



MINI REVIEW

Neonatal Blood Transfusion in Africa; Towards Optimizing Scarce Resource

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Summary

Neonatal transfusion is a common practice in Africa, where many infants are born with low birth weight and require blood transfusions. The use of paediatric packs for neonatal blood transfusions has been recommended. However, the optimal use of these packs in Africa is not clearly understood by some healthcare practitioners. This review aims to provide insights into the optimal use of paediatric packs in neonatal transfusion in Africa. The World Health Organization (WHO) recommends restrictive transfusion practices for paediatric patients, including neonates, based on expert opinion. Transfusion triggers in neonates are controversial and mainly based on expert clinical opinion, although recent randomized controlled trials of 'liberal' versus 'restrictive' red cell transfusion policies in very low birth weight preterm babies are starting to influence clinical guidelines. Many neonatal red cell transfusions are given to replace losses from frequent blood sampling. This can be reduced by avoiding non-essential tests, using low-volume sample tubes, validated near patient testing, micro-techniques in the laboratory, and non-invasive monitoring where possible. The use of CMV-seronegative blood products for transfusion in low birth weight neonates is not deemed necessary. The primary rationale is that the risk of transfusion-transmitted infections should be reduced by stringent screening of donors, restrictive transfusion practice and certain interventions like irradiation of blood units before transfusion. A recent international survey of transfusion practices for extremely premature infants showed that factors considered "very important" regarding the need to administer blood transfusions included degree of oxygen requirement and need for respiratory support. Donor exposure can also be reduced by allocating single donor units, split into paedipacks, to babies predicted to need more than one transfusion episode within the expiry date of the donation. Implementing a program to improve compliance with neonatal intensive care unit transfusion guidelines was accompanied by a reduction in transfusion rate. The implementation of guidelines to improve compliance with neonatal intensive care unit transfusion

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guidelines can also reduce the transfusion rate.

Keywords: Paedipacks, neonatal transfusion, TTIs, safety.

Introduction

Neonatal transfusions are a critical aspect of healthcare in Africa, often necessitated by conditions such as anaemia, prematurity, and neonatal jaundice. Neonatal transfusion is a common practice in Africa, where many infants are born with low birth weight and require blood transfusions. The use of paediatric packs for neonatal blood transfusions has been recommended (1,2). However, the optimal use of paediatric blood packs in these scenarios remains an ongoing concern, in most African countries, Nigeria inclusive. This review examines the current state of paediatric pack utilization in neonatal transfusions across Africa, identifies challenges, and offers potential solutions to improve the efficiency of this life-saving process.

Transfusion Triggers in Neonates

Transfusion triggers in neonates are controversial and mainly based on expert clinical opinion, although a randomized controlled trials of 'liberal' versus 'restrictive' red cell transfusion policies in very low birth weight preterm babies in United Kingdom eventually influenced clinical guidelines in that clime (3). The literature supports the use of restrictive transfusion practices in neonates (4). The global perspectives revealed that many neonatal red cell transfusions are given to replace losses from frequent blood sampling which can be reduced by avoiding non-essential tests, using low-volume sample tubes, validated near patient testing, micro-techniques in the laboratory, and non-invasive monitoring where possible (3)

However, neonatal transfusion in Africa is mainly based on expert clinical opinion, although evidence abound that most neonatal transfusions are carried out in low birth weight preterm infants treated on neonatal intensive care units (NICUs) (3)

An international survey of transfusion practices for extremely premature infants showed that factors considered "very important" regarding the need to administer blood transfusions included degree of oxygen requirement (44.7% of respondents) and need for respiratory support (44.1% of respondents) (5)

Immediate transfusion in African children with uncomplicated severe anaemia has been studied in recent years. A study conducted in 2019 showed that the triggered-transfusion strategy in the control group resulted in 60% lower blood use; however, the length of hospital stay was 20% longer (6)

Stored blood for neonatal transfusion

In the last 2 decades, it has been established that the common practice of transfusing neonates with relatively fresh red blood cells because of the increased amount of plasma potassium in stored red blood cells and decreased levels of 2,3-diphosphoglycerate (2,3-DPG) in red blood cells after extended storage; is not universally justifiable.

