MAYO CLINIC LABORATORIES

Test Definition: CARU

Cyclic Adenosine Monophosphate (cAMP), Urinary Excretion, Serum and Urine

Overview

Useful For

Differential diagnosis of hypercalcemia

As an adjunct to serum parathyroid hormone measurements, especially in the diagnosis of parathyroid hormone resistance states, such as pseudohypoparathyroidism

Profile Information

Test Id	Reporting Name	Available Separately	Always Performed
ACREA	Creatinine, S	Yes, (order CRTS1)	Yes
CAMP	Cyclic Amp, Urinary Excretion	No	Yes
CRETR	Creatinine, Random, U	Yes, (order RCTUR)	Yes

Method Name

ACREA, CRETR: Enzymatic Colorimetric Assay
CAMP: Liquid Chromatography-Tandem Mass Spectrometry (LC-MS/MS)

NY State Available

Yes

Specimen

Specimen Type

Serum
Urine

Specimen Required

Both serum and urine are required. Serum must be collected at the time of the urine collection.

Specimen Type: Serum
Supplies: Sarstedt Aliquot Tube, 5 mL (T914)
Container/Tube:
Preferred: Serum gel
Acceptable: Red top
Submission Container/Tube: Plastic vial
Specimen Volume: 1 mL

Collection Instructions:
1. Within 2 hours of collection serum gel tubes should be centrifuged.
2. Within 2 hours of collection red-top tubes should be centrifuged, and the serum aliquoted into a plastic vial.
3. Label specimen as serum.

Specimen Type: Urine
Supplies: Sarstedt Aliquot Tube, 5 mL (T914)
Container/Tube: Plastic vial
Specimen Volume: 5 mL
Collection Instructions:
1. Collect a random urine specimen.
2. Label specimen as urine.

Specimen Minimum Volume

Serum: 0.5 mL
Urine: 1 mL

Reject Due To

Gross hemolysis	Reject
Gross lipemia	OK
Gross icterus	OK

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Serum	Refrigerated (preferred)	7 days	
	Frozen	90 days	
Urine	Refrigerated (preferred)	28 days	
	Frozen	28 days	

Clinical & Interpretive

Clinical Information

3'-5'-cyclic adenosine monophosphate (cAMP) functions as an intracellular "second messenger" playing a key role in cellular functions such as transcription, metabolism, mitochondrial homeostasis, cell division, and cell death. Several hormones such as calcitonin, dopamine, glucagon, glucagon like peptide-1, vasoactive intestinal peptide and parathyroid hormone (PTH) have been shown to increase the formation of cAMP in the kidney by the action of adenylate cyclase. It has been shown that a significant portion of the urinary cAMP is generated in response to parathyroid hormone. As a result, urinary cAMP measurements can be used for distinguishing between PTH or non-PTH mediated hypercalcemia and aid in the differential diagnosis of hypercalcemia. Additionally, measurements of urinary cAMP levels following PTH stimulation are useful for the differential diagnosis of hypoparathyroid disorders. Urinary cAMP is elevated in about 85%

of patients with hyperparathyroidism.

Reference Values

CYCLIC AMP
1.3-3.7 nmol/dL of glomerular filtrate

CREATININE, SERUM
Males
0-11 months: 0.17-0.42 mg/dL
1-5 years: 0.19-0.49 mg/dL
6-10 years: 0.26-0.61 mg/dL
11-14 years: 0.35-0.86 mg/dL
> or =15 years: 0.74-1.35 mg/dL

Females
0-11 months: 0.17-0.42 mg/dL
1-5 years: 0.19-0.49 mg/dL
6-10 years: 0.26-0.61 mg/dL
11-15 years: 0.35-0.86 mg/dL
> or =16 years: 0.59-1.04 mg/dL

CREATININE, URINE
No reference values apply. Interpret with other clinical data.

Interpretation

3'-5' -cyclic adenosine monophosphate (cAMP) is elevated in about 85% of patients with hyperparathyroidism and in about 50% of patients with humoral hypercalcemia of malignancy.

Minimal to no increase in cAMP levels following parathyroid hormone stimulation suggests type I pseudohypoparathyroidism.

Cautions

Parathyroid suppression (hypoparathyroidism) does not lower urinary 3'-5'-cyclic adenosine monophosphate (cAMP) excretion to definitively subnormal values.

Clinical Reference

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2. Babka JC, Bower RH, Sode J. Nephrogenous cyclic AMP levels in primary hyperparathyroidism. Arch Intern Med. 1976;136(10):1140-1144
3. Dohan PH, Yamashita K, Larsen PR, Davis B, Deftos L, Field JB. Evaluation of urinary cyclic 3'5'-adenosine monophosphate excretion in the differential diagnosis of hypercalcemia. J Clin Endocrinol Metab. 1972;35(6):775-784. doi:10.1210/jcem-35-6-775
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hypercalciurias. N Engl J Med. 1975;292(10):497-500. doi:10.1056/NEJM197503062921002
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7. Delrue C, Speeckaert R, Moresco RN, Speeckaert MM. Cyclic Adenosine Monophosphate Signaling in Chronic Kidney Disease: Molecular Targets and Therapeutic Potentials. Int J Mol Sci. 2024;25(17):9441. doi:10.3390/ijms25179441
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9. Tze WJ, Saunders J, Drummond GI. Urinary 3'5' cyclic AMP. Diagnostic test in pseudohypoparathyroidism. Arch Dis Child. 1975;50(8):656-658. doi:10.1136/adc.50.8.656
10. Ishida M, Seino Y, Simotsuji T, et al. Differential diagnosis of hypoparathyroid disorders during childhood. Calcif Tissue Int. 1980;31(3):203-207. doi:10.1007/BF02407182
11. Mantovani G. Clinical review: Pseudohypoparathyroidism: diagnosis and treatment. J Clin Endocrinol Metab. 2011;96(10):3020-3030. doi:10.1210/jc.2011-1048

Performance

Method Description

Acetonitrile is added to urine samples to dilute and precipitate proteins in proteinaceous samples. Next, the sample is further diluted with buffer followed by the addition of internal standard (8-methyl amino cyclic AMP). The resulting supernatant is then injected on the liquid chromatography tandem mass spectrometry instrument, which performs chromatographic separation and target measurement of 3'-5'-cyclic adenosine monophosphate (cAMP). Urine and serum creatinine levels are used to determine the clearance of cAMP from the kidneys.(Unpublished Mayo method)

Creatinine:
The enzymatic method is based on the determination of sarcosine from creatinine with the aid of creatininase, creatinase, and sarcosine oxidase. The liberated hydrogen peroxide is measured via a modified Trinder reaction using a colorimetric indicator. Optimization of the buffer system and the colorimetric indicator enables the creatinine concentration to be quantified both precisely and specifically.(Package insert: Creatinine plus v2. Roche Diagnostics; V15.0, 03/2019)

PDF Report

No

Day(s) Performed

Wednesday

Report Available

2 to 11 days

Specimen Retention Time

14 days

Test Definition: CARU

Cyclic Adenosine Monophosphate (cAMP), Urinary Excretion, Serum and Urine

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

82030
82570
82565

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
CARU	Cyclic Amp, Urinary Excretion	21052-6

Result ID	Test Result Name	Result LOINC® Value
179	Cyclic Amp, Urinary Excretion	22712-4
ACREA	Creatinine, S	2160-0
CRETR	Creatinine, Random, U	2161-8