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Transfusion Practices in Pediatrics at Tengandogo University Hospital from July 1 to October 31, 2022

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Abstract

Objective: To describe the epidemiological, clinical, biological, transfusion-related, and outcome aspects of children transfused in the pediatric department of Tengandogo University Hospital. **Methods:** A prospective descriptive study was conducted from July 1 to October 31, 2022. Children aged 0 - 15 years hospitalized and receiving at least one blood transfusion were included. Data were collected from medical records and hemovigilance forms, then analyzed using SPSS® version 20.0. **Results:** Among 512 hospitalized children, 108 were transfused (21.1%). The mean age was 32.9 ± 39 months, and 84.3% were under five years old. Malaria was the leading etiology (62%). The mean hemoglobin level increased from 5.1 g/dL before transfusion to 8.1 g/dL after transfusion. Packed red blood cells (PRBCs) were used in 93.5% of cases. Most transfusions (71%) were performed within 24 hours of the request, with a mean volume of 153.5 mL. Adverse effects occurred in 5.6% of children, mainly non-hemolytic febrile reactions. Hemovigilance forms were correctly completed in 64.1% of cases, but only 41.7% were returned to the blood bank. Clinical outcomes were favorable in 54.6% of children, while 17.5% died. **Conclusion:** Blood transfusion remains a cornerstone in the management of severe pediatric anemia. Despite satisfactory hemoglobin improvement and relatively few adverse effects, transfusion delays, high mortality, and insufficient hemovigilance highlight major challenges in transfusion safety. Strengthening blood product availability, improving traceability, and establishing hemovigilance committees are priorities to optimize pediatric transfusion practices and reduce mortality.

Keywords

Blood Transfusion, Pediatrics, Transfusion Safety, Hemovigilance, Burkina

Faso

1. Introduction

Blood transfusion is an essential therapeutic procedure in pediatrics, often indispensable for child survival. It is required in various clinical situations such as severe anemia, severe malaria, hemoglobinopathies, hemorrhage, and surgical interventions. Although effective, transfusion carries risks and requires rigorous monitoring.

In sub-Saharan Africa, children represent a significant proportion of recipients. In 2018, WHO reported that out of 2,248,721 blood units transfused in 19 African countries, 466,625 (21%) concerned pediatric patients. In five of these countries, more than 30% of transfused blood was intended for children, and in Burkina Faso, this figure reached 39% [1]. Children under five years and women of childbearing age constitute the majority of recipients in low-income countries, unlike high-income countries where transfusions mainly concern individuals over 60 years [1].

The demand for blood products increases with population growth, and Africa accounts for about 60% of global transfusion needs [1]. However, blood transfusion services face many challenges: lack of voluntary donors, limited infrastructure, and weak hemovigilance coverage. In 2021, only 40% of African countries reported having a national hemovigilance system [1].

Transfusion safety relies on several pillars: rigorous donor selection, systematic screening for infectious agents (HIV, hepatitis B and C, syphilis), and close monitoring of adverse effects. In Africa, hepatitis B virus prevalence can exceed 20%, reinforcing the need for strict control [2]. In Burkina Faso, the National Blood Transfusion Center (CNTS) coordinates transfusion activities. It requires health facilities to report incidents and adverse effects, establish Transfusion Safety and Hemovigilance Committees (CSTH), and designate hemovigilance correspondents [3].

Despite these efforts, local data on pediatric transfusion practices remain limited, hindering optimization of quality and safety. This study aims to describe the epidemiological, clinical, biological, transfusion-related, and outcome characteristics of transfused children at Tengandogo University Hospital, to contribute to improving transfusion practices nationally.

2. Materials and Methods

We conducted a prospective descriptive study from July 1 to October 31, 2022, in the pediatric department of Tengandogo University Hospital (CHU-T) in Ouagadougou, Burkina Faso. The study population included all children aged 0 to 15 years hospitalized during the study period. Sampling was exhaustive. All children who received at least one blood transfusion during hospitalization, with parental

consent, were included.

Data collection was performed using structured forms completed from medical records, hospitalization registers, and transfusion documents (blood request forms and hemovigilance sheets). Variables studied included sociodemographic data (age, sex, schooling, residence), clinical and paraclinical data (diagnosis, vital signs, blood count, blood group), and transfusion-related data (type of blood product, urgency, delay in supply, quality of request, adverse effects, erythrocyte transfusion yield, completion of hemovigilance forms). A transfusion request was classified as a "vital emergency" according to institutional criteria, defined as: severe anemia with clinical decompensation (Hb < 5 g/dL with signs of shock or respiratory distress), active severe hemorrhage, or hemodynamic instability requiring immediate transfusion. These criteria were added to clarify the urgency classification used in this study.

