

Immuno-hematological tests at the blood transfusion Center: Experience of the Avicenne military hospital in Marrakesh

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Abstract

Review Article

Blood transfusion is a therapeutic act that consists in administering blood or one of its cellular or plasma components, from one or more healthy subjects called "donors" to a sick subject called "recipient". Blood safety is ensured by controlling all stages of the transfusion chain, from blood collection, preparation and biological qualification to the performance of the transfusion act and even the follow-up of the recipients. The basis of immuno-hematological safety is the compatibility between the erythrocyte characteristics of the donor and those of the recipient. From an immuno-hematological point of view, all the antigens present on the surface of an individual's red blood cells determine the erythrocyte phenotype. Only a limited number of erythrocyte antigens that make up this erythrocyte phenotype are sought in current practice. Only a perfect knowledge of the phenotypic and molecular immune-hematological data of donors and recipients will allow to determine the true perimeter of transfusion safety. On this basis, our work focuses on the feasibility of immune-hematological examinations in blood transfusion.

Keywords: Blood transfusion - immuno-hematological tests- ABO blood group system - RH system.

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I. INTRODUCTION

Blood transfusion is a therapy at the frontier of hematology and immunology involving medicine, biology, bio-industry and sociology and based on ethics. It is defined by the WHO as the transfer of blood or one of its components from one individual (called donor) to another (called recipient) [1].

Our work is a retrospective study on the feasibility of immune-hematological examinations in the blood transfusion center of the AMH of Marrakesh.

II. Immuno-hematological examinations at the transfusion center of the Avicenne military hospital in Marrakesh

A. Systematic immuno-hematological tests:

1. ABO blood grouping:

a. Definition:

It is the presence or absence of major A and/or B antigens on the surface of red blood cells in tissues and secretions and the presence of natural and regular antibodies in the serum that correspond to the antigen or antigens absent on the surface of red blood cells [2].

ABO erythrocyte antigens: They are of a carbohydrate nature; characterized by two sugars on the surface of the erythrocyte: a Galactose (Ag B); or an N-Acetyl-Galactosamine (Ag A); these sugars are attached to a base substance called substance H; itself osidic. The ABO system includes four antigens: A, B, AB and A1. The H system includes a high frequency antigen: H, biochemical precursor of A and B antigens [3].

Natural anti-A and anti-B antibodies = isoagglutinins: these are the regular natural antibodies. They are immunoglobulins of type M (IgM), found from the first months of life without any apparent allo-immunization.

Irregular immune antibodies: These are most often IgG antibodies that appear following various antigenic stimuli (foreign red blood cells).

Special case: the Bombay phenotype: It is extremely rare [4] and dangerous: apparently group O, this phenotype is characterized by the absence of H antigen, An antigen and B antigen and therefore the presence of anti-H, anti-A and anti-B antibodies.

b. Principle:

Principle of ABO grouping: ABO grouping is identified by two mandatory complementary methods: The Beth-Vincent method and the Simonin method[6].

Beth-Vincent test: This is an agglutination test of red blood cells with test sera.

Simonin test or plasma test: It consists in searching for anti-A and anti-B antibodies corresponding to absent red cell antigens using known test red cells[7].

2. The RH system:**a. Definition:**

It includes about 50 antigens but only 5 of them are of clinical interest in transfusion medicine. These are the D (RH1), C (RH2), E (RH3), c (RH4) and e (RH5) antigens. They are highly immunizing and the most important is Ag D: Its presence defines the Rhesus+ character (85% of subjects)[5].

b. Principle:

Principle of RH1 (D-ag) phenotyping: Standard Rh grouping is performed at laboratory temperature and consists of searching for the D-Ag by direct agglutination technique between the D-antigen carried on the test red blood cells and the anti-D test serum.

3. Extended RH-Kell1 Phenotyping:

The antigens of the rhesus system are restricted to the RBC, abundant on the RBC, codominant and antithetic.

They are immunogenic Ags especially Ag D, their immunogenetic order is: D > E > c > e > C. Rhesus antibodies are always acquired either during transfusions or pregnancies:

- They are IgG immune type Ab rarely IgA.
- They are warm Ab
- They only very rarely agglutinate RH+ RBCs in saline suspension.
- They are hemolytic.

