MAYO CLINIC LABORATORIES

Test Definition: FLCS

Immunoglobulin Free Light Chains, Serum

Overview

Useful For

Monitoring serum from patients with monoclonal light chain diseases without a M-protein.

May be useful as a diagnostic test in patients in whom there is a suspicion of primary systemic amyloidosis, light chain deposition disease, or non-secretory myeloma

Profile Information

Test Id	Reporting Name	Available Separately	Always Performed
KFLCS	Kappa Free Light Chain, S	No	Yes
LFLCS	Lambda Free Light Chain, S	No	Yes
KLRS	Kappa/Lambda FLC Ratio	No	Yes

Testing Algorithm

The following algorithms are available:
-Amyloidosis: Laboratory Approach to Diagnosis
-Multiple Myeloma: Laboratory Screening

Special Instructions

- Amyloidosis: Laboratory Approach to Diagnosis
- Multiple Myeloma: Laboratory Screening

Method Name

KFLCS, LFLCS: Turbidimetry
KLRS: Calculation

NY State Available

Yes

Specimen

Specimen Type

Serum

Specimen Required

Supplies: Sarstedt Aliquot Tube, 5 mL (T914)
Collection Container/Tube:
Preferred: Serum gel
Acceptable: Red top

Submission Container/Tube: Plastic vial
Specimen Volume: 1 mL Serum
Collection Instructions: Centrifuge and aliquot serum into a plastic vial.

Forms

If not ordering electronically, complete, print, and send 1 of the following forms with the specimen:
-General Request (T239)
-Hematopathology/Cytogenetics Test Request (T726)
-Renal Diagnostics Test Request (T830)
-Kidney Transplant Test Request

Specimen Minimum Volume

Serum: 0.5 mL

Reject Due To

Gross hemolysis	OK
Gross lipemia	Reject
Gross icterus	OK

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Serum	Refrigerated (preferred)	28 days	
	Ambient	72 hours	
	Frozen	28 days	

Clinical & Interpretive

Clinical Information

The monoclonal gammopathies are characterized by a clonal expansion of plasma cells that secrete a monoclonal immunoglobulin. The monoclonal immunoglobulin secreted by these cells serves as a marker of the clonal proliferation, and the quantification of monoclonal protein can be used to monitor the disease course. The monoclonal gammopathies include multiple myeloma (MM), light chain MM (LCMM), Waldenstrom macroglobulinemia, nonsecretory MM (NSMM), smoldering MM (SMM), monoclonal gammopathy of undetermined significance, primary systemic amyloidosis (AL), and light chain deposition disease (LCDD). The monoclonal light chain diseases (LCMM, AL, LCDD, and NSMM) often do not have serum intact monoclonal proteins in high enough concentration to be detected and quantitated.

An elevated ratio of kappa to lambda free light chains (FLC K/L) indicates a monoclonal kappa FLC, and an abnormally low FLC K/L indicates a monoclonal lambda FLC. The kappa and lambda FLC may both be elevated in the sera of patients with polyclonal hypergammaglobulinemia, but the FLC K/L is normal. If a patient has an abnormal serum FLC K/L ratio but has no serum monoclonal protein detected by immunofixation, a urine monoclonal protein study (eg, immunofixation) should be performed and the serum immunofixation should be repeated.

The FLC K/L ratio may be useful as a diagnostic test for patients in whom immunofixation for serum monoclonal light chains is negative and in whom there is a suspicion of primary systemic amyloidosis, light chain deposition disease, or non-secretory myeloma.

The quantification of kappa or lambda immunoglobulin free light chains may be used to monitor disease activity in patients with monoclonal light chain diseases without a serum M-spike.

The following algorithms are available:
-Amyloidosis: Laboratory Approach to Diagnosis
-Multiple Myeloma: Laboratory Screening

Reference Values

KAPPA-FREE LIGHT CHAIN
0.61-4.02 mg/dL

LAMBDA-FREE LIGHT CHAIN
0.67-3.46 mg/dL

KAPPA/LAMBDA FLC RATIO
0.57-2.45

Interpretation

The specificity of this assay for detection of monoclonal light chains relies on the ratio of free kappa and lambda (K/L) light chains. Once an abnormal free light chain (FLC) K/L ratio has been demonstrated and a diagnosis has been made, the quantification of the monoclonal light chain is useful for monitoring disease activity.

Changes in FLC quantitation reflect changes in the size of the monoclonal plasma cell population. Our experience to date is limited, but changes of more than 25% or trending of multiple specimens are needed to conclude biological significance.

Cautions

Elevated kappa and lambda (K/L) free light chain (FLC) may occur due to polyclonal hypergammaglobulinemia or impaired renal clearance. A specific increase in FLC (eg, FLC K:L ratio) must be demonstrated for diagnostic purposes.

This assay has not been established for use with the pediatric population.

Moderate-to-marked lipemia may interfere with the ability to perform testing.

Undetected antigen excess is a rare event but cannot be excluded. Results should always be interpreted in conjunction with other laboratory tests and clinical evidence.

