MAYO CLINIC LABORATORIES

Test Definition: NICOS

Nicotine and Metabolites, Serum

Overview

Useful For
Monitoring tobacco use in a clinical setting

Method Name
Liquid Chromatography Tandem Mass Spectrometry (LC-MS/MS)

NY State Available
Yes

Specimen

Specimen Type
Serum Red

Specimen Required
Supplies: Sarstedt Aliquot Tube, 5 mL (T914)
Collection Container/Tube: Red top (serum gel/SST are **not** acceptable)
Submission Container/Tube: Plastic vial
Specimen Volume: 0.8 mL
Collection Instructions: Within 2 hours of collection, centrifuge and aliquot serum into a plastic vial.

Forms
If not ordering electronically, complete, print, and send a Therapeutics Test Request (T831) with the specimen.

Specimen Minimum Volume
0.5 mL

Reject Due To

Gross hemolysis	OK
Gross lipemia	OK
Gross icterus	OK

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Serum Red	Refrigerated (preferred)	28 days	
	Ambient	28 days	

	Frozen	28 days	

Clinical & Interpretive

Clinical Information

Tobacco use remains the leading cause of preventable disease, disability, and death in the United States. Nicotine, coadministered in tobacco products such as cigarettes, pipe tobacco, cigars, or chew, is an addicting substance that causes individuals to continue use of tobacco despite concerted efforts to quit. Nicotine stimulates dopamine release and increases dopamine concentration in the nucleus accumbens, a mechanism that is thought to be the basis for addiction for drugs of abuse.

Nicotine-dependent patients use tobacco products to achieve a peak serum nicotine value of 30 to 50 ng/mL, the concentration at which the nicotine high is maximized. Nicotine is metabolized in the liver to cotinine. Cotinine accumulates in serum in proportion to dose and hepatic metabolism (which is genetically determined); most tobacco users accumulate cotinine in the range of 200 to 800 ng/mL. Serum concentrations of nicotine and metabolites in these ranges indicate the patient is using tobacco or is receiving high-dose nicotine patch therapy.

Nicotine is rapidly metabolized, exhibiting an elimination half-life of approximately 2 hours. Cotinine exhibits an apparent elimination half-life of approximately 24 hours. Heavy tobacco users who abstain from tobacco for 2 weeks exhibit serum nicotine values less than 3.0 ng/mL and cotinine less than 3.0 ng/mL.

Passive exposure to tobacco smoke can cause accumulation of nicotine metabolites in nontobacco users. Serum cotinine has been observed to accumulate up to 8 ng/mL from passive exposure.

Tobacco users engaged in programs to abstain from tobacco require support in the form of counseling, pharmacotherapy, and continuous encouragement. Occasionally, counselors may elect to monitor abstinence by biochemical measurement of nicotine and metabolites in serum to verify abstinence. If results of biologic testing indicate the patient is actively using a tobacco product during therapy, additional counseling or intervention may be appropriate.

Reference Values

NICOTINE
<3.0 ng/mL

COTININE
<3.0 ng/mL

Interpretation

Serum nicotine concentration in the range of 30 to 50 ng/mL with cotinine in the range of 200 to 800 ng/mL indicates the subject is either actively using a tobacco product or on nicotine replacement therapy.

To discriminate if a patient on nicotine replacement therapy is also actively using a tobacco product, see NICOU / Nicotine and Metabolites, Random, Urine analysis; the presence of anabasine in urine, a tobacco alkaloid not present in nicotine replacement products, indicates recent tobacco use.

Typical findings are as follows:

While using a tobacco product:
-Peak nicotine concentration: 30 to 50 ng/mL
-Peak cotinine concentration: 200 to 800 ng/mL*
*Higher values may be seen in subjects with high cytochrome P450 2D6 activity

Tobacco user after 2 weeks complete abstinence:
-Nicotine concentration: <3.0 ng/mL
-Cotinine concentration: <3.0 ng/mL

Nontobacco user with passive exposure:
-Nicotine concentration: <3.0 ng/mL
-Cotinine concentration: <8.0 ng/mL

Nontobacco user with no passive exposure:
-Nicotine concentration: <3.0 ng/mL
-Cotinine concentration: <3.0 ng/mL

Cautions

Knowledge of time elapsed between last dose and specimen collection is important for interpretation of test results.

Clinical Reference

1. Dale LC, Hurt RD, Hays JT. Drug therapy to aid in smoking cessation. Tips on maximizing patients' chances for success. Postgrad Med. 1998;104(6):75-78, 83-84
2. Moyer TP, Charlson JR, Enger RJ, et al. Simultaneous analysis of nicotine, nicotine metabolites, and tobacco alkaloids in serum or urine by tandem mass spectrometry, with clinically relevant metabolic profiles. Clin Chem. 2002;48(9):1460-1471
3. Nicotine and cotinine. Testing.com; Updated February 2, 2023. Accessed February 16, 2024. Available at www.testing.com/tests/nicotine-and-cotinine/
4. McGrath-Morrow SA, Gorzkowski J, Groner JA, et al. The effects of nicotine on development. Pediatrics. 2020;145(3):e20191346. doi:10.1542/peds.2019-1346

Performance

Method Description

Nicotine and metabolites are extracted from serum. The extract is quantified by high-performance liquid chromatography-tandem mass spectrometry.(Unpublished Mayo method)

PDF Report

No

Day(s) Performed

Monday through Sunday

Report Available
2 to 4 days

Specimen Retention Time
2 weeks

Performing Laboratory Location
Rochester

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
80323
G0480 (if appropriate)

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
NICOS	Nicotine and Metabolites, S	90226-2

Result ID	Test Result Name	Result LOINC® Value
21313	Nicotine	3853-9
21314	Cotinine	10365-5