Indications and Patterns of Blood Transfusion in Neonatal Intensive Care Unit of a Tertiary Hospital in North West Nigeria

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Abstract

Background: Neonates requiring intensive care are among the most frequently transfused group of patients. Indications for blood transfusion in neonates could be physiological or pathological. However, despite frequent blood transfusions in neonates in Zaria, there is a paucity of studies on its indications and patterns among neonates in our setting. **Objectives:** The objective of this study is to determine the indications and patterns of blood transfusions among neonates in the neonatal intensive care unit (NICU) of Ahmadu Bello University Teaching Hospital (ABUTH), Zaria, Nigeria. **Methods:** This was a cross-sectional study on neonates in the NICU of ABUTH, Zaria. A pro forma was used to collect information from the mothers and neonates' case notes. Charts and table were used to show frequencies and proportions on the indications and types of blood transfusion given. **Results:** A total number of 172 neonates were admitted during the study period among whom 60 had blood transfusion. The median age (interquartile range) of the neonates was 2.5 (27) days, and the mean (± standard deviation) birth weight and hematocrit of the neonates were 2432.5 ± 722.9 g and $37.19 \pm 8.76\%$, respectively, with 32 (53.3%) being males. Neonatal anemia (30, 50%), neonatal jaundice (25, 41.7%), neonatal sepsis (3, 5%), and preparation for surgery (2, 3.3%) were the indications for blood transfusion. Thirty-nine (65.0%) and 21 (35.0%) of the neonates had top-up and exchange blood transfusion, respectively. **Conclusions:** Neonatal anemia and jaundice were the major indications for blood transfusion while simple top-up was the main type of blood transfusions among the neonates in this study.

Keywords: Blood transfusion, indications, neonatal intensive care unit, neonate

INTRODUCTION

The need for blood transfusion in neonates may occur due to physiological or pathological causes. Anemia of prematurity is a physiological phenomenon, which is related to inadequate maternofetal transfer of iron and poor postnatal production of endogenous erythropoietin.[1] Studies have shown that over 50% of all hospitalized pediatric patients in sub-Saharan Africa received blood transfusions for anemia.[2]

Neonates admitted into an intensive care unit (ICU) are among the most frequently transfused group of patients.[3] In addition, blood transfusion is also costly with associated potential risks.[4,5] Therefore, many attempts have been made to identify ways to reduce its frequency.[6]

Blood transfusion is commonly used in parts of the developing world where recombinant erythropoietin is not readily available. Top-up blood transfusion with red cells is done for severe anemia while exchange blood transfusion (EBT) is recommended for severe hyperbilirubinemia.[1] Despite the huge requirement for the use of blood and its products in neonatal care, the practice in most parts of the developing world is fraught with the lack of a well-developed transfusion service.[7] Yet, neonatologists in the developing countries of the world are confronted with the clinical need to transfuse a larger number of critically ill neonates. These make strict adherence to universal guidelines on the use of blood and its products difficult in this

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setting. This study, therefore, aimed to review the indications and types of blood transfusions given to neonates in Ahmadu Bello University Teaching Hospital (ABUTH), a tertiary health institution in Zaria, North West Nigeria. This is with a view to identify common indications for neonatal blood transfusion and also to set up a guide for clinically appropriate neonatal transfusion protocols in our setting.

METHODS

Study settings

This study was conducted in the neonatal ICU (NICU) of the Paediatrics Department of ABUTH, Zaria. This unit has a total number of 32 beds with an average of 22 neonatal admissions requiring blood transfusion per month.

Study design

This was a cross-sectional study on neonates requiring blood transfusion in the NICU of ABUTH, Zaria, from February to May 2017. A total of 172 neonates (newborns aged 0–28 days) were admitted during the 3-month study period. A pro forma was used to collect information from the mothers' and neonates' case notes. Two milliliters of venous blood by femoral tap were drawn from each neonate after thoroughly cleaning the area with methylated sprite with fully gloved hands. About 2 ml of blood were dispensed into the ethylenediaminetetraacetic acid-containing bottle. This was immediately taken to the laboratory for the determination of full blood count using automated hematology analyzer (Swelab Alfa, Boule Medical AB, Domnarvsgatan 4, P.O. BOX 42056 SE-126 13 Stockholm, Sweden). Charts and table were used to show frequencies and proportions on the indications and types of blood transfusion given.

Study population

These were the newborns aged 0–28 days who were admitted into the NICU for various indications and required at least one type of blood transfusion from February to May 2017.

Sampling technique

The neonates were selected consecutively as they presented using convenient sampling technique.

Data collection

A pro forma was used to collect information from the mothers and neonates' case notes. However, mothers were asked to clarify some missing information from the case notes using questionnaire. Ethical conduct guiding a research such as respecting the autonomy of the participants and confidentiality were upheld.

