ORIGINAL ARTICLE

DISTRIBUTION OF ABO, Rh D BLOOD GROUPS AND HAEMOGLOBIN PHENOTYPES AMONG ANTENATAL CLINIC ATTENDEES IN FEDERAL MEDICAL CENTRE NGURU, NIGERIA

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ABSTRACT

Background: Blood groups antigens and haemoglobin genotypes are genetically controlled and are specific to an individual. Blood groups remain unchanged throughout life and are important to avoid fatal blood transfusion reactions. Haemoglobin phenotypes are necessary for the laboratory detection of most common clinically important haemoglobin variants as it determines the transfusion demand which is necessary for setting up and planning of a blood transfusion unit. **Objectives:** To determine the distribution of ABO, Rh D blood groups and haemoglobin phenotypes in pregnant women attending antenatal care at the Federal Medical Centre (FMC) Nguru, Yobe state, North-Eastern Nigeria. **Methods:** A retrospective chart analysis of 5,519 records of pregnant women who were sequentially booked in antenatal care clinic at the permanent site of FMC Nguru, over a 2 year period, from January 2009 to December 2010. The ABO and Rh D blood groups and haemoglobin electrophoretic pattern were obtained from the haematology antenatal record register and analyzed. **Results:** Overall, a total of 5474 and 5508 records were analyzed for ABO/Rh D blood groups and haemoglobin electrophoretic pattern respectively. The mean age of the study subjects was 24.6 ± 5.84 years and a mean packed cell volume of 32.6 ±4.51%. Blood group O was commonest accounting for 49.2% followed by blood group B (26.0%) and A (21.3%) while blood group AB had the lowest distribution of 3.5% (O>B>A>AB). Rhesus Rh D positivity (RhD/RhDd) rate was 95.4% while RhD negativity (Rhdd) accounted for 4.6%. Five haemoglobin phenotypes (electrophoretic pattern) were recorded in the order of HbAA (76.12%) > HbAS (23.4%) > HbAC (0.27%) > HbSS (0.16%) > HbSC (0.05%). HbAA and HbAS occurred more frequently than other haemoglobin variants. **Conclusion:** Although our study included only pregnant women, the finding of this study is consistent with the previously published data in Nigeria. This study will serve as a baseline data for FMC Nguru to determine and formulate an effective and efficient blood transfusion services amongst pregnant women and also it will serve as a guide for premarital counselling in this community.

KEYWORDS : Blood groups, Haemoglobin phenotype, Blood transfusion.

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INTRODUCTION

Until 1901 when an assistant at the pathological institute of Vienna "Karl Landsteiner" discovered the ABO blood group system, it was thought that all blood was the same, a misunderstanding that led to frequently fatal transfusions of animal blood into humans and hazardous transfusions of blood between people.[1] Most blood groups are inherited as Mendelian characters (genetically controlled), although environmental factors may occasionally affect their expression.[2] Blood group antigens appear early in intrauterine life, are specific to an individual and remain unchanged.[2] Of the 29 human

blood group system, ABO system was the first to be recognized and remains the most important in transfusion and transplantation medicine.[2] The reason for this is that almost everybody over the age of about 6 months has clinically significant antibodies (anti-A and/or anti-B for ABO system and anti-D for Rh system) in their serum if they lack the corresponding antigens on their red cells.[2,3] Thus the clinical relevance of these blood group system is related to the ability of these alloantibodies (directed against antigens not possessed by the individual) to cause destruction of transfused red cells, haemolytic transfusion reaction (HTR) or to cross the placenta and give rise to haemolytic disease of the newborn (HDN).[2,3]

Haemoglobin genotypes (phenotypes) are also inherited blood characters. The inherited diseases of haemoglobin are the commonest single-gene disorders with about 7% of the world population being carriers.[4] Of these, sickling disorders are found frequently in the Afro-Caribbean populations and sporadically throughout the Mediterranean region, India, and the Middle East.[4] These sickling disorders include the heterozygous state for haemoglobin S or the sickle cell trait (HbAS), the homozygous for haemoglobin S (HbSS) or sickle cell anaemia(SCA), and the compound heterozygote for haemoglobin S together with haemoglobin C, D, E or other structural variants.[4]

It is estimated that about 20–25 million individuals worldwide have SCA; 12–15 million in sub-Saharan Africa, 5–10 million in India and about 3 million distributed in different parts of the world.[5] It is on record that about 300,000 children are born with SCD worldwide every year.[6] In West Africa, more than 150,000 children are born with the disease annually and 4 million people are afflicted.[7,8] Sickle cell anaemia is the commonest autosomal recessively inherited genetic disease and affects about 2% of Nigerians.[9]

Several published data have reported the significant variation in the frequencies of these inherited characters in various populations and ethnic groups worldwide.[10-12] In Nigeria several published data were also reported but none in Nguru, North-Eastern Nigeria. This study was therefore designed to provide the distribution of haemoglobin phenotypes, ABO and Rh D blood groups for reference purposes, for comparison with previously published data, for use in the setting up of a hospital based blood transfusion unit and as a basis for premarital counselling as well as a tool for forensic medicine. This study was carried out amongst pregnant women as they constitute a large proportion of hospital attendees in this region.

