

# **BLOOD GROUP ANTIBODIES AND THEIR CLINICAL SIGNIFICANCE IN TRANSFUSION MEDICINE**

*Essay*

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*Presented by*

**Tarek Metwalli Abdou**

*M.B., B.Ch.*

*Supervised by*

***Prof. Dr. Sanaa Omar Asaad***

Professor of Clinical and Chemical pathology  
Faculty of Medicine, Cairo University

***Prof. Dr. Iman Refaat Elmahgoub***

Professor of Clinical and Chemical pathology  
Faculty of Medicine, Cairo University

***Dr. Noheir Soliman Mohamed***

Lecturer of Clinical and Chemical pathology  
Faculty of Medicine, Cairo University

Faculty of Medicine

Cairo University

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ  
وَمَا أُوتِيتُمْ مِنَ الْعِظَمِ إِلَّا قَلِيلًا  
صَلَّى اللَّهُ الْعَظِيمِ

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## **Abstract**

Abs to red Cell Ags Which are approximately 302 Ags , Can Cause HTRs and HDFN. The most important Abs are those of the ABO, RH, Kell , Kidd , Duffy and Ss blood group systems . Extended red cell Phenotyping of chronic patients and screening & identification of red cell Abs Shoud be done befor transfusion . Tubes , microplates , CAT and DNA techniques can be used for this purpose . Clinical bioassays can be Used as a functional assessment for the significance of red cell Abs .

**Key Words :** Abs – Ags – HTRs – HDFN  
CAT – DNA

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## **List of Abbreviations**

<b>Ab</b>	Antibody
<b>ADCC</b>	Antibody-dependent cellular cytotoxicity
<b>Ag</b>	Antigen
<b>AHG</b>	Anti human globulin
<b>AIHA</b>	Auto-immune hemolytic anemia
<b>CAT</b>	Column agglutination technology
<b>CD</b>	Clusters of differentiation
<b>CLL</b>	Chronic lymphocytic leukaemia
<b>CLT</b>	Chemiluminescence Test
<b>CMV</b>	Cytomegalovirus
<b>DAF</b>	Decay-accelerating factor
<b>DAT</b>	Direct antiglobulin test
<b>DHTRs</b>	Delayed hemolytic transfusion reactions
<b>DIC</b>	Disseminated intravascular coagulation
<b>DL</b>	Donath-Landsteiner
<b>DNA</b>	Deoxyribose nucleic acid
<b>ELISA</b>	Enzyme linked immunosorbent assay
<b>gp</b>	glycoprotein
<b>GVHD</b>	Graft versus host disease
<b>HDFN</b>	Hemolytic disease of fetus and newborn

<b>HLA</b>	Human Leukocyte Antigen
<b>IAT</b>	Indirect antiglobulin test
<b>Ig</b>	Immunoglobulin
<b>IHTRs</b>	Immediate hemolytic transfusion reactions
<b>ISBT</b>	International society of blood transfusion
<b>IVIG</b>	Intravenous immunoglobulin
<b>LISS</b>	Low ionic strength saline
<b>MAIEA</b>	Monoclonal antibody- specific immobilization of erythrocyte antigens assay
<b>MMA</b>	Monocyte monolayer assay
<b>NAT</b>	Nucleic acid testing
<b>PCH</b>	Paroxysmal cold haemoglobinuria
<b>PCR</b>	Polymerase chain reaction
<b>PEG</b>	Polyethylene glycol
<b>RBCs</b>	Red blood cells
<b>RFLP</b>	Restricted fragment length polymorphism
<b>Rh</b>	Rhesus
<b>SLE</b>	Systemic lupus erythematosus
<b>SNP</b>	Single- nucleotide polymorphism
<b>SPH</b>	Solid phase
<b>ZZAP</b>	ZZ-activated papain



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## **Introduction**

Blood group serology includes the study of antigenic molecules present on the various cellular and soluble components of whole blood, together with the study of antibodies and lectins that recognize them and their interactions. However, in practice, the term blood group serology is restricted to red cell surface antigens and their interactions with specific antibodies. In this narrower sense, the complexities of HLA, granulocyte, platelet and plasma protein determinants do not normally fall within the blood group serologist's realm, even though all are likewise genetically polymorphic and play a role in blood transfusion (*Contreras and Daniels, 2005*).

