

BLOOD COMPONENTS AND ITS USAGE: A CLINICAL INSIGHT FROM DIAGNOSTIC LENS

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Abstract

Blood is a key fluid which circulates inside the body with various significant benefits. One of the most important role of it is respiration, excretion, maintenance of normal acid base balance, nutrition, regulation of water balance, regulation of body temperature, transport of hormones, vitamins, salts and transportation of various essential vitamins required inside the body etc. Blood has various components present which perform various important roles. It has red blood cells, white blood cells, platelets, plasma etc. The knowledge of the function of all the blood components helps all the medical professionals to utilize it to the maximum level for the benefit of the patients. If the patient is having low haemoglobin level, we can transfuse packet red blood cells, if the patient is suffering from thrombocytopenia due to various reasons like dengue, gynaecological reasons or any other reasons we can transfuse platelets. And if patients require coagulation factors during various medical procedures we can transfuse plasma or factor IX or factor VIII to obtain immediate relief. The usage of blood and its various components has given a new dimension in the field of medical sciences. Owing to its impact and phenomenal usage in various surgeries, the department of transfusion medicine became an integral section in every hospital. A hospital without a blood bank holds a lesser relevance as compared to the hospital which is fully equipped with all the sophisticated amenities of blood bank. It all started back in 1932 after realizing the usage of blood in various treatment the first blood bank was established in Leningrad hospital. In 1937 Bernard fantus, director of therapeutics at the cook county hospital in Chicago, establishes the first hospital blood bank in the united states. Charles Richard Drew known as father of blood bank is an eminent pioneer in this field, whose work on the banking of blood products and the plans of collecting and distributing blood saved countless lives in the trenches of World War II and the wards of military and civilian hospitals. In India owing to its vast population and maximum requirements of blood. Leela Moolgaonkar, a social reformer, started the movement of voluntary blood donation camps in Mumbai from 1954. The 1960s saw many blood banks open in different cities. Though as per the various sources the first records of the voluntary blood donation started in India at Kolkata in west Bengal during world war-II.

Keywords: Neutrophil, Platelet, Thrombocytopenia, Polycythemia.

INTRODUCTION

Blood transfusion can be life-saving. Surgeons and anaesthetists regularly request and administer blood components to their patients. All surgeons must be familiar with indications and appropriate use of blood and blood components and their alternatives, but close liaison with haematology specialists and their local blood sciences laboratory is encouraged. Considerable changes in approaches to optimal use of blood components, together with the use of alternative products, have become apparent over the past decade, leading to a need to update previous guidelines and adapt them for the use of surgeons working throughout the hospital system[1].

Total volume of blood inside the human body is around 8% of body weight.[2] Blood can be termed as specialized connective tissue, and moves in a closed system of blood vessels. The moving blood consists of suspension of formed elements such as erythrocytes, leucocytes and platelets in a pale yellow coloured fluid called plasma.[3] In adults the total volume of blood comprises about 8% of the body weight or about 5,600 ml in a 70 kg man. The formed elements account for about 46% of total blood volume. All the components present inside the blood plays specific roles and realizing these roles of blood components and its usage, the patients with their deficiency are treated. If the patient is suffering from severe anaemia with marked decrease in haemoglobin level, the packed red blood cells can be transfused. If patients require coagulation factors plasma can be infused and if the patient is having thrombocytopenia the platelets can be transfused. During the impact of dengue in which there is a marked decrease in platelet level of the affected patient, a mega unit of platelets is prepared from a normal donor through a

procedure known as apheresis and is immediately transfused to the patient, this apheresis procedure became a lifesaving procedure in the entire world.

These are the various blood components present in our body:

1. Erythrocytes (RBCs),
2. Leucocytes (WBCs),
3. Plasma,
4. Thrombocytes.

1. Red blood cells (Erythrocytes)

Erythrocyte is a circular, biconcave cell without a nucleus. It has a diameter of about 7.5 micrometre and thickness of 2 micrometre. It contains haemoglobin and is the heaviest of all the formed elements of blood. The normal red cell has a life span of about 120 days. The erythrocytes at the end of their life span are destroyed in the reticuloendothelial cells.^[4] Its impact on human holds a great relevance, like if the RBC count is high that means the patient could be suffering from heart disease, polycythaemia vera, or bone marrow function could be effected. If the RBC count is low, possibly the patient is suffering from severe anaemia.

