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Audit of blood transfusion practices in a neonatal care unit of a tertiary Hospital

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Abstract: *Introduction:* SSNB (Small and sick newborns), particularly the very preterm infants, may require multiple blood transfusions when they stay in neonatal care unit (NCU) for an extended period of time. Transfusion is often based on the clinical opinion of the clinician rather than specific guidelines.
Objective: To audit the practice of blood transfusion in SSNB admitted in NCU at a tertiary hospital in Sub-Saharan Africa.
Methodology: This is a hospital based retrospective study of all SSNB who received blood transfusion in NCU for three months. Analysis was done by SPSS.
Results: A total of 125 SSNB received 292 blood transfusions: male were 65 (52.0%) and preterm <37 weeks of gestational age were 96 (76.8%). A total of 184 (63.0%) units were packed red blood cells, 53 (18.2%) platelets, 35 (12.0%) fresh frozen plasma and 20 (6.8%) were whole blood. Majority (48%) had their first transfusion during the second week of life: with 58 (46.4%) requiring transfusion due to infections, 23 (18.4%) due to acute hemorrhage and 20 (16%) due to anemia of prematurity. Very preterm neonates required multiple transfusions the most (p= 0.024): 82 (65.6%) of first transfusions, adhered to the blood transfusion guideline of the unit.
Conclusion: Premature neonates were transfused the most (76.8%) among all SSNB. Majority of first transfusions were done in the second week of life (48.0%). The commonest reason for transfusion was infections. Eighty two (65.6%) infants were transfused according to the guideline in NCU.

Keywords: Blood transfusion, neonatal care unit, PRBC, platelets, FFP

Résumé: *Introduction*: Les nouveau-nés malades et de petite taille, en particulier les grands prématurés, peuvent nécessiter de multiples transfusions sanguines lorsqu'ils séjournent dans une unité de soins néonatals (USN) pendant une période prolongée. La transfusion est souvent basée sur l'opinion clinique du clinicien plutôt que sur des directives spécifiques.
Objectif : Auditer la pratique de la transfusion sanguine chez les nouveau-nés admis dans l'unité de soins néonatals d'un hôpital tertiaire d'Afrique subsaharienne.
Méthodologie: Il s'agissait d'une étude rétrospective hospitalièreincluant tous les nouveau-nés malades et de petit poidsqui ont reçu une transfusion sanguine dans l'unité de soins intensifs pendant trois mois. L'analyse a été effectuée à l'aide du logiciel SPSS.
Résultats: Au total, 125 nouveaunés ont reçu 292 transfusions sanguines. Soixante-cinq (52,0 %) étaient de sexe masculin et 96 (76,8 %) des prématurés de moins de 37 semaines d'âge gestationnel. Les produits transfusés étaient des concentrés de globules rouges dans 184 cas (63,0 %), des plaquettes dans 53 cas (18,2 %), du plasma frais congelé dans 35 cas (12,0 %) et du sang total dans 20 cas (6,8 %). La majorité (48%) a reçu sa première transfusion au cours de la deuxième semaine de vie.L'infection était la cause de la transfusion dans 58 cas (46,4%), l'hémorragie aiguë dans 23 cas (18,4%)et l'anémie de la prématurité dans 20 cas (16%). Les

nouveau-nés grand prématurés sont ceux qui ont eu le plus besoin de transfusions multiples (p= 0.024). Les transfusions étaient conformes aux directives de l'unité en matière de transfusion sanguine dans 82 cas (65,6%).
Conclusion: Les nouveau-nés prématurés ont été les plus transfusés (76,8%) parmi lesnouveau-nés malades et de petit poids. La majorité des premières transfusions ont été effectuées au cours de la deuxième semaine de vie (48,0 %). La raison la plus fréquente de la transfusion était l'infection. Quatre-vingt-deux (65,6 %) nouveau-nés ont été transfusés conformément aux directives de l'unité de soins.

Mots-clés : Transfusion sanguine, unité de soins néonatals, Concentré de globule rouge, plaquettes, plasma frais congelé

Introduction

Neonates who are small and sick may require multiple blood transfusion when they stay in neonatal care unit (NCU) for an extended period of time. Transfusion is often based on the clinical opinion of the clinician rather than complying to the specific guidelines[1]. These neonates, particularly very preterm infants, are one of the most frequently transfused groups of patients, with the number of transfusions increasing as the gestation age decreases[2].

