MAYO CLINIC LABORATORIES

Test Definition: CATU

Catecholamine Fractionation, Free, 24 Hour, Urine

Overview

Useful For

An auxiliary test to fractionated plasma and urine metanephrine measurements in the diagnosis of pheochromocytoma and paraganglioma

An auxiliary test to urine vanillylmandelic acid and homovanillic acid determination in the diagnosis and follow-up of patients with neuroblastoma and related tumors

This test is **not useful as** a first-line test for pheochromocytoma.

Special Instructions

- Urine Preservatives-Collection and Transportation for 24-Hour Urine Specimens

Method Name

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

NY State Available

Yes

Specimen

Specimen Type

Urine

Ordering Guidance

This assay is of greatest value when the specimen is collected during a hypertensive episode.

Do not perform the test on patients withdrawing from legal or illegal drugs known to cause rebound catecholamine release during withdrawal (see Cautions).

This test **is not** a first-line test for pheochromocytoma. The recommended first-line laboratory tests for pheochromocytoma are PMET / Metanephrines, Fractionated, Free, Plasma; and METAF / Metanephrines, Fractionated, 24 Hour, Urine.

Necessary Information

24-Hour volume (in milliliters) is required.

Specimen Required

Patient Preparation:

1. If medically feasible, discontinue drugs that release or hinder metabolism of epinephrine, norepinephrine, or dopamine for at least 1 week prior to specimen collection (see Cautions for details). If this is not possible for medical reasons, contact the laboratory to discuss whether a shorter drug-withdrawal period may be acceptable.
2. Unless the reason for testing is drug monitoring, the patient should stop any epinephrine, norepinephrine, or dopamine injections or infusions for at least 12 hours prior to specimen collection.

Supplies: Sarstedt Aliquot Tube, 5 mL (T914)

Collection Container: Plastic vial

Specimen Volume: 2 mL

Collection Instructions:

1. Add 25 mL of 50% acetic acid as preservative at start of collection. Use 15 mL of 50% acetic acid for children younger than 5 years old. This preservative is intended to achieve a pH of between approximately 2 and 4.
2. Collect urine for 24 hours.

Additional Information: See Urine Preservatives-Collection and Transportation for 24-Hour Urine Specimens for multiple collections.

Forms

If not ordering electronically, complete, print, and send 1 of the following forms with the specimen:

-Oncology Test Request (T729)

-Renal Diagnostics Test Request (T830)

Urine Preservative Collection Options

Preservative must be added at the start of the collection.

Ambient (no additive)	No
Refrigerate (no additive)	No
Frozen (no additive)	No
50% Acetic Acid	Preferred
Boric Acid	OK
Diazolidinyl Urea	No
6M Hydrochloric Acid	OK
6M Nitric Acid	OK
Sodium Carbonate	No
Toluene	No

Specimen Minimum Volume

1.5 mL

Reject Due To

All specimens will be evaluated at Mayo Clinic Laboratories for test suitability.

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container

Urine	Refrigerated (preferred)	28 days	
	Frozen	28 days	

Clinical & Interpretive

Clinical Information

The catecholamines (dopamine, epinephrine, and norepinephrine) are derived from tyrosine via a series of enzymatic conversions. All 3 catecholamines are important neurotransmitters in the central nervous system and play crucial roles in the autonomic regulation of many homeostatic functions, namely vascular tone, intestinal and bronchial smooth muscle tone, cardiac rate and contractility, and glucose metabolism. Their actions are mediated via alpha- and beta-adrenergic receptors and dopamine receptors, all existing in several subforms. The 3 catecholamines overlap but also differ in their receptor activation profile and consequent biological actions.

The systemically circulating fraction of the catecholamines is derived almost exclusively from the adrenal medulla, with small contributions from sympathetic ganglia. They are normally present in the plasma in minute amounts, but levels can increase dramatically and rapidly in response to change in posture, environmental temperature, physical and emotional stress, hypovolemia, blood loss, hypotension, hypoglycemia, and exercise.

