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ORIGINAL ARTICLE

DOES BLOOD GROUP CHANGE IN SLE? NO, IT'S A DISCREPANCY

FAHMIDA SHARMIN CHOWDHURY[1], MD. ALI EHSAN SIDDIQUI[2], PULAK NATH BANIK[3], TONMOY BURMON[2], MD. WASIM[4], MIR KAMRUL ISLAM[5]

Abstract

Background: *ABO and Rh blood group antigens are inherited traits ,located on chromosome 1 and19. They are usually not altered throughout the life of an individual. Blood grouping consists of forward grouping and reverse grouping and both procedures should match with each other. A blood group discrepancy exists when results of forward grouping and reverse grouping do not match each other. ABO and Rh blood group discrepancy should be resolved before transfusion and blood group to be properly labeled to prevent transfusion reaction.* ***Methods:*** *A prospective study was carried out in Department of Transfusion Medicine and Blood Bank , National Institute of Kidney Diseases & Urology (NIKDU), Dhaka Bangladesh from January 2014 to Dcember-2016. Total 50 blood samples from SLE patients were included in the study . The ABO and Rh D typing was done by tube technique using monoclonal IgM (œShield Diagnostic ,UK) Anti-A, Anti-B, Anti-AB and pooled A, B and O cell and Anti-D.* ***Results:*** *A total of 50 blood group testing were done where we found 50 blood group discrepancies with overall frequency was 100% and transfused safely.* ***Conclusion:*** *Any discrepancy between forward and reverse blood grouping methods should be resolved before transfusion of blood components.*

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Introduction:

Many precautions are taken regarding transfusion of red blood cells in patients with autoimmune haemolytic anaemia (AIHA) due to systemic lupus erythematosus (SLE). Frequently, considerable efforts are made to examine the indication and serological compatibility prior to transfusion in such patients.

Many of the reported recommendations regarding transfusion of red blood cells in autoimmune haemolytic anaemia are highly questionable and positive serological cross-matches should not result in a delay or refusal of necessary blood transfusions.

Systemic Lupus Erythematosus (SLE)

Systgemic lupus erythematosus is an autoimmune disease in which the body's immune system mistakenly attacks healthy tissue in many parts of the body[1]. Common symptoms include painful and swollen joints, fever, chest pain, hair loss, mouth ulcer, swollen lymph nodes, feeling tired and a red rash which is most commonly on the face.[2]

Anaemia of chronic disease (ACD), iron deficiency anaemia (IDA), autoimmune haemolytic anaemia (AIHA), anaemia of chronic renal insufficiency, and

1. Professor, Transfusion Medicine, National Institute of Kidney Diseases & Urology, Dhaka, Bangladesh.
2. Consultant, Cardiology, National Institute of Traumatology & Orthopaedic Rehabilitation (*NITOR*), Dhaka, Bangladesh.
3. Medical Officer, Transfusion Medicine, National Institute of Kidney Diseases & Urology (NIKDU), Dhaka, Bangladesh.
4. Assisstant Professor, Transfusion Medicine, Sir Salimullah Medical College, Dhaka, Bangladesh.
5. SMT, Transfusion Medicine, National Institute of Kidney Diseases & Urology, Dhaka, Bangladesh.

Address of Correspondence: Dr. Fahmida Sharmin Chowdhury, Professor, Transfusion Medicine, National Institute of Kidney Diseases & Urology, Bangladesh. E-mail: fschowdhurytm@gmail.com

cyclophosphamide induced myelotoxicity are the most common causes of anaemia in SLE. [3,4,5,6]

Autoantibody generally generated against self-red blood cell (RBC) antigens. In contrast, alloantibody formed due to exposure to foreign RBC antigens. Direct antiglobulin test (DAT) is generally positive without hemolysis in SLE.[7,8]

Autoimmune Haemolytic Anaemia

AIHA is a group of disorders where immune system mistakenly destroys own red blood cells characterized by a malfunction of the immune system that produces autoantibodies which attack red blood cells as if they were recognized foreign to the body. [9]

RBCs normally have a lifespan of around 120 days. However, when antibodies bind to RBCs by mistake, they become targets for the immune system. The immune system then destroys the RBCs before the end of their natural lifespan. [10]

Causes of AIHA [11,12]

1. Idiopathic: approximately 50% of cases.
2. Secondary AIHA : lymphoproliferative disorders (e.g., chronic lymphocytic leukemia, lymphoma) autoimmune disorders (e.g., systemic lupus erythematosus SLE, rheumatoid arthritis, scleroderma, crohn's disease, ulcerative colitis).
3. Drug-induced AIHA including á-methyldopa and penicillin.