Over the last decade, there has been a progressive decrease in number of transfusions, though critically ill and extremely low birth weight (ELBW) neonates still have high transfusion needs[3,4,5]. The most common blood products to be administered in SSNB are PRBC [5,7].
More than 90% of ELBW infants are estimated to receive at least one packed red blood cells (PRBC) transfusion during a neonatal intensive care unit (NICU) stay [6]. On the other hand, 60% of very low birth weight (VLBW) infants will receive PRBC transfusions during a NICU stay[5].
Transfusion guidelines take several factors into account including hematocrit and hemoglobin levels, gestational age at birth and postnatal age at the time of transfusion. The clinical condition of the neonate, especially focusing on cardiorespiratory function is also put into account before transfusion[8]. Neonates with surgical conditions often need volume replacement with blood or blood products during the perioperative period[9].
A healthy infant can tolerate a drop in hemoglobin level to 7-8 g/dl as long as they remain hemodynamically stable, have a normal cardiac output and maintain adequate delivery of oxygen to the tissues[10,11]. Hence, before transfusing a neonate, balance has to be maintained between severe anemia and increasing the risk of morbidity and mortality by exposing a patient to donor blood[10].

Over the past twenty years, the safety of transfusion has greatly improved due to screening for infectious agents in donors and blood products, as well as the possibility for leukocyte depletion in RBC transfusions[12]. This has caused a decrease in concern of infection transmission during blood transfusion, shifting to non-infectious serious hazards of transfusions (NISHOTs) and with certain complications specific to premature neonates[13]. VLBW are not only exposed to metabolic alterations after receiving transfusion of various blood components containing additives, but also to infectious and immunological risks, such as Graft-versus-Host disease (GVHD) and transfusion related acute lung injury (TRALI) [14]. Transfusion associated circulatory overload (TACO) may be observed if transfusion is given in excess of more than 20 mL/kg[1]. Other multiple complications associated with transfusion in NICU include retinopathy of prematurity (ROP), bronchopulmonary dysplasia (BPD), intraventricular hemorrhage (IVH) and long-term abnormal neurodevelopmental outcomes[12,15,16,17,18].
Transfusion thresholds in neonates are controversial and mainly based on expert clinical opinion. A 2014 Cochrane review comparing lower (restrictive) versus higher (liberal) transfusion thresholds in preterm infants concluded that restrictive transfusion practices do not appear to have a significant effect but the restrictive group received fewer transfusions and lowered donor exposures than the liberal group[19,20]. Restrictive transfusion policy is still favored by many experts[21].
Appropriate transfusion of FFP in neonates is considerable uncertain reflecting the lack of evidence in this area. Multiple national audits have shown that high proportions of transfusion of FFP are given for prophylaxis [22,23,24].

The use of prophylactic FFP, including prior to surgery is of unproven benefit and uncertainty[25].
In SSNB who are bleeding and have thrombocytopenia, the use of platelet transfusions is considered appropriate. Recent trials support the use of lower platelet transfusion thresholds (25,000/µL) in preterm neonates, although data is limited to guide transfusion among more mature neonates[26]. Evidence based review of platelets noted that most studies explored the relationships between thrombocytopenia and clinical outcomes rather than the direct effects of platelet transfusions27,28. Whole blood transfusion in neonates is not a common practice and is not recommended as it can lead to volume overload as a complication[29].
It is therefore essential not only to use the most appropriate guidelines available, but also to continuously improve the protocols for blood products use in neonates [2,4]. There is also importance of reinforcing blood audit in the clinical settings [30].

Materials and methods

This is a hospital based retrospective study of neonates who were admitted in neonatal care unit and received blood transfusion at Muhimbili National Hospital

(MNH) between 1st February, 2023 to 30th April, 2023. Data were extracted from Blood transfusion book, medical records MNH and progress notes from the patient's files.

Data analysis was done using the Statistical Package for Social Sciences (SPSS) version 20.0. Descriptive statistics and a chi-square test were used. A p-value < 0.05 was considered statistically significant.

