Test Definition: CSTCE

Cystatin C with Estimated Glomerular Filtration Rate (eGFR), Serum

Overview

Useful For

Assessing kidney function in patients suspected of having kidney disease

Monitoring treatment response in patients with kidney disease

An index of glomerular filtration rate (GFR), especially in patients where serum creatinine may be misleading (eg, very obese, older adults, or malnourished patients)

Calculation of Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) cystatin C estimated GFR for patients where serum creatinine may be misleading (eg, very obese, older adults, or malnourished patients)

Method Name

Immunoturbidimetric

NY State Available

Yes

Specimen

Specimen Type

Serum

Specimen Required

Collection Container/Tube:
Preferred: Serum gel
Acceptable: Red top
Submission Container/Tube: Plastic vial
Specimen Volume: 0.5 mL
Collection Instructions:
1. Serum gel tubes should be centrifuged within 2 hours of collection.
2. Red-top tubes should be centrifuged and serum aliquoted into a plastic vial within 2 hours of collection.

Forms

If not ordering electronically, complete, print, and send one of the following forms with the specimen:
-General Test Request (T239)
-Cardiovascular Test Request Form (T724)
-Renal Diagnostics Test Request (T830)
-Kidney Transplant Test Request

Specimen Minimum Volume

0.25 mL

Reject Due To

Gross hemolysis	Reject
Gross lipemia	OK
Gross icterus	Reject

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Serum	Refrigerated (preferred)	14 days	
	Ambient	7 days	
	Frozen	30 days	

Clinical & Interpretive

Clinical Information

Cystatin C is a low-molecular weight (13,250 Da) cysteine proteinase inhibitor that is produced by all nucleated cells and found in body fluids, including serum. Since it is formed at a constant rate and freely filtered by the kidneys, its serum concentration is inversely correlated with the glomerular filtration rate (GFR); ie, a high concentration indicates a low GFR, while a lower concentration indicates a higher GFR, similar to creatinine.

The renal handling of cystatin C differs from creatinine. While both are freely filtered by glomeruli, once filtered, cystatin C, unlike creatinine, is reabsorbed and metabolized by proximal renal tubules. Therefore, under normal conditions, cystatin C does not enter the final excreted urine to any significant degree.

The serum concentration of cystatin C is not greatly affected by body mass, age, sex, or race. Thus, in certain cases, cystatin C may be a more reliable marker of kidney function (ie, GFR) than creatinine.

GFR can be estimated (eGFR) from serum cystatin C utilizing an equation that includes the age and sex of the patient. The Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) cystatin C equation was developed by Inker et al(1) and demonstrated good correlation with measured iothalamate clearance in patients with all common causes of kidney disease, including kidney transplant recipients. Cystatin C eGFR may have advantages over creatinine eGFR in certain patient groups whose muscle mass is abnormally high or low (for example quadriplegics, much older adults, or malnourished individuals). Blood levels of cystatin C also equilibrate more quickly than creatinine, and therefore, serum cystatin C may be more accurate than serum creatinine when kidney function is rapidly changing (eg, amongst hospitalized individuals).(2)

The same group also developed an eGFR equation that uses serum creatinine and cystatin C, in addition to age, sex, and

race.(1) This equation may be useful to average out potential confounders of creatinine versus cystatin C.

Reference Values

CYSTATIN C:
18-49 years: 0.63-1.03 mg/L
> or =50 years: 0.67-1.21 mg/L
0-17 years: Reference values have not been established. Refer to estimated glomerular filtration rate (eGFR).

ESTIMATED GFR:
>60 mL/min/BSA (body surface area)
Adult eGFR: Estimated GFR calculated using CKD-EPI Cystatin C equation.(1)
Pediatric eGFR: Estimated GFR calculated using Schwartz Cystatin C equation.(12)

Interpretation

Cystatin C:
Cystatin C inversely correlates with the glomerular filtration rate (GFR), that is, elevated levels of cystatin C indicate decreased GFR. Cystatin C may provide more accurate assessment of GFR for very obese, older adults, or malnourished patients than creatinine. Cystatin C equation does not require patient ethnic data and can be used for those patients with this information unavailable.

Due to immaturity of kidney function, cystatin C levels are higher in neonates less than 3 months of age.(3)

Estimated GFR:
Chronic kidney disease (CKD) is defined as the presence of persistent and usually progressive reduction in GFR (GFR <60 mL/min/1.73 m[2]) and/or albuminuria (>30 mg of urinary albumin per gram of urinary creatinine), regardless of GFR.

