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ORIGINAL RESEARCH

Indications for blood and blood products transfusions among children in a semi-urban tertiary hospital in Nigeria

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Abstract

Background: Anaemia is prevalent among children in our environment, often necessitating blood transfusions. The knowledge of the common indications for blood transfusion and the required preventive measures is likely to reduce the transfusion rates.
Objective: To determine the disease conditions requiring blood transfusion in post-neonatal age children at the Olabisi Onabanjo University Teaching Hospital, Sagamu, Nigeria.
Methods: The hospital records of all children aged 1 month to 18 years admitted into the post-neonatal ward who received blood transfusions over 18 months (1st July 2015to31st December 2016) were reviewed.
Results: There were 710 paediatric admissions out of which 82 (11.6%) received blood transfusions. Ninety transfusions were carried out amongst 82 children, at a ratio of 1.1 transfusions per child. Severe malaria (28.1%), sickle cell anaemia (19.5%) and septicaemia (18.3) were the most common disease conditions requiring blood transfusions. The leading blood products transfused included packed red cells (64.5%) and whole blood (30.0%).
Conclusion: Blood transfusion is frequently indicated in the paediatric population in our setting, largely due to severe malaria and sickle cell anaemia problems. Intensifying efforts on the use of long-lasting insecticide-treated nets and environmental control may reduce the prevalence of severe malaria, while improved nutrition, adequate hydration, regular malaria prophylaxis, prompt treatment of infections and regular use of haematinics may minimize the need for blood transfusions among children with sickle cell anaemia.

Keywords: Blood, Blood products, Plasma, Red blood cells, Transfusion.

Introduction

Anaemia is a common life-threatening condition among children in the tropics.[1 - 3] It results in varying levels of hypoxaemia and lactic acidosis depending on the degree of severity, which affects the functions of nearly all the organs in the body. Blood transfusion therapy is an integral part of care for anaemia and it is frequently carried out among children.[4] The goal of blood transfusion maybe to maintain life through either increased cardiac output and oxygen delivery to tissues or removal of toxins destroying the blood cells from the body.[5]

The blood transfusion rates vary from countries and regions to another.[6] Available data show that over 5 million patients are transfused with about 15 million units of blood products in the United States every year.[7] In Nigeria, about half a million units of blood are supplied from blood banks nationwide annually yet, it is insufficient to

meet the nation's need which is put at one and a half million annually.[8] Most of the published figures are institution-based,[9 - 12] and may not represent the bulk of the problem in the communities, particularly the rural settings.

Despite this huge requirement for the use of blood and its products in paediatric practice in most parts of the developing world, there is a co-existing problem of the inefficient blood banking system. [12]The shortage of facilities for extensive screening of donor blood, with attendant risks of blood-borne infections such as Hepatitis and HIV, worsens the non-availability of blood for safe transfusion.[13]
A prospective, multicenter, six-month observational study was conducted by Bateman *et al*[14] to understand the development of anaemia, blood loss, and red blood cell transfusions among children below 18 years of age admitted into 30 Paediatric Intensive Care Units (PICU) in North America. The most common reason for transfusion as reported by the prescribing physician in the PICU was low haemoglobin, although the need for blood transfusion was highly variable. A retrospective study of anaemia and blood transfusion practices among 2,722 Kenyan children demonstrated that 55% of transfusions were received by children with severe anaemia, 29% by children admitted with moderate anaemia and 14% by children who had mild or no anaemia at admission.[15]

This study determined the common clinical conditions requiring blood transfusion among children at the Olabisi Onabanjo University Teaching Hospital, Sagamu, Nigeria. It is hoped that the knowledge of the common reasons for blood transfusion and the institution of appropriate preventive measures may likely reduce transfusion rates in our setting.

Methods

This retrospective study was conducted in the Post-neonatal Children's Ward of the Olabisi Onabanjo University Teaching Hospital, Sagamu, Nigeria over 18 months spanning 1st July 2015 to 31st December 2016. The hospital records of all children aged 1 month to 18 years who received a blood transfusion in the unit were reviewed. The biodata, underlying medical conditions and the type of blood transfusion, were retrieved from the patients' medical records.
Continuous data were presented as the mean values (with standard deviations) while categorical data were presented as proportions.
The study methodology was conducted in accordance with the ethical standards prescribed by the Health Research Ethics Committee of the Olabisi Onabanjo University Teaching Hospital, Sagamu and with the Helsinki Declaration of 1975, as reviewed in 2000.

