

Proteins in Blood and Urine

Objective

Type of proteins in blood

**clinical utility of proteins in blood
and urine**

Proteins are important materials and nutrients in human body. All enzymes, receptors, membrane channels, Ags, Abs(Igs), coagulation factors and peotide hormones(GH, prolactin),... are proteins in nature. Proteins may be linear structural(such as collagen) or globular functional such as enzymes, hormones Proteins are polymer of amino acids, formed by peptide bond between adjacent two amino acids. Amount of proteins in blood depend on balance:

**rate of synthesis \leftrightarrow rate of catabolism+
clearance.**

However, protein distribution between the IV and EV compartments is also important, so protein concentrations in blood also affected by amounts of blood(water) in IV compartment. All protein are synthesized in the liver, with exception of complement systems(by liver and macrophages), and Igs (by B Lymphocytes of immune system.

Proteins in blood are fractionated and separated by electrophoresis technique in which serum but not plasma (presence of fibrinogen makes the results difficult to be interpreted) is introduced to filter paper or acrylamide ... etc which is found in PH 8.6. Then electrical current is passed into media and the protein is separated into: albumin, α 1-globulin, α 2-globulin, β -globulin, γ -globulin. The latter four fractions referred to total globulin.

**So: Total protein=albumin+total globulin.
Total protein in human is \approx 56-86 gr/l,
albumin alone \approx 38-51 gr/l. The total
globulin is calculated by subtraction of
total protein from albumin.
The finding of normal total protein does
not excludes the abnormal condition as
the significant decrease of albumin may
be accompanied by significant increase of
total globulin.**

Hyperproteinemia and hyperalbuminemia are rare and of no significant value and may be obtained from prolonged vein stasis during blood collection and from excessive dehydration.

Hypoalbuminemia:

It is important as albumin is one of the major components of osmotic colloid pressure of blood vessels and so in normal fluid distribution and blood pressure.

Hypoalbuminemia causes are:

1. Chronic liver disease;liver cirrhosis
2. Advanced kidney disease;Nephrotic syndrome
3. Malnutrition and malabsorption
4. Loss through GIT;Enteropathy & skin; extensive burns.

Clinical consequences:

1. oedema due to migration of fluid from IV to interstitial compartment
2. transporter and binding capacity defects; such as for fatty acids, bilirubin, steroid Hs and drugs which may leads to toxicity with appropriate dose.

Globulin

Increased in globulin may be due to increased in one or more of its fractions; α , β , and γ . The α -1 and -2 include :antitrypsin(anti-protease enzymes to limit the host enzymes during the infection period), haptoglobin(Hb binder during hemolysis to conserve the body iron), ceruloplasmin, C- reactive protein(CRP, inflammatory factor), α 2- macroglobulin.... etc. The β includes transferrin, β 1-microglobulin.... . The γ includes the IgG,M,A,D and E. The α and β components are increased in acute infection while γ components increased in chronic infection, such as chronic viral hepatitis.

α_2 macroglobulin is the only protein fraction that increased in end stage of kidney disease because of its large MW, while other proteins decreased due to their leakage in the urine. B1-microglobulin is marker of tumor as increased in malignancy of blood cells; in multiple myeloma and leukemia.

Protein in urine normally less than 150 mg/day of proteins appear in urine, in kidney disease this value increased according to degree of kidney damage which reflect mainly the glomerular damage. Normally glomerulus is permeable to proteins of MW \leq 60 KD. In kidney damage(glomerulus) excess amounts of proteins of large MW $>$ 60 KD will pass in the urine and may reach 5-50 gr/day.

Presence of low MW of proteins in the urine indicates the renal tubules damage as these tubules normally catabolize and reabsorb the low MW proteins. In tubules damage these proteins will escape from the damaged tubules and appear in the urine