Characteristics of ABO antigens [13,14]

These are antigens sugar attached to the red blood cell membrane. [13] Clinically these are important because they are the most immunogenic. Inherited traits, located on chromosome 19 .They are usually not altered throughout the life of an individual. Within the ABO Blood Group system, the A and B genes are co-dominant, i.e. these will be expressed whenever the gene is present. The O gene is silent and only expressed when neither A nor B is present. [14] Besides their presence on red blood cells, soluble antigens can be present in plasma, saliva, and other secretions. .[15] This last fact is important to consider in organ transplantation. These modifications of blood group antigens usually revert to normal after remission is attained. Loss or weakening of ABO antigens is usually detected as a discrepancy in the forward and reverse typing of patients.[16]

Characteristics of abo antibodies: [17]

Naturally occurring antibodies that occur without exposure to red cells containing the antigen. IgM antibodies, predominantly .They react in saline and readily agglutinate. Their optimum temperature is less than 30ºC ie ,cold antibody, but reactions do take place at body temperature .Commonly present in high titer, 1/128 or 1/256. They are absent at birth and start to appear around 3-6 months as result of stimulus by bacterial polysaccharides. For this reason, newborn blood is only forward typed.

Characteristics of rh antigens[18]

The Rh blood group systeis attributable to two genes, RHD and RHCE, which are located on chromosome1. Rh positivity or Rh negativity is distinguished by testing for the RhD antigen, the expression of which depends upon whether an RHD gene has been inherited from one or both parent. The RhD group is also dominant and will be expressed if inherited from either parent. If the RhD gene is not inherited from either biological parent then the individual will be RhD negative.

Characteristics of Rh Antibody [19]

The majority of antibodies formed against the Rh antigens are of the immune antibody, IgG type, best react at37ºC ie, warm antibody accurately detected by IAT. They are capable of causing significant HTR and HDN. Rh antibodies rarely, if ever, bind complement, and therefore RBC destruction is mediated almost exclusively via macrophages in the spleen (extravascular hemolysis).

Landsteiner's Law[20,21,22]

It states that:

1. *If an agglutinogen is present in the red cells of a blood, the corresponding agglutinin must be absent from the plasma.*
2. *If an agglutinogen is absent in the red cells of a blood, the corresponding agglutinin must be present in the plasma.*

Applicability of the law:

The first law holds true for all types of blood grouping.

The second law is a fact for ABO blood groups.

The Rh,M,N and other blood groups do not follow the second part of landsteiner's law.

Antigen And Antibody of ABO System

Blood Group	Antigen	Antibody
A	A	B
B	B	A
A B	A B	No A or B
o	No A or B	A , B

ABO TYPING

Antigen typing referred to as the forward typing (1st Law)

Antibody detection referred to as the reverse typing (2nd Law)

Table-II

Forward typing determines antigens on patient's or donor's red cells

Anti A	AntiB	AntiAB	Bood Group
+	-	+	A
-	+	+	B
+	+	+	AB
-	-	-	O

(-) No agglutination, (+) Agglutination

Table-II

Reverse typing determines antibodies in patient's or donor's serum or plasma

A Cell	B Cell	O Cell	Blood Roup
-	+	-	A
+	-	-	B
-	-	-	AB
+	+	-	O

Table-III

Final Result

Forward Grouping			Reverse Grouping			Auto Controll	Blood
Anti A	Anti B	Anti AB	A Cell	B Cell	O Cell	Self Cell+Self Serum	Group
+	-	+	-	+	-	-	A
-	+	+	+	-	-	-	B
+	+	+	-	-	-	-	AB
-	-	-	+	+	-	-	O
+ +	+ +	+ +	+ +	++	++	+++	??????

How To Resolve The Discrepency In Sle

Check the patient's age and sex

Check the diagnosis

Check the transfusion history

Check for clerical/technical errors

Check results of the screening cells.

Always re-test first-

Forward grouping and Reverse grouping

Autocontroll

Direct and Indirect Antihuman globulin test (DAT and IAT)

Transfusion in SLE

The AIHA in patients with SLE is seldom severe and rarely fatal as prednisolone is usually sufficient in controlling it. So blood requirement is rare in SLE patients.

