Frequency of Alloantibodies Among Chronic Renal Failure Patients in Red Sea State

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Abstract Chronic renal failure patients need regular blood transfusion support to treat anemia and the development of erythrocyte alloantibodies complicates transfusion therapy. The aim of this study was to determine the frequency and specificity of alloantibodies against red cell antigens in CRF patients. This was a descriptive cross-sectional study done in the blood bank, Port Sudan, during the period of May–September 2012. A total of 84 patients (58 male and 26 female) with CRF who received at least one unit of RBC matched for ABO & Rh(D) antigens only were enrolled. Sera were screened for the presence of alloantibody by antibody screening test. The positive samples were subjected for antibody identification. The incidence of alloantibody among CRF patients was 13.1 % and the most common alloantibodies were Anti-c (27.3 %), anti-C (18.2 %), and anti-K (18.2 %). The risk of alloimmunization among CRF patients was 4.8 % with the frequency of 13.1 % and Anti-c being the commonest alloantibodies identified.

Keyword CRF Chronic renal failure

Introduction

Anemia is a severe complication of chronic kidney disease (CKD) that is common in more than 80 % of patients with impaired renal function [1]. Although there are many mechanisms involved in the pathogenesis of anemia (iron, folate, or vitamin B12 deficiency; gastrointestinal bleeding; severe hyperparathyroidism; systemic inflammation; and shortened red blood cell survival), the primary cause is the inadequate production of erythropoietin by the damaged kidneys. Erythropoietin is a glycoprotein secreted by the kidney interstitial fibroblasts [2] and is essential for the growth and differentiation of red blood cells in the bone marrow. In CKD, tubular atrophy generates tubulointerstitial fibrosis, which compromises renal erythropoietin synthetic capacity and results in anemia [2].

Red blood cell alloimmunization is a common complication among CRF patients who need regular blood transfusion [3]. Immune response due to genetic difference between the blood donor and the recipient induces the formation of alloantibody. The other factors that influence alloantibody formation are the recipient's immune status as well as the dose, route of administration and the immunogenicity of the antigen [4–6]. This type of sensitization results in difficulty obtaining compatible blood, transfusion reactions, haemolysis and occasionally life-threatening events [7].

Several studies have demonstrated the incidence of alloimmunization among chronic renal failure patients, study done by Mervat Mostafa Azab et al. reported alloimmunization rate of 9.5 % in multiple transfused patients [8] while Shukla et al. [9] reported RBC alloimmunization rate of 9.8 % in chronic renal failure patients undergoing haemodialysis and Domen and Ramirez [10] have reported low rate 6.1 % of antibody formation in the same group of patients.

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This study was conducted to determine the frequency and specificity of the red cell alloantibody detected in chronic renal failure patient in the red sea state, in order to provide appropriate recommendations for the care of these patients.

Materials and Methods

Ethical Consideration

This study was approved by the Port Sudan hospital ethics committee and Al-Neelian university, and an informed consent was obtained from the patients after explaining the purpose of the study.

A cross sectional study was done in the blood bank, port Sudan, red sea state, Sudan, during the period from May to September 2012. A total of 84 patients diagnosed to have chronic renal failure who had been received at least 1 transfusion with units of ABO and Rh(D) matched RBCs were selected.

Laboratory Investigation

Antibody Screening

Patients sera were tested against 2-cell panel with homozygous expression of the antigens (ID-Diacell I-II-DiaMed, Switzerland). Any sera that had a positive antibody screening were subjected for antibody identification.

Antibody Identification

The antibody specificity was determined with commercial panels of 11 cells (ID-DiaPanel-DiaMed, Switzerland),

against the patient's serum in the same phases as antibody screening.

Statistical Analysis

Descriptive analysis were used to test the relationship between gender as well as transfused units and alloimmunized status. p value <0.05 was considered significant. The present analyses were performed using SPSS software version 15.

Results

A total of 84 patients diagnosed chronic renal failure and received at least one unit of red blood cell transfusion were screened for the presence of red blood cell alloantibodies.