Data management

The questionnaires were examined for completeness and accuracy. The data were subsequently entered into an electronic database using Microsoft Excel version 2010 for windows. Charts and table were used to show frequencies and proportions on the indications and types of blood transfusion given.

Ethical considerations

The study protocol was submitted to the Health Research Ethics Committee of ABUTH, Zaria, and approval was granted to conduct the research. Participation of the mothers in this research was voluntary. A written informed consent was obtained from the literate participants while nonliterate participants' thumb printed the consent form.

RESULTS

A total number of 172 neonates were seen, among whom 60 had blood transfusion. The median age (interquartile range) of the neonates was 2.5 (27) days, and the mean (±standard deviation) birth weight and hematocrit of the neonates were 2432.5 ± 722.9 g and 37.19 ± 8.76%, respectively, with 32 (53.3%) being males. Neonatal anemia 30 (50%), neonatal jaundice (NNJ) (25, 41.7%), neonatal sepsis (3, 5%), and preparation for surgery (2, 3.3%) were the indications for blood transfusion [Table 1]. Thirty-nine (65.0%) and 21 (35.0%) of the neonates had top-up and EBT, respectively [Figure 1]. Blood group O was the most common (49.1%) among the transfused neonates [Figure 2].

DISCUSSION

This study showed that about two-third of the neonates admitted into the NICU requiring transfusion received top-up blood transfusions [Figure 1] which involved the use of whole blood and/or sedimented cells. This is similar to the findings by Ogunlesi and Ogunfowora[8] in South West Nigeria and Essabar *et al*.[9] in Morocco who recorded high top-up transfusion among neonates admitted into ICU. Further, in another study by Rath *et al*.[10] in neonates with hemolytic disease of the fetus and newborn (HDFN) due to Rh D and Kell antigens, the frequency of top-up transfusion was similar to what was found in the present study in both conditions. In neonatal transfusion, cytomegalovirus (CMV) negative or leukodepleted red cell concentrate is the ideal component for top-up transfusion, but infrastructural and related limitations prevent easy access to this component in the study. Due to relative immunodeficiency in neonates, the use of CMV negative or leukodepleted red cells could reduce the risk of viral transmission and prevention of other noninfective adverse events of blood transfusion. This should form a basis of advocacy for policy formulation and planning toward universal improvement in human resource and equipment needed for neonatal transfusion.

The other one-third of the transfused neonates had EBT which is quite high [Table 1]. The presumed major causes of hyperbilirubinemia found in this study are HDFN from

Table 1: Indications for blood transfusion

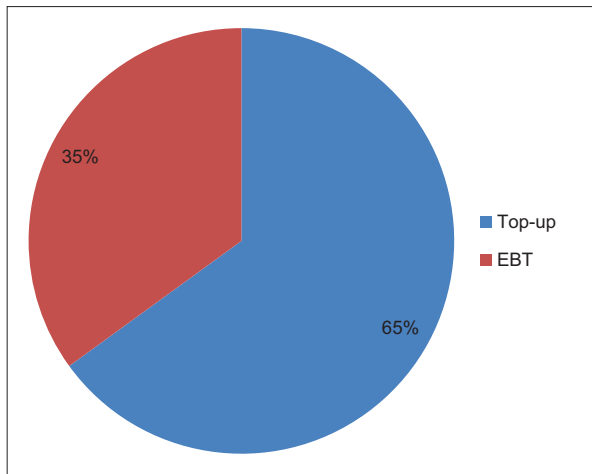| Indications	Frequency (%)
Anemia at term	25 (41.7)
Anemia of prematurity	5 (8.3)
Neonatal jaundice	25 (41.7)
Neonatal sepsis	3 (5.0)
Preparation for surgery	2 (3.3)
Total	60 (100)

Figure 1: Types of blood transfusion given to the neonates

ABO blood group incompatibility, Rh isoimmunization as well as severe neonatal sepsis. Hyperbilirubinemia has been found to be the leading cause of EBT among the neonates in this study. A similar finding had previously been reported by Owa and Taiwo[11] and Onyearugha[12] in different studies comparing the rate of EBT between babies born within the particular health facility and those referred from other health facilities in question (inborn and outborn). They reported high EBT rate among the outborn babies which are similar to the findings of this study. They also reported a lower rate among the inborn babies. However, Owa and Ogunlesi[13] in a more recent study reported a lower rate of EBT among neonates admitted into their special care baby unit (SCBU). This could be because they utilized a larger sample size compared to this study. Furthermore, the reason for high EBT rate observed in this study may be due to the very late presentation of the neonates, especially by the outborn. However, most of the neonates with severe NNJ in this study were delivered in places with inadequate medical and nursing services. EBT is used in the management of severe unconjugated hyperbilirubinemia and it is the most rapid method for reducing serum bilirubin and the risk of kernicterus. EBT is rather an invasive procedure fraught with potentially serious risks. In advanced countries, EBT is gradually abandoned for phototherapy as the management of NNJ is often commenced *in utero* using method such as intrauterine blood transfusion.[13]

