Total Protein

Interpretive Summary

**Description:** Total protein in the blood is primarily composed of albumin and globulins (see individual interpretive summaries) with a minor contribution from coagulation proteins and fibrinogen.

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**Decreased Total Protein**

**Common Causes**

- Decreased production:
  - Intestinal malabsorption
  - Malnutrition
  - Severe gastrointestinal (GI) parasitism (multifactorial)
  - Liver insufficiency/failure
- Increased loss
  - Hemorrhage (especially external)
  - Protein-losing nephropathy (PLN)
  - Protein-losing enteropathy (PLE)/lymphangiectasia
- Other causes
  - Exocrine pancreatic insufficiency (EPI) leading to maldigestion

**Uncommon Causes**

- Decreased production
  - Addison's disease (decreased albumin production)
  - Immunodeficiency (decreased globulins)
    - Congenital
    - Inherited
    - Acquired
- Increased loss
  - Severe exudative skin disease
  - Vasculitis
  - Peritonitis
  - Pleuritis
- Other causes
  - Failure of passive transfer of colostrum (neonates)
  - Hemodilution
    - Intravenous fluids
    - Edema disorders
      - Congestive heart failure
      - Nephrotic syndrome
      - Hydrothorax
      - Ascites
      - Concurrent hypovolemia and increased total body water
        - Fluid accumulation in third space
        - Fluid accumulation in GI tract
      - Syndrome of inappropriate ADH secretion (SIADH)

**Related Findings**

- Decreased production
  - Intestinal malabsorption
    - Decreased albumin and globulins
- Albumin:globulin (A:G) ratio should be normal
- Increased or decreased serum folate, decreased cobalamin
  - GI parasitism
    - Positive fecal ova and parasites
  - Liver disease
    - Increased liver enzymes (ALT, AST, GGT, ALP), bile acids
    - Decreased albumin, BUN, cholesterol, glucose
    - Primarily due to decreased albumin production; A:G ratio decreased
- Increased loss
  - Hemorrhage
    - Regenerative anemia on CBC
    - Decreased albumin and globulins
    - A:G ratio should be normal
  - Protein-losing nephropathy
    - Increased urine protein:creatinine ratio
    - Decreased urine specific gravity
    - Increased BUN, creatinine, phosphorus with secondary tubular damage
    - Primarily loss of albumin. A:G ratio decreased
    - Globulins may be increased if chronic antigenic stimulation due to underlying cause
  - Protein losing enteropathy
    - Both albumin and globulins are decreased
    - A:G ratio should be normal
    - Increased or decreased serum folate, decreased cobalamin (B12)
    - Fecal alpha one protease inhibitor increased
    - Decreased cholesterol with lymphangiectasia and also with other severe intestinal disease
- EPI
  - Decreased trypsin-like immunoreactivity (TLI)

### Increased Total Protein

#### Common Causes
- Dehydration
- Chronic inflammation
- Infection
  - Viral (feline infectious peritonitis [FIP])
  - Rickettsial (especially ehrlichiosis)
  - Chronic bacterial
- Neoplasia
  - Plasma cell myeloma
  - Extra medullary plasmacytoma
  - Some lymphomas

#### Uncommon Causes
- Infection
  - Viral (feline immunodeficiency virus [FIV])
  - Protozoal
  - Fungal
  - Parasites (e.g. heartworms)
- Immune-mediated disease
- Artifact (all cause false increases)
  - Lipemia
  - Hemolysis
  - Icterus
Related Findings

- **Dehydration**
  - Increased hematocrit
  - Pre-renal azotemia
  - Well concentrated urine
  - Albumin and globulin both increased; A:G ratio normal

- **Chronic inflammation**
  - Increased neutrophils and monocytes

- **Infection**
  - Polyclonal gammopathy on serum protein electrophoresis (SPE); occasionally monoclonal in ehrlichiosis
  - Positive viral antibody or antigen titers/PCR

- **Neoplasia**
  - Monoclonal gammopathy on SPE
  - Bence Jones protein positive in urine (myeloma, some extra medullary plasma cell tumors)
  - Monoclonal gammopathy on urine protein electrophoresis (myeloma, some extra medullary plasma cell tumors)
  - CBC may show cytopenias in other cell lines

- **Artifact**
  - Gross examination of sample shows
    - Hemolysis
    - Icterus
    - Lipemia

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Additional Information

**Physiology**

- Total protein in serum is made up of albumin and globulins only. In plasma there is also some contribution from fibrinogen and coagulation proteins
- Total protein in the body is manufactured mostly in the liver and by the structures that comprise the immune system (which make gamma-globulins)

**References**


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