MAYO CLINIC LABORATORIES

Test Definition: STRC

Standard Renal Clearance, Plasma and Random Urine

Overview

Useful For

Precise measurement of glomerular filtration rate and renal plasma flow

Profile Information

Test Id	Reporting Name	Available Separately	Always Performed
IOTC	Iothalamate Clearance	No	Yes
PAHCC	PAH Clearance	No	Yes

Method Name

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

NY State Available

Yes

Specimen

Specimen Type

Plasma Na Heparin
Urine

Specimen Required

Contact MLI for approval prior to ordering this test.

Both plasma and urine are required.

Specimen Type: Plasma
Container/Tube: 6-mL Green top (sodium heparin)
Specimen Volume: 3-4 mL
Collection Instructions: Label specimen as plasma.

Specimen Type: Urine
Container/Tube: Sarstedt 5 mL Aliquot Tube (T914)
Specimen Volume: 5 mL
Collection Instructions:
1. Collect a random urine collection.
2. No preservative.
3. Label specimen as urine.

Specimen Minimum Volume

2 mL plasma/5 mL urine

Reject Due To

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

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Plasma Na Heparin	Refrigerated (preferred)	7 days	
	Frozen	7 days	
Urine	Refrigerated (preferred)	7 days	
	Frozen	7 days	

Clinical & Interpretive

Clinical Information

The assessment of glomerular filtration rate (GFR) is an important parameter of renal function utilized by clinicians in the care of patients with varying renal diseases, and for clinical research when precise assessment of renal function is necessary. The GFR is the sum of all the filtration rates of the individual nephrons within the kidney and, as such, reflects the number of functioning nephrons.

GFR can fall due to a chronic renal disease that causes a permanent loss of nephrons, or due to an acute renal injury that is potentially reversible. In addition, a decline in renal blood flow, ie, secondary to volume depletion, can result in a fall in GFR that is functional and (potentially) quickly reversible. GFR increases when factors that decreased renal blood flow are corrected, or the kidney heals after an acute injury. GFR also increases transiently during pregnancy, as well as in response to other physiologic stimuli that include hyperglycemia or a dietary protein load.

Measurement of GFR can be performed by several methodologies including creatinine clearance, iothalamate clearance, and inulin clearance. Of these methods, the latter 2 are significantly more accurate and reproducible than the former.

Renal clearance of inulin, a fructose polymer, has traditionally been considered the gold standard for determination of GFR. Disadvantages to the use of inulin are its high cost, limited availability, and analytical expense. Previous studies have shown close correlation between iothalamate and inulin GFR determinations. The short renal clearance test, which utilizes a subcutaneous injection of nonradiolabeled iothalamate and a single (1 hour) urine specimen, is the preferred method for measurement of GFR in most situations since it is less time consuming and less costly.

The Standard Renal Clearance test, which utilizes continuous intravenous infusion of iothalamate (or inulin) and additional urine and plasma collections, is an alternative means of measuring GFR and may be preferable in patients with low urine flows (eg, patients with severe liver failure).

The Standard Renal Clearance test also measures renal plasma flow (RPF). Intravenously administered para-aminohippurate (PAH) is used to determine RPF because PAH is nearly completely removed from the renal circulation in a single pass, by a combination of glomerular filtration and tubular secretion.

Reference Values

GLOMERULAR FILTRATION RATE
20 years: 87-141 mL/min/SA
(Iothalmate) Decreases by 4.95 mL/min/decade

< or = 19 years: Not established
20 years: 87-141
21 years: 86-140
22 years: 86-140
23 years: 85-139
24 years: 85-139
25 years: 84-138
26 years: 84-138
27 years: 83-137
28 years: 83-137
29 years: 82-136
30 years: 81-136
31 years: 81-136
32 years: 81-135
33 years: 80-135
34 years: 80-134
35 years: 79-134
36 years: 79-133
37 years: 78-133
38 years: 78-132
39 years: 77-132
40 years: 77-131
41 years: 76-131
42 years: 76-130
43 years: 75-130
44 years: 75-129
45 years: 74-129
46 years: 74-128
47 years: 73-128
48 years: 73-127
49 years: 72-127
50 years: 72-126
51 years: 72-126
52 years: 71-125
53 years: 71-125