Operational definitions included: newborn (0 - 28 days), infant (29 days-24 months), young child (2 - 5 years), older child (5 - 10 years), pre-adolescent (10 - 12 years), adolescent (12 - 15 years); urban, peri-urban, or rural residence; and vaccination status up-to-date according to the Expanded Program on Immunization.

Data entry was performed with Microsoft Excel® 2010 and analyzed using SPSS® version 20.0. Results were expressed as frequencies, percentages, means ± standard deviation. Erythrocyte transfusion yield (ETY) was calculated as:

$$\mathrm{ETY} = \frac{\mathrm{Hb}_{\mathrm{post}} - \mathrm{Hb}_{\mathrm{pre}}}{\text{transfused volume/weight}}$$

Ethical approval was obtained, and written parental consent was required for each inclusion. Patient anonymity was respected.

3. Results

3.1. Epidemiological Aspects

3.1.1. Frequency

During the study period, 108 children were transfused out of 512 admissions in the pediatric department of Tengandogo University Hospital, representing a hospital transfusion frequency of 21.09%.

3.1.2. Sociodemographic Data

The mean age of transfused children was 32.87 ± 39.04 months, ranging from 1 day to 180 months. Children under five years accounted for 84.3% of cases. Males were slightly predominant (54.6%), with a sex ratio of 1.2. Regarding residence, 44.3% lived in rural areas, 36.8% in urban areas, and 18.9% in peri-urban areas. Among school-aged children, 62% were enrolled, including 22.2% at post-primary level.

3.2. Clinical and Biological Data

The main clinical signs observed were pallor (84.5%), tachycardia (68.9%), dysp-

nea (50.5%), altered consciousness (20.4%), and hemorrhage (6.8%). Malaria was the most frequent underlying pathology, accounting for 62% of cases. Among the 19 deceased children, severe malaria with profound anemia was the primary diagnosis in 15 cases (78.9%). Other contributing comorbidities in this group included bacterial co-infection (3 cases), severe acute malnutrition (2 cases), and neonatal sepsis (2 cases).

The mean hemoglobin level before transfusion was 5.1 ± 2.8 g/dL, and 8.1 ± 2.9 g/dL after transfusion. The mean erythrocyte transfusion yield (ETY) was 1.01 ± 0.5. Before transfusion, severe microcytic normochromic anemia represented 47% of cases, while after transfusion, moderate microcytic normochromic anemia was found in 56.1% of cases. The distribution of children according to anemia type before transfusion is shown in Figure 1, and biological parameters before and after transfusion are presented in Table 1.

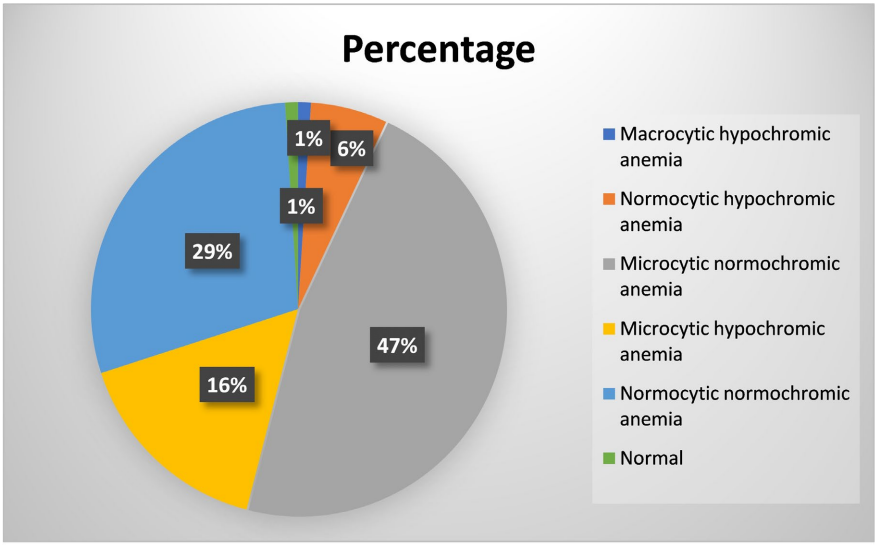

Figure 1. Distribution of children according to the type of anemia before transfusion.

Table 1. Biological parameters before and after transfusion.

Parameter	Before transfusion	After transfusion	Standard deviation
Hemoglobin (g/dL)	5.1	8.1	±2.9
MCV (fL)	82.2	81.4	±8.4
MCHC (g/dL)	32.7	32.2	±2.3
Mean ETY		1.01	±0.5

3.3. Transfusion Data

Packed red blood cells (PRBCs) were the most frequently used blood product (93.5%). Most transfusions (71%) were performed within 24 hours of the request. The mean volume of PRBC transfused was 153.5 mL, with 63.4% of bags ranging between 100 and 300 mL. In neonatology, 44.4% of transfused volumes ranged between 25 and 60 mL. The mean transfusion rate was 1.9 mL/min, with extremes

of 0.13 and 8 mL/min. The duration of transfusion was between 30 minutes and 1 hour in 40.6% of cases. The majority of children (88.4%) received a single transfusion. Figure 2 illustrates the delay between the request for blood products and the transfusion.

