White blood cells: leukocytes function

Fluid plasma and formed elements constitutes blood. Blood plasma is mainly fluid which consists of dissolved minerals and nutrients. It makes up 55% of the total blood volume. Formed elements makes up the remaining percentage of blood. 99% of formed elements are red blood cells (erythrocytes). Platelets and white blood cells (leukocytes) constitute the last 1%.

What is a White Blood Cell Differential Count?

Different types of leukocytes

leukocytes are formed through the process of leucopoiesis. There are primarily 2 types of white blood cells namely granular and agranular leukocytes. Granular leukocytes are aptly named so because these particular leukocytes contain conspicuous granules. Granular leukocytes are divided further into neutrophils, eosinophils and basophils; each containing granules with noticeable differences in colour among the three.

Agranular leukocytes, as the name suggests does not contain any granules. There are 2 types of agranular leukocytes mainly lymphocytes and monocytes. The B and T cells (lymphocytes) each have specific functions.

As mentioned earlier, granular leukocytes are distinctively different from agranular leukocytes due to the presence of granules. In addition to that, granular leukocytes have multi-lobed (2 or more lobes) nucleus whereas the nucleus of agranular leukocytes are bi-lobed.

Granular leukocytes

Neutrophils being the most abundant of the 3 granular leukocytes (and apparently of the entire white blood cell population as well) constitutes 60-

70% of the differential white blood cell count. Neutrophils stained pale lilac in acid-base dye. A cubic millimetre of blood has 3, 000 to 7, 000 counts of neutrophils. The cytoplasm stained pink and the multi-lobed (has 3 to 7 lobes) nucleus linked by thin strands of nucleoplasm, a deep purple. The granules are too fine to be seen under the microscope.

Function:

Eosinophils on the hand make up only 1-4% of the differential white blood cell count; a much smaller percentage compared to neutrophils. Eosinophils stained red-orange in acidic dye and blue-red for the bi-lobed nucleus. There are 100 to 400 counts of eosinophils per cubic millimetre of blood. Eosinophils are characterized by the presence of red coarse cytoplasmic granules.

Function:

Allergic reactions would trigger an increase in eosinophils number. Phagocytosis of parasitic worm occurs through the attachment of eosinophils onto the surface of the worm and destroys it (the worm is too large for eosinophils to engulf).

Basophils are leukocytes with the least differential white blood cell count, 0. 25-5%. Basophils stained blue purple with basic dye and the nucleus shaped into a constricted S or U-shape stained dark blue. There are 20 to 50 counts of basophils per cubic millimetre of blood.

Upon inflammation, the blue-purple granules found in the cytoplasm are triggered to release histamine a vasolidator chemical to where it is required.

Agranular leukocytes

Lymphocytes and monocytes constitute only 25% of the white blood cells. Lymphocytes are the second most abundant leukocytes after neutrophils with 25-33% differential white blood cell count. A cubic millimetre of blood contains 1500 to 3000 counts of lymphocytes. The large nucleus stained dark purple and the thin layer of cytoplasm sky blue. The lymphocytes are mostly found lymph nodes, spleen and walls of large intestine in abundance.

Lymphocytes can be classified further into B and T lymphocytes. B lymphocytes engulf bacteria and prevent initiation of toxins. Antibodies which are microorganism-specific are produced to attack any foreign particles entering the body.

T lymphocytes are responsible for destroying any invading external agents. Rejection of foreign tissue can be associated with T lymphocytes. Thymus gland converts undeveloped cells to immunocompetent cells which are capable of performing such functions mentioned earlier.

Monocytes have a kidney-shaped nucleus which stained dark purple and the cytoplasm a grey-blue colour. Monocytes are different from lymphocytes in the way in which they are utilized. When an infection is detected, monocytes are mobilized and these leukocytes differentiate into macrophages. Once the macrophages are formed, phagocytosis of the foreign matter takes place. There is a surge in monocyte numbers during a persistent infection (one example would be tuberculosis).

Methodology of testing sample

Conditions caused by Abnormal Counts of leukocytes

Infectious mononucleosis occurs when the number of lymphocytes in blood is abnormally high and structurally disrupted (not in the usual spherical form). Leukemia is caused by an uncontrollable sudden surge in numbers of leukocytes. The white blood cells count may reach as high as 50, 000 cubic millimetre compared to the normal 7, 000 cubic millimetre. Most of the cells are abnormal or immature thus preventing them from carrying out their normal defense function (quote). Leukemia affects the counts of other cells such as erythrocytes and platelets. Anaemia could result due to decreased production in red blood cells (or known as erythropoeisis). Insufficient platelet numbers causes internal bleeding. Both would eventually bring about a myriad of infections and haemorrhages. Patients suffering from leukemia most often die from these cases.