As autoantibody reacts with most of the donor RBCs, it is difficult to find out compatible units. In that case, first, we have to rule out alloantibody and second find out best-matched blood units for transfusion. Finding compatible blood unit is virtually impossible."least incompatible" RBC's may be selected from 5 to 6 donors.

Blood should be transfused by keeping warm the patient not the blood.

Methods:

50 SLE patients with cold-type autoimmune haemolytic anaemia were included in this study. In this study, data were collected from patients with true (clinically and laboratory verified) AIHA due to SLE and detectable serum autoantibodies and required RBC transfusion. Patients who had not received transfusions or received compatible RBC transfusion (negative cross-match) have not been considered in this study. Prior to RBC transfusion, all patients were either receiving immunosuppressive therapy, i.e. prednisolone and/ or azathioprine or cyclophosphamide, or prednisolone treatment was started with at least 100–250 mg.

Standard serological assays were employed for the detection and characterization of antibodies to red blood cells. If a sample showed evidence of strong autoagglutination, cells were washed with pre warmed saline to detect presence of cold autoantibody. In severe cases pre-warming the patient cells, serum/plasma and grouping reagents prior to mixing and incubation of the tests at 37°C was done. patient's serum with screening cells and an auto control.

Cold autoantibodies react against all adult cells including screening cells(A and B cells) and autologus cells. An auto-control is used to differentiate between cold autoantibodies from cold alloantibodies. If the auto control is positive, the reactions observed with the A and B cells and screening cells are probably the result of autoantibodies. When autoantibody is detected, special techniques to identify the antibody and remove antibody reactivity by prewarming techniques can be used. Serological assays including direct and indirect antiglobulin tests (DAT and IAT) done. Strategy to distinguish between cold autoantibodies or cold alloantibodies are, by testing the at room temperature.

Identification and characterisation of serum and/or eluted antibodies, and antibody adsorption were not performed. Significant alloantibodies were not detected in the serum samples .

Results:

A positive direct antiglobulin test (DAT) was observed in all 50 patients. A positive direct antiglobulin test is a criterion for the diagnosis of systemic lupus erythematosus (SLE). A DAT-positive reaction points to the presence of IgG and/or complement attached to the red cells. It can be positive in several cases, but in our case, it was mainly due to the presence of an autoimmune disease (SLE).

It is essential to exclude an underlying alloantibody along with autoantibody.. In 50 patients, red blood cell transfusion was done with no significant haemolytic transfusion reactions due to auto - antibodies.

Table

Distribution by age

Class interval	No of patients	Percentage
11-20	05	10
21-30	20	40
31-40	22	44
41-50	03	06
Total	50	100

Table

Distribution by sex

Sex	No of patients	Percentage
Male	20	40
Female	30	60
Total	50	100

Table
Distribution by blood group

Blood group	No of patients	Percentage
A+	12	24
A -	00	00
B+	14	28
B-	01	02
AB+	08	16
AB-	01	02
O+	12	24
O-	02	04
Total	50	100

Table
Distribution by haemogloin

Gm/dl	No of patients	Percentage
4-5	08	16
6-7	22	44
7-8	20	40
Total	50	100

Table
Distribution by unit of blood transfused

Unit of blood	No of patients	Percentage
1-3	32	64
4- 6	12	24
7-9	06	12
Total	50	100

Discussion:

Many of the reported recommendations regarding transfusion of red blood cells in autoimmune haemolytic anaemia are highly questionable. RBC transfusion in these patients is associated with the risk of a haemolytic transfusion reaction due to mismatched blood, and thus the attending physician is responsible for any possible unfavourable transfusion outcome. Similarly, transfusion is only indicated in life-threatening situations, and, if indicated, the total volume transfused should not exceed 1 mL/kg/hour[23, 24] Serological assays including direct and indirect antiglobulin tests (DAT and IAT, respectively), identification and characterisation of serum and/ or eluted antibodies, and antibody adsorption should be performed [25,26, 27]

Blood grouping includes both forward and reverse grouping methods as each method serves as a check on each other. Blood group discrepancy occurs when both methods do not match with each other. On occasions, the reason for this discrepancy in blood grouping and Rh typing may be due to autoantibodies present in the blood. This may lead to mismatch during crossmatching, which may lead to the transfusion of incorrect ABO blood group. This may result in transfusion reactions in the patient. Hence, finding the correct blood group is of utmost importance. In our case, we used the prewarming technique,[28]

