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ABSTRACT

***Objectives*: To determine the indications, practices and outcomes of transfusion on children.**
***Design*: A descriptive retrospective study.**
***Setting*: Paediatric wards of University of Nigeria Teaching Hospital, Enugu, Nigeria.**
***Subjects*: Children one month to 18 years that received blood transfusion.**
***Main outcome measures*: Indications for the transfusion, haemoglobin rise, vital signs, duration of transfusion and adverse events.**
***Results*: The two hundred and thirty eight transfusions reviewed were given amongst 95 patients, at a ratio of 2.5 transfusions per patient. The indicators of the transfusion were: malignancy (31.7%), sepsis (15.1%), sickle cell anaemia (12.1%), malaria (10.0%), hyperbilirubinaemia (10.0%), HIV/AIDS (8.3%), nephrotic syndrome (7.2%) and malnutrition (5.4%). Whole blood (56.4%) and sedimented cells (36.3%) were the main types of blood transfused. About 96.4% were transfused appropriate volume of blood. The mean Haemoglobin concentration (Hb) increase was 3.1g/dl and 12.8% of the recipients recorded an Hb increase of ≥ 5g/dl. The mean duration of transfusion was 4.6 hours and 59.7% of the transfusions exceeded the recommended four hours. Pulse and respiratory rates returned to normal post transfusion in 26.1 and 21.8% of the recipients respectively. In 10% of the transfusions there were minor adverse events; chills/fever (5.1%), itching (3.4%), hypothermia (1.0%) and vomiting (0.5%).**
***Conclusion*: Blood transfusion in this tertiary institution is not common and mainly due to non-communicable diseases. The expected optimal rise in Hb and normalising of vitals sign are not always the case. The duration of most transfusions was unduly prolonged and transfusion-related adverse events are rare.**

INTRODUCTION

Anaemia is a global public health problem; affecting a significant number of children (1). Blood transfusion has remained a valuable healthcare intervention amongst anaemic children (2,3). All patients requiring transfusion should be given the correct blood or blood products, appropriate to their clinical needs, provided in time and over an appropriate period and safety administered. When the blood transfusion is correctly done, it is expected to raise the haemoglobin concentration, (4,5) achieve haemodynamic stability, and cause the recipient no harm in the terms of transfusion related infections or adverse events (6,7). In order to ensure that the aforementioned are achieved, WHO developed a guideline for blood transfusion (8).

The WHO Guidelines are essentially to ensure safe and rational use of blood, reduce unnecessary and unsafe transfusions and improve patients outcomes and safety (8). The principal components of these strategies include: prevention, early diagnosis and effective treatment of the conditions that could result in the need for transfusion, optimal patient management and rational use of blood products (9,10) and safe clinical transfusion processes for ensuring patient safety (10). The extent to which these strategies are observed has not been explored amongst blood transfusion especially in children. Most transfusion audits have focused on: practice of proper screening

of donated blood,(11,12) safe bedside transfusion practice like proper patient identification, and documentation of intra-transfusion monitoring (13). There is a dearth of data on indications for blood transfusion, and outcome of transfusions especially in children in sub-Saharan African regions.

Provision of evidence-based information on indications and outcome of transfusion given in children will not only be useful in designing and implementing interventions to reduce the need for blood transfusion but will also be accessible in the formulation of a blood transfusion policy for children in Nigeria. This study was set to determine the indications for blood transfusion, the relative duration of transfusion, pre-transfusion haemoglobin concentration (Hb), the intra-transfusion monitoring, duration of transfusion, and relative outcome of transfusion with regards to rise in Hb and restoration of vital signs: respiratory rate, pulse rate and body temperature in children and adverse events noted. These findings can be evidence needed in the design of interventions to improve the outcome of blood transfusions especially in children.