Results

Socio-demographics characteristics of study subjects
During the study period, there were 710 admissions into the post-neonatal Children's Ward of the hospital with 387 males and 323 females giving a male to female ratio of 1.2:1; 82(11.6%) of the children had blood transfusions. A total of 90 transfusions were carried out amongst 82 children, at a ratio of 1.1 transfusions per child. Out of the 82 transfused children, 51 (62.2%) were males and 31 (37.8%) were females (male-to-female ratio of 1.7:1). Their ages ranged from 1 month to 16 years, (mean age = 4.7±4.4 years, median age = 2.8 years). The socio-demographic characteristics of the children are presented in Table I.

Table I: Socio-demographic characteristics of subjects

Characteristics	*Number transfused*	*Number not transfused*	*All Subjects*
Age (years)			
≤2	37 (10.7)	308 (89.3)	345
>2 – 5	13 (10.3)	113 (89.7)	126
>5 – 10	20 (18.7)	87 (81.3)	107
>10 – 16	12 (9.1)	120 (90.9)	132
Total	82 (11.6)	628 (88.4)	710
Gender			
Male	51 (13.2)	336 (86.8)	387
Female	*31*(9.6)	292 (90.4)	323
Total	*82*(11.6)	628 (88.4)	710

Figures in parentheses are percentages of the total in the group

Pre- and post-transfusion Packed Cell Volume of study subjects

Table II shows the pre- and post-transfusion Packed Cell Volume (PCV) of the study subjects. The pre-transfusion PCV ranged from 4.4% to 31.7% with a mean of 15.2±5.6% while the post-transfusion PCV ranged from 10.0% to 48.9% with a mean of 29.4±7.5%. The percent rises in packed cell volume values ranged from 0.3% to 34.9% with a mean of 16.0±7.3%. In both males and females as well as across the age categories, the mean pre-transfusion, mean post-transfusion and mean percent rises in PCV values were comparable. Only one patient had a pre-transfusion PCV of 4.4%. The majority of the subjects had pre-transfusion PCV of >15 – 20%. In about two-fifth of the subjects, the PCV increased to >30 – 40%, post-transfusion. Only one patient had a pre-transfusion PCV greater than 30.0%; this was a child with nephrotic syndrome with severe hypoproteinaemia and evidence of extravascular compartment contraction.

Clinical indications for blood transfusion among study subjects

The underlying clinical indications for blood transfusion are shown in Figure 1. Severe malaria (28.1%), sickle cell anaemia (19.5%) and septicaemia (18.3%) were the most common indications for blood transfusion. The conditions described as renal diseases included acute glomerulonephritis, nephrotic syndrome, and renal failure. The complications of sickle cell disorder for which blood transfusion was given included infections and malaria. Two of the children with cancers had leukaemia while the third had neuroblastoma.

Type of blood and blood products transfused

Table III shows the types of blood and blood products transfused. Packed red cells (64.5%) and whole blood (30.0%) were the most frequently transfused types of blood. The two children who received platelets concentrate although it was not available in the centre had leukaemia and overwhelming septicaemia. These children, also, received whole blood transfusion.

Discussion

The overall blood transfusion rate in the present study was higher than 8.9% reported in a survey of 956 admissions at the Jos University Teaching Hospital, Jos, located in the northern part of Nigeria. [16] The observed difference is possibly related to differences in the sample size used in the current study since small sample sizes are known to produce exaggerated prevalence rates. In addition, the disparity in the study durations may also account for the observed difference in rates of blood transfusion.