Literature revealed that these concerns are valid for infants receiving large-volume transfusions (>20 ml/kg) as the potassium content of stored blood when administered rapidly may be lethal for a neonatal patient. Infants receiving smaller volume transfusions (<20 ml/kg) over three or four hours, in most cases, do not require fresh red blood cells. In fact, widespread practice has demonstrated the safety of assigning a fresh red blood cell unit to a neonatal patient and using aliquots of this same unit up to its normal expiry date, depending on the anticoagulant in the blood bag, for subsequent small-volume red blood cell transfusions (7) This strategy is beneficial as it contributes to decreased donor exposure for the infant. A more recent study conducted

about a decade ago, showed that the use of fresh red blood cells compared with standard blood bank practice did not improve outcomes from major neonatal morbidities; including necrotizing enterocolitis, retinopathy of prematurity, bronchopulmonary dysplasia or intraventricular haemorrhage in premature very low-birth-weight infants requiring a transfusion (8)

Paediatric Packs

The use of paediatric packs for neonatal blood transfusions has been recommended (2) These packs contain smaller volumes of blood products, which are more appropriate for neonatal transfusions. Donor exposure can also be reduced by allocating single donor units, split into 'paedipacks', to babies predicted to need more than one transfusion episode within the expiry date of the donation

In Africa, as in many other parts of the world, paediatric blood transfusion packs are essential for treating children with various medical conditions, including anaemia, malaria, sickle cell disease, and trauma. These packs are specially designed to meet the unique needs of paediatric patients, considering their smaller size, weight, and specific medical requirements.

Some common types of paediatric blood transfusion packs that may be available in Africa are hereby highlighted.

Packed Red Blood Cells (PRBCs): PRBCs are concentrated red blood cell units that have been separated from whole blood. paediatric PRBC packs are designed to provide smaller volumes of red blood cells, typically in 50-100 ml bags, making them suitable for transfusing children.

Platelet Concentrates: Platelet transfusions are crucial for children with bleeding disorders or those undergoing chemotherapy. paediatric platelet packs contain a lower volume of platelets compared to adult packs.

Fresh Frozen Plasma (FFP): FFP is used to treat clotting disorders and replace lost blood volume. paediatric FFP packs contain age-appropriate volumes of plasma.

Cryoprecipitate: Cryoprecipitate is used to manage bleeding disorders. paediatric cryoprecipitate packs are prepared in smaller quantities to meet the needs of children.

Blood Bags with paediatric-Sized Tubing: paediatric blood transfusion packs often come with specialized tubing and filters designed for paediatric patients. These smaller-sized components ensure accurate transfusions and reduce the risk of overtransfusion.

Pathogen-Reduced Blood Products: In some regions, pathogen-reduced blood products may be available to reduce the risk of transfusion-transmitted infections. These products may also be adapted for paediatric use.

Blood Warmers: For neonates and infants, blood warmers are used to transfuse blood at the appropriate temperature to prevent complications such as hypothermia.

Blood Storage Solutions: Proper storage solutions are essential for preserving the quality of blood products during transport and storage in resource-limited settings.

It's important to note that the availability of these paediatric blood transfusion packs can vary by country, region, and healthcare facility.

There are different types of paediatric packs used for blood transfusion in Africa, and the pack type used varies depending on the availability of donor blood. The pack type used for transfusion in the Transfusion and Treatment of Severe Anaemia in African Children Trial (TRACT) was either whole blood or red cell concentrates (6,9) The distribution of pack types varies depending on the hospital, as shown in three audits

examining the distribution of pack types, haematological quality, and storage duration of donor blood used in a paediatric clinical trial of blood at four hospitals in Uganda and Malawi. One blood transfusion service in Blantyre, Malawi, has developed a new technique to split up whole blood bags into smaller packs, which is more appropriate for neonatal transfusions (10)

