**Examination**

Protein Electrophoresis (Total protein, albumin, Bence Jones protein, serum protein electrophoresis SPE, myeloma, and other B cell dyscrasias screen)

**Purpose of test**

The main reasons for requesting a protein electrophoresis (SPE) is in the
- investigation and monitoring of myeloma, and other B cell dyscrasias
- investigation of high serum globulin level
- suspicion of abnormal alpha-1 antitrypsin

If total protein >90 or globulin fraction >45 on first presentation we recommend obtaining patient consent for SPE if there is a clinical suspicion of plasma cell dyscrasia

**Sample**

Blood & Urine

**Sample Tube/Container**

Adult- Yellow top
- Qualitative - Random Urine (early morning)
- Quantitative - 24 hour urine (no preservative)

Paediatric- Yellow top
- Qualitative - Random Urine (early morning)

**Sample Volume**

4ml (blood)
10ml (urine)
Minimum (see calculation of minimum volume)

**Special Precautions**

No specific requirements

**Request Form:**

Clinical Chemistry & Haematology Requests

**Laboratory**

Biochemistry

**Biological reference range**

Total Protein 60 - 80 g/L
Albumin 35 - 50 g/L
Globulin: 18 - 36 g/L
Bence Jones protein not normally detected

Electrophoresis: visual interpretation

**Clinical decision values**

New paraprotein bands are telephoned to the clinician responsible for the patient if they warrant haematology referral. eg IgG ≥15 g/L, IgA or IgM ≥10 g/L.
The consultant haematologist is informed if the patient is a risk of hyperviscosity. (IgG > 60g/L, IgA >40g/L, IgM >30g/L)

See also additional section

**Factors affecting performance**

Haemolysed samples are unsuitable as they can show extra banding in the alpha-2/beta fractions. Plasma samples are unsuitable since fibrinogen appears as an additional band in the beta/gamma region.
Samples when frozen or stored in fridge can show anodic
shift of beta-lipoproteins from within beta zone to anywhere up to alpha-1 zone, degree of shift is proportional to the length of storage. Thawed samples can give application marks due to protein denaturation. These additional bands may cause difficulty in interpretation.

Monoclonal antibody therapy may produce false positive SPE results

**Turnaround times:** The Laboratory aims to report 90% of requests within the stated time from receipt

5 working days

**Patient preparation** No specific requirements

**Instructions for patient collected sample** No specific requirements

**Sample transportation** No specific requirements

**Special handling needs** No specific requirements

**Patient consent required** Implied consent

**Specific rejection criteria** Generic rejection applies

**Additional information** Minimum Retest Intervals- Follow up MGUS by repeating serum or urine electrophoresis every 3 months and extend interval to 6 months if stable and no symptoms. In MM(multiple myeloma) follow up in 3 weeks or at consultant’s request

Recommended testing strategies

- Investigation of suspected myeloma
  - SPE
  - bence jones protein
  - immunofixation
  - immunoglobulins
- elevated serum protein (>90g/L)
  - reflex SPE testing with addition of immunoglobulins if M protein detected
- follow up
  - SPE and /or bence Jones

Follow up of newly found M-protein in serum
- request full blood count, renal function, calcium, albumin and LDH
- request serum immunoglobulin levels, and repeat protein electrophoresis
- send spot urine for detection of BJP

In patient with IgG, IgA, IgD or IgE paraprotein
assess for symptoms and signs of:
- myeloma- hypercalcaemia, anaemia, bone pain, infection, hyperviscosity
- lymphoma- lymphadenopathy, hepatosplenomegaly, pancytopenia, symptoms eg night sweats, fever, weight loss
- amyloidosis- macroglossia, unexplained heart failure, peripheral neuropathy, carpal tunnel syndrome, nephritic syndrome
- consider performing X-rays of symptomatic areas

In patient with IgM, paraprotein assess for symptoms and signs of:
- lymphoma- lymphadenopathy, hepatosplenomegaly, pancytopenia, symptoms eg night sweats, fever, weight loss
- peripheral neuropathy
- myeloma- although unusual

monoclonal gammopathy of undetermined significance (MGUS) likely if
- IgG PP <15g/L
- IgA PP < 10g/L
- IgM PP < 10g/L
- uninvolved immunoglobulins normal
- asymptomatic
- no other abnormal results
Follow up MGUS by repeating serum or urine electrophoresis every 3 months and extend interval to 6 months if stable and no symptoms

Refer to haematologists in following circumstances
- if age < 60 years
- symptomatic of suspected treatable disorder
- abnormal physical signs suggestive of underlying plasma cell or lymphoproliferative disorder
- unexplained abnormal investigation results (blood or x-ray)
- IgG PP > 15g/L
- IgA PP > 10g/L
- IgM PP > 10g/L
- any IgD or IgE paraprotein irrespective of size
- MGUS patient where
  •new symptoms/signs: Such as new bone pain, weight loss, fatigue
  •M-protein rises by >25% (minimum absolute rise of 5g/L)
  •unexplained anaemia, other cytopenias, renal impairment, hypercalcaemia

Certain conditions or diseases may be associated with decreases or increases in various serum proteins, as
reflected below:

**Albumin**
- decreased with malnutrition and malabsorption, pregnancy, kidney disease (especially nephrotic syndrome), liver disease, inflammatory conditions, and protein-losing syndromes
- increased with dehydration

**Alpha1 globulin**
- decreased in congenital emphyseaema (a1-antitrypsin deficiency, a rare genetic disease) or severe liver disease
- increased in acute or chronic inflammatory diseases

**Alpha2 globulin**
- decreased with hyperthyroidism or severe liver disease, haemolysis (red blood cell breakage)
- increased with kidney disease (nephrotic syndrome), acute or chronic inflammatory disease

**Beta globulin**
- decreased with malnutrition, cirrhosis
- increased with hypercholesterolaemia, iron deficiency anaemia, some cases of multiple myeloma or MGUS

**Gamma globulin**
- decreased variety of genetic immune disorders, and in secondary immune deficiency
- increased Polyclonal: chronic inflammatory disease, rheumatoid arthritis, systemic lupus erythematosus, cirrhosis, chronic liver disease, acute and chronic infection, recent immunization. Monoclonal: Waldenstrom's macroglobulinaemia, multiple myeloma, monoclonal gammopathies of undetermined significance (MGUS)

**References**
- Lab Tests Online
- WHO use of anticoagulants in diagnostic laboratory investigations
- National Minimum Re-testing Interval Project: A final report detailing consensus recommendations for minimum re-testing intervals for use in Clinical Biochemistry 2012
- Northern Ireland regional audit group for clinical biochemistry- laboratory investigation of suspected multiple myeloma E Hanna 2012
- UK Myeloma Forum and Nordic Myeloma Study group: Guidelines for the investigation of newly detected M-proteins and the management of monoclonal gammopathy of undetermined significance (MGUS) British journal of Haematology 2009; 147, 22-42
- International Myeloma Working Group guidelines for serum-free light chain analysis in multiple myeloma and
related disorders. Leukaemia 2008; 23: Number 2