There is an autoantibody in the unknown serum active at the temperature of the test, the red cells agglutinated before being tested. This is usually observed at temperatures lower than 37°C and found in 9 cases which is about 17.64%. Mishra et al. found it about 35.1% and Heo et al. found it in about 5.5% and Makroo et al. found cold-reacting autoantibody (57%) and it was the most common cause of ABO discrepancy. Cold autoantibodies react usually all cells including screening cells, A, B, and autologous cells. An auto-control is usually used to differentiate between cold autoantibodies from cold alloantibodies. If the auto-control is positive, the reactions observed with all cells. Washing red cells at 37°C or 45°C may disperse the agglutination and the red cells can be grouped in that way. In this study we also found a part of group discrepancy and mixed Rhesus phenotype about 5 (9.80%) cases [29,30,31,37]

N, Fujita T, Nakamura M, et al showed that A transient blood group change from A to AB in a 26-year-old woman presenting with systemic lupus erythematosus (SLE), was interpreted that her blood type returned to A after steroid pulse therapy.[32]

Ananda N Malaya et al showed that A 53-years old woman presenting with systemic lupus erythematosus (SLE), was underwent hysterectomy , her blood typed as B Positive and returned to O Positive after steroid pulse therapy.[33]

Mishra D et al showed that A total of 25,559 blood group testing were done where we found 57 blood group discrepancies with overall frequency was 0.22%. Out of 57 discrepancies we were found 20 (35.09%) cases of technical error and 37 (64.91%)

cases of sample related error. Among these sample related problems, we found weak/missing antibody, weak antigen expression, rouleaux, cold autoantibodies, cold alloantibodies, Bombay phenotype with the frequency of 13.51%, 2.70%, 2.70%, 54.06%, 8.11%, 18.92% respectively.[34]

Makroo RN et al The most common cause of ABO typing discrepancies was due to cold autoantibodies among the patients (50·7%) and blood donors (57%) causing discrepant results in reverse typing. The various other causes of reverse typing discrepancies among patients were weak/missing antibody (25·4%), cold-reacting alloantibody (4·3%), warm autoantibody (2·2%), anti-A1 antibody (2·2%), Bombay phenotype (1·5%), transplantation (0·7%) and rouleaux (0·7%), whereas in blood donors, the causes were cold-reacting antibody (7%) and weak antibody (7%). The major cause of forward typing discrepancies among patients (12·3%) and blood donors (29%) was ABO subgroups.[35]

The most frequent cause of ABO discrepancies in forward grouping was subgroups of A Antigen (44.6%) and in reverse grouping was cold autoantibody (23.9%). There were 11 (8.4%) cases with alloantibodies. Two blood donors with rare Bombay phenotype and p blood group were also identified.[36]

A total 25,082 blood group testing was done, 318 samples were carried out for group confirmation and discrepancy found in 51 cases. Technical and clerical errors were found in 18 cases. The remaining 33 samples reported as true discrepancy which was detected by Coombs analysis (both direct and indirect), antibody screening, determination of Rhesus genotype and phenotype, and minor antibody detection. The rate of discrepancy is about 0.20%. Meanwhile, missing antigen was found in 3 cases (5.88%), missing antibody in 1 (1.96%), additional reaction due to rouleaux's in 4 (7.84%), mixed field (mf) reaction due to mismatched blood transfusion in 6 (11.76%), alloantibody with mixed phenotype in 5 (9.80%), cold antibody in 9 (17.24%), and Bombay in 5 cases (9.80%).[37]

Conclusion:

Mistyping either a donor or a recipient can lead to transfusion with ABO-incompatible blood, which can result in severe hemolysis and may even result in the death of the recipient. Clinicians are generally reluctant to give a best-matched blood transfusion to patients with autoantibody-induced hemolysis of red cells. Transfusion medicine specialists should help the clinician understand that this is the best treatment plan for the patient and safe blood transfusion. Transfusion medicine specialists should request the clinician to fillup the blood requisition form correctly.

Limitations of the study:

This study was not without limitation. One of the limitations of the study was small sample size. Also it was a single centre study. Only patients of NIKDU, Dhaka were taken for the study. So this will not reflect the overall picture of the country. A large scale study needs to be conducted to reach to a definitive conclusion. Study was conducted in a tertiary care hospital which may not represent the real scenario of primary or secondary care centre.

Conflict of Interest:

The authors stated that there is no conflict of interest in this study

Funding:

No specific funding was received for this study.

Ethical consideration:

The study was conducted after approval from the ethical review committee. The confidentiality and anonymity of the study participants were maintained

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