MAYO CLINIC LABORATORIES

Test Definition: MPSS

Monoclonal Protein Study, Serum

Overview

Useful For

Diagnosis of monoclonal gammopathies, when used in conjunction with urine monoclonal studies

Monitoring patients with monoclonal gammopathies

Protein electrophoresis alone is **not considered** an adequate screen for monoclonal gammopathies.

Profile Information

Test Id	Reporting Name	Available Separately	Always Performed
TPE	Total Protein	Yes, (order TP)	Yes
ELP	Protein Electrophoresis	No	Yes
IMFX	Immunofixation	Yes, (order IMFXO)	Yes

Reflex Tests

Test Id	Reporting Name	Available Separately	Always Performed
IFXED	Immunofixation Delta and Epsilon, S	Yes	No

Testing Algorithm

This test includes total protein, serum protein electrophoresis, and immunofixation. If a monoclonal light chain is detected in the absence of an associated monoclonal heavy chain, an immunofixation electrophoresis (IFE) specific for delta and epsilon chains is performed.

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

TPE: Colorimetric, Biuret
ELP: Agarose Gel Electrophoresis
IMFX, IFXED: Immunofixation

NY State Available

No

Specimen

Specimen Type
Serum

Ordering Guidance
To monitor a patient with an established diagnosis of a monoclonal gammopathy, order PELO / M-Spike Follow-up, Serum.

Specimen Required
Patient Preparation:
Fasting: 8 hours, preferred but not required
Collection Container/Tube:
Preferred: Serum gel
Acceptable: Red top
Submission Container/Tube: Plastic vial
Specimen Volume: 1 mL
Collection Instructions: Centrifuge and aliquot serum into a plastic vial.

Specimen Minimum Volume
0.6 mL

Reject Due To

Gross hemolysis	OK
Gross lipemia	OK
Gross icterus	OK

Specimen Stability Information

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

Clinical & Interpretive

Clinical Information
Monoclonal proteins are markers of plasma cell proliferative disorders. It has been recommended that serum and urine protein electrophoresis (PEL) and immunofixation electrophoresis (IFE) be performed as the diagnostic algorithm. A monoclonal band (M-spike) on serum and/or urine PEL identifies a monoclonal process and quantitates the abnormality.

IFE characterizes the type of monoclonal protein (gamma, alpha, mu, delta, or epsilon heavy chain; kappa or lambda light chain). IFE is also more sensitive than PEL for detecting small abnormalities that may be present in diseases such as light chain multiple myeloma, oligosecretory myeloma, and plasmacytomas.

Monoclonal gammopathies may be present in a wide spectrum of diseases that include malignancies of plasma cells or B lymphocytes (multiple myeloma [MM], macroglobulinemia, plasmacytoma, B-cell lymphoma), disorders of monoclonal protein structure (primary amyloid, light chain deposition disease, cryoglobulinemia), and apparently benign, premalignant conditions (monoclonal gammopathy of undetermined significance [MGUS], smoldering MM). While the identification of the monoclonal gammopathy is a laboratory diagnosis, the specific clinical diagnosis is dependent on a number of other laboratory and clinical assessments.

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

Reference Values

PROTEIN, TOTAL
> or =1 year: 6.3-7.9 g/dL
Reference values have not been established for patients that are younger than 12 months of age.

PROTEIN ELECTROPHORESIS
Albumin: 3.4-4.7 g/dL
Alpha-1-globulin: 0.1-0.3 g/dL
Alpha-2-globulin: 0.6-1.0 g/dL
Beta-globulin: 0.7-1.2 g/dL
Gamma-globulin: 0.6-1.6 g/dL
M-Spike: 0.0 g/dL
An interpretive comment is provided with the report.

IMMUNOFIXATION
No monoclonal protein detected

IMMUNOFIXATION FLAG
Negative

Interpretation

Monoclonal Gammopathies:
-A characteristic monoclonal band (M-spike) is often found on protein electrophoresis (PEL) in the gamma globulin region and, more rarely, in the beta or alpha-2 regions. The finding of an M-spike, restricted migration, or hypogammaglobulinemic PEL pattern is suggestive of a possible monoclonal protein and should be followed by MPSU / Monoclonal Protein Study, 24 Hour, Urine, which includes immunofixation (IF), to identify the immunoglobulin heavy chain and/or light chain.
-A monoclonal IgG or IgA of greater than 3 g/dL is consistent with multiple myeloma (MM).
-A monoclonal IgG or IgA of less than 3 g/dL may be consistent with monoclonal gammopathy of undetermined significance (MGUS), primary systemic amyloidosis, early or treated myeloma, as well as a number of other monoclonal gammopathies.

-A monoclonal IgM of greater than 3 g/dL is consistent with macroglobulinemia.
-The initial identification of a serum M-spike greater than 1.5 g/dL on PEL should be followed by MPSU / Monoclonal Protein Study, 24 Hour, Urine.
-The initial identification of an IgM, IgA, or IgG M-spike greater than 4 g/dL, greater than 5 g/dL, and greater than 6 g/dL respectively, should be followed by SVISC / Viscosity, Serum.
-After the initial identification of an M-spike, quantitation of the M-spike on follow-up PEL can be used to monitor the monoclonal gammopathy. However, if the monoclonal protein falls within the beta region (most commonly an IgA or an IgM) quantitative immunoglobulin levels may be more a useful tool to follow the monoclonal protein level than PEL. A decrease or increase of the M-spike that is greater than 0.5 g/dL is considered a significant change.
-Patients suspected of having a monoclonal gammopathy may have normal serum PEL patterns. Approximately 11% of patients with MM have a completely normal serum PEL, with the monoclonal protein only identified by IF. Approximately 8% of MM patients have hypogammaglobulinemia without a quantifiable M-spike on PEL but identified by IF. Accordingly, a normal serum PEL does not rule out the disease and PEL should not be used to screen for the disorder.

