

*Full Length Research Paper*

# A study of blood transfusion in sickle cell anaemia patients in South-South Nigeria

Kate Tubonemi

Department of Paediatrics and Child Health, University of Port Harcourt, Port Harcourt, Rivers State, Nigeria. E-mail: [kate\\_tubonemi@yahoo.com](mailto:kate_tubonemi@yahoo.com).

Accepted 09 November, 2015

Sickle cell disease (SCD) and its variants are genetic disorders resulting from the presence of a mutated form of hemoglobin, hemoglobin S (HbS). The most common and severe form of SCD found in Nigeria is homozygous HbS disease (HbSS) which is a common cause of morbidity and mortality in Nigeria. A key component in management of patients with sickle cell anaemia is transfusion therapy. This study aims to determine the prevalence and risk factors for blood transfusion among SCD patients. This was a retrospective study, in which files of patients seen in clinic or admitted in the Pediatrics Department of the University of Port Harcourt Teaching Hospital within 2 years were reviewed. Of the 131 cases, 130 had genotype Hb SS and 1 had genotype Hb SC. Fifty seven percent had received at least one blood transfusion and the commonest indication for transfusion was severe anemia. Considering the complications of blood transfusion, efforts must be made to reduce the frequency of blood transfusion by preventive measures such as early diagnosis, regular follow-up, malaria prophylaxis and folic acid usage.

**Key words:** Blood transfusions, sickle cell anaemia, children, prevalence, Nigeria.

## INTRODUCTION

Sickle cell disease (SCD) and its variants are genetic disorders resulting from the presence of a mutated form of hemoglobin, hemoglobin S (HbS). The most common and severe form of SCD found in Nigeria is homozygous HbS disease (HbSS), an autosomal recessive disorder first described by Herrick in 1910 (Akinyanju, 1989). The disease affects mostly black people of West and Central Africa descent, with a prevalence rate of 2-3% (Akinyanju, 1989; Weatherall and Clegg, 2001).

The clinical outcomes of sickle cell disease (SCD) have vastly improved over the years as a result of advanced medical technologies, improved patient education, and multidisciplinary care. A key component in the successful management of patients with SCD is red blood cell (RBC) transfusion therapy used in the treatment and prevention of sickle cell complications including cerebrovascular accident and acute chest syndrome. The major goals of RBC transfusion in SCD include improving the oxygen-carrying capacity, by increasing the total hemoglobin (Hb) level, decreasing blood viscosity and increasing oxygen saturation (Josephson et al., 2007; Wahland Quirolo,

2009; Nifong and Domen, 2002; Thurston et al., 2004).

Overall, RBC transfusion in the patient with SCD helps improve symptomatic anemia as well as prevent and resolve vaso-occlusive events that result in acute chest syndrome (ACS), stroke, and other ischemic organ damages (Fullerton et al., 2004; Cheung et al., 2012; Brousse et al., 2013). In this study, an experience of blood transfusion among sickle cell disease patients in University of Port Harcourt Teaching Hospital (UPTH) was presented, after which the frequency of transfusion was determined and its pattern and related problems were established.

## MATERIALS AND METHODS

A retrospective study was conducted in the Paediatrics Department of the University of Port Harcourt Teaching Hospital, a major referral centre in the South-South region of Nigeria. All children <18 years with sickle cell

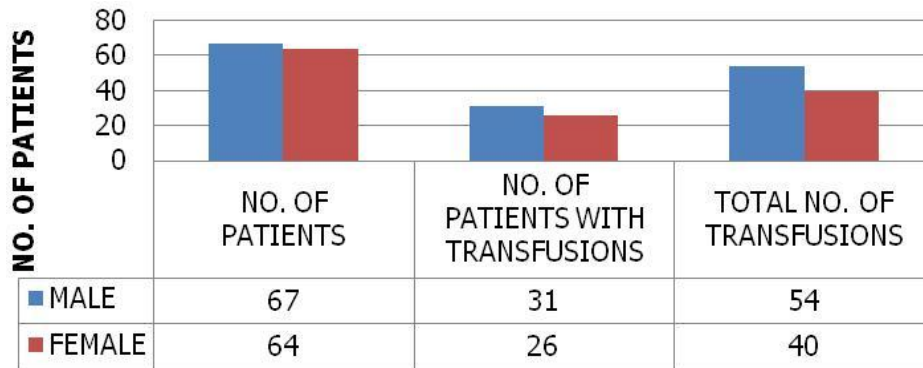


Figure 1. Relationship between sex and prevalence of transfusion.

