Hematocrit

Interpretive Summary

Description: Hematocrit is the percentage of blood volume made up by red blood cells. Red blood cells are the most numerous blood cells and are critical for oxygen delivery and acid-base balance.

Decreased Hematocrit

Common Causes

- Hemolysis
  - Immune-mediated (IMHA)
  - Infectious: hemotropic mycoplasma, rickettsial diseases, babesiosis, cytauxzoonosis, heartworm
  - Zinc toxicity
- Blood loss
  - Trauma
  - Ruptured neoplasms
  - Parasitism
  - Hemostasis defects
  - Marked thrombocytopenia
- Decreased or ineffective production of red blood cells
  - Anemia of chronic inflammatory disease
  - Decreased erythropoietin (chronic renal disease, hypothyroidism, Addison's disease)
  - Infections (FeLV, FIV, rickettsial)
  - Bone marrow disease/myelophthisis (e.g. lymphoproliferative, myeloproliferative disorders, metastatic neoplasia, myelofibrosis)

Uncommon Causes

- Hemolysis
  - Drugs: methimazole, phenobarbital, sulfas
  - Mechanical fragmentation (e.g. heartworm disease, hemangiosarcoma, DIC)
  - Neoplasia
  - Toxins, envenomations
  - Pyruvate kinase deficiency, phosphofructokinase deficiency
  - Hypophosphatemia
  - Idiopathic
- Blood loss
  - Gastrointestinal ulcers
- Decreased or ineffective production of red blood cells
  - Drugs (chemotherapeutics, radiation, estrogen)
  - Iron or copper deficiency
  - Cobalamin (vitamin B12) or folate deficiency
  - Immune-mediated destruction within the bone marrow
  - Chronic lead poisoning
  - Idiopathic

Related Findings

- Hemolysis
  - Increased reticulocytes
  - Increased leukocytes, +/- decreased platelets
  - Increased serum bilirubin, bilirubinuria, +/- hemoglobinuria
  - Spherocytosis (in dogs), autoagglutination, +/- positive Coombs or saline agglutination test (IMHA)

    - Positive serology, PCR, or antigen testing for infectious causes
    - Blood parasites visualized on blood smear
    - Gastrointestinal metallic foreign body found on abdominal radiographs
- Blood loss
    - Increased reticulocytes
    - Decreased total protein and/or albumin
    - Pleural or peritoneal effusion and/or pulmonary hemorrhage on radiographs or ultrasound
    - Positive fecal ova and parasite screen, positive fecal occult blood
    - +/- Decreased serum iron concentration, normal total iron binding capacity, and decreased serum ferritin (if chronic blood loss)
    - Increased PT and/or PTT, decreased platelets, prolonged buccal mucosal bleeding time, or low von Willebrand factor level
- Decreased or ineffective production of red blood cells
    - Normal to decreased reticulocyte count
    - Increased BUN and creatinine, +/- increased phosphorus, low urine specific gravity (chronic kidney disease)
    - Decreased T4 and free T4, increased TSH (hypothyroidism)
    - Abnormal ACTH stimulation test, decreased sodium, increased potassium, decreased Na/K, and decreased cholesterol and albumin (Addison's disease)
    - Possible decreased white blood cell count and/or platelet count
    - Positive serology or PCR for infectious causes
    - Abnormal findings on bone marrow aspirate cytology or biopsy

Increased Hematocrit

Common Causes

- Relative increase with normal red blood cell mass
    - Dehydration
    - Splenic contraction
- Secondary physiologic increase in erythropoiesis in response to renal or systemic hypoxemia
    - Chronic lung disease
    - Chronic cardiac disease

Uncommon Causes

- Relative increase with normal red blood cell mass
    - Internal shifting of fluid
- Secondary physiologic increase in erythropoiesis in response to renal or systemic hypoxemia
    - High altitude
    - Hyperthyroidism
- Secondary increase in erythropoiesis in response to inappropriate erythropoietin secretion
    - Renal: cysts, tumors, hydronephrosis
    - Erythropoietin-secreting tumors (paraneoplastic)
- Primary absolute increase due to red blood cell neoplasia (polycythemia vera)

Related Findings

- Relative increase with normal red blood cell mass
    - Dehydration
        - Increased total protein and/or albumin
        - Increased sodium and chloride
        - Increased BUN and creatinine, increased urine specific gravity
- Secondary increase in erythropoiesis
    - Chronic lung disease
        - Increased reticulocyte count and nucleated red blood cells
        - Decreased PO_2 on arterial blood gas, low SpO_2 on pulse oximeter
        - Pulmonary pathology on thoracic radiographs
    - Chronic cardiac disease

- Increased Cardiopet® proBNP
- Cardiomegaly +/- pulmonary edema on thoracic radiographs
- Abnormalities on echocardiogram with possible right to left shunting

Additional Information

Physiology

- Red blood cells (RBCs, erythrocytes, red cells, red corpuscles) are the longest-lived of the circulating blood cells. They are produced primarily in the bone marrow, but some production can occur at secondary sites (spleen, liver). Red blood cell production is stimulated by erythropoietin which is released from the kidneys.
- Red blood cells contain hemoglobin and are critical in bringing oxygen to tissues.

Diagnostic Methodology

- Automated hematology analyzers calculate the hematocrit by multiplying the number of red blood cells X their average volume or RBC x MCV. Stated simply - HCT = (RBC x MCV)/10.
- A packed cell volume (PCV) by definition means that centrifugation was used to separate the blood sample into three layers: plasma, buffy coat (leukocytes and platelets), and packed red cells.
- Because of plasma trapping a PCV is usually slightly greater than a HCT determined by automated equipment. The difference is usually less than 2% but may approach 4% in some samples. (Example: a single canine EDTA whole blood sample with a PCV = 48% and a HCT = 46.9%.)
- Anemia is defined as a decrease in the hematocrit. More specifically, anemia can be a reduction in the numbers (count) of red blood cells (RBC), the concentration of HGB, or the HCT or packed cell volume (PCV). Note that decreases in these parameters may not be uniform, owing to differences in reference intervals or to the presence of abnormal RBCs.

References

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