Functions:

1. Carry oxygen from the lungs to the tissues
2. Carry carbon dioxide from the tissues to the lungs for excretion.
3. Helps maintain acid base balance

Normal range RBCs in human body is 5-5.5 million/mm³.^[5]

2. White blood cells (Leukocytes)

The leukocytes are another of the formed elements of the blood. It has three independent series which lead to the formation of, a) Granulocytes b) Agranulocytes (Lymphocytes and Monocytes)

Normal range of WBCs in human body is 4000-10,000 wbc / mm³.^[6,7]

A. Granulocytes contain sacs in cytoplasm. It further divided into 3 parts:

1. Eosinophil = It has bilobed nucleus. It circulates in blood. The function of eosinophil is inflammatory.
2. Basophil = It has bi-trilobed nucleus. The function of this is antigen response, circulates in blood.
3. Neutrophil = Multi-lobed nucleus. It migrates from blood vessels into tissues, function is bacterial infection.

B. Agranulocytes do not have granules. It further divided into two parts:

1. Monocyte = It has kidney shaped nucleus. Stored in spleen, function is immune surveillance.
2. Lymphocytes = It has eccentric nucleus.

Lymphocytes have three parts;

- a. B- lymphocytes = The function is anti-body production. Memory cells may live for years.
- b. T- lymphocytes = The function is cellular immune response. Memory cells may live for years.
- c. NK- lymphocytes = It's characteristic feature, it kills tumour cells.

Functions:

The main function of the leukocytes seems to be in helping the body to defend itself against invading organisms like bacteria, viruses, parasites and cancer cells. It is mainly the neutrophils and the monocytes that attack and destroy viruses and bacteria in the circulating blood.[13]

3. PLASMA

Plasma is the fluid part of the blood. Blood removed from the body has a natural tendency to clot. But if blood is prevented from clotting by the addition of an anticoagulant, and this anti coagulated blood is allowed to sit in a glass tube, the cells gradually sink to the bottom leaving a clear yellow fluid above, which is the plasma.[12] The colour of plasma varies from pale yellow to deep yellow, or even slightly orange. If there has been any release of haemoglobin from the red blood cells into the fluid (haemolysis), the colour will be reddish. If there is jaundice, the colour will be dark yellow to yellowish green.[8] A few drugs may also give some colour to the plasma.

The plasma consists of water, various inorganic salts electrolytes, and various organic compounds, which include nutrients, waste products of metabolism, a variety of proteins, and trace amounts of various hormones and other substances.

Functions of Plasma:

1. Keeps the blood fluid, so it can flow through the blood vessels to all parts of the body.
2. Carries the formed elements
3. Carries food materials as well as oxygen to the cells in the various tissues.
4. Carries waste products, including carbon dioxide, from the tissues to the excretory organs.
5. Carries the various hormones or chemical messengers of the body
6. Maintain the correct water balance in the body.
7. Helps in controlling body temperature.

4. Platelets (Thrombocytes):

Thrombocytes, or platelets are not true cells, but rather they are non-nucleated fragments of the cytoplasm of the very large cells, megakaryocytes of the bone marrow [9]. They are shaped like small flattened discs about 2-4 micrometres in diameter. They contain many small granules. Their main function is to assist in haemostasis, which includes both the prevention of bleeding and the stopping of bleeding when injuries occur to the blood vessels with leakage of blood[0]. Their life span in the blood will depend upon the rate at which they are called to stop bleeding somewhere, varying from a few hours to 4-6 days [11]

Conclusion:

Blood is the most vital fluid in human body, which performs various roles. It is a combination of various cell components which performs various roles in human and animal body. They manage gaseous exchange, circulation of vitamins, certain hormones, helps in controlling body temperature, maintain acid base balance etc. The knowledge of the function of blood components greatly helps the medical professionals in treating many patients. If the patient has severe anaemia and has very low haemoglobin level, packed red blood cells can be transfused immediately, if the patient is suffering from dengue, thrombocytopenia or leukaemia in which platelets count gets very low, immediately platelets or mega units of platelets can be infused to get immediate relief. During certain urgent cases in emergency ward if any patient comes who is bleeding profusely due to accident, stab or gunshot immediately plasma can be transfused to give required coagulation factors in combination with red blood cells. Hence blood holds a great relevance in human and animal body.

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