutiny.

Reference Values
Negative (Positive result is reported with a quantitative result)

Cutoff concentration by gas chromatography mass spectrometry:
6-Monoacetylmorphine cutoff concentration: 5 ng/mL

Interpretation
The presence of 6-monoacetylmorphine (6-MAM) in urine is definitive for recent heroin use. However, the absence of 6-MAM does not rule out heroin use because of its short half-life. 6-MAM is typically only detectable within 24 hours of heroin use. 6-MAM is further metabolized into morphine, which may be detected 1 to 2 days after 6-MAM is no longer measurable. Morphine will also typically be found in a specimen containing 6-MAM.(2,3)

Cautions
While 6-monoacetylmorphine (6-MAM) is metabolized to morphine, the presence of morphine alone is not sufficient evidence to prove heroin use. 6-MAM is the only definitive metabolite of heroin.

Clinical Reference
1. Giovannelli M, Bedforth N, Aitkenhead A. Survey of intrathecal opioid usage in the UK. Eur J Anaesthesiol. 2008;25(2):118-122
2. Principles of Forensic Toxicology. 2nd ed. AACC Press; 2003:187-205
3. Hardman JG, Limbird LE, Gilman AG. Goodman and Gilman's. The Pharmacological Basis of Therapeutics. 10th ed. McGraw-Hill Book Company; 2001:590-592
4. Levine BS, Kerrigan S, eds. Principles of Forensic Toxicology. 5th ed. Springer; 2020
5. Brunton LL, Knollmann BC, eds. Goodman and Gilman's The Pharmacological Basis of Therapeutics. 14th ed. McGraw Hill LLC; 2023
6. Langman LJ, Bechtel LK, Holstege CP. Clinical toxicology. In: Rifai N, Chiu RWK, Young I, Burnham CAD, Wittwer CT, eds. Tietz Textbook of Laboratory Medicine. 7th ed. Elsevier; 2023:Chapter 43

Performance

Method Description
6-Monoacetylmorphine is extracted using solid phase extraction techniques. The eluent is evaporated, reconstituted in organic solvent, and then derivatized. It is then analyzed by gas chromatography mass spectrometry using selected ion monitoring.(Unpublished Mayo method)

PDF Report
No

Day(s) Performed
Tuesday, Thursday

Report Available

3 to 7 days

Specimen Retention Time

14 days

Performing Laboratory Location

Mayo Clinic Laboratories - Rochester Superior Drive

Fees & Codes

Fees

- Authorized users can sign in to Test Prices for detailed fee information.
- Clients without access to Test Prices can contact Customer Service 24 hours a day, seven days a week.
- Prospective clients should contact their account representative. For assistance, contact Customer Service.

Test Classification

This test was developed and its performance characteristics determined by Mayo Clinic in a manner consistent with CLIA requirements. It has not been cleared or approved by the US Food and Drug Administration.

CPT Code Information

G0480
80356 (if appropriate for select payers)
Clinical Toxicology CPT Code Client Guidance

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
6MAMX	6-MAM Confirmation, CoC, U	19593-3

Result ID	Test Result Name	Result LOINC® Value
36118	6-Monoacetylmorphine by GC/MS	19593-3
36119	6-MAM Interpretation	69050-3
36120	Chain of Custody	77202-0