Anti-D Alloimmunization After D- Incompatible RBC Transfusions: a 6-Year Retrospective Review

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Introduction:

Patients not expressing the D (RhoD/ Rhesus) surface antigen on erythrocytes are said to be Rh-negative. All Rh-negative patients are at risk for development of an anti-D antibody if exposed to D-positive blood.[1] Over 80% of D negative patients who receive a transfusion of one unit of D positive red blood cells (~200 mL) produce anti-D and 18% of D negative women who are exposed to a few mL of D positive fetal blood during pregnancy or giving birth also produce anti-D.

In emergency situations, uncrossmatched type-O-negative red blood cells is recommended for the immediate transfusion when the patient's blood group is unknown. In order to preserve the O-negative inventory, O-positive blood is given to females older than 45 and all males. Transfusion of D-positive RBCs to D-negative recipients can lead to alloimmunization with associated risks of hemolytic transfusion reactions from subsequent mismatched transfusions.

Method:

Transfusion Service database and electronic patient files were linked to perform a retrospective analysis of every emergency transfusion ordered for trauma and emergency patients at our hospital during a six year period, from January 1, 2006 to December 31, 2012. Rh group and antibody screening were reviewed for each patient to determine whether potential sensitizing events occurred.

Criteria for exclusion from analysis included patients with prior anti-D, unresolved Rh antibody at admission, if antibody screen was not performed after transfusion, or if the patient did not meet the minimum 4 day antibody screen criteria (Figure 1).

Results:

Among 1,359 patients identified, 51 D-negative patients received D-positive RBC transfusions; 27 of those patients had an antibody screen performed after 4 days of Rh-incompatible transfusion and 24 patients were excluded from analysis due to prior anti-D and lack of follow-up antibody screening.

Of 27 eligible D-negative patients, 22% (6 patients) developed anti-D (Table 1). A significant observation was that 2 patients who received incompatible D-positive RBCs with evidence of prior anti-D did not manifest any severe transfusion reactions.

Two patients enrolled during this period had been previously transfused with O-Positive and this was not considered at the moment of transfusion.

