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.

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

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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