OPINION

Blood and its formed element

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ABSTRACT

Blood is a highly complex fluid made up of formed elements (red cells, white cells, platelets) as well as plasma. The most common formed element is red blood cells (erythrocytes), which transport oxygen to the body's cells via their main component, haemoglobin.

Key Words: *Erythrocytes; Platelets; Plasma*

INTRODUCTION

White blood cells are present in approximately 1/700th the number of erythrocytes and serve as mediators of immune responses to infection or other inflammatory stimuli. Platelets are the formed elements involved in coagulation. Plasma is mostly made up of water, electrolytes, and plasma proteins. Coagulation factors are the plasma proteins that play the most important role in blood clotting. Because blood circulates throughout the body, changes in normal blood physiology—whether formed elements or plasma proteins—may have far-reaching consequences.

BONE MARROW AND HEMATOPOIESIS

Although the mature formed elements of blood differ greatly in structure and function, all of these cells develop from a common hematopoietic stem cell population found in bone marrow. The process is known as hematopoiesis, and it represents a massive metabolic task for the body. Every day, more than 100 billion cells are produced. As a result, bone marrow is one of the body's most active organs. The vertebrae, sternum, and ribs contain the majority of the active marrow in adults. The marrow in the long bones is more active in children.

Erythropoietin is the primary hormone that stimulates the production of erythrocytes (erythropoiesis). This peptide is produced by the kidneys and, through a feedback system, regulates red blood cell production: When haemoglobin levels in the blood fall (anaemia), oxygen delivery to the kidneys decreases, and they produce more erythropoietin, causing the marrow to produce more red cells. When haemoglobin levels rise, the kidney makes less erythropoietin and the bone marrow produces fewer red blood cells. The most important are Interleukin-3 (IL-3), Granulocyte Colony-Stimulating Factor (G-CSF), and Granulocyte-Macrophage Colony-Stimulating Factor (GM-CSF). Purified, sequenced, and cloned proteins are all available. The latter two proteins are used for therapeutic purposes. GM-CSF, unlike G-CSF, promotes the maturation of a different white blood cell line, the monocyte-macrophage line. These cells are also part of the immune system and can live in skin and other tissues in addition to blood. Their function, like that of the B and T-lymphocyte populations.

Platelets are not cells, but rather fragments of larger multinucleated cells found in bone marrow known as megakaryocytes. Platelets play an important role in normal blood clotting.

Examining the appropriateness of blood cell development is best done under a microscope with a thin blood smear. Modern technical equipment that can optically sort cells by size and various optical reflective parameters provides critical information, particularly about whether cell numbers are outside of normal ranges. However, microscopic examination of the blood smear, typically with Wright stain, provides additional information once an abnormality is detected and should always be performed when a blood disorder is suspected clinically.

ERYTHROCYTES

Mature red blood cells are biconcave disk-shaped cells filled with haemoglobin that serve as the blood's oxygen-carrying component. They do not have nuclei at maturity, unlike most other cells; their nuclei are extruded during the final stage of erythrocyte development. The presence of nucleated erythrocytes in a peripheral blood smear suggests an underlying disease state. Normal red cells (RBCs) have a diameter of about 8 mm which is larger than the smallest capillaries. Their biconcave shape, on the other hand, allows them to slip through small capillaries and deliver oxygen to the tissues. Individual erythrocytes function for about 120 days after being extruded from the bone marrow before being removed from the circulation by the spleen.

The most important substance in an erythrocyte is haemoglobin. This protein is a tetramer composed of two -protein subunits and two -protein subunits. Each-or-subunit contains the complex's actual oxygen-binding portion, heme. Heme is a compound whose centrally important atom is iron; it is this atom that binds oxygen in the lungs and then releases it in the body's tissues. Anemia, the most common general blood disorder, is defined as a low level of haemoglobin in the blood due to a variety of causes.

GRANULOCYTES: NEUTROPHILS, EOSINOPHILS AND BASOPHILS

Granulocytes are the most common type of white blood cell, with neutrophils being the most abundant, followed by eosinophils and

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basophils. All three types are similar in terms of development: Their nuclei become more convoluted and multilobed as they mature, and each develops a cytoplasm filled with granules. These granules contain a variety of enzymes, prostaglandins, and inflammatory mediators, with different factors depending on the cell type. On microscopic examination of the bone marrow, early progenitor cells for each type of granulocyte ("blasts") are indistinguishable, but under the influence of different cytokines, they differentiate into morphologically distinct cell types.

OTHER WHITE BLOOD CELLS: MONOCYTES AND LYMPHOCYTES

Monocytes and lymphocytes both develop from the same stem cell. The ability of stem cells to differentiate into these cells, in addition to granulocytes, erythrocytes, and platelets, is what makes bone marrow transplantation a viable treatment option for immune system disorders and cancer. Monocytes have a very long life span, probably several months, but only spend about three days in the bloodstream. They primarily reside in tissues and function as immune cells that engulf (phagocytoze) bacteria and then "present" components of these bacteria to lymphocytes, amplifying and refining the immune response. Monocytes are the largest cells seen on blood smears, with irregular but not multilobed nuclei and pale blue cytoplasm, often with prominent vacuoles.