MATERIALS AND METHODS

Study area and population: This study was conducted in the Paediatric wards of the University of Nigeria Teaching Hospital (UNTH) Ituku Ozalla, Enugu State. The University of Nigeria Teaching Hospital is a tertiary health facility located in Ituku Ozalla in Enugu State, South Eastern region of Nigeria. It has a functional blood bank that provides all the departments in the hospital with different blood parts- a whole blood, platelets, fresh frozen plasma and others. The Paediatric department has four wards: New born special care unit, Wards 6A and 6B, and Children Emergency Room. Since the objective of this study was to review non-emergency blood transfusion given to patients on admission, the transfusions given at the Children Emergency Room (CHER) were not included in the review. Majority of donor blood transfused in wards are from the hospital blood bank. The blood is screened for HIV and Hepatits B and C.

Study design: The study was a descriptive retrospective study that reviewed the medical records of children that were transfused in the wards over a 12 month period (January to December 2011) in the paediatric wards of University of Nigeria Teaching Hospital, Enugu, Southeast Nigeria.

Ethical considerations: Ethical clearance was obtained from the Ethics Committee of the University of Nigeria Teaching Hospital, Enugu.

Data collection: The records department provided the medical files of these -patients. Information documented in a profoma were: Age, gender, weight, diagnosis, blood group of the donor and recipient, volume of blood transfused, patient's vital signs pre and post transfusion, pre and post transfusion packed cell volume (PCV) and duration of the transfusion from the medical case notes and nurses records in the paediatric wards of UNTH. The adequacy of the volume of blood transfused was compared with the expected volume calculated using the standard formula (14). Acute transfusion reactions that is, events during transfusion and within 24 hours post transfusion were also recorded.

Data analysis: The data were analysed using Epi- Info version 6.04 (15) and SPSS version 15.0 statistical software. The children pre-transfusion haemoglobin was grouped into three age groups: <5 g/dl, 5 g/dl to 7 g/dl and >7 g/dl. Their pre and post vital signs were categorised into normal, low and high with regards to patient's age. The period of transfusion were categorised into three groups: ≤ 4 hours, > 4 hours to 6 hours and > 6 hours. The adequacy of transfused blood volume was determined by comparing the transfused volume with the calculated volume using the formulae; wt x (HBb-HBa) x v/HBs, where wt = child's weight, HBa = pre-transfusion haemoglobin, HBb – desired haemoglobin, v = blood volume in children, and HBs = haemoglobin concentration of donor blood (14). The volume of blood "v" in children is estimated to be 80 ml/kg, while the average for HBs are 13.3 g/dl, 23 g/dl and 40g/dl for whole blood, sedimented red cells and packed cells respectively (14). Therefore, substituting the values of "v" and "HBs" in v/HBs, will give a constant of 6, 3.5 and 2 for whole blood, sedimented blood and packed cells respectively.

RESULTS

There were 789 admissions in the paediatric wards and New Born Special Care Unit and a total of 325 blood transfusions were given within the review period, given a prevalence of transfusion to be 41.2%. Out of the 325 transfusions given, 238 transfusions had complete data and were reviewed. There were administered amongst 95 patients, given a transfusion ratio of 2.5 transfusions per patient. Table 1 shows the indications for transfusion. Childhood Malignancy (31.7%), Sepsis (15.1%), Sickle cell anaemia (12.1%), Malaria (10.2%), Hyperbilirubinaemia (10.0%) and HIV/AIDS (8.3%) were the main diagnosis.

Table 1
The spectrum of diagnosis of the 95 children that received blood transfusions.

Diagnosis	Number of transfusions n = 238*	Percentage %
Malignancy	75	31.7
Sepsis	36	15.1
Sickle cell anaemia	28	12.1
Malaria	25	10.2
Hyperbilirubinaemia	24	10.0
HIV / AIDS	20	8.3
Nephrotic syndrome	17	7.2
Malnutrition	13	5.4
Total	238	100

* A total of 95 patients received the 238 transfusion and diagnosis was documented per transfusion.

