BLOOD TRANSFUSION IN SURGERY

Essay Submitted for Partial Fulfillment of
Master Degree in Surgery

Presented by

AHMED FOUAD AHMED AWADALLA

Under Observation of

Prof. DR. MAGED GAMAL EL-DIN ZAYED
Prof. of G. Surgery, Faculty of Medicine, Ain Shams University
Director of Ain Shams University Specialized Hosp.

DR. ALAA EL-DIN ABDALLA
Assist. Prof. of General Surgery
Faculty of Medicine, Ain Shams University

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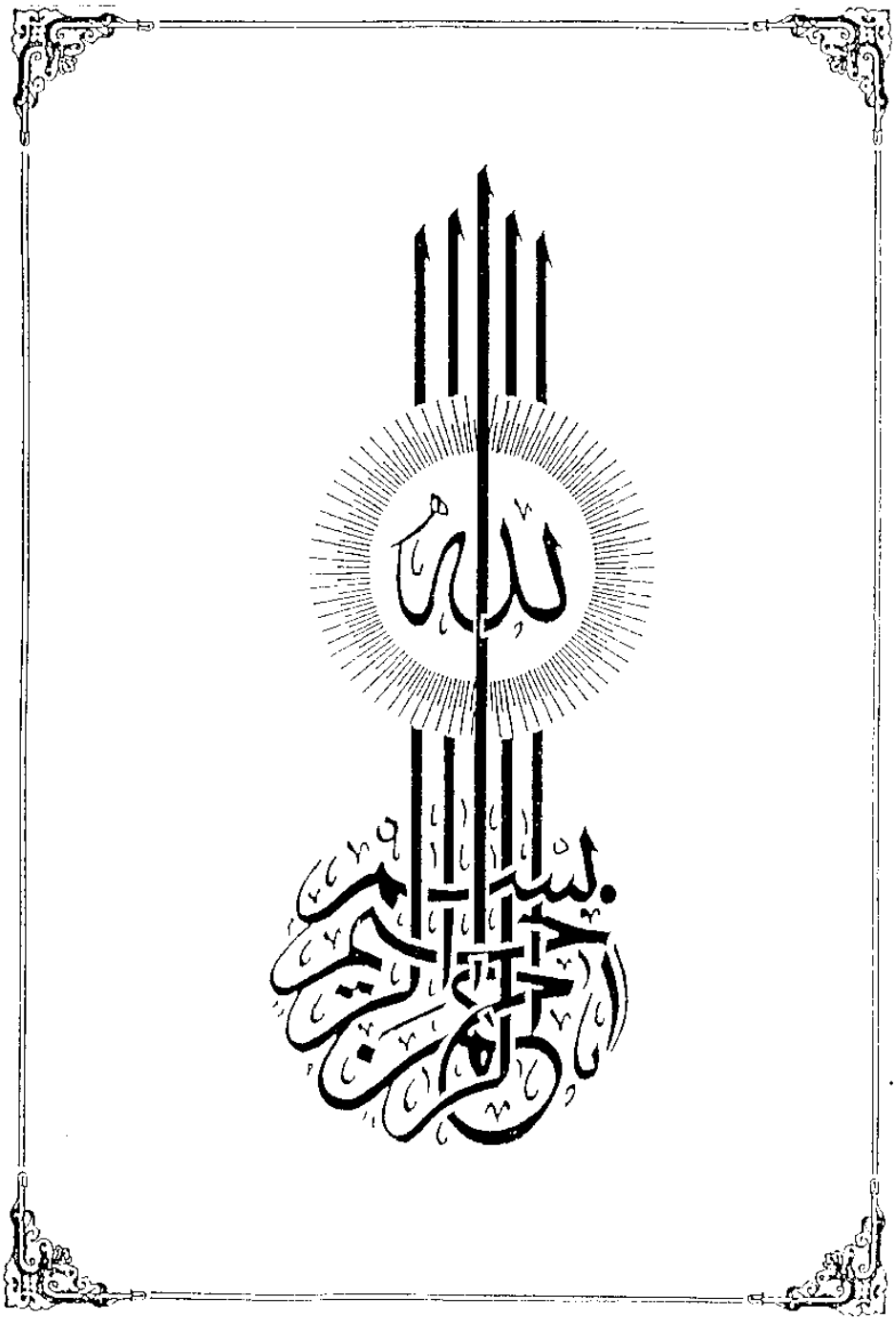

TO
MY
MOTHER

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Introduction :

Blood transfusion is an important hospital function. Whole blood or its components is transfused for three main reasons 1) The correction of intravascular volume deficit; 2) the correction of oxygen transport deficit and 3) the correction of bleeding disorders ***(Urbaniak and Cash, 1977).***

Without blood transfusion the treatment of the hemorrhage is difficult or impossible and many surgical procedures cannot be safely attempted.

With the advance of surgery, demand on blood transfusion is increased and it became one of the pillars of modern surgery. On the other hand blood transfusion has its own hazards and serious risks.

These serious risks, associated with allogenic blood transfusion, including mainly immune responses and transmission of infectious diseases e.g AIDS virus, hepatitis C and B viruses, malaria and leishmania parasites, ...etc. ***(Valeri 1993).***

Although WHO mandates that blood products be tested for transmissible diseases, blood transfusion is not completely risk-free as some side effects can be prevented, others cannot ***(Williams et al., 1990).***

Thus, surgeons should limit the use of allogenic blood and have come to depend more on autologous blood.

The advantages of autologous blood transfusion seems very substantial : all risks of incompatibility and of alloimmunization, and of the transmission of infectious diseases are avoided ***(Peterson et al., 1992).***

Auto-transfusion is now becoming an acceptable procedure for both elective and emergency surgical cases. There are many alternatives available to the surgical team to carry out this procedure.