In patients with pheochromocytoma, a potentially curable tumor of catecholamine-producing cells of the adrenal medulla, or less commonly of sympathetic ganglia (paraganglioma), urine catecholamine levels may be elevated. This results in episodic or sustained hypertension and often in intermittent attacks of palpitations, cardiac arrhythmias, headache, sweating, pallor, anxiety, tremor, and nausea ("spells"). Elevations of the urine levels of 1 or several of the catecholamines may also be observed in patients with neuroblastoma and related tumors (ganglioneuroblastomas and ganglioneuromas) and, very occasionally, in other neuroectodermal tumors.

At the other end of the spectrum, inherited and acquired syndromes of autonomic dysfunction/failure and autonomic neuropathies are characterized by either inadequate production of 1 or several of the catecholamines or by insufficient release of catecholamines upon appropriate physiological stimuli (eg, change in posture from supine to standing, cold exposure, exercise, stress).

Reference Values

Norepinephrine <1 year: <11 mcg/24 h
1 year: 1-17 mcg/24 h
2-3 years: 4-29 mcg/24 h
4-6 years: 8-45 mcg/24 h
7-9 years: 13-65 mcg/24 h
> or =10 years: 15-80 mcg/24 h

Epinephrine
<1 year: <2.6 mcg/24 h
1 year: <3.6 mcg/24 h
2-3 years: <6.1 mcg/24 h
4-9 years: 0.2-10.0 mcg/24 h

10-15 years: 0.5-20.0 mcg/24 h
> or =16 years: <21 mcg/24 h

Dopamine
<1 year: <86 mcg/24 h
1 year: 10-140 mcg/24 h
2-3 years: 40-260 mcg/24 h
> or =4 years: 65-400 mcg/24 h

For International System of Units (SI) conversion for Reference Values, see www.mayocliniclabs.com/order-tests/si-unit-conversion.html.

Interpretation

Diagnosis of Pheochromocytoma:
This test **should not be used** as the first-line test for pheochromocytoma. PMET / Metanephrines, Fractionated, Free, Plasma (the most sensitive assay) and METAF / Metanephrines, Fractionated, 24 Hour, Urine (almost as sensitive and highly specific) are the recommended first-line laboratory tests for pheochromocytoma.

However, urine catecholamine measurements can still be useful in patients whose plasma or urine metanephrine measurements do not completely exclude the diagnosis. In such cases, urine catecholamine specimens have an 86% diagnostic sensitivity when cutoff levels of greater than 80 mg/24 hours for norepinephrine and greater than 20 mg/24 hours for epinephrine are employed. Unfortunately, the specificity of these cutoff levels for separating tumor patients from other patients with similar symptoms is only 88%. When more specific (98%) decision levels of greater than 170 mg/24 hours for norepinephrine or greater than 35 mg/24 hours for epinephrine are used, the assay's sensitivity falls to about 77%.

Diagnosis of Neuroblastoma:
Vanillylmandelic acid, homovanillic acid, and sometimes urine catecholamine measurements using either random urine or 24-hour urine collections are the mainstay of biochemical diagnosis and follow-up of neuroblastoma; 1 or more of these analytes may be elevated.

Cautions

Many alterations in physiologic and pathologic states can profoundly affect catecholamine concentrations.

Any environmental factors that may increase endogenous catecholamine production should be avoided. These include noise, stress, discomfort, body position, and the consumption of food, caffeinated beverages, and nicotine. Caffeine and nicotine effects are short term, a few minutes to hours only.

Other substances and drugs that may affect the results include:
1. Substances that result in increased release or diminished metabolism of endogenous catecholamines:
-Monamine oxidase inhibitors (MOI): a class of anti-depressants with marked effects on catecholamine levels, particularly if the patient consumes tyrosine rich foods, such as nuts, bananas, or cheese
-Catecholamine reuptake inhibitors including cocaine and synthetic cocaine derivatives, such as many local anesthetics, which also can be antiarrhythmic drugs (eg, lidocaine)

