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Research Article

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Prevalence of Rhesus C and E Phenotype among Pregnant Women Attending Antenatal Clinic in Usmanu Danfodiyo University Teaching Hospital, Sokoto

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Abstract

Rhesus (Rh) antigen was discovered in 1940 by Karl Landsteiner and Wiener. In later years, because of its immunogenicity along with ABO antigens, Rh D antigen testing was made mandatory before issuing a compatible blood. Presently there are five major Rh antigens (D, C, E, c and e) in the Rh blood group system. The aim is this study is to determine the prevalence of Rh c and e phenotype among pregnant women attending antenatal clinic (ANC) in Usmanu Danfodiyo University Teaching Hospital Sokoto. The prevalence and distribution of Rh c and e phenotype was determined among 200 consecutively recruited pregnant women aged 18-45 years and mean age 27.19 ± 4.72 years. Samples were tested for Rh c and e phenotype using the conventional tube agglutination method using Lorne Laboratories (UK) anti c and e antisera. Out of 200 samples studied, the prevalence of Rh c was 92% while Rh e was 98.5%. We observed a statistically significant ethnic variation in the distribution of Rh c and e antigens among the pregnant subjects (p = 0.05 and 0.02) respectively. The prevalence of Rhesus c and e antigens was significantly higher among the Hausa ethnic group compared to the other ethnic groups. A significant number of antenatal attendees were better educated with secondary and tertiary education compared to those with primary and non-formal education. We recommend that all pregnant women in the area be screened for the presence of clinically significant red cell antigens including Rh c and e blood group antigens on their first antenatal visit. There is need to introduce routine alloantibody screening for clinically significant red cell antibodies to facilitate the effective management of anti-c and e related haemolytic disease of the foetus and newborn as well as to prevent haemolytic transfusion reactions. Policy should be developed to facilitate optimum stocking of c and e negative cell in blood bank for emergency use in the area.

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Introduction

The Rh blood group system is second most clinically significant blood group system after the ABO blood group system[1-2]. Antibodies of the Rh blood group system cause Haemolytic Transfusion Reaction (HTR) and Haemolytic Disease of the Newborn (HDN). Since the introduction of postpartum anti-D prophylaxis in the late 1960s, and its objective use in the developed world in the early 1990s, the incidence of HDN due to Rh D all immunization has been reduced by more than 90%. Up to 1% of all pregnant women have clinically significant HDN causing all antibodies[3-4]. To prevent all immunization, women of reproductive age are given red cell transfusions compatible for Rh antigens such as C, c, D, E and e in addition to the Kell (K) antigen of the Kell blood

group system. This requirement may also be indicated for transfusion-dependent patients who receive regular red cell transfusions to prevent all antibodies against Rh and Kell antigens. Alloantibody production can compromise future transfusion in these patient and make it more difficult and time consuming to provide compatible units for these patients[5]. Rh antigen distribution is vital in pregnancy and for blood transfusion purposes. It can also facilitate the optimum stocking of antigen negative red cells for patients with all antibodies against these antigens. There is paucity on the distribution of Rhesus c and e antigens among women of African descent in Sokoto North Western Nigeria. The aim of this study was to investigate the distribution of Rhesus c and e phenotype among consecutively recruited pregnant women of African descent attending antenatal clinic in Sokoto Nigeria.

Description of the Study Area

This study was carried out at the Haematology Department of Usmanu Danfodiyo University Teaching Hospital which is located in Wamakko Local Government within Sokoto Metropolis. Sokoto is located in the Sudan Savannah of North-Western Nigeria and has a longitude of 50 14' East and latitude of 130 04' North. It covers a land area of about 60.33 Km^2. It has a mean annual rainfall of 500 - 1300 mm. The State shares borders with Kebbi State to the West and South-East, Zamfara State to the West and Niger Republic to the North. Report from the 2007 National Population Commission indicated that the state had a population of 3.6 million[6]. The residents are mainly Hausa/Fulani and other non-indigenous ethnic groups like Yoruba, Igbo, and Zabarma tribe from neighboring Niger Republic. The main occupation of the people is trading, farming with few numbers of civil servants.

Study design

Two hundred consecutively recruited pregnant women visiting the antenatal clinic of Usmanu Danfodiyo University Teaching Hospital in Sokoto, North Western, Nigeria constituted the subjects for this case study. The aim of the study was to investigate the prevalence of Rhesus c and e phenotype among the pregnant subjects. Pregnant women who met the eligibility criteria for this study (age ≥ 18 years, confirmed pregnant by a consultant obstetrician, willingness to give written informed consent and who had no history of recent transfusion in the last 4 months) were recruited as subjects.