The blood groups of the recipients were mainly O+ (44.5%), B+ (21.0%), and A+ (20.2%). The least amongst the recipients' blood groups were A- (0.5%), B- (2.5%), O- (4.2%) and AB+ (7.1%). None of the recipient was of AB- blood group.
Table 2 show the distribution of the type of blood products transfused. Whole blood (56.4%) and sedimented red cell (36.3%) were the most transfused blood type. Those that received Platelets and fresh frozen plasma were 5.6% and 1.7% respectively. None of the patients received packed red blood cells.

Table 2
The blood products transfused amongst the 95 subjects.

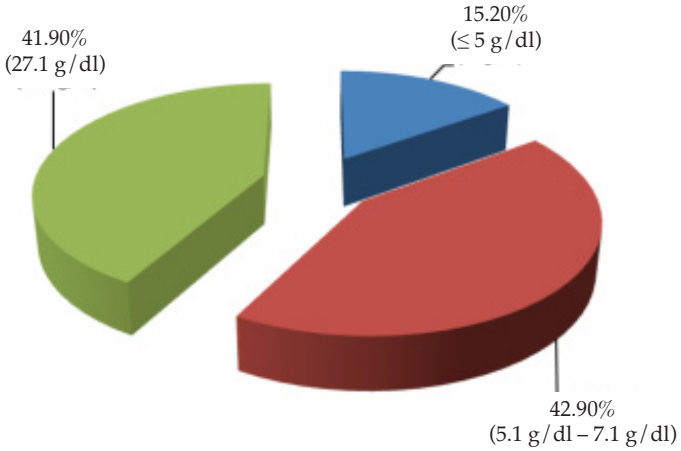
Type of blood / blood product transfused	Number of transfusions n = 238*	Percentage %
Whole blood	134	56.4
Sedimented Red blood cells	86	36.3
Platelets	13	5.6
Fresh Frozen Plasma	4	1.7
Packed Red Blood Cells	0	-
Total	238	100

* A total of 95 patients received the 238 transfusion and the blood group of each recipient of blood transfusion was documented.

Ninety six percent were transfused with appropriate volume of blood. The pre-transfusion haemoglobin levels were represented in Figure 1. Pre-transfusion haemoglobin concentrations of 15.2% of the transfused children were <5g/dl, 42.9% were within the range of 5g/dl to 7g/dl and exceeded 7g/dl in 41.9% of transfused patients.

Figure 1

The pre-transfusion Hb of the Children that received BT.

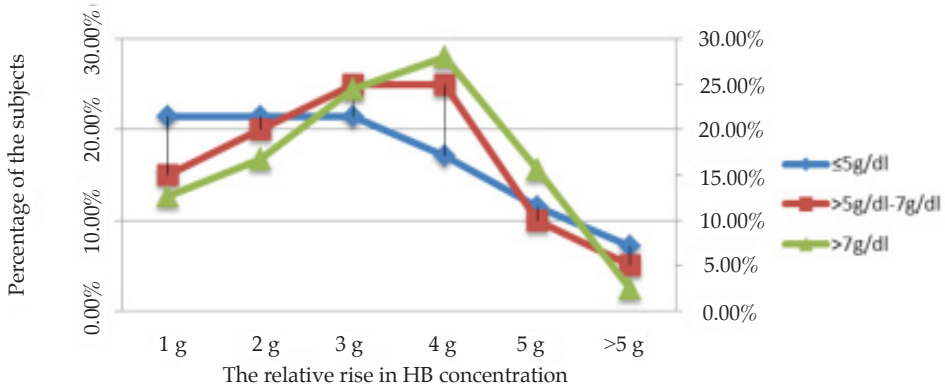


There was an increase in post transfusion Hb in 217 (91.2%) transfusions with a mean Hb increase of 3.1 g/dl. Only 28 (12.8%) recipient recorded an increase in Hb of ≥ 5 g/dl.

When the relative rise in post-transfusion Haemoglobin was compared with the pre-transfusion Haemoglobin, 64.2%, 60.0% and 53.9% had a Hb rise of ≤3 g/dl in group with pre-transfusion Hb of < 5 g/dl, 5 gdl to 7 g/dl and > 7 g/dl respectively as shown in Figure 2.

