International Journal of Health Sciences and Research
www.ijhsr.org ISSN: 2249-9571

Original Research Article

Pattern and Indications for Neonatal Blood Transfusion in Ogbomoso, Southwestern Nigeria

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ABSTRACT

Background: Neonates are among the most transfused patients in the hospital due to the reduced marrow activity in the neonatal period and common illnesses in the newborn that can be associated with haemolysis or blood loss resulting into anaemia. In spite of the huge need for the use of blood products among the newborns, there is paucity of local data on neonatal blood transfusion and the adherence to transfusion guidelines in Nigeria.
Objective: To determine the pattern, indications and immediate outcome of blood transfusion in the special care baby unit (SCBU) of Ladoke Akintola University of Technology Teaching Hospital, Ogbomoso, Nigeria.
Materials and Methods: Newborn babies who required blood transfusions between February 2012 and December 2016, were retrospectively studied. The gestational age, birth weight, sex, clinical conditions, indications for transfusion, type of blood product transfused, and the outcome were analyzed using IBM SPSS Statistics.
Results: A total of 905 neonates were hospitalized and 106 (11.7%) had blood transfusion; 58 (54.7%) had exchange blood transfusion, 93 (87.7%) had red cells transfusion and 10 (9.4%) had plasma transfusion. Seventy-five (70.8%) had multiple transfusions. The main indications for blood transfusion were severe anaemia (50.9%), severe hyperbilirubinaemia (23.6%), anaemia combined with hyperbilirubinaemia (21.7%) and bleeding disorders (3.8%). Overall, 161 transfusions were done for the 106 subjects and the majority (59.4%) were preterm babies. Referred babies constituted most (64.2%) of the subjects. Major transfusion reactions were rare in the studied population. However, 11.3% of the subjects developed necrotizing enterocolitis following blood transfusion.
Conclusion: The prevalence of neonatal blood transfusion was high in this facility and prematurity, severe anaemia and hyperbilirubinaemia rank high in the indications. Improvement of the strategies to identify infants at greater risk for multiple transfusions and the implementation of prophylactic measures can reduce the incidence of significant anaemia and the rate of blood transfusion.

Keywords: Blood, products, newborn and transfusion

INTRODUCTION

Blood transfusion is often life saving and an important form of medical treatment particularly in the paediatric age group in which common illnesses can be associated with destruction, loss and deterioration in the quality of blood and its constituents. [1] Babies born prematurely may experience a form of physiological anaemia between 4 and 12 weeks of age, due to the inadequate materno-foetal transfer of iron and poor postnatal production of endogenous erythropoietin in infants. [2-4] Although replacement therapy with recombinant human erythropoietin (rHuEPO) is the ideal and common practice in the developed world, [5,6] blood transfusion is commonly used in parts of developing world where the ideal is unavailable and/or unaffordable. [7,8] Blood transfusion procedure replaces the volume and specific constituents of blood which play specific roles in oxygen transport, immunity and clotting as well as removal of toxins such as bilirubin from the body. [9]

The leading causes of neonatal morbidity and mortality in the developing world are prematurity, perinatal asphyxia, infections and jaundice. [10,11] The correct management of these conditions and their complications often require blood transfusion which may take the form of top-up, partial or full exchange.

Unfortunately the high demand for the use of blood and its products in neonatal medicine in the developing world is hampered by the problem of inadequate and inefficient blood banking, cross-matching and blood product preparation systems. [12] Thus the availability of blood products like packed cells, fresh frozen plasma, platelet concentrates and cryoprecipitate when required cannot often be assured.

This makes strict adherence to universal guidelines on blood and blood products use difficult and to comply with in the developing world

As a step towards improving the safety and efficiency of blood transfusion therapies in such resource-poor settings, it is essential to generate data on the pattern of use of blood transfusion among newborn babies. The objective of this study is to examine the pattern, indications for blood transfusion and the immediate outcome among the patients. These data can then be used to devise measures useful for improving transfusion services in such poor resource settings. The present study is to our knowledge the first report from a Nigerian neonatal intensive care unit which was established eight years previously.

MATERIALS AND METHODS

The study was conducted at the Special Care Baby Unit (SCBU) of Ladoke Akintola University of Technology (LAUTECH) Teaching Hospital, Ogbomoso, Nigeria. This is a tertiary hospital located in Ogbomoso, an urban community located at 107.1 kilometers North East of Ibadan the capital of Oyo State, Southwest Nigeria. The hospital's SCBU provides general and specialized neonatal care services to babies delivered in the Maternity Unit of the hospital as well as newborns referred from other hospitals within the state and neighbouring states.