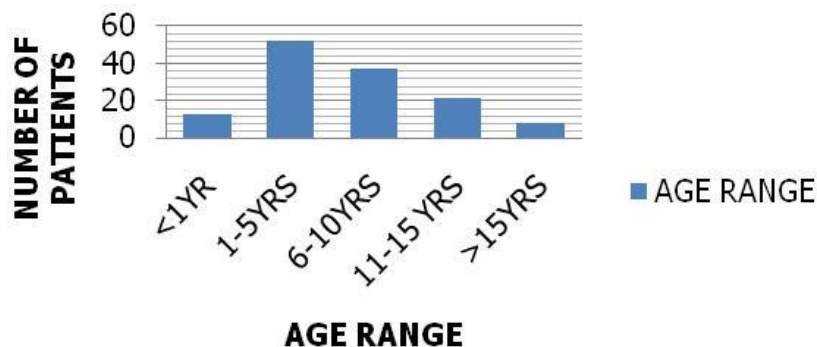


Figure 2. Age of patients at diagnosis.

anaemia who were seen in clinic or admitted in the pediatrics department of the hospital between May 2006 and June 2008 were included. The study was approved as an audit by the research and ethics committee of the university's hospital.

For identified cases, patient's written case notes were extracted for age, sex, age of first diagnosis with SCD, number of hospital admissions, number of transfusions, number of siblings with SCD, types of crisis, co-morbidity and usage of routine drugs. The genotype of these patients was obtained using haemoglobin electrophoresis, a test which observes the rates of transit of negatively-charged proteins in an electric field medium.

Data from the study were analyzed using Statistical Package for Social Sciences (SPSS) version 11.0 software. These data were presented as charts, graphs and tables in simple proportion and comparisons carried out with chi square test. Statistical significance of 95% confidence interval set at p-value <0.05 was used.

**RESULTS**

Of all the 131 cases reviewed, 130 had genotype Hb SS and 1 had genotype Hb SC. There were sixty- seven

males (51.1%) and sixty- four females (48.9%) with age at diagnosis ranging from three months to eighteen years (Figures 1 and 2 respectively). Most of the patients (44.3%) were diagnosed between 1 and 5 years. Ten (7.6%) were diagnosed before the age of one year, 58 (39.7%) between 6 and 15 years and 5 (3.8) above the age of fifteen years (Figure 2).

Twenty (15.3%) of the patients had one sibling with SCD, one each had two, three, four and five siblings respectively with SCD, while most (77%) did not have any sibling with sickle cell disease. One hundred and fourteen of the patients (87%) were compliant to routine drugs and attended clinic regularly. Vaso occlusive crises were the commonest crises, occurring in 85.4% of the patients (Table 1). One child had a cerebrovascular accident (CVA) at nine months of age.

One hundred and five (80.2%) had been admitted to hospital at least once. Malaria (53%) and septicaemia (18%) were the most common presentations and risk factors for anaemia in the study population (Table 2). A few of the patients (4.4%) had other co-morbid conditions not directly caused by sickle cell disease; one each had HIV/AIDS, Hepatitis B and an acyanotic congenital heart disease (VSD) and three with pulmonary tuberculosis.

Of the fifty seven children (44%) who had received

**Table 1.** Types of sickle cell crises.

Type of crises	Number of patients	%
Hemolytic (HC)	7	5.3
Vaso-occlusive (VOC)	113	86.2
Sequestration (SC)	4	3.1
VOC + HC	2	1.5
SC + HC	1	0.8
VOC + Acute chest syndrome	4	3.1
Total	131	100

**Table 2.** Indication for admission in the hospital.

Risk factor	Number of patients	%
Upper gastro-intestinal bleeding	1	1
Subglеal hemorrhage	1	1
Septicaemia	27	18
Malaria	72	53
Cardiomyopathy	1	1
Skin sepsis	5	4
Malnutrition	2	2
Pulmonary tuberculosis	2	2
Osteomyelitis	2	2
Tropical splenomegaly syndrome	1	1
Partial intestinal obstruction	1	1
Acute chest syndrome	4	3
Cephalhematoma	1	1
Tonsilitis	1	1
Urinary tract infection	1	1
Bronchopneumonia	3	2
Hepatitis	1	1
Dactylitis	3	3
Priapism	2	2
Total	131	100