Paediatric Packs for Neonatal Blood Transfusions

Paediatric packs are used for neonatal blood transfusions. These packs contain smaller volumes of blood products, which are more appropriate for neonatal transfusions. Donor exposure can also be reduced by allocating single donor units, split into 'paedipacks', to babies predicted to need more than one transfusion episode within the expiry date of the donation (3,11) The use of CMV-seronegative blood products for transfusion in low birth weight neonates is not deemed necessary, given the fact that the common transfusion transmissible infections in such clime are screened for, stringently (12,13) There are different sizes of blood bags used for neonatal or paediatric transfusion, and the size of the bag used depends on the transfusion volume required. The commonly used packs ranges from 50ml to 260ml capacities, where available. One blood transfusion service in Blantyre, Malawi, has developed a new technique to split up whole blood bags into smaller packs, which is more appropriate for neonatal transfusions (14,15) In general, packed red cell concentrates are to be transfused at a dosage of 10-20 mL/kg in neonatal intensive care units (16)

Current Scenario: In many African countries, the availability of paediatric blood packs suitable for neonatal transfusions is limited. This scarcity often leads to suboptimal utilization, with health facilities resorting to dividing adult blood units, which can increase the risk of contamination and waste. Additionally, there is a lack of standardized

guidelines for the selection and administration of paediatric blood packs in some facilities.

Challenges

Several challenges contribute to the suboptimal use of paediatric blood packs in neonatal transfusions in Africa:

1. **Supply Chain Issues:** Uneven distribution and shortages of paediatric blood packs in healthcare facilities.
2. **Lack of Education:** Inadequate training among healthcare providers in neonatal transfusion techniques and proper utilization of paediatric blood packs.
3. **Cultural Beliefs:** Reluctance among some communities to accept blood transfusions, even when medically necessary.
4. **Equipment Limitations:** Insufficient availability of specialized neonatal transfusion equipment.
5. **Regulatory Barriers:** Lack of standardized protocols and regulatory frameworks for neonatal transfusions.

Potential Solutions

To address these challenges and optimize neonatal transfusions across Africa, several strategies can be considered:

1. Many neonatal red cell transfusions are given to replace losses from frequent blood sampling. This can be reduced by avoiding non-essential tests, using low-volume sample tubes, validated near patient testing, micro-techniques in the laboratory, and non-invasive monitoring where possible
2. **Strengthening Supply Chains:** Develop regional coordination mechanisms to ensure a consistent supply of paediatric blood packs to healthcare facilities.
3. **Training and Education:** Implement training programs for healthcare providers on neonatal transfusion techniques and best practices.
4. **Community Engagement:** Promote community awareness and education about the importance of neonatal transfusions, dispelling myths and

misconceptions.

5. **Neonatal Equipment Provision:** Advocate for the procurement of specialized equipment for neonatal transfusions.
6. **Standardized Guidelines:** Develop and disseminate national and regional guidelines for neonatal transfusions to ensure uniformity in practice.(Reference?)

Safety of Neonatal Transfusion

To ensure the safety of neonatal transfusion, there are several mandatory steps that need to be taken. The pre-transfusion testing required for neonates include testing for the transfusion transmissible infections. When transfusing neonates, particularly preterm infants, efforts should be made to reduce donor exposure, transfusion-transmitted infections, and transfusion-associated graft-versus-host disease. Such efforts include reducing the number of blood transfusions as much as possible, using irradiated blood components, and using single-donor units split into paedipacks. Additionally, the transfusion should be monitored closely for any adverse

reactions, and the neonate should be observed for any signs of haemolysis, sepsis, or other complications (1)

Conclusion

Optimizing the use of paediatric blood packs in neonatal transfusions is crucial to improve the survival rates and overall health outcomes of neonates across Africa. Addressing supply chain issues, enhancing healthcare provider education, engaging communities, providing specialized equipment, and implementing standardized guidelines are key steps toward achieving this goal. Collaboration among health workers is essential to overcome the challenges and ensure the optimal use of paediatric blood packs in neonatal transfusions, ultimately saving countless young lives in Africa, without compromising safety.

Conflicts of interest

There is no conflict of interest.

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