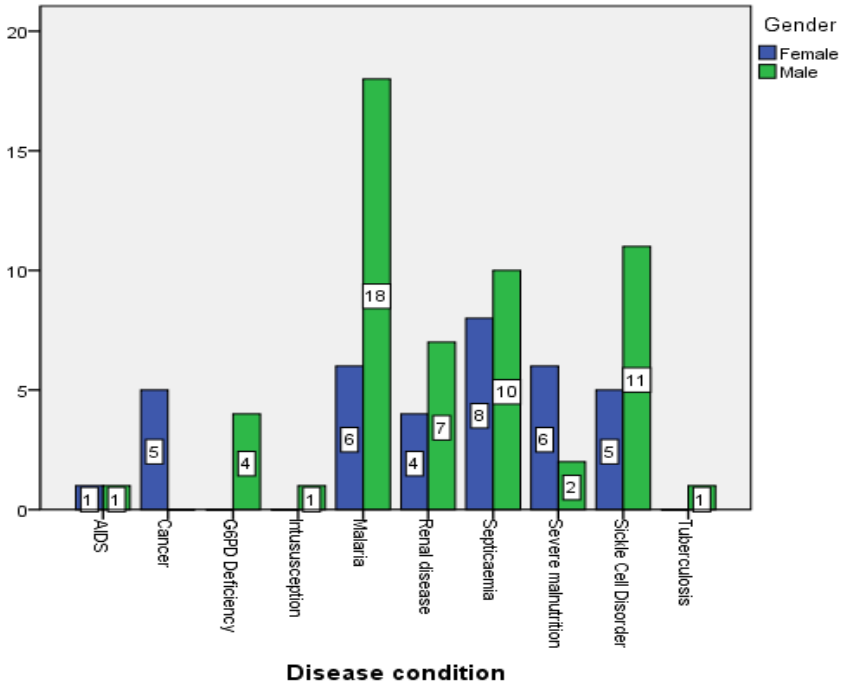

Figure 1: Clinical indications necessitating blood transfusion distributed according to gender.

Table II: Pre- and post-transfusion Packed Cell Volume of study subjects

Packed Cell Volume (%)	**Number (%)**
Pre-transfusion	
0 - 5	1 (1.4)
>5 – 10	15 (20.5)
>10 – 15	19 (26.0)
>15 – 20	23 (31.5)
>20 - 25	11 (15.1)
>25 – 30	3 (4.1)
>30	1 (1.4)
Post-transfusion	
10 – 20	10 (16.1)
>20 – 30	23 (37.1)
>30 - 40	25 (40.3)
>40	4 (6.5)

The duration of the current study was 18 months, unlike 12 months in the Jos study. In variance to the reported high blood transfusion rate in the present study, a lower value of 5% was reported in a multicenter study from the United States. [12] The observed difference is possibly an effect of the low incidence of genetically inherited haematological disorders like sickle cell anaemia in the US, with attendant lower rates of infections and malaria.

From the present study, males are more frequently transfused with blood compared with their female counterparts. A similar pattern was reported by previous workers within Nigeria, [16] and elsewhere. [17] There is no readily available explanation for this male preponderance. However, one may attribute

the observation to gender-related health-seeking behaviour which is influenced by cultural attitude and/or genetic factor which favours the male gender. The observation of male predominance in the study population was different from some studies which reported female dominance. [18, 19]

Table III: Type of blood and blood products transfused

Disease Conditions	*Blood type*			
	Packed red cells	*Whole blood*	*Platelets*	*Plasma*
AIDS	2 (3.5)	0 (0.0)	0 (0.0)	0 (0.0)
Cancer	0 (0.0)	4 (14.8)	1 (50.0)	0 (0.0)
G6PD Deficiency	3 (5.2)	1 (3.7)	0 (0.0)	0 (0.0)
Intussusception	0 (0.0)	1 (3.7)	0 (0.0)	0 (0.0)
Malaria	24 (41.3)	0 (0.0)	0 (0.0)	0 (0.0)
Renal Disease	2 (3.5)	6 (22.2)	0 (0.0)	0 (0.0)
Septicaemia	10 (17.2)	7 (25.9)	0 (0.0)	0 (0.0)
Severe malnutrition	5 (8.6)	3 (11.2)	0 (0.0)	3 (100.0)
Sickle Cell Disorder	11 (19.0)	5 (18.5)	0 (0.0)	0 (0.0)
Tuberculosis	1 (1.7)	0 (0.0)	1 (50.0)	0 (0.0)
Total	58 (64.5)	27 (30.0)	2 (2.2)	3 (3.3)