54 years: 70-124
55 years: 70-124
56 years: 69-123
57 years: 69-123
58 years: 68-122
59 years: 68-122
60 years: 67-121
61 years: 67-121
62 years: 66-120
63 years: 66-120
64 years: 65-119
65 years: 65-119
66 years: 65-119
67 years: 64-118
68 years: 64-118
69 years: 63-117
70-150 years: 62-116

PARA-AMINOHIPPURATE (PAH) CLEARANCE
PAH Clearance
0-19 years: not established
20-29 years: >448 mL/min/SA
30-39 years: >413 mL/min/SA
40-49 years: >378 mL/min/SA
50-59 years: >343 mL/min/SA
60-69 years: >308 mL/min/SA
70-79 years: >273 mL/min/SA
80-89 years: >238 mL/min/SA
90-99 years: >203 mL/min/SA

Note: Reference range decreases by 35mL/decade.

FILTRATION FRACTION
>or=16 years: 18-22%

Interpretation

Iothalamate Clearance:
Low glomerular filtration rate (GFR) values indicate abnormal renal function, which may be either reversible/transient or irreversible/permanent. GFR tends to decline with age.

Para-Aminohippurate (PAH) Clearance:
The renal clearance of PAH, calculated from measurements of PAH in serum and timed urine specimens, equals renal plasma flow (RPF). However, it is important to note that only 85% to 90% of PAH is cleared from the circulation in a single pass, so the PAH clearance may underestimate RPF by 10% to 15%.

Filtration Fraction (FF):
The FF is the fraction of plasma perfusing the kidneys that is filtered (FF=GFR/RPF). Under normal conditions, FF is approximately 20%. Values significantly different from this provide an index to changes in GFR relative to RPF. For example, in states of decreased renal perfusion due to congestive heart failure, both RPF and GFR are decreased, whereas the FF is >20%.

Cautions

A theoretical complication (one that has not been observed clinically to date) is transient suppression of thyroid function in premature and newborn infants. Therefore, a sensitive thyrotropin test is suggested approximately 23 weeks after a standard renal clearance test in that age group.

Because complete clearance of para aminohippurate (PAH) is dependent on tubular secretion, diseases or conditions that disproportionately affect renal tubular cells may decrease PAH clearance without necessarily causing a proportional decrease renal plasma flow. Therefore, PAH clearance may underestimate renal perfusion flow in patients with selected diseases that affect renal tubulointerstitium.

Clinical Reference

1. Seegmiller JC, Burns BE, Fauq AH, et al: Iothalamate quantification by tandem mass spectrometry to measure glomerular filtration rate. Clin Chem 2010;56:568-574
2. Slack TK, Wilson DM: Normal renal function CIN and CPAH in healthy donors before and after nephrectomy. Mayo Clin Proc 1976;51:296-300
3. Liedtke RR, Durate CG: Laboratory protocols and methods for the measurement of glomerular filtration rate and renal plasma flow. In Renal Function Tests. Edited by CG Duarte. Boston, Little Brown and Co., 1980, pp 49-63
4. Kasiske BL, Keane WF: Laboratory assessment of renal disease: clearence, urinalysis, and renal biopsy. In Brenner and Rector's The Kidney. Sixth edition. Edited by BM Brenner. Philadelphia, PA, WB Saunders Co, 2000, pp 1129-1142
5. Wilson DM, Bergert JH, Larson TS, Liedtke RR: GFR determined by nonradiolabeled iothalamate using capillary electrophoresis. Am J Kid Dis 1997;30:646-652

Performance

Method Description

Blood and timed urine samples are obtained after continuous intravenous infusion of iothalamate and para-aminohippurate (PAH), the patient is allowed to equilibrate. Both iothalamate and PAH are measured by liquid chromatography-tandem mass spectrometry (LC/MS/MS). Renal clearance is calculated using the standard clearance formula.

PDF Report

No

Day(s) Performed

Monday through Friday

Report Available
Same day/1 to 4 days

Specimen Retention Time
7 days

Performing Laboratory Location
Mayo Clinic Laboratories - Rochester Main Campus

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
82542 x 7

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
STRC	Standard Renal Clearance	96403-1

Result ID	Test Result Name	Result LOINC® Value
IOTC	Iothalamate Clearance	90995-2
PAHC	PAH Clearance	96404-9
FILT	Filtration Fraction	96405-6
CMT13	Comment	77202-0