BLOOD TRANSFUSION

The Frequency and Clinical Significance of Structural Haemoglobin Variants in Donor Blood at University of Maiduguri Teaching Hospital

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ABSTRACT

The Haemoglobin (Hb) genotypes of 1672 healthy blood donors at the university of Maiduguri Teaching hospital (UMTH) during the year 1999 were analysed. Hb AA, AS and SC were detected in 78.94%, 21% and 0.06% of the donor population respectively. There is the need for strict application of Hb electrophoresis on all donor blood in order to detect rare cases of mild forms of sickle cell disease who may present as donors. All blood banks should label their blood units with the appropriate tags to indicate the Hb genotype (Hb AA or Hb AS) status of the donor; and clinicians must indicate on transfusion request forms whenever the use of Hb AA rather than HbAS blood is specifically indicated as may be the case in the management of sickle cell disease patients on exchange transfusion. In this way we can improve the efficacy of transfusion therapy in sickle cell disease and related conditions *(Nig J Surg Res 2000; 2:127-130)*

KEY WORDS: Haemoglobin Electrophoresis, Blood Donor

Introduction

The selections of suitable blood donors have the purpose of ensuring that the potential donor is in good health.[1] The ultimate purpose, however, is to protect the recipient from any ill-effect through transmission of diseases by blood transfusion as well as to protect the donor from any harm to his/her health. [1-4] At the donor clinic, the pre donation haemoglobin levels of all potential donors must be determined to ensure that the levels are not lower than 135g/L and 125g/L (13.5g/dl and 12.5 g/dl) for males and females respectively. [2,5] Most individuals with clinically significant red cell abnormalities such as sickle cell diseases are often too ill to volunteer to donate blood and cannot pass the pre-donation haemoglobin estimation tests. [1,6] However, persons who have minor red cell abnormalities such as sickle cell or thalassaemia traits are accepted as donors an long as they are in good health and have passed the pre-donation haemoglobin test. [1,2,5,6]

This is a report of frequencies of abnormal structural haemoglobin variants in blood donors and their clinical significance in current practice of transfusion medicine.

Materials and Methods

The results of haemoglobin (Hb) electrophoresis (haemoglobin genotypes) of 1672 healthy blood donors between the ages of 25 to 45 years (mean age 31 years) bled at the University of Maiduguri Teaching Hospital (UMTH) blood

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bank in the year 1999 were analysed. In all cases, electrophoresis was performed by standard method [7] on cellulose acetate in ethylene diamine tetra-acetate tris buffer at pH 8.9, using 1% saponin as haemolysing agent, at 250V for 20 minutes. All tests were run and read with control samples containing Hb A, F, S, and C.

Results

The Hb electrophoresis results of the blood donors revealed that 1319 (78.94%) donors had HbAA genotype while 352 (21%) donors had the Hb AS genotype. However, one donor constituting 0.06% of the donors studied was found to have HbSC genotype (Table 1).

Table 1: Hb genotypes of 1672 blood donors at the UMTH blood bank in 1999

Hb genotype	No. of donors (%)
AA	1319 (78.94)
AS	352 (21)
SC	1 (0.06)
Total	1672 (100)

Discussion

Only persons in good health are accepted as donors and even polycythaemic patients referred for therapeutic venesection should not be accepted as donors. [1] In general, blood donation should be by adults between the ages of 18 and 65 years, however, pregnant and lactating mothers are not accepted as donors. [2] In order to minimise the risk of transmitting infections to recipients, persons who are engaged in high risk behaviours for Human Immune Deficiency virus infection such as prostitution, intravenous drug abuse or homosexuality are not allowed to donate. [2-4]

The Hb electrophoresis results of the majority of the in this report revealed the HbAA genotype. However, up to 21% of the donors were of the HbAS genotype (sickle cell trait). This frequency of sickle cell trait (SCT) is similar to the results of earlier workers, [8, 9] who found a SCT frequency level of 20.1% in a previous survey conducted in a rural population in the same (North East Nigeria) sub region. The red cell lifespan is normal in persons with SCT [10] and hence the transfusion of such red cells is usually not associated with any adverse effect in the recipient. In SCT individuals less than one-half (about 40%) of the Hb in each red cell is HbS, and the abundance of normal HbA (about 60%) prevents sickling under most physiological circumstances. [2] However, SCT red cells will sickle at an oxygen tension of about 15mm Hg, [11,12] infact, in severe cyanotic congenital heart disease such as the tetralogy of Fallot, even persons with SCT may show signs of haemolysis. [12] Therefore SCT red cells have limited survival under conditions of reduced oxygen tension and should ideally not be transfused to new born infants and patients with cardiopulmonary diseases and hypoxia. [2] The transfusion of SCT red cells into patients with sickle cell disease (SCD) is obviously undesirable [2,6] since such red cells contain about 40% HbS and cannot be efficacious in reversing the effect of sickling in such patients who are best transfused with normal HbAA red cells. [13] The relative lack of efficacy of SCT red cells in the clinical management of SCD will be more obvious in critically ill patients (such as those with cerebrovascular accidents, or acute chest syndrome) and in patients being prepared for major surgery when it is essential to offer exchange transfusions in order to significantly bring down the level of Hb S to less than 20-25%. [14,15] At this level, the critically ill patient will show dramatic clinical improvement while those scheduled for surgery will be able to withstand prolonged general anaesthesia uneventfully. [2,14,15]

In all such cases of exchange transfusion, HbAA red cells should be used because the use of SCT red cells which contain about 40% HbS will slow down the rate of fall of HbS levels in the patient thereby prolonging

the exchange procedure and hence retarding rate of clinical improvement.

It is generally believed that persons with SCD are too ill to volunteer as donors. It is therefore interesting to note that one (0.06%) of the donors, a 25 year old University undergraduate, had sickle cell haemoglobin C (HbSC) disease and yet at that age had never experienced any symptoms and even passed the pre-donation Hb estimation test. In fact, very rare cases of donation by apparently normal persons with mild forms of sickle cell diseases such as HbSC and Hb SS with high level of HbF have been reported. [6] These very rare incidents clearly dictate the absolute necessity for performing Hb electrophoresis on all donor blood and not merely relying completely on the sickling test, which would inadvertently label such donors as SCT in view of their apparent physical fitness, and normal Hb levels. Obviously all donations by SCD persons, irrespective of any other considerations are not suitable for transfusion and should be discarded and the donor must be appropriately counselled.

Conclusion

Donor blood units should not be issued for transfusion at random. Issuance of blood units should take into consideration the clinical condition of the recipient as well as the Hb genotype of the donor blood. Therefore, blood banks should clearly label donor units with their Hb genotypes (AA or AS) and clinicians should always indicate on blood request forms whenever a patient needs to be transfused with normal HbAA red cells specifically. In this way, the efficacy of transfusion therapy in the management of SCD in particular and in other categories of patients for whom transfusion with Hb S-containing red cells is clinically undesirable can be improved. The fact that rare cases of mild forms of SCD may be asymptomatic and have normal Hb levels warrants screening of all donors by electrophoresis rather than sickling test alone.

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