Test Definition: MSP3

Multiple Sclerosis (MS) Cascade, Serum and Spinal Fluid

Overview

Useful For

Diagnosing multiple sclerosis, especially helpful in patients with equivocal clinical or radiological findings

Profile Information

Test Id	Reporting Name	Available Separately	Always Performed
KCSFP	Kappa Free Light Chain, CSF	Yes, (KCSF)	Yes
XSRM	Additional sample for reflex OLIGS	No	Yes

Reflex Tests

Test Id	Reporting Name	Available Separately	Always Performed
OLIGS	Serum Bands	Yes, (Order OLIG, submit CSF and Serum)	No
OLIGC	CSF Bands	Yes, (Order OLIG, submit CSF and Serum)	No

Testing Algorithm

Kappa free light-chain testing will be performed by nephelometry on cerebral spinal fluid (CSF) samples. When kappa free light-chain testing indicates either borderline or positive results (> or =0.0600 mg/dL), the oligoclonal banding test will be performed at an additional charge.

If the time of testing exceeds the specimen stability for oligoclonal banding tests, only kappa free light-chain testing will be performed. Kappa free light-chain testing will only be performed up to specimen stability.

For more information see Central Nervous System Demyelinating Disease Diagnostic Algorithm.

Special Instructions

- Central Nervous System Demyelinating Disease Diagnostic Algorithm

Method Name

KCSFP: Nephelometry
OLIGC, OLIGS: Isoelectric Focusing (IEF) with IgG Immunoblot Detection

NY State Available

Yes

Specimen

Specimen Type
CSF
Serum

Specimen Required
Both serum and spinal fluid are required. Spinal fluid must be obtained within 1 week of serum collection.

Specimen Type: Spinal fluid
Container/Tube: Sterile vial
Specimen Volume: 1 mL
Collection Instructions:
1. Submit CSF from collection vial no. 4.(preferred); vial no. 1, 3, 2 are also acceptable (in this order).
2. Label specimen as spinal fluid.

Specimen Type: Serum
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
Collection Instructions:
1. Within 2 hours of collection, centrifuge and aliquot serum into a plastic vial.
2. Label specimen as serum.

Forms
If not ordering electronically, complete, print, and send a Neurology Specialty Testing Client Test Request (T732) with the specimen.

Specimen Minimum Volume
Serum, Spinal fluid: 0.5 mL

Reject Due To

Gross hemolysis	Reject
Gross lipemia	OK
Gross icterus	OK

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
CSF	Frozen (preferred)	14 days	
	Ambient	24 hours	
	Refrigerated	72 hours	
Serum	Frozen (preferred)	14 days	
	Ambient	14 days	
	Refrigerated	14 days	

Clinical & Interpretive

Clinical Information

Multiple sclerosis (MS) is a chronic inflammatory demyelinating disease characterized by visual, motor, and sensory disturbances. The diagnosis of MS is dependent on clinical, radiological, and laboratory findings. The detection of increased intrathecal immunoglobulin synthesis is the basis for current diagnostic laboratory tests for MS. These tests include the kappa free light chain detection in cerebrospinal fluid (CSF) and CSF oligoclonal bands detection.

Reference Values

KAPPA FREE LIGHT CHAIN
Medical decision point: 0.1000 mg/dL
Positive: > or =0.1000 mg/dL
Borderline: 0.0600 mg/dL-0.0999 mg/dL
Negative <0.0600 mg/dL

OLIGOCLONAL BANDS:
<2 bands

Interpretation

When the result is less than 0.0600 mg/dL, the kappa free light-chain concentration measured in cerebrospinal fluid (CSF) is lower than the threshold associated with demyelinating disease. This is a negative result. Testing for oligoclonal banding is not performed. Clinical correlation is recommended.

When the result is between 0.0600 and 0.0999 mg/dL, this is a borderline result. These findings are not specific for multiple sclerosis (MS) because CSF-specific immunoglobulin synthesis may also be detected in patients with other neurologic diseases (infectious, inflammatory, cerebrovascular, autoimmune, and paraneoplastic). Clinical correlation is recommended. Automatic reflexing to oligoclonal bands will occur.