The subjects studied were consecutive admissions between February 2012 and December 2016 who received blood or blood product transfusion for medically indicated reasons during the period of hospitalization. Their hospital records were retrospectively analyzed for their bio-data, gestational age (GA) by date and/or Ballard score, birth weight, weight at admission, gestational age-birth weight profile, medical problems, admission diagnosis, diagnosis at discharge, indications for blood transfusion, type of transfusion done, type of blood product transfused and the frequency, clinical signs during the immediate pre-transfusion, intra-transfusion and post-transfusion periods. The babies were clerked and classified into preterm, term, post-term, appropriate for gestational age (AGA), small for gestational age (SGA) and large for gestational age

(LGA), using intrauterine growth chart as appropriate.

All blood transfusions were administered according to the hospital's guidelines and protocol.

Data were managed with SPSS version 15 software using descriptive statistics. Frequencies were generated for categorical variables and compared using tables, pie and bar charts.

RESULTS

Numbers and sexes of babies, gestation at birth and ages at admission

A total of 905 neonates were admitted during the period of the study. Of these, 106 (11.7%) were transfused with one blood product or the other. The 106 consisted of 63 (59.4%) males and 43 (40.6%) females; M:F ratio 1.47:1. The gestational ages of the babies at delivery ranged between 26 to 43 weeks with a mean ± SD of 35.64 ± 3.825 weeks. These are shown in Figure 1. The majority of the babies 63 (59.4%) were preterms consisting of 29 (27.4%) early preterms born before 34 weeks gestation and 34 (32.1%) late preterms born between 34 and 36 weeks gestation. Forty-one (38.7%) babies were born at term (37 – 42 weeks). Two babies (1.9%) were post term (over 42 week's gestation).

The ages at admission ranged between 1 and 26 days (mean ± SD 4.07 ± 4.74) days. The distribution of babies according to ages at admission is shown in Figure 2. The numbers and percentages admitted at postnatal ages from birth to 7 days, 8 to 14 days, 15 to 21 days and 22 to 28 days respectively were 91 (85.8%), 9 (8.5%, 4 (3.8%) and 2 (1.9%).

Places of birth and admission weights

Thirty eight (35.8%) of the babies were inborn and the remaining 68 (64.2%) outborn. Their weights ranged between 0.75 kg and 4.80 kg with a mean ± SD of 2.32 ± 0.87 kg. Fifty four (50.9%) of the babies were low birth weight weighing less than 2.5 kg, whilst 29 (27.4%) weighed below 1.5 kg, 50 (47.2%) were of normal birth weight (2.5-4.0) kg and 2 were macrosomic (over 4 kg).

Diagnoses in transfused babies and indications for transfusion

The main diagnoses in the transfused babies are shown in Table I.

Prematurity, sepsis, birth asphyxia and acute bilirubin encephalopathy were the main diagnoses accounting for 87.8% of the diagnoses. Sepsis was the commonest diagnosis and a major problem resulting in clinical situations warranting transfusions. Figure 3 shows the indications for transfusion which are anaemia, hyperbilirubinaemia and bleeding disorders.

Details of transfusion

Overall, 161 transfusions were done. Of these, 93 (87.7%) were top up transfusions, 58 (54.7%) were exchange blood transfusions (EBTs), and 10 (9.4%) were transfusions of fresh plasma. Seventy five (70.8%) babies had multiple transfusions (more than one each) while 31 (29.2%) had only one each. Of the 58 EBTs, 13 (22.4%) were single volume and 45 (77.6%) were double volume procedures. Forty one (91.8%) of the double volume EBTs were done for severe jaundice and the remaining 4 (8.9%) for bleeding diathesis. For 14 (13.2%) of the transfused babies only the EBT was done, for 42 (39.6%) only the top up blood transfusion was done, for 40 (37.7%) babies, EBT was done as well as top up transfusion. Four babies (3.8%) had EBT, top up transfusion and fresh frozen plasma. Six (5.7%) had top up plus fresh plasma transfusions.

Forty one (70.7%) of the 58 babies who had EBT subsequently developed anaemia requiring top up transfusion. Platelet-rich plasma and platelet concentrate preparations were not available.

Complications of blood transfusion

Febrile reactions occurred in 6 (5.7%) babies with a maximum temperature rise above preceding level of 1.9ºC. No

baby developed rigors, rash, post transfusion jaundice, oliguria or abrupt haematocrit drop. Twelve babies (3 term and 9 preterm very low birth weight (VLBW)) among the subjects developed necrotizing enterocolitis (NEC). The 3 term and 3 out of the 9 preterm babies had double volume EBT plus top up transfusion while the remaining 6 preterm VLBW babies had multiple red blood cell top up transfusions. The babies who developed NEC did so within 4 days after the transfusion.