Supportive Data

Studies at Mayo Clinic have shown that in some patients with urine monoclonal light chains and negative serum immunofixation, the free light chain (FLC) assay can identify monoclonal FLC in the serum. These studies support the increased sensitivity of the turbidimetric FLC assay. In a series of patients with primary systemic amyloid treated by stem

cell transplantation, the quantitation and monitoring of FLC predicted organ response (eg, disease course).

Reference values for this test were updated in February 2026 by Mayo Clinic. Multiinstitutional studies confirmed substantial assay platform-specific variability, reinforcing calls from professional organizations to move toward locally validated or assay-appropriate ranges. Most recently, large population-based datasets from the iStopMM study(1) enabled robust age and kidney function–stratified reference intervals derived from tens of thousands of participants, culminating in updated interpretive workflows. Together, these developments made it clear that updating reference intervals was a necessary step to ensure accurate interpretation and reduce clinically meaningful misclassification. Mayo Clinic pursued a new reference interval (RI) study using current stabilized Optilite Freelite Kappa Free and Lambda Free reagents (The Binding Site Group, Ltd). Data from 489 patients (51% female) between the ages of 30 to 88 years were used. The new Mayo Clinic RIs were established as a central 99% range. The data compares closely with the iSTOPMM(1) recently published 99% central RI for healthy subjects and includes the RI proposed by Bertamini and colleagues(2) for individuals of African descent (Free Light Chain ratio of 0.686 to 2.10).

Clinical Reference

1. Einarsson Long T, Rognvaldsson S, Thorsteinsdottir S, et al. Revised Definition of Free Light Chains in Serum and Light Chain Monoclonal Gammopathy of Undetermined Significance: Results of the Istopmm Study. Blood 2023;142(Supplement 1):535-535. doi:10.1182/blood-2023-188547
2. Bertamini L, Alberge JB, Lee DJ, et al. Serum free light chains in a racially diverse population including African Americans and populations from South Africa. Blood. 2025;145(8):840-849. doi:10.1182/blood.2024026078
3. Kaleta E, Kyle R, Clark R, Katzmann J. Analysis of patients with gamma-heavy chain disease by the heavy/light chain and free light chain assays. Clin Chem Lab Med. 2014;52(5):665-669. doi:10.1515/cclm-2013-0714
4. Palladini G, Russo P, Bosoni T, et al. Identification of amyloidogenic light chains requires the combination of serum-free light chain assay with immunofixation of serum and urine. Clin Chem. 2009;55(3):499-504. doi:10.1373/clinchem.2008.117143
5. Dispenzieri A, Kyle R, Merlini G, et al. International Myeloma Working Group guidelines for serum-free light chain analysis in multiple myeloma and related disorders. Leukemia. 2009;23(2):215-224. doi:10.1038/leu.2008.307
6. Drayson M, Tang LX, Drew R, Mead GP, Carr-Smith H, Bradwell AR. Serum free light-chain measurements for identifying and monitoring patients with nonsecretory multiple myeloma. Blood. 2001;97(9):2900-2902
7. Bertamini L, Alberge JB, Lee DJ, et al. Serum free light chains in a racially diverse population including African Americans and populations from South Africa. Blood. 2025;145(8):840-849
8. Farnsworth CW, Roemmich B, Spears GM, Murray DL, Dispenzieri A, Willrich MAV. Clinical specificity of two assays for immunoglobulin kappa and lambda free light chains. Clin Chem Lab Med. 2023;62(5):929-938
9. Rozenova K, Willrich M, Snyder M, et al. Kappa free light chain drift prompts the need for a new upper limit of normal free light chain ratio to avoid an epidemic of kappa light chain monoclonal gammopathy of undermined significance. J Appl Lab Med. 2023;8(4):742-750
10. Fink SL, Wener MH, Rudolf JW, et al. A universal reference interval for serum immunoglobulins free light chains may be outdated. Clin Chem Lab Med. 2023;61(11):e229-e232

Performance

Method Description

The determination of the soluble antigen concentration by turbidimetric methods involves the reaction with specific

antiserum to form insoluble complexes. When light is passed through the suspension formed a portion of the light is transmitted and focused onto a photodiode by an optical lens system. The amount of transmitted light is indirectly proportional to the specific protein concentration in the test sample. Concentrations are automatically calculated by reference to a calibrations curve stored within the instrument.(Package inserts: Optilite Freelite Kappa Free Kit. The Binding Site Group, Ltd; 01/2024; Optilite Freelite Lambda Free Kit. The Binding Site Group, Ltd; 01/2024)

PDF Report
No

Day(s) Performed
Monday through Friday

Report Available
1 to 3 days

Specimen Retention Time
14 days

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 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
83521 x 2

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
FLCS	Immunoglobulin Free Light Chains, S	104533-5

Result ID	Test Result Name	Result LOINC® Value
LFLCS	Lambda Free Light Chain, S	33944-0
KLRS	Kappa/Lambda FLC Ratio	104546-7
KFLCS	Kappa Free Light Chain, S	104544-2