The narrower definition of blood group serology encompasses the following: (*Janeway et al., 2001*).

- I. The determination of the phenotype of red cells with antibodies and reagents of known specificity.
- II. The search for and identification of antibodies with red cells of known phenotype.
- III. Compatibility testing of patients' sera against cell samples from donor units of the same ABO and RhD groups.

The discovery of almost universally present naturally occurring antibodies in blood plasma led to the discovery of the ABO blood group system which remains, more than 100 years later, the most important and clinically significant of all blood groups. Blood group antibodies play an important role in transfusion medicine; both in relation to the practice of blood transfusion and in pregnancy (*Stefanova, 2005*).

Clinically significant antibodies are capable of causing adverse events following transfusion, ranging from mild to severe, and of causing hemolytic disease of the fetus and newborn following placental transfer from mother to fetus. Assessing the clinical significance of antibodies relies heavily on mode of reactivity and historical data relating to specificity; functional assays are sometimes employed (*Poole and Daniels, 2007*).

The principals of methodology for blood typing and antibody identification have changed little over the years, relying mainly on serological methods involving red cell agglutination. The recent advent of blood typing using DNA technology, although still in relative infancy, will surely eventually supersede serology. However, deciding on the clinical significance of an antibody when compatible blood is not immediately available is likely to remain as one of the most common dilemmas facing transfusion practitioners (*Poole and Daniels, 2007*).

### **Aim of the work**

The aim of this essay is to elucidate the role of blood group antibodies in transfusion medicine, both in relation to the practice of blood transfusion and in pregnancy.

# BLOOD GROUP ANTIGENS AND ANTIBODIES

## I. Introduction:

The observation by Landsteiner in 1900 that red cells of some individuals could be agglutinated by the serum of others led to the discovery of the ABO blood group system. Following the identification of the A and B blood group antigens, blood group serology blossomed throughout the 20th century, such that in humans approximately 302 blood group antigens were identified, most of which belong to 1 of 29 genetically discrete blood group systems (*Contreras and Daniels, 2005*).

The genes representing the 29 systems have been located on specific chromosomes (**Table 1**). All are autosomal except XG and XK, which are X- borne and MIC2, which is on both the X and Y chromosomes. All the genes have been cloned, with the exception of P1 (*Webert et al., 2004*).

Blood group antigens may be proteins, glycoproteins or glycolipids. Most red cell antigens are synthesized by the red cells, however, some antigens such as those of Lewis, are adsorbed onto the red cell membrane from the plasma. Some red cell antigens are specific to the red cells, however others are found on other cells throughout the body (*Lewis et al., 1990*).

Antibodies to many of these antigens have the potential to be clinically significant; that is, they can facilitate accelerated destruction of

red cells carrying the corresponding antigen. It has been recognized that knowledge and understanding of blood groups are essential for transfusion therapy. This is because individuals who lack antigens on their red blood cells can be alloimmunized, if they are exposed to blood expressing the antigen. This might occur with transfusion of blood products or during pregnancy. Antibodies that react with red blood cell antigens can cause problems such as delayed and immediate hemolytic transfusion reactions (HTRs) and hemolytic disease of the newborn (*Ness et al., 1990*).

## **II. International Society of Blood Transfusion (ISBT)**

### **Terminology:**

The ISBT working party on terminology for red cell surface antigens was established in 1980 with the goal of creating a uniform nomenclature. Blood group antigens are now categorized into 29 systems, five collections, and two series (*Contreras and Daniels, 2005*).

Each blood group antigen is given an identification number consisting of six digits. The first three numbers represent the system to which the antigen has been assigned. The second three digits identify the antigen in the order it was discovered. For example, the ABO system is number 001, and the A antigen is the first antigen in that system; thus, it has the ISBT number 001001 or ABO001 (*Dean, 2005*).