Outcome

Five (4.7%) of the 106 babies died within the first week after birth. These 5 deaths constituted 4.5% of the 110 deaths recorded among the 905 babies hospitalized during the study period. The number of deaths recorded among babies who had blood transfusion compared with the deaths among those who did not was statistically significant (p = 0.020). Four of the five babies who died were outborn and the remaining one was inborn. One of the deaths occurred in a term and the remaining 4 in preterm babies. The term baby had hypoxic ischaemic encephalopathy stage III, sepsis, DIC and died 4 days after admission. The remaining 4 preterm LBW baby deaths occurred on days 1, 4, 5 and 6 after admission. Eighty four (79.2%) of the babies were discharged home improved, 14 (13.2%) against medical advice whilst 3 (2.8%) were referred to other hospitals.

Table I: Clinical diagnoses in Babies Transfused

Diagnosis	Frequency (%)
Prematurity + Anaemia	23 (21.7)
Sepsis + Anemia	29 (27..4)
Birth asphyxia + Anaemia	16 (15.1)
Acute bilirubin encephalopathy	11 (10.4)
Prematurity + Sepsis + Anaemia	10 (9.4)
Birth asphyxia + Sepsis + Anaemia	4 (3.8)
Haemorrhagic disease of newborn + Anaemia	4 (3.8)
G-6PD deficiency+ Jaundice + Anaemia	3 (2.8%)
ABO/Rh-Incompatibility + Jaundice + Anaemia	6 (5.7)

Figure 1: Gestational Age Distribution

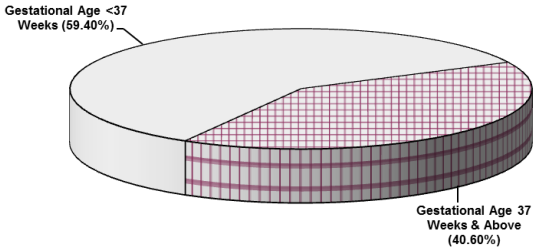


Figure 2: Age Distribution of the Neonates as at Admission

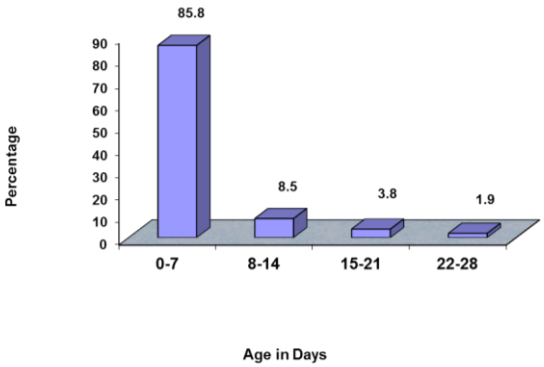
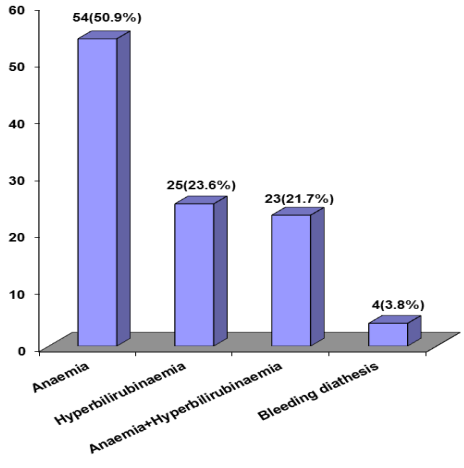


Figure 3: Indications for Transfusion



DISCUSSION

Although guidelines for red blood cell transfusions exist, [13-15] transfusion practices for high risk newborn infants vary among neonatal centers based on considerations of factors of gestational age,

birth weight and severity of illness. [15-19] In general, neonates should be transfused if they suffer acute blood loss of over 10% of their total blood volume or have a haemoglobin concentration of less than 80 gm/ litre with symptoms of anaemia. Also a haemoglobin concentration of less than 120 gm/litre together with respiratory distress syndrome or congenital heart disease [14] would be valid indications for blood transfusion.

The prevalence of blood transfusion of 11.7% in the present study is lower than the 16.5% reported by Pam et al [21] from Jos Northern Nigeria and than the 27.9% and 30.8% reported by Ayede et al [7] and Ogunlesi et al [8] respectively both from South western Nigeria. Perhaps our population studied is low compared to Ayede and Ogunlesis' study site because of the relatively young age of our facility which was established barely 8 years prior to the study and with its catchment pattern and composite subspecialties still developing.

The lack of facilities for platelet and leucocyte concentrates have limited us in our practice to the use of whole blood, partially packed red cells and plasma in some cases where the ideal would have been otherwise.

This our constraint is similar to the experience of some other centers. [7,8,21] We hope that centers in Nigeria, ours inclusive will develop towards the better practices abroad where choice of specific blood concentrates will be regularly accessible and available options.