When the result is 0.1000 mg/dL or greater, the kappa free light chain concentration measured in CSF is at or greater than the threshold associated with demyelinating disease. This is a positive result. These findings, however, are not specific for MS because CSF-specific immunoglobulin synthesis may also be detected in patients with other neurologic diseases (infectious, inflammatory, cerebrovascular, autoimmune, and paraneoplastic). Clinical correlation is recommended. Automatic reflexing to oligoclonal bands will occur.

A Mayo Clinic study published in 2018 with 325 patients suggested that a kappa free light-chain concentration in CSF

greater than or equal to 0.06 mg/dL has 92% clinical sensitivity for the diagnosis of MS.(1)
A second, larger Mayo Clinic study with 1355 patients published in 2021 showed that a kappa CSF concentration greater than or equal to 0.06 mg/dL had approximately 89% sensitivity. When the kappa value was greater than or equal to 0.1 mg/dL, it had similar sensitivity (87%) to the finding of two unique CSF oligoclonal bands (89%).(2)
Given the difference in thresholds based on these studies and highest sensitivity at the threshold of 0.06 mg/dL, any CSF kappa free light-chain result greater than or equal to 0.06 mg/dL will reflex to oligoclonal banding when the multiple sclerosis cascade test is ordered.

When the oligoclonal band assay detects two or more unique IgG bands in the CSF, the result is positive. Cerebrospinal fluid is used in the diagnosis of MS by identifying increased intrathecal IgG synthesis qualitatively (oligoclonal bands). The presence of two or more unique CSF oligoclonal bands was reintroduced as one of the diagnostic criteria for MS in the 2017 revised McDonald criteria.(3) These findings, however, are not specific for MS as CSF-specific IgG synthesis may also be found in patients with other neurologic diseases including infectious, inflammatory, cerebrovascular, and paraneoplastic disorders. Clinical correlation is recommended.

Clinical test performance of CSF kappa free light chain-based approaches was evaluated in a retrospective cohort of 325 subjects, including 67 patients with clinically diagnosed MS, using contemporary cutoffs and interpretation criteria. Diagnostic performance was compared across oligoclonal banding (greater than or equal to 2 CSF-restricted bands), CSF kappa free light chain concentration alone (where greater than or equal to 0.6 mg/dL), kappa index (greater than or equal to 6.1), and the multiple sclerosis reflex testing strategy used in this test.

Oligoclonal banding demonstrated a sensitivity of 94% and specificity of 72%. CSF kappa free light chain concentration alone demonstrated a sensitivity of 92.5% with a specificity of 73.6%. The kappa index demonstrated a sensitivity of 94% with a specificity of 71.9%, closely approximating the performance of oligoclonal banding. The reflex testing strategy demonstrated a sensitivity of 91% with a specificity of 78.7%.

Statistical comparison of sensitivity and specificity across these methods demonstrated no statistically significant differences. CSF kappa free light chain concentration, kappa index, the reflex and oligoclonal banding were mutually non-inferior with respect to sensitivity. The reflex testing strategy demonstrated modestly higher specificity.

Cautions

Increased intrathecal immunoglobulin synthesis may occur in other inflammatory central nervous system diseases, and therefore, these assays are not specific for multiple sclerosis.

In patients with hypogammaglobulinemia or who are receiving B cell depleting therapy (eg. anti-CD20), the kappa index or oligoclonal banding may be more informative than absolute cerebrospinal fluid (CSF) kappa free light chain concentrations. Interpretation should consider serum kappa concentration and CSF/serum albumin quotient, particularly in the presence of blood-CSF barrier disruption or profound immunosuppression.

Supportive Data

In a cohort of 1307 patients, where 159 had demyelinating disease, the Mayo Clinic oligoclonal banding test had a clinical sensitivity of 74% and clinical specificity of 89%, area under the ROC (receiver operating characteristic) curve of 0.813, when two or more unique cerebrospinal fluid (CSF) bands are used as a cutoff for positive. This kappa free light chain test, when considered positive at a concentration greater than or equal to 0.1000 mg/dL as a medical decision

point, has a sensitivity of 70% with a specificity of 87%. The differences between the two tests are not statistically significant and the 2 tests show comparable performance with shorter turn-around-time for results and an objective quantitative result.