Kell1 phenotyping: The presence or absence of an antigen called K-antigen defines the Kell+ or Kell- group. It is one of the most immunogenic antigens after the D antigen [8,9].

A RH-Kell1 phenotype test requires the use of monoclonal antiRH2, antiRH3, antiRH4, antiRH5, antiKell1 reagents and the appropriate control reagent(s).

4. Irregular agglutinin research: IAR

The purpose of the I.A.R. is to detect and identify anti-erythrocyte antibodies by placing a range of test red blood cells O phenotyped by most blood grouping systems in the presence of serum (or plasma to be studied).

It has a maximum validity of 3 days for the transfusion of red blood cells (RGC). A screening step: The 3 batches of group O test red blood cells must allow the detection of the Ac corresponding to RH1 (D), RH2(C), RH3 (E), RH4 (c), RH5 (e), KEL 1 (K) Ag, KEL 2 (Cellano k), KEL 4 (Kpb), FY1 (Fya), FY 2 (Fyb), JK1 (Jka), JK2 (Jkb), MNS1 (M), MNS2 (N), MNS3 (S), MNS4 (s), LE1 (Lea), LE2 (Leb), P1, LU1 (Lua) LU2 (Lub).

An identification step: All of these group O red blood cells must contain the following antigens: Ag RH1 (D), RH2 (C), RH3 (E), RH4 (c), RH5 (e), RH8 (Cw), KEL 1 (K), KEL 2 (Cellano k), KEL3 (Kpa), KEL 4 (Kpb), FY1 (Fya), FY 2 (Fyb), JK1 (Jka), JK2 (Jkb), MNS1 (M), MNS2 (N), MNS3 (S), MNS4 (s), LE1 (Lea), LE2 (Leb), P1, LU1 (Lua), LU2 (Lub).

The following phenotypes must be represented on at least 2 red blood cells: KEL1, FY1;-2, JK 1;-2, JK-1;2, MNS 3;-4, MNS -3;4, P-1.

5. Direct Laboratory Compatibility Test: DLCT

A laboratory test that consists of testing the patient's serum or plasma for the erythrocyte concentrates intended for transfusion, using the same techniques as the irregular antibody test.

This test is recommended for multi-transfused patients who do not have irregular anti-erythrocyte antibodies. It is no longer recommended for pregnant women.

A. Non-systematic immuno-hematological tests:**1. Phenotyping extended to other systems (Kell2; MNS; DUFFY; KIDD; LUTHERAN; LEWIS):**

Generally, Ag from the Duffy, Kidd, and MNS systems are limited, but other Ags may also be sought [10].

Rhesus Ag Cw (RH8), Kell Ag Cellano (Kell2) (k), Duffy Ag Fya (FY1), Fyb (FY2), Kidd Ag Jka (JK1), Jkb (JK2), MNS Ag M (MNS1), N (MNS2), S (MNS3), s (MNS4) and Lewis Ag Lea (LE1), Leb (LE2)).

2. Direct antiglobulin test (DAT): Direct coombs test:

The direct anti-globulin test allows the demonstration of in vivo sensitization of human red blood cells by IgG antibodies and/or complement fractions. This test should preferably be performed on an anti-coagulated sample.

The presence of irregular antibodies is sought on red blood cells already sensitized by antibodies present in a patient's serum by indirect active agglutination using monospecific anti-human globulin (AHG) detecting IgG and the C3 fraction of complement [11].

3. Indirect antiglobulin test (IAT): Indirect coombs test:

It is used to detect a non-agglutinating irregular antibody in serum or a blood group antigen on erythrocytes.

The presence of irregular antibodies is sought in a patient's serum by indirect active agglutination using AHG with a panel of phenotyped red blood cells.

III. CONCLUSION

Transfusion safety relies largely on the detection and identification of anti-erythrocyte antibodies. To date, antibody detection techniques have evolved little. However, significant improvements have been introduced in the 1990s and, in particular, new media to highlight the agglutination reaction (also valid for phenotyping), such as the microfiltration technique (gel or beads...), the microplate technique or the immunoadherence technique. These different media have made it possible to provide ease of reading, better sensitivity and the possibility of automation. The downside of sensitivity is, however, in some cases, the presence of non-specific reactivities of no transfusion interest, which can delay the result and therefore the transfusion decision.

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