The finding in the present study of a pattern reflecting the prominence of preterm (59.4%) and low birth weight (52.3%) babies among the patients transfused is confirmatory of the pattern previously found by earlier researchers. [2,7-9,19-21] This is partly understandable because of the fact that early preterm infants born before 32 weeks gestation are prone to experience exaggerated physiological anaemia between 4 and 6 weeks of age. This is usually a non-deficient normocytic anaemia.

Other causes of anaemia in preterm babies include their predisposition to infections (septicaemia, etc.) with their complications and also iatrogenic insults from frequent phlebotomies necessitated by investigations during their prolonged admission. The repeated little phlebotomy blood losses become drops of water that become a mighty ocean. Moreover, their poor marrow response to anaemia is a problem that increases the severity of the anaemia. Thus, the non-physiological falling of the haematocrit and reticulocytes, bone marrow hypoplasia and the low endogenous erythropoietin production all combine to cause or increase anaemia. [19,20]

Most of the babies in the present studies are outborn or referred patients. This is consistent with the previous findings. [8,21] Such babies have been shown to be at higher risks for morbidity and mortality. [10,11,22] One important way to reduce the prevalence of anaemia would be to pay closer attention to the training of the traditional birth attendants (TBAs) who conduct the delivery of many of the referred babies. They can prevent or minimize bleeding during delivery for example, by ensuring delayed cord clamping which has been shown to reduce neonatal transfusion rates. [23]

Another way of reducing the prevalence of anaemia would be to pay close attention to the care of neonates in their first two weeks of life. The rationale for this is that three quarters of all the transfusions in the present study were undertaken on babies of this age group. There is a need for post discharge supervision of neonates especially but not exclusively the early discharges. A combination of well trained traditional birth attendants and community midwives can profitably meet this need.

The various indications for transfusion in the present study are reflections of the national neonatal burden which includes prematurity, neonatal jaundice, sepsis and perinatal asphyxia. [24] Jaundice was the most prevalent indication

for transfusion. Aggressive prevention of severe hyperbilirubinaemia using effective methods like phototherapy should reduce the bulk of EBTs. [25,26] Many (70.7%) of the babies who had EBT subsequently developed anaemia and required top up transfusion, thus increasing the bulk of multiple transfusions.

The physiological immaturity of various organ systems in the newborn gives rise to differences in the incidences and types of adverse reactions to transfusions when compared with older children and adults. Febrile non-haemolytic transfusion reactions (FNHTRs) recorded in 6 (5.7%) babies in the present study was recorded in 5% by Ayede *et* al. [7]

Currently, leukocyte reduction by filtration from platelet and blood packages intended for transfusion done preferably prior to the storage of the platelet or red blood cell packages has been shown to reduce the risk of FNHTR [27] and are valid measures for preventing FNHTRs.

Unfortunately, red blood cells and platelet concentrates are not available and the removal of leukocytes from them is a non issue. That is the present status of our neonatal medical practice so far.

NEC complicated 11.3% of the transfusions in the present study. This is slightly higher than the 10.6% incidence among the babies not transfused. Actually, evidence to support a causal relationship between red blood cell transfusion and NEC is thin. [28] It is possible that some other investigative or therapeutic neonatal practice like catheterization is the real cause of NEC or that the anaemia itself is an independent risk factor for NEC. The elucidation of the exact cause or association must therefore await further research. Almost, one in eight babies transfused (13.2%) were discharged against medical advice. This figure is only slightly lower than the 14.6% previously reported by Joel-Medewase *et al* in a previous earlier study. [29]

What should be done to reduce the frequency and severity of anaemia and blood transfusions in neonates? One suggestion is to undertake larger research on the subject. Certain specific actions and steps can also help. Delayed clamping of the umbilical cord at birth, minimizing blood sampling to bare essentials and using microtechnique laboratory procedures, using non invasive monitoring methods, for example, transcutaneous bilirubinometer to monitor jaundice, giving iron and vitamin supplements when indicated and using rHuEPO to stimulate erythropoiesis when available are some of these specific actions.

The facts that the majority of admissions and blood transfusions took place within two to three weeks of birth and in outborns indicate that attention should be more seriously directed to the perinatal period and especially after delivery of the babies. To this end, the training of community nurses and midwives as well as of traditional birth attendants should be improved and their efforts enlisted to ensure effective surveillance of newborns after birth so that proactive actions can be taken to prevent or reduce anaemia and blood transfusions in babies.

ACKNOWLEDGEMENT

It is with deep gratitude that I acknowledge Prof. G.A. Oyedeji for the contributions towards this manuscript. The immense assistance of Rev. F.O. Olasunkanmi is gratefully acknowledged.

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How to cite this article: Joel-Medewase VI, Olufemi-Aworinde JK, Alabi AO et.al. Pattern and indications for neonatal blood transfusion in Ogbomoso, Southwestern Nigeria. Int J Health Sci Res. 2019; 9(10):111-118.

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