Figures in parentheses are percentages of the total in group

The present study also revealed a higher transfusion rate of blood and blood products among subjects older than five years of age compared with their counterparts below five years of age. The findings disagreed with those of previous authors [17, 20] The apparent reason may be a result of a higher concentration of disorders of haemoglobin synthesis such as sickle cell disorder and malignancies which occur commonly among older children. [21] The mean pre-transfusion PCV value of 15.2% observed in the present study was higher than 14.6% previously reported by Adedoyin *et al* [20] in Ilorin. The observed difference is possibly an effect of the selection of study subjects. The subjects in the Ilorin study were patients diagnosed as having severe anaemia based on PCV <20%. [20]

The post-transfusion PCV values showed that one-sixth of the transfused subjects remained severely anaemic following transfusion. This is difficult to explain but the various formulae used to calculate the amount of blood to be transfused have been reported to be associated with challenges such as under- or over-transfusion [20] as demonstrated in the current study. The mean PCV percent rise of 16% reported in the present study was higher than 13.3% recorded by Adedoyin *et al* [20] in Ilorin. The implication of this is that a higher volume of blood was likely to have been transfused in the present study. The observed difference between both studies may be due to disparity in weight across the studies which would be very difficult to compare.

The most frequent clinical condition associated with blood transfusion was severe malaria. This may reflect poor malaria control efforts in the environment. This finding corroborates the reports of other workers.[11, 17, 20] Contrary to what was observed in the present study, only one out of the 85 blood transfusions was performed as a result of severe malaria as reported by Okpe *et al* [16] among children in Northern Nigeria. The complications of sickle cell disorder were also responsible for a good percentage of transfusions in this study. These were mainly as a result of severe anaemia consequent upon exaggerated haemolysis of sickle red cells. This is similar to the finding in the Ilorin survey,[20] where sickle cell disorder constituted the second most common clinical condition necessitating blood transfusion.

It was also observed that packed red cells were the most transfused blood product. This finding is contrary to previous reports that whole blood was the most requested blood product in Africa. [17,18] This finding probably suggests non-availability of red cell concentrates in the health facilities studied by previous authors[17, 18]; despite this non-availability, whole blood was most likely frequently delivered in place of packed cells. Platelets concentrate was scarcely available in our centre and such prescriptions were often changed to fresh whole blood.

Only three of the 82 subjects who received blood and blood products transfusion had fresh frozen plasma. These three patients had renal conditions: two patients had nephrotic syndrome while one had post-streptococcal acute glomerulonephritis. Fresh frozen plasma, which is a blood product made from the liquid portion of whole blood, was used to treat hypoproteinaemia associated with the conditions.

Glucose-6-Phosphate Dehydrogenase (G6PD) deficiency is an inherited X-linked disorder commonly seen in a population that has been exposed to malaria, either in the present or in the past[22], like the community where the present study was conducted. The severity of the drug-induced haemolytic attack in a G6PD-deficient subject is influenced by factors that may include the pharmacology of the drug, the dose, the G6PD mutation, the age, and coexisting disease conditions.[22] About 180 mutations of the G6PD gene have been reported resulting in protein variants with different levels of enzyme activity. NADPH is essential for both oxidant and antioxidant systems of cells.[23] The low number of transfusions among children with G6PD deficiency, as observed in the present study, may be attributed to the presence of G6PD mutation variants which usually do not have severe haemolytic anaemia, since heterogeneity may occur within and between populations.[24]

Conclusion

Blood and its components are life-saving drugs with inherent risks. Blood transfusion is frequently indicated in the paediatric population in the Nigerian setting, largely due to problems of severe malaria and sickle cell anaemia. Intensifying efforts on the use of long-lasting insecticide-treated nets and environmental control may reduce the prevalence of severe malaria. Premarital screening and counselling targeted at sickle cell anaemia may reduce sickle cell anaemia incidence while improved nutrition, optimal hydration, regular malaria prophylaxis, prompt treatment of infections and regular use of haematinics may minimize the need for blood transfusions among children with sickle cell anaemia.

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