Ethical clearance

Given by the Clinical Research, Training and Consultancy MNH.

Results

We studied 125 SSNB who received 292 units of blood transfusion in the neonatal unit within three months. (Fig 1)

More than half of 125 infants received a single transfusion (69; 55.2%) and two infants were transfused more than ten times, with 22 being the highest number of transfusion products one infant received. (Fig 2)

Fig 1: Frequency and type of transfused blood product

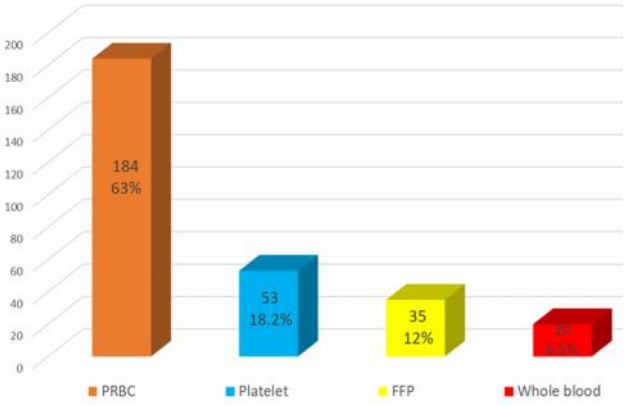

Fig 2: Frequency of transfused unit of blood per patient

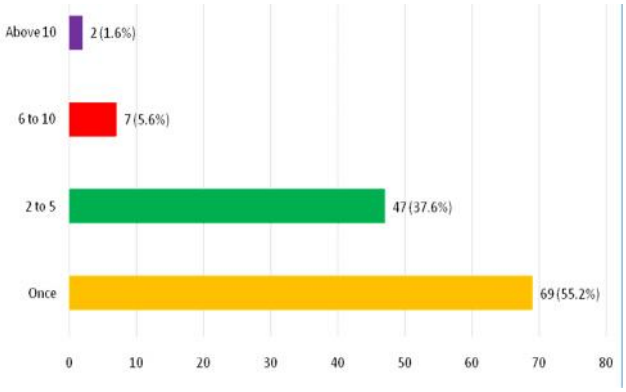

Table 1: Demographic and baseline characteristics of study participants

Characteristics	N (%)
Sex	
Male	60 (48.0)
Female	65 (52.0)
Gestational Age (weeks)	
<28 (Extreme preterm)	15 (12.0)
$28^{0/7}$ to $31^{6/7}$ (Very preterm)	49 (39.2)
$32^{0/7}$ to $33^{6/7}$ (Moderate preterm)	7 (5.6)
$34^{0/7}$ to $36^{6/7}$ (Late preterm)	25 (20.0)
≥37 (Term)	29 (23.2)
Birth weight (grams)	
<1000 (Extremely low birth weight)	24 (19.2)
1000 to <1500 (Very low birth weight)	39 (31.2)
1500 to <2500 (Low birth weight)	30 (24.0)
≥2500	32 (25.6)
Blood Group	
O Positive	53 (42.4)
A Positive	43 (34.4)
B Positive	20 (16.0)
AB Positive	6 (4.8)
Rhesus Negative	3 (2.4)
Place of delivery	
Inborn	40 (32.0)
Out born	85 (68.0)
Age at first transfusion	
0-7 days	49 (39.2)
8-28 days	60 (48.0)
>28 days	16 (12.8)
Respiratory Support	
Yes	96 (76.8)
No	29 (23.2)

Almost half of transfused SSNB had their first transfusion during the second week of life 60 (48.0%), whereby 49 (39.2%) were in the first week of life; the rest 16 (12.8%) were first transfused at three weeks' post-natal age and older.

The majority 58 (46.4%) required transfusion due to infections (Neonatal sepsis: meningitis, pneumonia and other infections), 23 (18.4%) due to acute hemorrhage (pulmonary hemorrhage, intracranial hemorrhage, gastrointestinal bleeding, Vitamin K deficiency bleeding, disseminated intravascular coagulopathy), 20 (16%) due to anemia of prematurity and 17 (14%) had no clear documentation on the cause of blood transfusion. Other reasons for transfusion were five (4%) for prophylaxis before major surgery and two (2%) ABO incompatibility (Fig 3)

Infections is the category which consumed the most PRBC, and all anemia of prematurity were transfused PRBC. Majority of platelets and FFP transfusion were due to infections and acute hemorrhage. Whole blood was only given when there was acute hemorrhage.