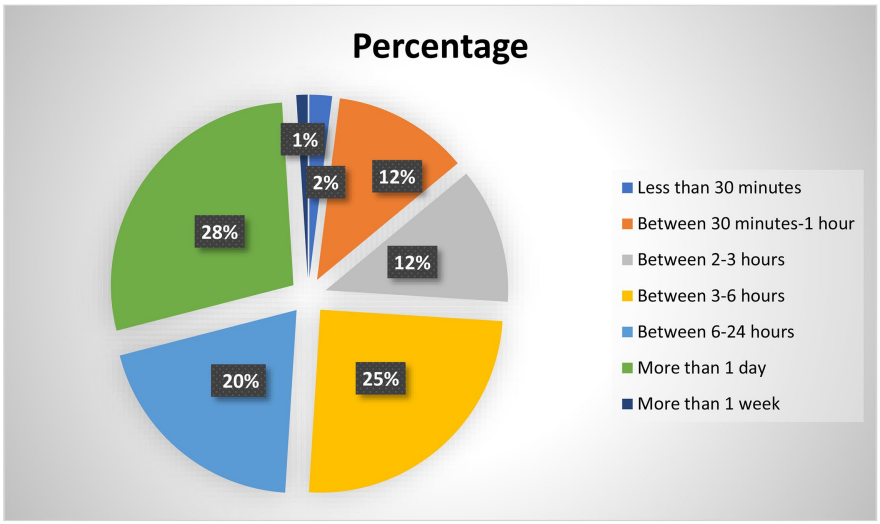

Figure 2. Delay between the request for labile blood products and transfusion.

3.4. Blood Groups

Blood group B Rh^+ was the most frequent among transfused children (32.4%), followed by group O Rh^+ (29.6%). In neonates under 28 days (n = 18), group O Rh^+ predominated (33.3%). Among mothers of children under four months (n = 23), blood group O Rh^+ was also the most represented (34.8%), followed by groups O Rh^- and B Rh^+ (21.7% each), A Rh^+ (13%), then AB Rh^+ and B Rh^- (4.3% each).

3.5. Transfusion Safety

Per-transfusion incidents were observed in 2% of cases. Adverse effects occurred in 5.6% of children, mainly fever/chills (83.3%) and dark urine (16.7%). Hemovigilance forms were correctly completed in 64.1% of cases, but only 41.7% were returned to the blood bank. Blood request forms were compliant in 88.5% of cases.

3.6. Clinical Outcomes

After transfusion, mucosal coloration was normal in 60.8% of children, while 39.2% still presented pallor. Among children with persistent signs of decompensation, tachycardia was found in 70% of cases and dyspnea in 30%. Clinical outcomes were favorable in 59 children (54.6%), 29 (26.8%) were still hospitalized, 1 (0.9%) had discharged against medical advice, and 19 (17.5%) died.

4. Discussion

4.1. Study Limitations

The main limitations of this study lie in its short duration, monocentric nature,

and the absence of multivariate analysis to identify predictive factors of poor outcomes. Furthermore, the absence of a hemovigilance committee in the department limited post-transfusion traceability. Additionally, the study was conducted from July to October, corresponding to the peak malaria transmission season in Burkina Faso, which may have increased the number of transfusions and the predominance of malaria-related anemia. This seasonal concentration limits the generalizability of the findings to other periods of the year. Despite these limitations, this study provided an overview of transfusion practices in our working context.

4.2. Frequency of Blood Transfusions

The high frequency of pediatric transfusions (21.09%) observed in this study is consistent with trends widely reported in sub-Saharan Africa, where the high prevalence of severe malaria-related anemia, delayed consultations, limited transfusion coverage in peripheral health facilities, and concentration of resources in urban centers make blood transfusion both frequent and indispensable in hospitals [1] [4]-[7].

4.3. Sociodemographic Characteristics

The predominance of children under five years (84.3%) among transfused patients may be explained by the high incidence of severe malaria in this age group, as confirmed by data from the Ministry of Health of Burkina Faso [5]. Male sex accounted for more than half of recipients (54.6%), a trend also observed in Porto-Novo (55.7%) [4] and Antananarivo (51.2%) [8]. This predominance may reflect increased vulnerability of boys to severe anemia, particularly in malaria contexts, as well as sociocultural factors favoring healthcare access for male children [4]. The majority of transfused children resided in rural areas (44.3%), reflecting difficulties in blood product supply in peripheral districts, leading to referrals to urban centers [5].

