LEUKODEPLETION OF BLOOD PRODUCTS BY FILTRATION

ESSAY

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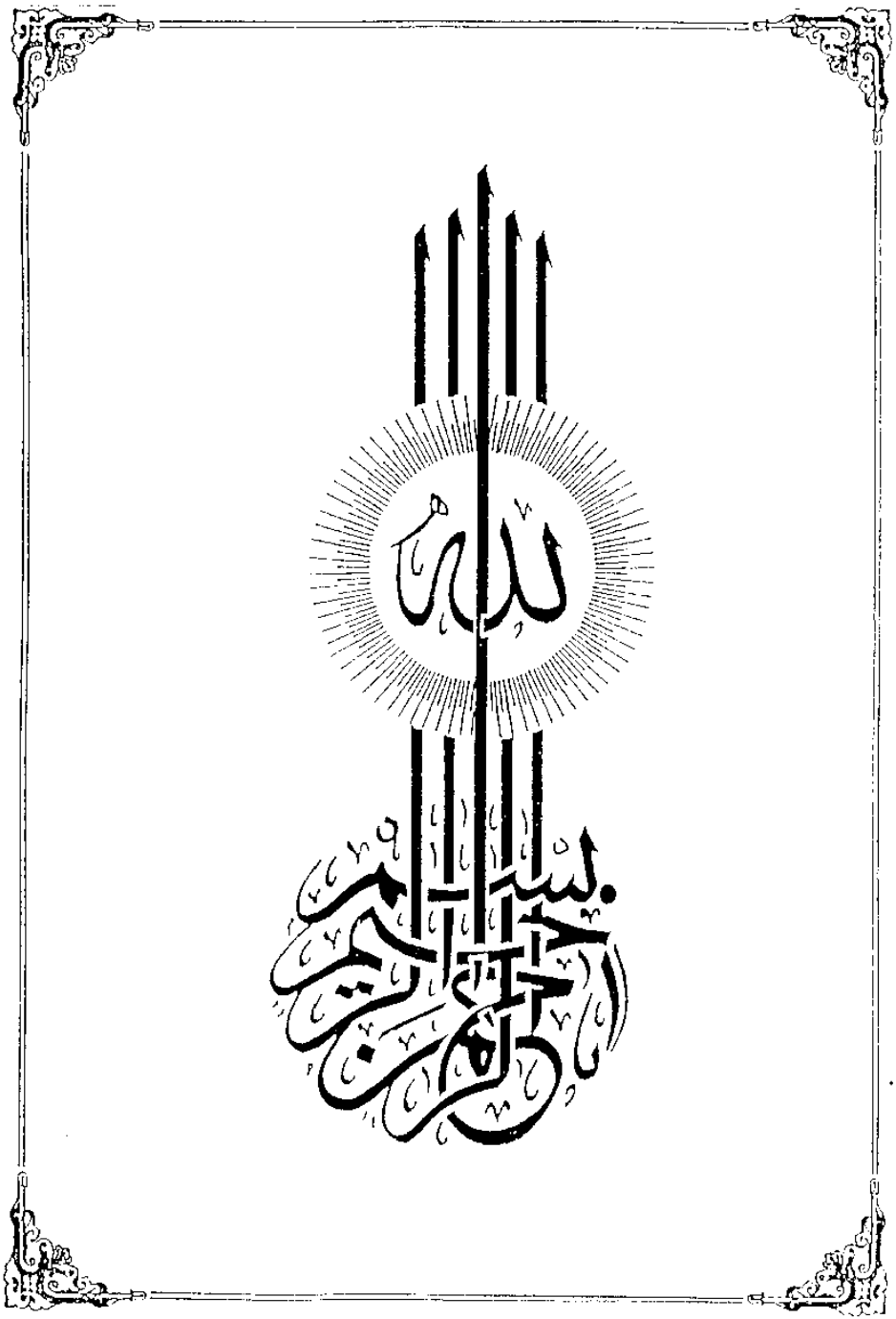
بسم الله الرحمن الرحيم

سبحانك

لا علم لنا الا ما علمتنا انك انت

العليم الحكيم.

صدق الله العظيم



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To My Family

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Introduction

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Red cell transfusions are given for three main reasons- to replace blood loss during trauma or surgery, to maintain cell numbers in those individuals with abnormal cell function e.g. thalassaemics who have short-lived red blood cells and finally, to support the patients who cannot produce an adequate supply of red blood cells in their bone marrow e.g. bone marrow aplasia.

Similarly, platelet numbers must be sufficient to maintain haemostasis and thus prevent purpura or, in more severe cases, major bleeding.