Figure 2

The relative rise in post-transfusion Haemoglobin in patients with different pre-transfusion haemoglobin



Vital signs such as pulse rate (PR), respiratory rate (RR), and temperature were routinely recorded in all the patients transfused. The pulse and respiratory rates returned to expected normal values in 26.1% and 21.8% respectively.

The time the BTs was commenced and completed were documented in all the cases. The mean duration of transfusion was 4.6 hours and in 142 (59.7%) of BTs, the transfusion exceeded the recommended 4 hours as show in Figure 2.

Figure 3
The Duration of Blood transfusion in Hours

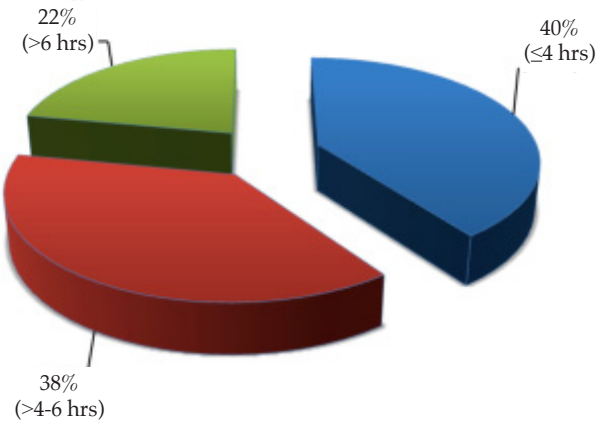
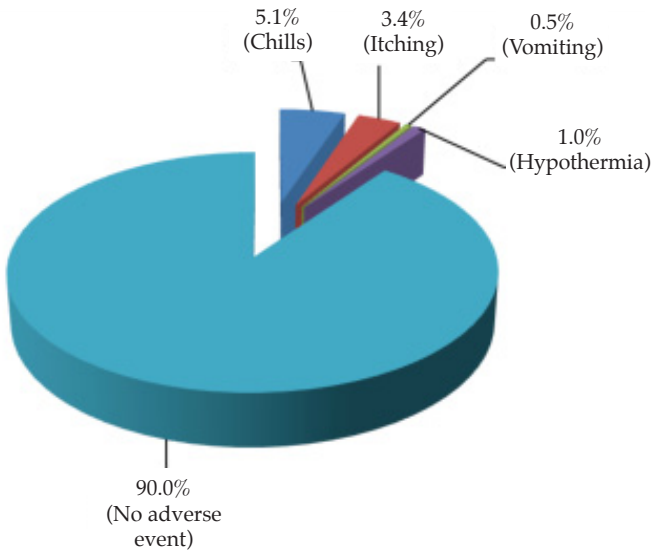


Figure 4 show the incidence of blood transfusion related adverse events. Only 10% of the transfusions were associated with minor adverse events such as; chills (5.1%), itching (3.4%), hypothermia (1.0%) and vomiting (0.5%).

Figure 4
Represents blood transfusion related adverse events



DISCUSSION

The transfusion rate during the period of review was high and most of the patients received multiple transfusions. This is similar to what was reported by Lackritz *et al* (16) and Akech *et al* (17) in their study. The reason for this seemly frequent blood transfusion may be attributed to lack of standard blood transfusion protocol visibly present in most health institutions as reported by Benhamou *et al* (18). This may have resulted in transfusion to be based on pre-transfusion haemoglobin concentration alone without considering the presence or non- presence of respiratory distress. In this study, patients with pre-transfusion Hb of ≥ 7 g/dl were transfused. The highest diagnosis amongst children that were transfused in this study was for malignancies, and Oncology patients on admission are often transfused multiple times to build up their Hb concentration to 10 g/dl as a prerequisite for cytotoxic medications. Also those who may have received blood due to exchange blood transfusion for hyperbilirubinaemia and sepsis may not actually have had a low pre-transfusion Hb concentration. All these factors may explain why more than 80 percent of transfusion was given amongst children with pre-transfusion Hb ≥ 5 g/dl. Nonetheless, efforts should be made to curtail any unwarranted blood transfusion whenever feasible. Since blood transfusions are not without its own risks, more so when antibody-negative, PCR-positive hepatitis in donated blood has been reported (19).