-Some anesthetic gases, particularly halothane
-Withdrawal from sedative drugs, medical or recreational, particularly alcohol, benzodiazepines (eg, Valium), opioids, and some central acting antihypertensive drugs, particularly Clonidine, but, generally not cannabis or other hallucinogens such as lysergic acid diethylamide (LSD), mescal, or peyote
-Vasodilating drugs (eg, calcium antagonists, alpha-blockers)
-Tricyclic antidepressants usually exert a negligible effect

2. Substances that reduce or increase plasma volume acutely (eg, diuretics, radiographic contrast media, synthetic antidiuretic hormone [eg, desmopressin 1-deamino-8-d-arginine vasopressin: DDAVP])

Historically, a third category of potentially interfering substances was represented by molecules that are either similar in chemical structure, antibody epitopes, or chromatographic migration pattern to the catecholamines, or have metabolites that can be mistaken for the catecholamines. The current liquid chromatography mass spectrometry-based assay is not subject to any significant direct interference of this kind. In most cases, the following drugs do not cause problems with the current assay that cannot be resolved: acetaminophen, allopurinol, amphetamines and its derivatives (methamphetamine, methylphenidate [Ritalin], fenfluramine, methylenedioxymethamphetamine [MDMA: ecstasy]), atropine, beta blockers (atenolol, labetalol, metoprolol, sotalol), buspirone, butalbital, carbamazepine, clorazepate, chlordiazepoxide, chlorpromazine, chlorothiazide, chlorthalidone, clonidine, codeine, diazepam, digoxin, dimethindene, diphenhydramine, diphenoxylate, dobutamine, doxycycline, ephedrine and pseudoephedrine, fludrocortisone, flurazepam, guanethidine, hydralazine, hydrochlorothiazide, hydroflumethiazide, indomethacin, insulin, isoprenaline, isosorbide dinitrate, L-Dopa, methenamine mandelate (mandelic acid), methyldopa, methylprednisolone, nitrofurantoin, nitroglycerine, oxazepam, pentazocine, phenacetin, phenformin, phenobarbital, phenytoin, prednisone, probenecid, progesterone, propoxyphene, propranolol, quinidine, spironolactone, tetracycline, thyroxine, and tripelennamine.

On occasion, when interference cannot be resolved, an interference comment will be reported.

The variability associated with age, sex, and kidney failure is uncertain.

Clinical Reference

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4. McDougall AJ, McLeod JG. Autonomic neuropathy, I. Clinical features, investigation, pathophysiology, and treatment. J Neurol Sci. 1996;137(2):79-88
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7. Ji C, Li W, Ren XD, et al. Diethylation labeling combined with UPLC/MS/MS for simultaneous determination of a panel of monoamine neurotransmitters in rat prefrontal cortex microdialysates. Anal Chem. 2008;80(23):9195-9203
8. Ellis AG, Zeglinski PT, Coleman KE, Whiting MJ. Dilute, derivatise and shoot: Measurement of urinary free metanephrines and catecholamines as ethyl derivatives by LC-MSMS. Clin Mass Spec. 2017;4-5:34-41

Performance

Method Description
Norepinephrine (NE), epinephrine (E), and dopamine (DA) are derivatized before being adsorbed onto activated alumina, washed with water, and eluted. The eluate is analyzed using liquid chromatography tandem mass spectrometry and quantified using stable isotope-labeled internal standards, d6-NE, d6-E, and d4-DA. Derivatized analytes and internal standards are ionized using electrospray ionization and are detected in the multiple-reaction monitoring mode.(Unpublished Mayo method)

PDF Report
No

Day(s) Performed
Monday through Saturday

Report Available
2 to 5 days

Specimen Retention Time
14 days

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
82384

LOINC® Information

Test Definition: CATU

Catecholamine Fractionation, Free, 24 Hour, Urine

Test ID	Test Order Name	Order LOINC® Value
CATU	Catecholamine Fract, Free, U	92938-0

Result ID	Test Result Name	Result LOINC® Value
TM48	Collection Duration (h)	13362-9
VL46	Volume (mL)	3167-4
2106	Norepinephrine	2668-2
2107	Epinephrine	2232-7
2108	Dopamine	2218-6