If a patient has bone marrow aplasia due to a disease state or chemotherapy, it is likely that they will require a proportionally greater number of platelet transfusions than red blood cell transfusions because of the shorter life span of platelets(10 days versus 120 days). It is also interesting to note that national figures from American Blood Comission report a 598 percent increase in platelet concentrate transfusions versus only a 58 percent rise in red blood cell transfusions in the period 1971-1980.

These figures undoubtedly reflect increased transfusion support for more patients with , perhaps , aggressive chemotherapy but also suggested that some of the platelets are used inappropriately (i.e not indicated) or that the product provided was not of sufficient quality (i.e the number of functioning platelets was not maximized) ***(Slichter ,1988)***

This notion highlights the need to consider if the components transfused are prepared or whether adverse transfusion effects from available factors (e.g. leukocytes and microaggregates) may counteract some of the great benefits conferred upon the patient by the erythrocytes and platelets that are actually prescribed. ***(Marshall, 1989)***

Since whole blood had been the transfusion standard for many years , it is not surprising that white cells contaminating red cell and platelet preparations were initially accepted by blood bankers and transfusionists as normal and non-controversial passengers.***(Meryman et al.,1980)***

Brittingham and Chaplin , in 1957 , were among the first to recognize the role of leukocytes and platelets in precipitating non haemolytic febrile reactions .

Perkins et al.,in 1966, demonstrated a semiquantitative relationship between non haemolytic febrile transfusions and contaminating leukocytes, particularly the granulocytes.

Alloimmunization first became a matter for serious concern in dialysis centres that were experiencing tremendous growth of alloimmunization and refractoriness to platelet transfusions, following passage of the End Stage Renal Disease Ligalization in 1972.

Kidney transplants could be compromized by preexisting immunization against Human Leukocyte Antigens

(HLAantigens) , even though the antibodies might be against antigens other than those of the transplant.*(Terasaki et al., 1971)*

Another hazard of leukocyte contamination , that of graft versus host disease which is an extremely unpleasant and sometimes fatal consequence of the engraftment of immunocompetent T-lymphocytes of the donor in an immunoincompetent recipient e.g. transfused neonates and other immunocompromised recipients and is manifested in human by fever , skin rash , diarrhoea and jaundice . *(Leitman and Holland , 1985)*

Cytomegalovirus (CMV) infection has been recognized as a possible complication of leukocyte contamination of red blood cells and platelets since 1962 . Yeager, in 1974 reported that the frequency of perinatal CMV infection in transfused infants (25%) was more than twice that in infants not transfused (11%) .Other viruses as hepatitis ***B*** virus and human T-cell lymphotropic virus (HTLV) are also known to be transmitted by leukocytes. *(Saltzman et al., 1988)*

Rapid progress in the understanding of immune mechanisms and increased appreciation of the hazards of immune modulation through transfusions , has created a growing demand for leukocyte-depleted red cells and platelets *(Meryman, 1989)*

A key development in blood banking techniques has been the provision of leukocyte-depleted blood to the hospitals for particular patient groups. More recently , there has been an increased awareness of the benefits of providing leukocyte depleted blood

products to a wider range of patients . This may necessitate a review of the technique required to provide such products and explore the possibility of providing the leukocyte-depleted components at the ward level . ***(Parravicini et al., 1984)***

This work summarizes some physiological and immunological basis to understand alloimmunization , immuno-supression and other problems associated with blood transfusion . It will also briefly review the evidences linking donor leukocytes and microaggregates with transfusion complications and explore the method of filtration employed to prepare leukocyte-depleted blood products to avoid these complications. Finally, it will discuss the role of micofilters, their types used for this purpose and potential problems associated with their use.

Chapter 1:
Physiological and Immunological Basis.

Physiological and immunological basis.

Leukocytes :

Leukocytes , along with erythrocytes and platelets comprise the formed cell components of whole blood . In the course of describing their adverse transfusion effects , all types of leukocytes need to be considered . ***(Marshall, 1989)***

Circulating leukocytes number 5,000-10,000 per cubic millimeter and the greatest proportion of them , approximately 70% , are granulocytes , also known as polymorphnuclear leukocytes (PMNLs) or macrophages. ***(Allison, 1988)***

The granulocytes are further subdivided into basophils , eosinophils and neutrophils . The neutrophils are the single largest group of leukocytes in the blood and play a vital role in non-specific cellular defense . The role of eosinophils is not well defined . Increased circulating levels of eosinophils are responsible for allergic reaction . Basophils contain granules that release histamine in response to stimulation produced by antigen-antibody reaction . ***(Gowans, 1990)***

Monocytes comprise about 4% of the leukocytes in the blood and are a part of the family of macrophages which make up the reticuloendothelial system (RES) . Other macrophages include alveolar macrophages (lung) , spleen macrophages , kupffer cells (liver) and histiocytes and langerhans cells in the connective tissue . These cells play a particularly key part in the induction of antibody