MATERIALS AND METHODS

This was a 2-year retrospective chart study carried out in the department of haematology and blood transfusion services at the permanent site of FMC Nguru. Federal Medical Centre Nguru, Yobe state, was established about 13 years ago and the permanent site became fully operational about 3 years prior to this study. It is located about 260 km away from Damaturu, the Yobe state capital. It serves as a federal referral centre for the state and quite a number of patients, mostly pregnant women are also seen from the neighbouring parts of Borno, Jigawa, Bauchi, Kano states and the neighbouring Francophone countries of Chad and Niger Republic. Nguru is a cosmopolitan town with the Mangawas, Kanuris, Bades, Hausa/Fulani, Igbo and Yorubas being the major residents.

A total of 5,519 records of pregnant women sequentially booked in antenatal care clinic were reviewed. ABO blood group, Rh D factor and haemoglobin electrophoretic pattern are among the routine booking investigations at the maternity centre of the hospital. We included only the records with complete data for analysis. The secondary data was obtained from the Haematology register of the pregnant women between January 2009 and December

2010. ABO grouping was carried out as described by Dacie and Lewis[12]. Haemoglobin electrophoretic pattern was determined by cellulose acetate electrophoresis at alkaline PH of 8.4, as described by Dacie and Lewis [12]. Data were analyzed using computer analytical software SPSS version 17 Inc, Chicago, USA, 2006. The results are presented in tabular form and charts. The institutional ethical and research committee of the hospital approved the study.

Results

A total of 5,519 records of pregnant women were reviewed. There were 5,474 complete records for ABO and Rh D blood group and 5,508 for haemoglobin electrophoretic pattern. The remaining data were either missing, not performed or not recorded in the antenatal register. The mean age of the study subjects was 24.6 ±5.84 years with a range of 12 to 50 years while the mean packed cell volume was 32.6 ±4.51% with a range of 10 to 59%. The distribution of ABO, Rh D blood groups of all the study participants are shown in table 1 and figure 1 respectively. Blood group O is the most common accounting for 49.2% while blood group AB (3.5%) is the least. Rh D positivity (RhD/RhDd) rate was 95.4% while RhD negativity (Rhdd) accounted for only 4.6%. Blood group O Rh D positivity rate was the highest (47.03%), followed by blood group B while blood group AB has the lowest Rh D negativity rate of 0.22%. Out of the 5,508 study participants, Five haemoglobin 'phenotypes' (electrophoretic pattern) were recorded in the order of HbAA 4193(76.12%) > HbAS 1288(23.40%) > HbAC 15(0.27%) > HbSS 9(0.16%) and HbSC 3(0.05%). This is depicted in figure 2.

Table1: Distribution of ABO blood group in the study population

Blood Group	Number (n)	Percentage (%)
A	1166	21.3
B	1424	26.0
AB	189	3.5
O	2695	49.2
TOTAL	**5474**	**100**