Statistical analysis

The data collected was recorded on an excel spreadsheet and later subjected to statistical analysis using a statistical software SPSS version 20. Statistical analysis included descriptive statistics of mean and bivariate analysis of t- test and chi- square. Correlation was compared using linear regression analysis. Differences were considered significant when $p \leq 0.05$.

Eligibility criteria

All consenting, consecutively recruited legal adults (≥ 18 years) and confirmed pregnant women (by a consultant obstetrician) attending the antenatal clinic (ANC) in Usmanu Danfodiyo University Teaching Hospital (UDUTH) Sokoto constituted the subjects of this study.

Exclusion criteria

The following women who did not meet the inclusion criteria were excluded from ; women who were not pregnant, pregnant but not consenting, pregnant women < 18 years of age and pregnant women who have had a history of a recent blood transfusion in the last 4 months.

Informed consent

Written informed consent was obtained from all pregnant women participating in this study, together with socio-demographic information. Ethical clearance was obtained from the ethical committee of Usmanu Danfodiyo University Teaching Hospital (UDUTH), Sokoto North Western, Nigeria.

Sample collection

Three milliliters of whole blood was collected using a syringe and needle into EDTA anti coagulated tube and used for the determination of Rhesus phenotype (c and e) using Lorne Laboratories (United Kingdom) anti-c and e reagents. The principle is based on the ability of Lorne anti-c and e reagents to cause a direct agglutination of the test RBCs that carry the corresponding Rhesus antigen. Agglutination indicated the presence of the group specific Rhesus antigen.

Result

Two hundred (200) blood samples were collected from pregnant women aged 18 - 45 years and mean age 27.19 ± 4.72 years attending ANC in UDUTH Sokoto were phenotyped for Rh c and e antigens. Table 1 shows the sociodemographic characteristics of the subjects. The age range of 24 - 29 years was found to have the highest frequency 102 (51%), followed by 30 - 34 years 46 (23%), 35 - 39 years 20 (10%). Educational distribution indicated that those whose highest level of education was secondary have the highest frequency 38.5%, followed by tertiary 31.0%, primary 4.5% and non formal 26.0%. Ethnic distribution indicated that Hausa had the highest frequency (58%), followed by Fulani (21%), Yoruba (10%), Igbo (7%) and others (4%). Table 2 shows the frequency of antigen c. A total o f 184 (92%) out of 200 samples were positive for Rh c antigen, while 16 (8%) of the samples were negative for the antigen. It was found that 197 (98.5%) of the samples were positive for Rh e phenotype whereas 3 (1.5%) tested to be negative for antigen e. Table 3 shows the frequencies of the Rh c and e antigen among different ethnic groups of the subjects. The prevalence of Rhesus c and e antigen was significantly higher among the Hausa ethnic group compared to the other ethnic groups ($p = 0.05$ and 0.02 respectively) compared to the other ethnic groups.

Table 1: Sociodemographic characteristics of the Subjects

Variable	Number	%
Age Groups (Years)		
16-25	86	43.0
26-35	90	45.0
36-45	24	12.0
Ethnic Groups		
Hausa	116	58.0
Fulani	42	21.0
Yoruba	20	10.0
Igbo	14	7.0
Others	8	4.0
Educational Status		
Non Formal	52	26.0
Primary	9	4.5
Secondary	77	38.5
Tertiary	62	31.0

Table 2: Prevalence of c and e antigen status among subjects

Rhesus Antigen Status	Rhesus c N(%)	Rhesus e N(%)
Positive	184 (92)	197 (98.5)
Negative	16(8)	3 (1.5)
Total	200 (100)	200 (100)

Table 3 :Ethnic distribution of Rh c and e antigen among subjects

Ethnic Group c antigen	Frequency	%	X2	p-value
Hausa	110	59.8	2.45	0.05
Fulani	40	21.7		
Yoruba	15	8.2		
Igbo	14	7.6		
Others	5	2.7		
e antigen				
Hausa	113	57.4	8.03	0.02
Fulani	42	21.3		
Yoruba	20	10.2		
Igbo	14	7.1		
Others	8	4.1		