AIM OF THE WORK

This work aims to highlight all the transfusion hazards and abuse of blood transfusion in surgical field.

Blood transfusion must be considered as last trial in patient management when its benefit must clearly outweigh its risk.

HISTORY

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Blood has always held a mysterious fascination for people and traditionally was thought of as being the living force of the body. Recognizing the beneficial and life - giving properties of blood, ancient Egyptians used it for baths to resuscitate the sick and rejuvenate the old and incapacitated. In ancient Rome, spectators rushed into the arena to drink the blood of dying gladiators ***(Zmijewski and Haesler, 1975).***

One of the pioneers of the practice of transfusion was ***Richard Lower*** in ***1665*** who performed experiments on dogs by direct transfusion from artery to vein. A short time later, ***Lower*** and ***King*** transfused sheep blood into people ***(Ehrlich and Sachs, 1905).***

Later blood from other animals including dogs and lambs to human was tried and some patients died of what recognized now as hemolytic transfusion reaction. ***(Ehrlich and Sachs, 1905).***

An English obstetrician named ***James Blundell*** was said to revive the procedure of blood transfusion in 1818. ***Blundell*** and his collaborators performed a considerable number of experiments and demonstrated the shocking effects of hemorrhage and how these effects could be reversed by relatively small amount of blood that were not injurious to the donor animal ***(Rawson et al., 1959).***

In 1914 and 1915, the problems encountered with blood clotting were solved when ***Hustin et al.,*** and ***Wein*** and other investigators noted that small non - toxic quantities of citrate prevented coagulation of blood. In 1916, ***Rous*** and ***Turner*** discovered that the use of small amounts of

dextrose added greatly to the preservation of the quality of blood undergoing storage ***(Mollison 1967).***

The development of suitable anticoagulant and the discovery that blood maintained at 4°C could be stored for up to 10 days and other efforts had lead to the establishment of the first blood bank in the world by ***Dr. Bernard Fantus*** in 1937. ***(Nakao et al 1960).***

The modern approach to safer blood transfusion began with the identification of isoagglutinating substances in the blood around 1900 by ***Landsteiner*** and this was the stimulus for generating interest in immuohematology. Thirty years later, ***Landsteiner*** received Noble prize for his discovery of ABO blood groups. In 1940 ***Landsleiner*** and ***Waner*** discovered Rh groups and associated relation of these groups to hemolytic diseases of newborn ***(Landsteiner, 1940).***

Since 1940 the Luthern, Kill, Duffy and other groups have been identified. Development of sensitive cross matching procedure took place in 1940 and with impetus of the world war II blood transfusion became a common procedure ***(Mollison 1961).***

Previously blood had been collected in glass bottle of various configurations closed by rubber stoppers and blood follow was promosed by vacuum created inside these container. The development of plastic bags eliminated all these difficulties and were the most significant event that made the approach of blood components therapy a reality ***(Telischi et al., 1976).***

As the scope of surgery was expanded, the requirement for larger amounts of blood transfusion has been increased.

BLOOD GROUPS

RED CELL BLOOD GROUPS

Antigen :

Human red blood cells contains on their surface a series of glycoproteins and glycolipids which constitute the blood group antigens. The development of these antigens is genetically controlled; they appear only in fetal life and remain unchanged until death. On the basis of these antigens at least 15 well defined red cell blood group systems of wide distribution in most racial groups have been described. They are : ABO, MN, P, Rh, Luthern, Kell, Lewis, Duffy, Kidd, Diego, YT, Xg, Ii, Dombrock and Colton systems ***(de Gruchy 1989).*** Of these red cell blood group systems, only 2 are of major importance in clinical practice, the ABO and Rh systems. ***(Brickman et al., 1992).***

Antibodies :

The antibodies to the red cell antigens are of two types naturally occurring and immune antibodies.

* Naturally occurring antibodies :

Obvious antigenic stimulus in the serum of individuals lacking the corresponding red cell antigen. The "isoagglutinins" of the ABO system are the main example. In the other blood group system naturally occurring antibodies are encountered only, occasionally or rarely.

* Immune or acquired antibodies :

Are produced in individuals as a result of stimulation by red cell antigen which is not present on their own red cells or in their body fluids. This antigenic stimulation may arise from blood transfusion or as the result of pregnancy ***(Williams et al., 1990).***

All red cell antigens have the power of stimulating the production of their corresponding antibodies, but some are much stronger antigens than others. Certain antibodies may also result from the injection of substances that are chemically closely related to a red cell antigen. For example, some biological products, such as tetanus toxoid, contain substances closely related to A and B antigens. Thus the sera of persons who have received injections of such biological products may contain immune anti - A or anti-B antibodies, particularly the former ***(Issitt, 1985).***

Complement binding antibodies :

Both naturally occurring and immune antibodies may or may not bind complement, the majority doing so. All the main blood group antibodies bind complement with the exception of Rh and MN antibodies ***(Scott, 1991).***

Immunochemistry :

Naturally occurring red cell antibodies are either wholly or partially IgM and generally react better with their corresponding antigens at temperature below 37°C. Immune antibodies most of which react best at 37°C may be either IgG or IgM usually the former. Antibodies produced later IgG. A difference of clinical importance between IgM and IgG antibodies is that the latter readily transfere across the placenta while the former do not ***(Simson et al., 1993).***

There are four main methods of detecting red cell antibodies; a) the saline agglutination test, b) tests using cells suspended in colloid media e.g. albumin, c) Tests using enzyme treated cells and d) the indirect anti globulin (Coombs) test ***(Dacie and Lewis, 1984).***