Figure 1. Outline of the study

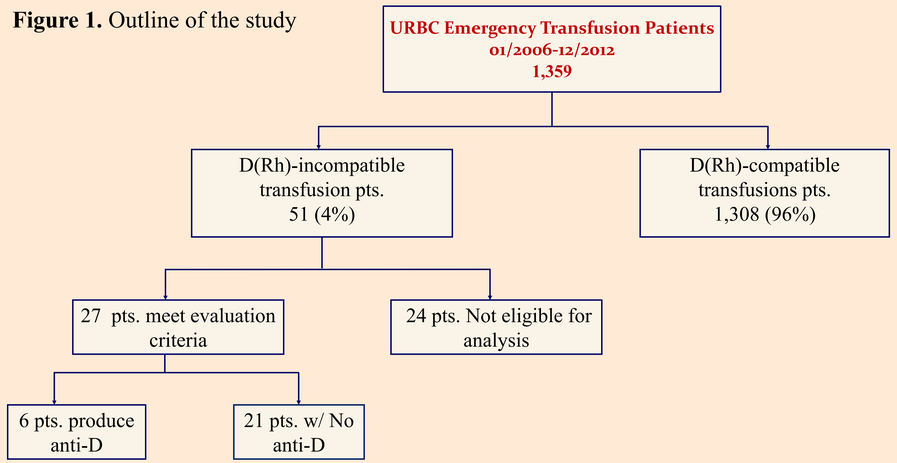

Table 1. D-negative Patients with Sensitizing Event

Age, years	Sex	Diagnosis	# of incompatible RBC units transfused (350mL/unit)	Cross matched Blood components transfused in 24 hrs	Follow-up (Days)	Anti-D
45	Male	Injury Mlt Site	1	N/A	21	Yes
27	Male	GSW	2	4PPRBC	1,095 (3yrs)	No
33	Male	GSW	1	4PRBC	13	Yes
39	Male	GSW	1	N/A	2,190 (6yrs)	No
53	Male	GSW	3	N/A	20	No
71	Male	Malignancy	2	N/A	4	No
44	Male	MVA	2	1 PRBC	12	No
19	Male	GSW	3	2 PRBC	60	No
27	Male	GSW	2	1 PRBC	19	No
14	Male	GSW	1	N/A	26	Yes
19	Male	MVA	1	1 PRBC	4	Yes
32	Male	GSW	2	3 PRBC	12	No
69	Male	GI Bleed	2	1 PRBC 6 Thawed Plasma	7	No
28	Male	GSW	2	N/A	20	No
30	Male	GSW	4	N/A	122	No
46	Male	MBT	4	3 Thawed Plasma	30	No
17	Male	GSW	1	1 PRBC	10	No
60	Male	MVA	2	N/A	13	No
21	Male	Stab Wound	2	1 PRBC 4 Thawed Plasma	150	Yes
65	Male	MBT	1	1 PRBC 2 Thawed Plasma	17	No
26	Male	GSW	2	1 Thawed Plasma	28	No
24	Male	GSW	1	N/A	610	No
37	Male	GSW	2	2 PRBC	10	Yes
36	Male	MBT	1	N/A	61	No
27	Male	GSW	2	2PRBC	29	No
30	Male	MVA	3	6 Thawed Plasma	10	No
25	Male	GSW	2	4 Thawed Plasma 6 Platelets	20	No
27	Male	GSW	3	6 Thawed Plasma	4	No

Discussion:

The importance of immediate replacement of blood in the resuscitation of trauma victims and emergency patients has been known for over a century. The safest blood to give is that which is fully crossmatched, but unfortunately the time required for this makes crossmatched blood unavailable for initial resuscitation. In order to meet the demand for immediate blood, the use of the "universal donor" given as Group O Rh-negative blood has been suggested and is most often requested, but this component is found in limited quantities and the practice of proper blood utilization must be emphasized. In emergencies, in order to preserve the O-negative inventory, O-positive blood is given to females older than 45 and all males. The potential for alloimmunization with this technique is increased. It is estimated that 10% of the Puerto Rican population is Rh- negative and this minimizes but does not eliminate a chance for isoimmunization.[8]

The objective of this study was to analyze the outcome associated with uncrossmatched Rh-incompatible blood transfusion during emergency situations and the rate of alloimmunization.

In our analysis no clear correlation was found between Rh-antibody response and the number of Rh-positive transfusions. In a significant number of patients follow-up anti-D antibody screen was not performed, which has lead us to revise the emergency transfusion protocol to establish a norm in which Rh-incompatible transfusions must be followed-up at 3 months for sensitization.

In this study it was brought to our attention the need for a patient identifier that will alert clinicians that a patient has been exposed to previous emergency transfusions and should be given O-negative RBCs to avoid adverse transfusion reactions.

The rate of seroconversion of Rh-negative patients in our study was 22%. Even though our sample size is small, a similar study done in 2008 at the Transfusion Service of the University Hospital of Salamanca, Spain, gave similar results. Their sample was 351 patients who received massive transfusions (the definition of massive transfusion varies, but historically it is defined as replacement of at least one blood volume within 24 hours, e,g, more than 8 units of RBC) and the incidence of alloimmunization was 21.4 %.[7]

Considering that our patients received one or more RBC transfusions, the expected alloimmunization (production of anti-D) would be over 80%. It is not clear why in our study, and similar studies, seroconversion was around 22%.

References

1. Schwab C, Shayne J, Turner J. Immediate Trauma Resuscitation with Type O Uncrossmatched Blood: A Two-Year Prospective Experience*: Journal of Trauma* 1986, Oct.26 (10) 897-902.
2. Ayache S, Herman J. Prevention of D sensitization after mismatched transfusion components: *Transfusion* . 2008 Sept 48: 1990-99.
3. Cid J, Ortin X, Elies E. Absence of anti-D alloimmunization in hematologic patients after D- incompatible platelet transfusions: *Transfusion.* 2002 Feb;42:173-76.
4. Inaba K, The impact of uncross-matched blood transfusion on the need for massive transfusion: *Journal of TRAUMA Injury Infection,and Critical care, 2008* Dec; 65 (6): 1222–26
5. Roback JD ed: Technical Manual Technical Manual, 17th edition. Bethesda: American Association of Blood Banks, 2011.
6. Carson TH ed: Standards for Blood Banks and Transfusion Services, 27th edition. Bethesda: American Association of Blood Banks, 2011.
7. Jose R. Gonzalez-Porras, Ignacio F. Graciani. Prospective evaluation of a transfusion policy of D+ red blood cells into D- patients *Transfusion:* 2008;48:1318-1324.7
8. Climent C. Personal communication.