Other Abnormal PEL Findings:
-A qualitatively normal but elevated gamma fraction (polyclonal hypergammaglobulinemia) is consistent with infection, liver disease, or autoimmune disease.
-A depressed gamma fraction (hypogammaglobulinemia) is consistent with immune deficiency and can also be associated with primary amyloidosis or nephrotic syndrome.
-A decreased albumin (<2 g/dL), increased alpha-2 fraction (>1.2 g/dL), and decreased gamma fraction (<1 g/dL) is consistent with nephritic syndrome and, when seen in an adult older than 40 years, should be followed by MPSU / Monoclonal Protein Study, 24 Hour, Urine.
-In the hereditary deficiency of a protein (eg, agammaglobulinemia, alpha-1-antitrypsin [A1AT] deficiency, hypoalbuminemia), the affected fraction is faint or absent.

Cautions

Protein electrophoresis (PEL) alone is not considered an adequate screen for monoclonal gammopathies.

Very large IgG M-spikes (>4 g/dL) may saturate the protein stain. In these situations, quantitative IgG assays (IGG / Immunoglobulin G [IgG], Serum) should be performed to accurately determine M-spike concentrations to monitor disease progression or response to therapy.

Although the PEL M-spike is the recommended method of monitoring monoclonal gammopathies, IgA and IgM proteins that are contained in the beta fraction may be more accurately monitored by quantitative immunoglobulins.

Fibrinogen will migrate as a distinct band in the beta-gamma fraction. Serum specimens from new patients with a beta-gamma band are to be treated with thrombin to ensure complete conversion of fibrinogen.

Hemolysis may augment the beta fraction.

Penicillin may split the albumin band.

Radiographic agents may produce an uninterpretable pattern.

Clinical Reference

1. Keren DF, Humphrey RL: Clinical indications and applications of serum and urine protein electrophoresis. In: Detrick B, Schmitz JL, Hamilton RG, eds. Manual of Molecular and Clinical Laboratory Immunology. 8th ed. ASM Press; 2016:74-88
2. Katzmann JA, Keren DF: Strategy for detecting and following monoclonal gammopathies. In: Detrick B, Schmitz JL, Hamilton RG, eds. Manual of Molecular and Clinical Laboratory Immunology. 8th ed. ASM Press; 2016:112-124
3. Kyle RA, Katzmann JA, Lust, JA, Dispenzieri A: Clinical indications and applications of electrophoresis and immunofixation. In: Rose NR, Hamilton RG, Detrick B, eds. Manual of Clinical Laboratory Immunology. 6th ed. ASM Press; 2002:66-70

Performance

Method Description

Electrophoresis:
Proteins are large molecules composed of covalently linked amino acids. Depending on electron distributions resulting from covalent or ionic bonding of structural subgroups, proteins can be either polar or nonpolar at a given pH. In the SPIFE TOUCH SPE procedure, proteins are separated according to their respective electrical charges on agarose gel using both the electrophoretic and electroendosmotic forces present in the system. The proteins are then stained with a visible stain. Multiplying by the serum total protein converts the percentage of protein in each fraction into serum concentration. (Package insert: Helena SPIFE TOUCH SPE Procedure. Helena Laboratories; 06/2018)

Immunofixation:
Immunofixation is performed with Sebia reagent sets and are specific for gamma, alpha, mu, kappa, and lambda immunoglobulin heavy and light chains.(Package insert: Sebia Hydrasys Hydragel 1, 2, 4, and 9IF. Sebia, Inc; 09/2015)

If a monoclonal light chain is detected in the absence of an associated monoclonal heavy chain, an immunofixation electrophoresis (IFE) specific for delta and epsilon chains is performed.(Sykes E, Posey Y: Immunochemical characterization of immunoglobulins in serum, urine, and cerebrospinal fluid. In: Detrick B, Schmitz JL, Hamilton RG, eds. Manual of Molecular and Clinical Laboratory Immunology. 8th ed. ASM Press; 2016:89-100)

Total Protein:
Divalent copper reacts in alkaline solution with protein peptide bonds to form the characteristic purple-colored biuret complex. Sodium potassium tartrate prevents the precipitation of copper hydroxide and potassium iodide prevents autoreduction of copper. The color intensity is directly proportional to the protein concentration which can be determined photometrically.(Package insert: TP2 cobas. Roche Diagnostics; V 12.0. 11/2019)

PDF Report

No

Day(s) Performed

Monday through Friday

Report Available

1 to 6 days

Specimen Retention Time

14 days

Performing Laboratory Location

Mayo Clinic Jacksonville Clinical Lab

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

84155
84165
86334
86334-Immunofixation Delta and Epsilon (if appropriate)

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
MPSS	Monoclonal Protein Study, S	24351-9

Result ID	Test Result Name	Result LOINC® Value
81653	Immunofixation	74665-1
606977	Flag, Immunofixation	No LOINC Needed
TPE	Total Protein	2885-2
2769	Albumin	2862-1
2770	Alpha-1 Globulin	2865-4
2771	Alpha-2 Globulin	2868-8
2773	Beta-Globulin	2871-2
2774	Gamma-Globulin	2874-6
2785	A/G Ratio	44429-9
22308	M spike	33358-3
22309	M spike	33358-3
15254	Impression	49296-7