**Table 3.** Prevalence of blood transfusions.

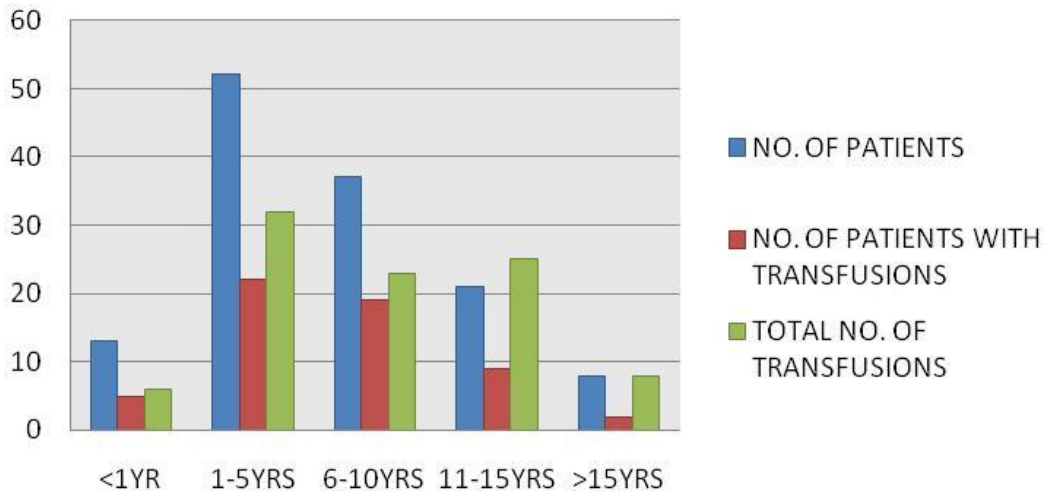
Number of transfusions	Number of patients	%
1	40	70
2	10	18
3	2	3
4	2	3
5	1	2
>5	2	4
Total	57	100

blood transfusion, 70% were transfused only once. Others had multiple blood transfusions (Table 3). The most common indication for transfusion was severe

anemia (73%). Over 50% presented in anemic heart failure (Table 4). Pre transfusion packed cell volume (PCV) ranged from 5 to 20% with a mean of 13.6% ±

**Table 4.** Indication for blood transfusion.

Indication	Number of patients	%
Severe anaemia, no heart failure	42	73
Anemic heart failure	13	23
Cerebro-vascular accident (cva)	1	2
Acute chest syndrome	1	2
Total	57	100



**Figure 3.** Relationship between age of patients at diagnosis and prevalence of blood transfusion.

3.87 (a reasonable estimate of Haemoglobin concentration is provided by multiplying the PCV by 0.30) (Velguth et al., 2010).

More than 2/5th (46%) of both sexes had received blood transfusion at least once. 38.5% of patients who were diagnosed before their first birthdays had received blood transfusions (Figure 3). For those diagnosed between one and five years, 42.3% were transfused while 51.4% of those diagnosed between six to ten years and 42.9% of those diagnosed between eleven and fifteen years were transfused. Of those diagnosed after fifteen years of age, only 25% were transfused. There was however no statistical significance between age at diagnosis and prevalence of blood transfusion ( $p < 0.05$ ).

About 59% of patients who were not compliant to clinic visits, use of routine drugs or both had received blood transfusions, while 41% of those who were compliant with clinic visits and routine drugs were transfused. All the patients (100%) who presented with more than one form of crises at the same time received blood transfusions at least once. All patients who had a co-morbid condition not directly resulting from sickle cell disease received blood transfused at least once with patients with pulmonary tuberculosis having the highest prevalence of blood transfusion.

## DISCUSSION

The prevalence rate of transfusion among the sickle cell anaemia patients of 44% seen in this study's patients is alarmingly high and worrisome considering the risks associated with blood transfusion. This finding is similar to that of other studies which show that transfusion of red blood cells is a common practice in the treatment of patients with sickle cell disease (Rosse et al., 1990; Afenyi-Annan and Brecher, 2004). Despite this, studies have shown blood transfusion to be an effective and proven treatment for some severe complications of sickle cell disease (Draser et al., 2011; Wahl and Quirolo, 2009).

The fact that the commonest indication for blood transfusion was severe anaemia in 96% of children (Table 4) out of which 24% had heart failure implies that this study is in agreement with a study from Congo which showed that severe symptomatic anemia was the only indication for transfusion (Tsilolo et al., 2007). This is however different from studies in developed countries where the indication for transfusion were variable (Josephson et al., 2007). Other indications for the transfusion in this study were cerebrovascular accident (CVA) and acute chest syndrome (ACS).

