Hematology

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Hematology

In a clinical laboratory the hematology department performs numerous different tests on blood. The most commonly performed test is the complete blood count (CBC) also called full blood count (FBC), which includes; white blood cell count, platelet count, hemoglobin level and several parameters of red blood cells. Coagulation is a sub-speciality of hematology; basic general coagulation tests are the prothrombin time (PT) and partial thromboplastin time (PTT). Another common hematology test in the erythrocyte sedimentation rate (ESR).

CBC

A complete blood count (CBC), also known as full blood count (FBC) or full blood exam (FBE) or blood panel, The cells that circulate in the bloodstream are generally divided into three types: white blood cells (leukocytes), red blood cells (erythrocytes), and platelets or thrombocytes. Abnormally high or low counts may indicate the presence of many forms of disease, and hence blood counts are amongst the most commonly performed blood tests in medicine. In the past, counting the cells in a patient's blood was performed manually, by viewing a slide prepared with a sample of the patient's blood under a microscope (a blood film, or peripheral smear). Nowadays, this process is generally automated by use of an automated analyzer, with only specific samples being examined manually. Counting chambers that hold a specified volume of diluted blood (as there are far too many cells if it is not diluted) are used to calculate the number of red and white cells per liter of blood.

A CBC Panel will normally include:

Red cells

- Total red blood cells - The number of red cells is given as an absolute number per litre.
- Hemoglobin - The amount of hemoglobin in the blood, expressed in grams per decilitre. (Low hemoglobin is called anemia.)
- Hematocrit or packed cell volume (PCV) - This is the fraction of whole blood volume that consists of red blood cells.
- Red blood cell indices
    - Mean corpuscular volume (MCV) - the average volume of the red cells, measured in femtolitres. Anemia is classified as microcytic or macrocytic based on whether this value is above or below the expected normal range. Other conditions that can affect MCV include thalassemia and reticulocytosis.
    - Mean corpuscular hemoglobin (MCH) - the average amount of hemoglobin per red blood cell, in picograms.
    - Mean corpuscular hemoglobin concentration (MCHC) - the average concentration of hemoglobin in the cells.
- Red blood cell distribution width (RDW) - a measure of the variation of the RBC population

White cells

- Total white blood cells - All the white cell types are given as a percentage and as an absolute number per litre.

  A complete blood count with differential will also include:

- Neutrophil granulocytes - May indicate bacterial infection. May also be raised in acute viral infections.Because of the segmented appearance of the nucleus, neutrophils are sometimes referred to as "segs." The nucleus of less mature neutrophils is not segmented, but has a band or rod-like shape. Less

mature neutrophils - those that have recently been released from the bone marrow into the bloodstream - are known as "bands" or "stabs". Stab is a German term for rod.[1]

- Lymphocytes - Higher with some viral infections such as glandular fever and. Also raised in lymphocytic leukaemia CLL. Can be decreased by HIV infection. In adults, lymphocytes are the second most common WBC type after neutrophils. In young children under age 8, lymphocytes are more common than neutrophils.[2].
- Monocytes - May be raised in bacterial infection, tuberculosis, malaria, Rocky Mountain spotted fever, monocytic leukemia, chronic ulcerative colitis and regional enteritis [3]
- Eosinophil granulocytes - Increased in parasitic infections, asthma, or allergic reaction.
- Basophil granulocytes- May be increased in bone marrow related conditions such as leukemia or lymphoma.

Platelets

- Platelet numbers are given, as well as information about their size and the range of sizes in the blood.

PT and PTT

The prothrombin time (PT) are measures of the *extrinsic pathway* of coagulation. Coagulation is a complex process by which blood forms clots. It is an important part of hemostasis (the cessation of blood loss from a damaged vessel) whereby a damaged blood vessel wall is covered by a platelet and fibrin containing clot to stop bleeding and begin repair of the damaged vessel. In all mammals, coagulation involves both a cellular (platelet) and a protein (coagulation factor) component. The prothrombin time is most commonly measured using blood plasma. Blood is drawn into a test tube containing liquid citrate, which acts as an anticoagulant by binding the calcium in a sample. The blood is mixed, then centrifuged to separate blood cells from plasma.
The partial thromboplastin time (PTT) is a performance indicator measuring the efficacy of both the "intrinsic"and the common coagulation pathways. Apart from detecting abnormalities in blood clotting, it is also used to monitor the treatment effects with heparin, a major anticoagulant.

ESR

The erythrocyte sedimentation rate (ESR), also called a sedimentation rate, sed rate, or Biernacki Reaction, is the rate at which red blood cells precipitate in a period of 1 hour. It's a common haematology test which is a non-specific measure of inflammation. To perform the test, anticoagulated blood is placed in an upright tube, known as a Westergren tube and the rate at which the red blood cells fall is measured and reported in mm/h. The ESR is increased by any cause or focus of inflammation. The ESR is decreased in sickle cell anemia, polycythemia, and congestive heart failure. The basal ESR is slightly higher in females.

Blood Films

A blood film or peripheral blood smear is a microscope slide made from a drop of blood, that allows the cells to be examined microscopically. Blood films are made by placing a drop of blood on one end of a slide, and using a *spreader slide* to disperse the blood over the slide's length. The aim is to get a region where the cells are spaced far enough apart to be counted and differentiated.

The slide is left to air dry, after which the blood is fixed to the slide by immersing it briefly in methanol. The fixative is essential for good staining and presentation of cellular detail. After fixation, the slide is stained to distinguish the cells from each other.

Vet Tech Hematology & Urinalysis Name_____

1. Define these terms:
    a. hematology
    b. urinalysis
    c. saphenous
    d. catheterization
    e. cystocentesis
    f. polyuria
    g. oliguria
    h. anuria
    i. glucosuria
    j. ketonuria
    k. coagulation
    l. anemia
    m. hemostasis
2. What is one advantage and one disadvantage to midstream collection, manual expression, catheterization, and cystocentesis.
3. What percent of your urine is water? Urea?
4. If I were to draw blood on a dog cephalically, where would I stick him?
5. Where is the best location to draw blood on a large animal?
6. If you collected a urine sample from a horse that appeared to be quite turbid, what might that indicate?
7. If you collect a urine sample that appeared brownish in color, what would that indicate?
8. Why would you want the urine to have a pH of about 6?
9. An over weight dog is being fed a calorie restricted diet and exercised to reduce his weight. What effect will that have on his urinalysis?
10. Why is it difficult to determine whether an animal is giving an appropriate volume of urine?
11. What does an elevated ESR reveal about the patient? A reduced?
12. Why must a blood be fixed and stained on a blood film?
13. What is the purpose of spreading the blood sample across the slide in a blood film?