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

<table>
<thead>
<tr>
<th>Test ID</th>
<th>Reporting Name</th>
<th>Available Separately</th>
<th>Always Performed</th>
</tr>
</thead>
<tbody>
<tr>
<td>TPE</td>
<td>Total Protein</td>
<td>Yes, (order TP)</td>
<td>Yes</td>
</tr>
<tr>
<td>ELP</td>
<td>Protein Electrophoresis</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>IMFX</td>
<td>Immunofixation</td>
<td>Yes, (order IMFXO)</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Testing Algorithm
This test includes total protein, serum protein electrophoresis, and heavy and light chain typing (kappa and lambda).

The following algorithms are available in Special Instructions:

- Laboratory Approach to the Diagnosis of Amyloidosis
- Laboratory Screening Tests for Suspected Multiple Myeloma

Special Instructions

- Laboratory Approach to the Diagnosis of Amyloidosis
- Laboratory Screening Tests for Suspected Multiple Myeloma

Method Name
TPE: Biuret
ELP: Agarose Gel Electrophoresis
IMFX: Immunofixation

NY State Available
Yes

Specimen

Specimen Type
Serum

Advisory Information
To monitor a patient with an established diagnosis of a monoclonal gammopathy, order MMOGA / Monoclonal
Test Definition: MPSS
Monoclonal Protein Study, Serum

Specimen Required

Patient Preparation: Fasting preferred but not required

Container/Tube:

Preferred: Serum gel

Acceptable: Red top

Specimen Volume: 1 mL

Forms

If not ordering electronically, complete, print, and send a General Request with the specimen.

Specimen Minimum Volume

0.6 mL

Reject Due To

<table>
<thead>
<tr>
<th>Gross hemolysis</th>
<th>OK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross lipemia</td>
<td>OK</td>
</tr>
<tr>
<td>Gross icterus</td>
<td>OK</td>
</tr>
</tbody>
</table>

Specimen Stability Information

<table>
<thead>
<tr>
<th>Specimen Type</th>
<th>Temperature</th>
<th>Time</th>
<th>Special Container</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serum</td>
<td>Refrigerated (preferred)</td>
<td>14 days</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ambient</td>
<td>14 days</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Frozen</td>
<td>14 days</td>
<td></td>
</tr>
</tbody>
</table>

Clinical and Interpretive

Clinical Information

Serum proteins can be grouped into 5 fractions by protein electrophoresis:

- Albumin, which represents almost two-thirds of the total serum protein

- Alpha-1, composed primarily of alpha-1-antitrypsin (A1AT), an alpha-1-acid glycoprotein

- Alpha-2, composed primarily of alpha-2-macroglobulin and haptoglobin

- Beta, composed primarily of transferrin and complement C3

- Gamma, composed primarily of immunoglobulins (Ig)
The concentration of these fractions and the electrophoretic pattern may be characteristic of diseases such as monoclonal gammopathies, A1AT deficiency disease, nephrotic syndrome, and inflammatory processes associated with infection, liver disease, and autoimmune diseases.

The following algorithms are available in Special Instructions:

- **Laboratory Approach to the Diagnosis of Amyloidosis**
- **Laboratory Screening Tests for Suspected Multiple Myeloma**

**Reference Values**

**PROTEIN, TOTAL**

> or =1 year: 6.3-7.9 g/dL

Reference values have not been established for patients that are <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

An interpretive comment is provided with the report.

Reference values have not been established for patients that are <16 years of age.

**IMMUNOFIXATION**

No monoclonal protein detected

**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 (Ig) 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 VISCS / 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.

Caution

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.

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

Performance

Method Description

Electrophoresis:

Serum proteins are separated in an electric field according to their size, shape, and electric charge. The separation is performed on agarose gels. The proteins are visualized by staining with acid blue and the intensity of staining is quantitated by densitometry (Helena Quick Scan 2000). Multiplying by the serum total protein converts the percentage of protein in each fraction into serum concentration. (Instruction manual: Helena SPIFE 3000 and package insert: Helena SPIFE SPE Vls Gel 2001)

Immunofixation:

Immunofixation is performed with Sebia reagent sets and are specific for gamma, alpha, mu, kappa, and lambda immunoglobulin heavy and light chains. 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. (Katzmann JA, Kyle RA: Chapter 10: Immunochemical characterization of immunoglobulins in serum, urine, and cerebrospinal fluid. In Manual of Molecular and Clinical Laboratory Immunology. Seventh edition. Edited by B Detrick, RG Hamilton, JD Folds. Washington DC. ASM Press, 2006, pp 88-100)

Free Light Chains:

The quantitation of free light chain (FLC) by nephelometry uses FLC antisera from The Binding Site, Ltd., and is performed on the Siemens Nephelometer II. (Bradwell AR, Carr-Smith HD, Mead GP, et al: Highly sensitive, automated immunoassay for immunoglobulin free light chains in serum and urine. Clin Chem 2001;47[4]:673-80)

PDF Report

No

Day(s) and Time(s) Test Performed

Monday through Saturday; 2 p.m.

Analytic Time

1 day

Maximum Laboratory Time

3 days

Specimen Retention Time

14 days

Performing Laboratory Location

Rochester

Fees and 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 Regional Manager. For assistance, contact Customer Service.

**Test Classification**

This test has been cleared or approved by the U.S. 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

**LOINC® Information**

<table>
<thead>
<tr>
<th>Test ID</th>
<th>Test Order Name</th>
<th>Order LOINC Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPSS</td>
<td>Monoclonal Protein Study, S</td>
<td>24351-9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Result ID</th>
<th>Test Result Name</th>
<th>Result LOINC Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>81653</td>
<td>Immunofixation</td>
<td>74665-1</td>
</tr>
<tr>
<td>TPE</td>
<td>Total Protein</td>
<td>2885-2</td>
</tr>
<tr>
<td>2769</td>
<td>Albumin</td>
<td>2862-1</td>
</tr>
<tr>
<td>2770</td>
<td>Alpha-1 Globulin</td>
<td>2865-4</td>
</tr>
<tr>
<td>2771</td>
<td>Alpha-2 Globulin</td>
<td>2868-8</td>
</tr>
<tr>
<td>2773</td>
<td>Beta-Globulin</td>
<td>2871-2</td>
</tr>
<tr>
<td>2774</td>
<td>Gamma-Globulin</td>
<td>2874-6</td>
</tr>
<tr>
<td>2785</td>
<td>A/G Ratio</td>
<td>44429-9</td>
</tr>
<tr>
<td>22308</td>
<td>M spike</td>
<td>33358-3</td>
</tr>
<tr>
<td>22309</td>
<td>M spike</td>
<td>33358-3</td>
</tr>
<tr>
<td>15254</td>
<td>Impression</td>
<td>49296-7</td>
</tr>
</tbody>
</table>