Though it is not clear in this retrospective study whether the transfusion of these patients was for prophylaxis or treatment, several studies have shown a decline in stroke rates among sickle cell patients who received intermittent blood transfusions (Ware and Helm, 2012; Verduzcol and Nathan, 2009; Kirkham, 2007). Although there is no information to support the use of transfusion therapy in recurrent ACS, some authors have advocated the use of chronic transfusion protocols as a means to prevent end-stage lung disease (Cheung et al., 2012).

The prevalence of transfusion was highest in the children aged 1 to 5 years. This is not surprising as this is the age when the children are prone to the various types of crises and infections, all of which will predispose to anemia and/or hyperviscosity. A study done in Jamaica by Thomas et al. (1982) reported the greatest number of death in the first five years of life.

There was also a higher prevalence of transfusion in the males than their female counterparts. The gender difference may be because there were more males than females and the possibility of greater health seeking behavior among male African parents cannot be underscored.

It is encouraging to note that most of the patients in the study (87%) were compliant with their routine drugs and attended clinic regularly and just a few (13%) were not compliant. The study showed a higher prevalence of transfusion among the patients who were not regular with their hospital visits or routine drugs. The probable contributing factor to the reduction of frequency of blood transfusion among the compliant patients is the administration of routine drugs including hematinics and malaria prophylaxis.

This study shows that just like in the normal population, malaria is the most common reason for presentation among the sickle cell anaemia patients in UPTH. This is followed by septicaemia. Malaria has been associated with severe anaemia in children with hemoglobin SS (Yale et al., 2000) and severe anaemia was therefore the commonest indication for transfusion in majority of the patients.

Vaso-occlusive crisis is usually due to hyperviscosity but inflammation resulting in activation of the vascular endothelium has been found to play an essential role in vaso-occlusion in SCD (Belcher et al., 2006). In the study, vaso-occlusive crisis was the commonest type of crisis experienced as was found in other studies (Almeida and Roberts, 2005). Although there is usually an increased incidence of transfusion in other forms of crisis such as sequestration and hemolytic crisis, it has been found in some studies that a patient's hemoglobin level often declines by at least 1 g/dL during a vaso-occlusive crisis (Akinyanju and Johnson, 1987). Also, children who suffer frequent vaso-occlusive crises may benefit from chronic transfusion therapy as it lowers the Hb S concentration to <30% thereby minimizing the painful

episodes and the risk of CVA, acute chest syndrome and multiorgan infarction (Ware and Helm, 2012; Verduzcol and Nathan, 2009; Kirkham, 2007; Wahl and Quirolo, 2009). On the other hand, studies by Akinyanju and Johnson (1987) showed less frequent episodes of pain crisis with higher degrees of anemia. Transfusion therapy could therefore worsen symptoms of acute pain crisis and is not recommended in the treatment of acute pain crisis.

The use of hydroxyurea has been widely advocated in the reduction of vasoocclusive events. The efficacy of hydroxyurea in SCD is generally attributed to its ability to raise the level of haemoglobin F (Hb F) in the blood. It also increases the water content of red blood cells, decreases neutrophil count and alters the adhesion of red blood cells to the endothelium (Segal et al., 2008). Hydroxyurea however is not routinely used in Nigeria due to its limited availability and the fact that it is very expensive.

About 4.6% of the patients had co-morbid conditions including HIV, tuberculosis and hepatitis B virus infection. What is not clear from this study is whether these infections especially HIV and hepatitis B occurred before or after the transfusion. However, it is a known and documented fact that infectious diseases can be transmitted through blood transfusion and is actually the highest source of infections in the United States (Hassan et al., 2003; Whitley and Thompson, 2012). Blood transfusion can also lead to iron overload which may result in haemochromatosis (Steinberg, 2008). Although the use of RBC transfusions in the management of SCD has greatly reduced the morbidity and mortality of SCD, their judicious use is warranted given the potential for adverse effects.

## CONCLUSION

Blood transfusion is an effective therapy in the acute and chronic treatment of sickle cell disease. In developing countries, the commonest indication for transfusion is severe anaemia most likely secondary to environmental factors including malaria and malnutrition. Because of the complications related to blood transfusion, efforts must be made to reduce the frequency of blood transfusion by preventive measures such as early diagnosis, regular outpatient follow up, malaria prophylaxis and hematinics.

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