Fig 3: Reason for blood transfusion in Neonatal Unit

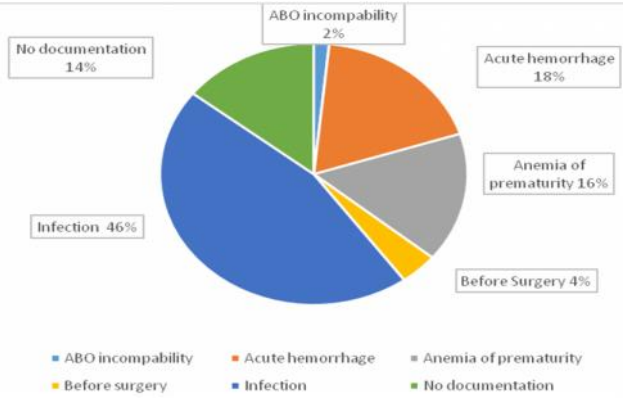

Table 2: Relationship between Gestational Age and frequency of transfusion

Gestational Age (GA)	Number of patients who were transfused				Total
	Once	2 – 5 times	6 – 10 times	Above 10 times	
< 28 (Extreme preterm)	9	6	0	0	15
31 – 28⋆ (Very preterm)	24	21	2	2	49
32 -33 (Moderate preterm)	3	4	0	0	7
34 – 36 (Late preterm)	10	10	5	0	25
*Total Preterm	46	41	7	2	96 (76.8%)
∞≥ 37 (Term)	23	6	0	0	29 (23.2%)
Total patients transfused	69	47	7	2	125

*A statistically significant correlation was found between prematurity and multiple transfusion (p = 0.024) whereby ⋆very preterm required transfusions the most. ∞No term baby was transfused more than five times.

We further assessed adherence to the available guideline for blood products transfusion threshold in the unit by analyzing only the first transfusion that each patient received. Eighty two (65.6%) infants were transfused appropriately according to the guideline and 43 (34.4%) did not adhere to the guideline available in the NCU.

Discussion

The use of blood components is common in SSNB, with decision of transfusion made by the clinician opinion rather than following the available guidelines hence, auditing of transfusion practices has become necessary.[31]

The overall instance of single transfusion was 55.2% which is comparable to Deb et al.[31] study and Butale et al.[2] study, in which 52% of participants received a single transfusion. Instances of multiple transfusions (44.8%), is comparable with 48% reported by Marti-Carvajal et al.[32,33] There was a strong relationship between prematurity and multiple transfusion (p = 0.024) in our study whereby very preterm babies were most affected. Unlike the findings in our study, in which more preterms were transfused (76.8%), Butale et al[2] found that term neonates were more often transfused.[2] This may be due to the reason that preterm neonates stay longer in our hospital, and have lower immunity, predisposing them to hospital acquired infections, anemia and hence the need of blood transfusion.

The commonest indications for blood transfusion were infections, acute haemorrhage and anemia of prematurity. This is somewhat similar to a study in 2020 by Amrutiya et al[3] in which infections were high on the list of causes for transfusing neonates. That study differed however, in that respiratory distress syndrome and neonatal hyperbilirubinemia were other major reasons for transfusion of neonates.

In general, a relatively low proportion (65.6%) of first transfusions, adhered to the guideline for transfusion threshold that was introduced and available in the NCU for a year. From observation, SSNB were transfused more basing on the clinician opinion before this guideline was kept in place . There is a need to adhere to the guidelines and reduce further unnecessary transfusions to avoid the adverse effects which come along with transfusions.

Conclusion

Premature neonates had a high rate of blood transfusion (76.8%). Majority of first transfusions were done in the second week of life (48.0%) which could be caused by hospital acquired infections, especially in the preterm population. The commonest reason for transfusion was due to infections and 82 (65.6%) infants were transfused appropriately according to the guideline in NCU.

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