Discussion

In this present study, 200 consecutively -recruited pregnant women were phenotyped for Rh c and e phenotype. The prevalence of Rh c and e phenotypes was 92% and 98.5% respectively. There was an ethnic variation in the distribution of Rh c and e phenotypes among the pregnant women studied. Our finding is consistent with a previous report among the 4 main ethnic groups in Port Harcourt, Nigeria which observed Rh c and e prevalence of 99.8% and 98.7% respectively[7] . Similarly Rhesus phenotypes distribution of the Ibibio, Efik, and Ibo ethnic nationalities in Calabar municipality, Nigeria, indicated c and e phenotypes prevalence of 100% and 96.38% respectively[8]. Also, a previous report among 100 consecutively-recruited blood donors in Aminu Kano Teaching Hospital Nigeria indicated Rh c and e prevalence of 85.4% and 96.1% respectively[9]. In India, the prevalence were Rh c 79% and Rh e 85%[10]. Similarly a previous report among a total of 3,073 blood samples from donors were phenotyped for Rh c and e antigens in India observed Rh c and e phenotype of 58% and 98% respectively[11]. This finding shows that there is an ethnic variation in the distribution of Rh c and e antigens in different population.

The finding from this study re-emphasizes the need for a policy to promote the optimum stocking of Rhesus antigen c and e negative blood in blood banks in the area for emergency use. Observation from this study also re-emphasizes the need for routine screening of pregnant women for clinically significant red cell antigens (including antigen c and e) and alloantibodies (antibody c and e) . This will facilitate the management of women positive for antibody c and e to prevent HDFN associated with alloantibody c and e. It will also enable those that have a clinically significant alloantibody c and e and who requires red cell transfusion to be transfused with donor blood that is negative for these antigens to which their antibody is specific. Prenatal immunohematologic care of pregnant women requires the investigation of unexpected RBC antibodies in their sera during pregnancy. When RBC antibody screening is positive, it is necessary to determine specificity of the antibody, its clinical importance, and the ability to cross the placenta and cause HDFN. In Sokoto, North Western Nigeria, alloantibody screening procedure is not routinely carried out as part of the pre-transfusion or prenatal testing protocol. This failure in stewardship can potentially put children at risk for HDFN. Rhesus antigens (c and e) are well developed at birth and have been identified in early foetal life as well as immunogenic (ability to stimulate antibody production) and therefore can easily cause HDFN if the baby has inherited Rh c and e antigens from their father. Anti-c and e antibodies are a common cause of delayed haemolytic transfusion reactions and HDFN[12]. The mechanism of maternal alloantibody production is that it is stimulated in mothers when they are exposed to foetal red blood cells containing an antigen absent on the mother's red cells. The foreign antigen (transfusion, pregnancy and transplant) stimulates the mother's immune system to produce maternal IgG antibodies. These antibodies can in subsequent pregnancy pass through the placenta and attack foetal red cells carrying the corresponding antigen causing HDFN. Similarly haemolytic transfusion reaction can also occur if the mother is transfused with red cell that are positive for the antigen to which she has developed alloantibodies[13-15]. Development of all antibodies can potentially complicate and limits transfusion therapy, contributing to a delay in getting compatible blood, technical complications and sometimes morbidity and mortality. Routine pre-transfusion testing of red cell antigens and alloantibodies during pregnancy is one of the important safety measures to detect the presence of clinically significant red cell antigens and unexpected red cell antibodies in the patient's serum to prevent the risk of immediate and delayed transfusion reaction and HDN[16].

The finding from this study is significant and can potentially by used by blood banks in the area in the optimum stocking of c and e antigen negative donor red cells. Determination of Rhesus (Rh) status has been shown to be of critical importance in the field of both transfusion and pregnancy[17-18]. The main

goal of pre-transfusion blood compatibility testing is to detect clinically significant antibodies to facilitate the provision of antigen negative blood units for those patients[19].

Conclusion

This present study indicated a high prevalence and ethnic variation in the distribution of Rhesus c and e phenotype among pregnant women in Sokoto, Nigeria.

Recommendation

We recommend that all pregnant women in the area should be screened for the presence clinically significant red cell antigens including Rhesus c and e blood group antigens on their first antenatal visit. There is need to introduce routine alloantibody screening for pregnant women in Sokoto Nigeria for clinically significant red cell antibodies to facilitate the management of HDFN as well as prevent HTR. Policy should be developed to facilitate optimum stocking of c and e negative cell in blood bank for emergency use in the area.

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