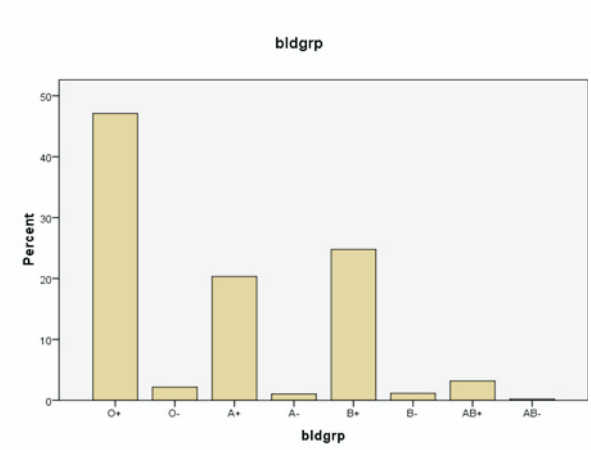

Figure 1: Rh D blood groups among the study population

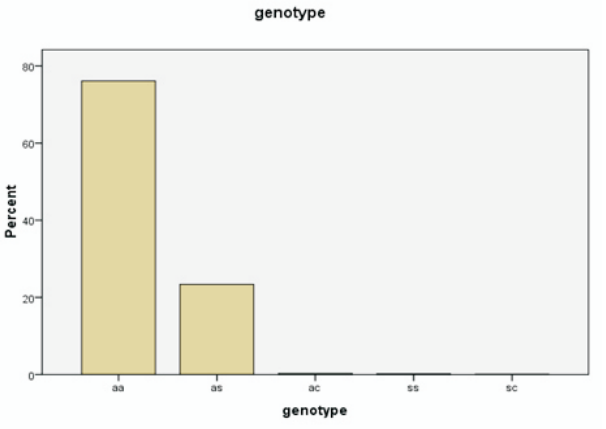

Figure 2: Haemoglobin electrophoretic pattern of ANC attendees in Nguru

DISCUSSION

This study found that among the ABO blood groups, blood group 0 has the highest frequency, followed by blood group B then blood group A while blood group AB has the lowest frequency. Usually, the distribution of ABO blood group varies from one population to another and or from race to race and even among ethnic groups/tribes. Although our study is among the pregnant women only, the findings is in keeping with several other studies[3,10,11] where blood group O has been found to be the most common and AB the least but differs in that blood group O is often followed by blood group A. In Black Americans, blood group B was found to be the least with a frequency of 2%.[10] As demonstrated in our study, it is reported that some Eastern Europeans[11] and Pakistans[3] have a higher proportion (up 33 to 40%) of blood group B. Similarly, in Nigeria the distribution of these blood groups varies in different regions and with some racial or ethnic groups/tribes differences.[14] Worlledge et al[14] reported that among the Yorubas in the South Western Nigeria and the Hausas in the central and Northern Nigeria, blood group O is the commonest (58%) while blood group AB is the least (2%). Recent studies by Hassan et al[15] in Zaria, North central Nigeria reported that blood group O remains the commonest (49.2%) while AB the least (5.2%). These findings are in keeping with our study. In agreement with our findings also, Adeyemo et al[16] in Lagos, Okeke et al[17] in Enugu and Zaccheaus [18] in Port Harcourt have similarly shown that blood group O is the predominant blood group but followed by blood group A while blood group AB remains the least frequent blood group. Overall, previous reports are in agreement with the frequencies obtained in this study and confirm that group O is the predominant ABO blood group.[19] Thus, the segregation of the genes responsible for the ABO blood systems has always taken a particular pattern for its distribution with variations in some exceptional cases. For instance in Nepal, where 'A' is the most common (34%) and 'O' is the least 1.5%[3] and in Nigeria, it was observed among the Gwari tribe of Abuja and the Rubuka tribe of the Plateau state, that blood group B was the predominant ABO blood group.[20]

The high frequency of group O observed in our study provides an advantage in terms of availability of blood for transfusions, especially in emergencies. Blood group O individuals lack ABO blood group antigens on their red cell and thus their blood can be given to individuals of other blood groups; the so called 'universal donor'.[1,2] However, it should be noted that the plasma of some group O blood individuals may contain high titre of potent A and B immune haemolytic antibodies called haemolysins.[1,2] Thus, some level of caution has to be exercised by carrying out a routine haemolysin test on all blood groups O. This allows those blood group O containing high titre haemolysin to be reserved only for group O patients. Those blood groups O which are negative for high titre haemolysin could be given to groups A, B, and AB individuals in emergency situations, where ABO group specific units are not available. This reduces the risk of transfusion reaction. In this study, it can be seen that blood group AB has the least percentage; which is most of the time very rare and this has been reported in other previous studies.[3,10,11]

After ABO blood group system, the Rh D blood group factor is the second most clinically significant red cell antigen. In this study only 4.59% of the study participants lack RhD antigen (Rhdd) while the remaining 95.41% showed positivity of Rh D antigen (RhD/RhDd). Similar pattern of distribution is also observed in other studies; 94% positivity in Yorubas[16] and 95.5-96.7% positivity among the Igbos.[20-22] Our findings also aligns well with the international literatures.[3,20-22] However Rh D negativity of 4.59% observed in our study is much lower than the prevalence rate of 14% observed among the Caucasians.[23] The low prevalence of D-negative in our study has an

obstetric advantage in the sense that Rh D alloimmunization (haemolytic disease in the newborn) may be less compared to western countries.

The observed frequency of HbAA and HbAS being significantly higher than other haemoglobin variants in this study is in agreement with previous reports.[16,18,24,25] The finding of 0.16% HbSS in our study indicates that sickle cell anaemia is extremely low in the study population when compared to previous reports[16, 18, 24, 25]. The low finding in our study may be related to the fact that this is hospital based retrospective study where data may be missing or not readily available for analysis and also some of the patients in the community might not avail themselves to the hospital to seek the available maternal health care services for various reasons.

The limitation of this study is that the study population included only pregnant women and thus our findings cannot be generalized to the whole population. Future studies among non-pregnant women and their male counterpart would give a complete picture of the distribution of ABO, Rhesus factor and haemoglobin phenotypes in the study setting.

In conclusion, an understanding of the distribution of the various blood groups as well as abnormal haemoglobin variants is essential in the setting up of a blood transfusion services, more so in pregnant women. It is also important in the formulation of premarital counselling policies (carrier screening) as well as in forensic medicine. ■

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