According to the National Kidney Foundation Kidney Disease Outcome Quality Initiative (KDOQI) classification, among patients with CKD, irrespective of diagnosis, the stage of disease should be assigned based on the level of kidney function.(4)

Table. Kidney Disease: Improving Global Outcomes (KDIGO) guidelines provide the following GFR categories

Stage	Description	GFR mL/min/BSA
1	Kidney damage with normal or increased GFR	90
2	Kidney damage with mild decrease in GFR	60-89
3A	Mild to moderate decrease in GFR	45-59
3B	Moderate to severe decrease in GFR	30-44
4	Severe decrease in GFR	15-29
5	Kidney failure	<15 (or dialysis)

Cautions

The estimated glomerular filtration rate (eGFR) is not a precise measure of GFR and can be influenced by nonrenal factors such as inflammation.

Clinical Reference

1. Inker LA, Schmid CH, Tighiouart H, et al; CKD-EPI Investigators: Estimating glomerular filtration rate from serum creatinine and cystatin C. N Engl J Med. 2012 Jul;367(1):20-29. doi: 10.1056/NEJMoa1114248
2. Frazee E, Rule AD, Lieske JC, et al: Cystatin C-guided vancomycin dosing in critically ill patients: a quality improvement project. Am J Kidney Dis. 2017 May;69(5):658-666. doi: 10.1053/j.ajkd.2016.11.016
3. Buehrig CK, Larson TS, Bergert JH, et al: Cystatin C is superior to serum creatinine for the assessment of renal function. J Am Soc Nephrol. 2001;12:194A
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5. Grubb AO: Cystatin C--properties and use as a diagnostic marker. Adv Clin Chem. 2000;35:63-99. doi: 10.1016/s0065-2423(01)35015-1
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8. Voskoboev NV, Larson TS, Rule AD, Lieske JC: Importance of cystatin C assay standardization. Clin Chem. 2011 Aug;57(8):1209-1211. doi: 10.1373/clinchem.2011.164798
9. Nitsch D, Sandling JK, Byberg L et al: Fetal, developmental, and parental influences on cystatin C in childhood: the Uppsala Family Study. Am J Kidney Dis. 2011 Jun;57(6):863-872. doi: 10.1053/j.ajkd.2010.12.025
10. Voskoboev NV, Larson TS, Rule AD, Lieske JC: Analytic and clinical validation of a standardized cystatin C particle enhanced turbidimetric assay (PETIA) to estimate glomerular filtration rate. Clin Chem Lab Med. 2012 Mar;50(9):1591-1596. doi: 10.1515/cclm-2012-0063
11. Finney H, Newman DJ, Thakkar H, Fell JM, Price CP: Reference ranges for the plasma cystatin C and creatinine measurements in premature infants, neonates, and older children. Arch Dis Child. 2000 Jan;82(1):71-75. doi: 10.1136/adc.82.1.71
12. Schwartz GJ, Schneider MF, Maier PS, et al: Improved equations estimating GFR in children with chronic kidney disease using an immunonephelometric determination of cystatin C. Kidney Int. 2012 Aug;82(4):445-453. doi: 10.1038/ki.2012.169

Performance

Method Description

Cystatin C:
Serum samples from patients are mixed with latex particles coated with anti-cystatin C antibodies. Human cystatin C agglutinates with latex particles coated with the anti-cystatin C antibodies. The aggregate is determined turbidimetrically at 546 nm.(Package insert: Tina-quant Cystatin C Gen.2. Roche Diagnostics; 10/2023)

Estimated GFR is calculated in the laboratory information system, SCC Soft, using the Schwartz Cystatin C equation for patients under 18 years old and the CKD-EPI Cystatin C Equation (2012) for patients 18 years of age and older (Salvador

CL, Tondel C, Rowe AD, et al: Estimating glomerular filtration rate in children: evaluation of creatinine- and cystatin C-based equations. Pediatr Nephrol. 2019 Feb;34(2):301-311. doi: 10.1007/s00467-018-4067-3; Inker LA, Schmid CH, Tighiouart H, CKD-EPI Investigators, et al: Estimating glomerular filtration rate from serum creatinine and cystatin C. N Engl J Med. 2012 Jul;367(1):20-29; National Kidney Foundation: CKD-EPI Cystatin C Equation (2012). Accessed March 25, 2021. Available at: www.kidney.org/content/ckd-epi-cystatin-c-equation-2012)

PDF Report
No

Day(s) Performed
Monday through Sunday

Report Available
Same day/1 to 3 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 has been cleared, approved, or is exempt by the US Food and Drug Administration and is used per manufacturer's instructions. Performance characteristics were verified by Mayo Clinic in a manner consistent with CLIA requirements.

CPT Code Information
82610

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
CSTCE	Cystatin C with Estimated GFR, S	87430-5

Result ID	Test Result Name	Result LOINC® Value
GFRC	eGFR by Cystatin C	In Process

CSTNC	Cystatin C, S	33863-2