Plasma Proteins

- Plasma contains >300 different proteins
- Many pathological conditions affect level of plasma proteins
- Mostly synthesized in the liver
- Some are produced in other sites
- A normal adult contains ~70 g/L of pps

Functions of plasma proteins

• Transport (Albumin, prealbumin, globulins)
• Maintain plasma oncotic pressure (Albumin)
• Defense (Immunoglobulinsand complement)
• Clotting and fibrinolysis (Thrombin and plasmin)

Measurement of Plasma Proteins

A) Quantitative measurement of a specific protein: Chemical or immunological reactions
B) Semiquantitative measurement by electrophoresis:
. Proteins are separated by their electrical charge in electrophoresis
. Five separate bands of proteins areobserved
. These bands change in disease

Types of Plasma Proteins

. Prealbumin
. Albumin
. α1-Globulins:
. α1-Antitrypsin, α-fetoprotein
. α2-Globulins:
. Ceruloplasmin, haptoglobin
. β-Globulins:
. CRP, transferrin, β2-microglobulin
. γ- Globulins

Prealbumin (Transthyretin)

. A transport protein for:
. Thyroid hormones
. Retinol (vitamin A)
. Migrates faster than albumin in electrophoresis
. Separated by immunoelectrophoresis
. Lower levels found in:
. liver disease, nephrotic syndrome, acute phase inflammatory response, malnutrition
. Short half-life (2 days)

Albumin

.

Most abundant plasma protein (~40 g/L) in normal adult

. Synthesized in the liver as preproalbumin and secreted as albumin

. Half-life in plasma: 20 days

. Decreases rapidly in injury, infection and surgery

Functions

• A non-specific carrier of

– hormones, calcium, free fatty acids, drugs, etc.

• Tissue cells can take up albumin by pinocytosis where it is hydrolyzed to amino acids

• Useful in treatment of liver diseases, hemorrhage, shock and burns.

α1-Antitrypsin

. Synthesized by the liver and macrophages

. An acute-phase protein that inhibits proteases

. Proteases are produced endogenously and from leukocytes and bacteria

. Digestive enzymes (trypsin, chymotrypsin)

. Other proteases (elastase, thrombin)

. Infection leads to protease release from bacteria and from leukocytes

α-Fetoprotein (AFP)

. Synthesized in the developing embryo and fetus by the parenchymal cells of the liver

. AFP levels decrease gradually during intra-uterine life and reach adult levels at birth

. Function is unknown but it may protect fetus fromimmunologic attack by the mother

. No knownphysiological function in adults

Ceruloplasmin

. Synthesized by the liver

. Contains >90% of serum copper

. An oxidoreductase that inactivates ROS causing tissue damage in acute phase response

. Important for iron absorption from the intestine

. Wilson's disease:

. Due to low plasma levels of ceruloplasmin

. Copper is accumulated in the liver and brain

β2–Microglobulin

. A component of human leukocyte antigen (HLA)

. Present on the surface of lymphocytes and most nucleated cells

. Filtered by the renal glomeruli due to its small size but most (>99%) is reabsorbed

. Elevated serum levels are found in

. Overproduction in disease

. May be a tumor marker for:

. Leukemia, lymphomas, multiple myeloma

C-Reactive Protein (CRP)

. An acute-phase protein synthesized by the liver

. Important for phagocytosis

. High plasma levels are found in many inflammatory conditions such as rheumatoid arthritis
. A marker for ischemic heart disease

Hypergammaglobulinemia
. May result from stimulation of
. B cells (Polyclonal hypergammaglobulinemia)
. Monoclonal proliferation (Paraproteinemia)
Polyclonal hypergammaglobulinemia:
. Stimulation of many clones of B cells produce a wide range of antibodies
. γ-globulin band appears large in electophoresis
. Clinical conditions: acute and chronic infections, autoimmune diseases, chronic liver diseases