4.4. Clinical Data

The most frequent clinical signs were pallor, tachycardia, and dyspnea, indicating anemia decompensation, often associated with malaria. These manifestations reflect tissue hypoxia secondary to reduced oxygen transport. Severe signs such as altered consciousness (20.4%) and hemorrhage (6.8%) were also observed. These results are comparable to those reported by Ba *et al.* in Bamako, where pallor and dyspnea were among the main clinical signs in transfused children [7]. Hemorrhage may be linked to emerging pathologies such as dengue, increasingly frequent in Burkina Faso [9], due to its ability to induce thrombocytopenia and increased vascular permeability.

4.5. Biological Data

The mean increase in hemoglobin after transfusion was satisfactory, rising from 5.1 g/dL to 8.1 g/dL. The relatively low ETY (1.01 ± 0.5) may reflect prolonged

administration delays, hemolysis associated with infections, or factors affecting the quality of blood products, such as storage duration, cold-chain interruptions, or variations in donor hematocrit. This hemoglobin gain meets clinical objectives, particularly exceeding the critical threshold of 7 g/dL. These values are close to those reported in Kinshasa (5.8 g/dL and 8.6 g/dL) [10], suggesting homogeneity of transfusion practices in African hospitals. Microcytic normochromic anemia was the most frequent form before transfusion (47%) and persisted in 56.1% of cases after transfusion. This profile suggests iron deficiency, justifying iron supplementation alongside transfusion in our context. It may also reflect inflammation related to infections.

4.6. Transfusion Data

PRBCs were the most prescribed blood product (93.5%), consistent with national recommendations and practices in most sub-Saharan countries for managing malaria-related anemia [3] [7]. The transfused volume was generally adapted to children's weight, with 63.4% of bags ranging between 100 and 300 mL. The mean transfusion rate was 1.9 mL/min, slightly below national guidelines recommending initiation between 2 and 3 mL/min [3].

The mention "vital emergency" appeared on 71.3% of blood request forms, yet 27.9% of transfusions were performed beyond 24 hours. This delay highlights persistent tensions in blood product supply, particularly during peak demand such as malaria season. This situation is corroborated by the ACTRAN report on transfusion chains in West Africa [6], which emphasizes structural and organizational constraints affecting transfusion responsiveness.

4.7. Blood Groups

Group B Rh^+ was the most frequent among transfused children (32.4%), followed by group O Rh^+ (29.6%). In neonates under 28 days, group O Rh^+ predominated (33.3%), as did in mothers of children under four months (34.8%). These distributions are similar to those reported by Ba *et al.* in Bamako, where group O Rh^+ was also predominant among transfused children [7]. The predominance of groups B and O in West Africa reflects regional genetic distribution, where group O is historically the most frequent in sub-Saharan populations. The concordance between neonates and their mothers can be explained by hereditary transmission of ABO and Rh antigens, well documented in immunohematology literature [11].

4.8. Transfusion Safety

Transfusion safety data show that reported incidents were infrequent but likely underreported, given the insufficient completion (64.1%) and return (41.7%) of hemovigilance forms. Immediate adverse effects occurred in 5.6% of children, mainly non-hemolytic febrile reactions (fever and chills). These results are consistent with those reported by Rakotoarisoa *et al.* in Madagascar, where 85.3% of adverse effects were febrile [9]. The absence of extended phenotyping and system-

atic screening for irregular antibodies may contribute to these reactions, favoring minor incompatibilities undetected during pre-transfusion checks. Establishing a CSTH in the department would be essential to improve traceability and systematic analysis of adverse events.

4.9. Clinical Outcomes

Post-transfusion outcomes were favorable in 54.6% of children, while 26.8% were still hospitalized at the end of the study. One child (0.9%) had absconded, and 19 (17.5%) died. The high mortality rate is concerning, markedly higher than that reported in Kinshasa, where Mbuyi *et al.* observed a mortality rate of 1.6% among transfused children [10]. This may be explained by the severity of initial clinical presentations (severe malaria, profound anemia), delays in transfusion supply, and the presence of severe comorbidities such as severe sepsis, severe acute malnutrition, and bacterial co-infection.

5. Conclusion

Blood transfusion remains a cornerstone in the management of severe pediatric anemia at Tengandogo University Hospital. While clinical efficacy is generally satisfactory with few adverse effects, transfusion delays, high mortality, and insufficient hemovigilance reveal major challenges in transfusion safety. Malaria remains the leading cause of anemia. Improving blood product availability, strengthening hemovigilance through staff training and simplified procedures, and establishing a functional hemovigilance committee are essential to optimize transfusion practices and reduce mortality.

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Conflicts of Interest

The authors declare no conflicts of interest.

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