There were 58 men (69 %) and 26 women (31 %). The total number of transfused units was 231. Men received an average of 2.45 units and women an average of 3.42 units. Red cell alloantibodies were detected in 11 patients (13.1 %) (Fig. 1), 4 men (6.9 %) and 7 women (26.9 %).

The most common alloantibodies among patients with positive result were Anti-c (27.2 %), followed by anti-C (18.2 %), anti-K (18.2 %), anti-e (9.1 %), anti-D (9.1 %), anti-M (9.1 %) anti-Le^a (9.1 %) (Table 1).

There were a significant relationship between the development of alloantibody with gender (Table 2) and number of red blood cell transfused units (p . value = 0.000).

The risk of alloimmunization in CRF patients was 4.8 %.

Fig. 1 Frequency of red blood cell alloantibody in chronic renal failure patient

Discussion

Alloantibodies arise in the chronic renal failure patients after exposure to repeated red blood cell transfusion. RBC alloimmunization results from disparity of antigens between donor and recipient. Recipient's immune status, immunogenicity of the antigen and dose of the antigen are the factors which play a significant role in alloimmunization. Red cell alloantibody formation complicates the transfusion therapy in which corresponding antigen negative matched blood is required for safer transfusion [5]. This study was undertaken to determine the frequency and specificity of RBC alloantibodies among the chronic renal failure patients.

Several studies had been examined the frequency and rate of alloimmunization in patients with different chronic

Table 1 Frequency of red blood cell alloantibody detected in 11 patients with chronic renal failure

Antibodies detected	Number of alloantibodies	Percentage
Anti-c	3	27.2
Anti-C	2	18.2
Anti-K	2	18.2
Anti-e	1	9.1
Anti-D	1	9.1
Anti-Le ^a	1	9.1
Anti-M	1	9.1

Table 2 The relationship between frequency of alloantibody and gender

Result	Sex		<i>p</i> value
	Male	Female	
Non-alloimmunized	54	19	
Anti-Le ^a	0	1	
Anti-C	2	0	
Anti-k	0	2	0.04
Anti-e	0	1	
Anti-c	1	2	
Anti-D	0	1	
Anti-M	1	0	
Total	58	26	

diseases [11–13]. However, very few data have been reported concerning alloantibody development in chronic renal failure patients.

In the present study alloimmunization rate was 13.1 % detected in 11 out of 84 CRF patients, this finding is higher than the frequency of 6.1 % reported by Domen and Ramirez [10] and frequency of 9.9 % reported by Shukla [9] in CRF patients undergoing dialysis.

Other study from Sharkia reported alloimmunization rate of 9.5 % in multiple transfused patients [14] while study by Patel et al. [15] had been shown that the alloimmunization rate 8.2 % in CRF patients. The differences in the alloimmunization rate were attributed to: Heterogeneity among the population, in pre-transfusion test blood were matched only for ABO and Rh(D) antigens, sample size of study population and sensitivity of the test method.

It has been documented that if blood were matched only for ABO and Rh(D) groups, a high rate of alloimmunization would be expected [16].

The most common alloantibodies among CRF patients was Anti-c, followed by anti-C, anti-e and anti-D (Rhesus system), and this finding were matched to result obtained by Azab et al. and Patel et al. This study as well as other study done by Shukla and Chaudhary have reported Kell antibody.

In this study there was a significant relationship between number of units transfused and alloimmunization ($p < 0.000$) and this is in agreement with a number of studies reported on an increasing number of alloimmunized patients dependent on the number of RBC units transfused [17, 18].

The overall alloimmunization risk in this study was 4.8 % is in accordance with the risk of alloimmunization per transfused unit reported to range from 0.5 to 5.9 % [19].

Conclusion

In conclude the alloimmunization to blood group antigens is common in regular transfused chronic renal failure patients with alloimmunization rate of 13.1 %, Anti-c being the commonest alloantibody and the risk of alloimmunisation is known to be influenced by recipient gender as well as per unit transfused.

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