In this study, we found that the major indication for blood transfusion in half of the neonates admitted into the NICU is anemia, which ranges from severe anemia at term to anemia of prematurity [Table 1]. This high blood transfusion rate due to anemia was similar to the findings reported by Ogunlesi and Ogunfowora on hospitalized neonates in South West Nigeria.[8] In another study, Onyearugha reported a higher number of neonates with anemia who were admitted into an SCBU compared to the findings in this study.[12] This may not be unexpected finding because nutritional deficiency in the mother may be a risk factor in the neonate to develop anemia.
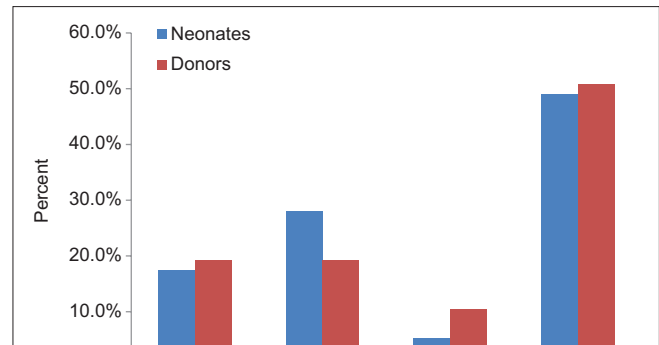

Figure 2: Distribution of blood groups of neonates and donors

NNJ was the second highest indication for blood transfusion among the neonates in this study. This is to say that NNJ contributes significantly to the requirements of blood transfusion in neonatal period. In a study by Onyearugha who reported similar findings among neonates admitted into SCBU,[12] Owa and Ogunlesi in their study reported a higher number of neonates who had EBT due to NNJ than the present study. This could be due to a larger sample size in their study compared to the present study.[13] In another study by Ogunlesi and Ogunfowora,[8] the number of neonates who had EBT due to hyperbilirubinemia was slightly higher than in the present study. However, Onyearugha reported a slightly lower number of neonates who had EBT due to hyperbilirubinemia compared to the present study.[12] This is similar to the finding by Olusanya *et al.*[14] in a study on the burden of NNJ across the six geopolitical zones in Nigeria.

In view of the fact that Nigeria ranks low in the human development index,[15] infection is still an important determinant of neonatal and under-five survival. It is, therefore, not surprising that anemia due to neonatal sepsis is the third common indication for top-up blood transfusion in this study. This is similar to the study by Ogunlesi and Ogunfowora[8] where they found neonatal sepsis as the fourth common indication for blood transfusion among the neonates. In another study, Pugni *et al.*[16] found a lower number of neonates with sepsis admitted into SCBU. This difference could be due to a larger sample size in their study compared to ours; in addition, the study was carried out in developed clime where there is high awareness of infection control measures among the pregnant women attending the antenatal clinic. Another reason could be that there are adequate health-care facilities and health personnel for both the mother and the neonates. Sepsis is still a major cause of morbidity and mortality in neonates, especially in preterm neonates, causing approximately 36% of the estimated 4 million neonatal deaths annually.[17,18] Therefore, sepsis is a life-threatening condition because it causes hemolysis and continues to be a major challenge for physicians, especially in NICUs of the resource-limited settings.

Optimization of patients for surgery constituted the least indication for blood transfusion among the neonates in this study. All the neonates who had blood transfusion in this study had neural tube defects. Neural tube defect is one of the

congenital abnormalities affecting about 3% of newborns.[19] Gangopadhyay *et al*.[20] in a study on neonatal surgery revealed that about 5% of the neonates admitted had encephalocele. This was also the least common indication for blood transfusion among the different surgeries carried in their study, but the prevalence was higher compared to the present study. This could be due to the much larger sample size utilized compared to this study, and it may also be due to the standard of care for neonates with such conditions which made it easy for referral and patronage.

Limitations

The outcome of this research would have been better if the levels of erythropoiesis supporting agents such as folic acid, iron, Vitamin B_{12} and B_6, erythropoietin, and growth factors of the neonates were assayed as deficiencies of the erythropoiesis supporting agents in the mothers may lead to anemia in neonates. The levels of minor blood group antigens of both the mothers and the neonates were not determined, and these may contribute to the high level of ABO incompatibility seen among the neonates in this study.

CONCLUSIONS

Neonatal anemia and jaundice were the major indications for transfusion, while simple top-up was the main type of blood transfusion among the neonates in this study.

Conflicts of interest

There are no conflicts of interest.

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