Most of the transfused children manifested sub-

optimal rise in post-transfusion Hb and majority of those with pre-transfusion respiratory distress, still remained in respiratory distress post-transfusion, similar to what Akech *et al* (17) reported. The study also revealed that irrespective of the pre-transfusion Hb concentration that only few patients recorded an Hb rise of 4 g/dl and above. This contrasts to the expectation that transfusion of appropriate volume of blood will raise the Hb concentration by 5 g/dl (14). This raises concern on the quality of blood being transfused with regard to the donor haemoglobin concentration. In view of this, a further study is required to assess the Hb of donated blood and the effect of storage on the Hb of donated blood over a period of time. Outcome of this will give insight to necessary modification in blood transfusion practices to ensure optimal benefit to those that received blood. This is important especially in developing countries where there are limited access to blood transfusion services and even where available, beneficiaries have to incur out-of-pocket spending (OOPs) (20). This extra cost of blood transfusion and lack of financial risk pool in health sector (21) does not only increase the cost of illness, but also make treatment of common illnesses to be a catastrophic health expenditure in the households concerned.

This study revealed that criteria for optimal blood transfusion practices were not always fulfilled; the time from commencement to completion of blood transfusion was unduly prolonged, and monitoring of vital signs during transfusion was sub-optimal, similar to what Mosha *et al* reported (22). This is largely due to lack of existence of quality assurance protocol in most clinics and wards in health facilities especially in many low income countries (18). The high patient/nurse ratio obtainable in Nigerian health sector in particular and other sub-Saharan regions in general may also contribute to this (23). In the interim, in any situation where blood on transfusion is exceeding four hours, we propose that an informed caregiver should be encouraged to alert the nursing staff to discontinue the transfusion. Furthermore, nursing staff monitoring any blood transfusion should be encouraged to set an alarm as a reminder on when to discontinue the transfusion. It is believed that if these are instituted, it has the capability of reducing the incidence of unduly prolonged duration of transfusion. This is still subject to further study and evaluation.

This study reported a 10% transfusion reaction, this was higher than 0.6% reported by Natukunda *et al (*12). This is no clear explanation for the difference in the incidence of blood transfusion related reaction, although the latter study assessed mainly severe blood transfusion related adverse events and was silent on the incidence of mild adverse reactions, which is in contrast to this study that documented mainly minor adverse reactions.

The rate of administration of BT in this tertiary institution is high and can be reduced if blood transfusion is reserved for mainly children with Hb concentration of ≤ 5 g/dl or otherwise indicated. The findings from this study reveal that in spite of the adequate volume of blood transfused in these patients, the expected post-transfusion optimal rise in Hb and normalising of vital signs were not always achieved. Even though the intra-transfusion monitoring was not adequate, the duration over which most transfusions were given was unduly prolonged which has also been documented in another study (22). Further studies may be required to evaluate the effect of prolonged period of blood transfusion on the outcome. This study also provides evidence that occurrence of major transfusion-related adverse events are rare. In view of the practices reported in this study there is need to establish a local committee to develop a standard operational protocol adaptable in this locality for proper monitoring of transfusion practices, and conduct regular interval paediatrics blood transfusion audits. In addition, further studies are required to explain the reason the behind poor rise in post-transfusion Hb and to evaluate outcome of children transfused at different pre-transfusion Hb levels. The outcome of which will serve as evidence based knowledge to enable policy makers and programme managers develop a protocol to guide blood transfusion practices.

AUTHOR CONTRIBUTIONS

Conceived the concept: EIJ, IAN. Designed the study: UMD, EIJ: Data collection: UMD, NSO. Analysis tools/Analyzed the data: UMD. Wrote the paper: UMD, EIJ, IAN, ISN.

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