Mean Corpuscular Hemoglobin Concentration (MCHC)

Interpretive Summary

Description: Mean corpuscular hemoglobin concentration (MCHC) is the calculated concentration of hemoglobin in a specific volume of red blood cells.

Decreased MCHC

Common Causes

- Reticulocytosis
  - Regenerative anemia
    - Hemolysis
    - Blood Loss
- Decreased hemoglobin production
  - Iron deficiency

Uncommon Causes

- Reticulocytosis
  - Idiopathic
- Decreased hemoglobin production
  - Possible copper or vitamin B6 (pyridoxine) deficiency

Related Findings

- Hemolysis
  - 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
  - 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
- Iron deficiency
  - Decreased total protein and/or albumin
  - Increased BUN and positive fecal occult blood
  - Bone marrow aspirate or biopsy consistent with low iron stores
  - +/- Decreased serum iron concentration, normal total iron binding capacity, and decreased serum ferritin (if chronic)

Increased MCHC

Common Causes

- Interfering substance or a test error

- In-vivo or in-vitro hemolysis
- Lipemia

Uncommon Causes

- Treatment with hemoglobin products (e.g. Oxyglobin)
- Heinz bodies

Related Findings

- In-vivo or in-vitro hemolysis
    - Anemia
    - Increased bilirubin, bilirubinuria, or hemoglobinuria

Additional Information

Physiology

- Hemoglobin is a large globular protein that is composed of two alpha chains and two beta chains for a total of four iron-containing heme groups bound to four globulin chains.
- Hemoglobin gives blood its characteristic red color and (as oxyhemoglobin) is responsible for oxygen transport by the red blood cells.
- Hemoglobin measurements are the most direct indication of oxygen transport capacity of blood in a patient.
- Neither red blood cell size changes nor in vitro hemolysis will alter the hemoglobin concentration, although both HCT and PCV may be affected.

Diagnostic Methodology

- The mean corpuscular hemoglobin concentration (MCHC) is the ratio of the weight of hemoglobin to the volume of the erythrocyte and is expressed as either a percentage or in grams per deciliter of red cells (g/dL).
- The MCHC is classically determined by the equation: MCHC = (HGB/HCT) x 100.
- In automated equipment, however, the HCT is a calculated value based on the RBC and the MCV values which are directly measured parameters. An MCHC value derived from an automated hematology analyzer, therefore, is based on all 3 directly measured red cell parameters (HGB, RBC and MCV) and is affected by an abnormality in any one of these measurements.
- MCHC corrects for cell volume (size) and should be used for classification of anemia if different from the MCH value.
- Since the MCHC is the mean value of all the red cells it is a relatively insensitive test. Multiple processes that affect the MCHC may balance each other out and result in a mean value within the reference interval (example: A reticulocytosis which decreases the MCHC may be counterbalanced by hemolysis which elevates the MCHC.).
- A true increase in MCHC is not possible as cells cannot contain an increased amount of hemoglobin.

References

- Latimer KS, Mahaffey EA, Prasse KW, eds. *Duncan and Prasse's Veterinary Laboratory Medicine: Clinical Pathology*, 4th ed. Ames, IA: Blackwell; 2003.
- Stockham SL, Scott MA. *Fundamentals of Veterinary Clinical Pathology*, 2nd ed. Ames, IA: Blackwell; 2008.

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