This panel combines the ease of use and interpretation of the quantitative measurement of kappa free light chains in CSF and allies it to the traditional interpretation of oligoclonal bands for optimized efficiency in laboratory testing for demyelinating diseases and improved test utilization.

Clinical Reference

1. Gurtner KM, Shosha E, Bryant SC, et al. CSF free light chain identification of demyelinating disease: comparison with oligoclonal banding and other CSF indexes. Clin Chem Lab Med. 2018;56(7):1071-1080
2. Saadeh RS, Bryant SC, McKeon A, et al. CSF kappa free light chains: cutoff validation for diagnosing multiple sclerosis. Mayo Clin Proc. 2022;97(4):738-751. doi:10.1016/j.mayocp.2021.09.014
3. Thompson AJ, Banwell BL, Barkhof F, et al. Diagnosis of multiple sclerosis: 2017 revisions of the McDonald criteria. Lancet Neurol. 2018;17(2):162-173
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6. Hegen H, Zinganell A, Auer M, Deisenhammer F. The clinical significance of single or double bands in cerebrospinal fluid isoelectric focusing. A retrospective study and systematic review. PLoS One. 2019;14(4):e0215410. doi:10.1371/journal.pone.0215410
7. Deisenhammer F, Zetterberg H, Fitzner B, Zettl UK. The Cerebrospinal fluid in multiple sclerosis. Front Immunol. 2019;10:726. doi:10.3389/fimmu.2019.00726
8. Susse M, Hannich M, Petersmann A, et al. Kappa free light chains in cerebrospinal fluid to identify patients with oligoclonal bands. Eur J Neurol. 2018;25(9):1134-1139. doi:10.1111/ene.13667
9. Hegen H, Arrambide G, Gnanapavan S, et al. Cerebrospinal fluid kappa free light chains for the diagnosis of multiple sclerosis: A consensus statement. Mult Scler. 2023;29(2):182-195. doi:10.1177/13524585221134217
10. Hegen H, Walde J, Berek K, et al. Cerebrospinal fluid kappa free light chains for the diagnosis of multiple sclerosis: A systematic review and meta-analysis. Mult Scler. 2023;29(2):169-181. doi:10.1177/13524585221134213

Performance

Method Description

Kappa Free Light Chain:
Kappa free light chain is measured by nephelometric method in which the light scattered onto the antigen-antibody complexes is measured. The intensity of the measured scattered light is proportional to the amount of antigen-antibody complexes in the sample under certain conditions.(Instruction manual: Siemens Nephelometer II. Siemens, Inc; Version 2.3, 2008; Addendum to the Instruction Manual 2.4, 07/2019)

Oligoclonal Banding:
The oligoclonal banding assay requires paired cerebrospinal fluid (CSF) and serum samples. Unconcentrated CSF and

diluted serum are electrophoresed by isoelectric focusing. The separated IgG bands are visualized by an IgG immunoblot, and oligoclonal bands present in the CSF and not in the serum are reported. The assay uses reagents from Helena Laboratories.(Saadeh RS, Ramos PA, Algeciras-Schimnich A, Flanagan EP, Pittock SJ, Willrich MA. An update on laboratory-based diagnostic biomarkers for multiple sclerosis and beyond. Clin Chem. 2022;68(9):1134-1150. doi:10.1093/clinchem/hvac061)

PDF Report
No

Day(s) Performed
Monday through Friday

Report Available
3 to 5 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 modified from the manufacturer's instructions. Its performance characteristics were determined by Mayo Clinic in a manner consistent with CLIA requirements. This test has not been cleared or approved by the US Food and Drug Administration.

CPT Code Information
83521
83916 x2 (if appropriate)

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
MSP3	Multiple Sclerosis Cascade	100757-4

Result ID	Test Result Name	Result LOINC® Value

KCSFP	Kappa Free Light Chain, CSF	48774-4
XSRM	Additional sample for Reflex OLIGS	No LOINC Needed