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Research Article

Epidemiology of Blood Transfusion in Children in the Democratic Republic of Congo

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ABSTRACT

Blood transfusion remains an essential practice in pediatrics, particularly in countries with a high prevalence of infectious diseases and severe anemia. This study aims to present the epidemiological profile of children transfused in hospitals in the Democratic Republic of Congo.

This is a retrospective, cross-sectional, multicenter study conducted on 2,097 children admitted to hospitalization between 2019 and 2021 in 5 hospitals in the DRC. We collected 753 cases who received at least one blood transfusion.

The results found show that the frequency of transfusions is 35.9%. The male gender is the most represented with 53.5%. The average age is 4 years and 64.5% of transfused children are under 5 years old. Three peaks in transfusion frequency were observed, notably April-May, July and December-January. Nearly 80% of children were on their first transfusion and 5.7% had known sickle cell disease. The main indications for transfusion are malaria (76.8%), sepsis (65.9%) and anemia (62.7%). Whole blood is the blood product transfused in 65.6% of cases. Mortality among transfused children is 8.2%.

The popularization of international and national standards in terms of transfusion practices, early programming of the collection of blood products according to peak needs and the establishment of blood processing means for the production of diversified blood products will help to optimize the benefit of transfusion in Congolese children.

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KEYWORDS

Transfusion practices; Child; Hemapheresis; DRC

INTRODUCTION

Blood transfusion is a therapeutic act that saves lives and improves the health of patients [1]. Its frequency varies greatly depending on the parameters that can be taken into account for its determination. Large variations are observed depending on the regions, age and clinical conditions of the patients [1]. The use of transfusion is frequent and constantly increasing [2,3]. In low-income countries, more than 60% of blood transfusions are administered to the pediatric population under conditions of poor compliance with established and revised standards of good transfusion practice [1-3].

Like any therapy, the implementation of transfusion requires the evaluation of the benefit/risk balance. This balance is the basis for the definition and constant revision of standards and recommendations regarding transfusion practices in all categories of patients [2]. Poor transfusion practices have many harmful effects, even making the transfusion act a danger to the health of patients [1].

Many children in resource-limited countries require blood transfusions but do not receive them due to lack of availability. Meanwhile, a significant number of unnecessary transfusions occur in the same areas. This unnecessarily exposes children to the risk of serious adverse transfusion reactions and transfusion-transmissible infections, and also reduces the availability of blood products for patients who need them [1].

To develop strategies that are contextualized in each setting and meet the constraints of good transfusion practice in children, it is necessary to know the transfusion needs as well as the profile of children transfused in said setting. It appears that few recent studies exist on the epidemiology of blood transfusion in children in hospitals in the Democratic Republic of Congo. The objective of this study is to present the epidemiological profile of children transfused in hospitals in the Democratic Republic of Congo.

ENVIRONMENT, PATIENTS AND METHODS

Environment

The study was conducted in five reference health facilities in the Democratic Republic of Congo. These facilities are located in four different cities across the country and offer specialized pediatric care. These facilities are:

- Centre hospitalier universitaire Renaissance à Kinshasa
- Hôpital Kimbanguiste de Kimbanseke à Kinshasa
- Cliniques universitaires de Lubumbashi à Lubumbashi
- Hôpital Général de Référence de Makiso à Kisangani
- Hôpital Général de Référence de Kindu à Kindu

From a climatic point of view, the DRC is a country crossed by the equator and dominated by the tropical climate which translates into two main seasons: a dry season (or "Congolese winter") and a rainy season. The dry season generally extends from June to August, while the rainy season extends from September to May for the part located south of the equator. North of the equator, on the other hand, the dry season runs from December to May and the rainy season from May to November [4].

Patients

We collected 753 records of children hospitalized in the pediatric department of the health facilities targeted by the study and who received at least one blood transfusion during their hospital stay. The total number of usable records of children admitted during our study period is 2,097. We retained the age of inclusion from 1 month to 20 years according to the WHO pediatric age reference [5]. Newborns were excluded from this study, including children admitted to severe acute malnutrition units.

METHODS

Type and Period

This study is a multicenter, cross-sectional and retrospective analysis of cases of blood transfusion performed in pediatrics from 2019 to 2021 in health facilities that provided pediatric morbidity data to the Disease Prevention and Control Unit of the University of Kindu.

Study Variables

The variables of interest for this study are age, sex, month of admission, morbidity, transfusion history, admission diagnosis, transfused blood product, post-transfusion outcome.

Data collection and Processing

The data presented in this study were extracted from the database of the Disease Prevention and Control Unit of the University of Kindu. They were processed using SPSS version 25 and Microsoft Excel version 2017 software.

Data Analysis

The determination of proportions and trend measurements, including means and standard deviations, are the main analyses performed. The calculation of the weighted percentage was carried out by the ratio of transfused cases to the total admissions of each category of the variable studied.

Ethical Considerations

This study was approved by the Ethics Committee of the Faculty of Medicine, University of Kindu. We used the database of the Disease Prevention and Control Unit, University of Kindu. Data processing was carried out in accordance with current ethical and regulatory standards.

RESULTS

The collected data show that 753 children were transfused out of the 2097 admitted during the study period, a frequency of 35.9%. Males represented 53.5% and the average age of transfused children was 4 years. More than half of transfused children (64.5%) were in the under 5 age group. By weighting, children aged 5 to 10 years were the most likely to have required a transfusion, representing 42.8% of all hospitalized patients in this age group. They are followed by those under 5 years (36.7%). This information is presented in Table 1.

Variables	Transfused (n=753)	Admissions (n=2097)	Percentage	Weighted percentage
Age				
< 5 years	486	1323	64.5	36.7
5 to 10 years	195	456	25.9	42.8
11 to 15 years	60	247	8.0	24.3
16 to 20 years	12	71	1.6	16.9
Sex				
Female	350	981	46.5	35.7
Male	403	1116	53.5	36.1

Table 1: Age and sex of transfused children.

Month	Transfused	Admissions	Percentage (n=753)	Weighted percentage
January	83	210	11.0	39.5
February	47	152	6.2	30.9
March	40	157	5.3	25.5
April	91	211	12.1	43.1
May	93	252	12.4	36.9
June	55	157	7.3	35.0
July	80	156	10.6	51.3
August	48	152	6.4	31.6
September	40	131	5.3	30.5
October	43	171	5.7	25.1
November	43	110	5.7	39.1
Décember	90	238	12.0	37.8
Total	**753**	**2097**	**100.0**	**35.9**

Table 2: Monthly distribution of transfused cases.

The analysis of the monthly data in Table 2 indicates three peaks in the frequency of the number of children transfused. The first peak is observed from April to May, the second in July and the last from December to January. However, the monthly weighting indicates that July is the month with the highest number of children being transfused among all admissions in that month, a weighted percentage of 51.3%.

Variables	Number (n=753)	Perrcentage
Known morbid terrain		
Sickle cell disease	43	5.7
Malnutrition	18	2.4
Bronchial asthma	8	1.1
Tuberculosis	3	0.4
HIV	2	0.3
Transfusion history		
Absent	603	80.1
Present	150	19.9

Table 3: Morbidity and transfusion history of transfused children

Eighty percent of transfused children were on their first transfusion and 5.7% of them had known sickle cell disease as shown in Table 3.

Variables	Number (n=753)	Percentage
Admission diagnosis		
Malaria	578	76.8
Septicemia/Sepsis	496	65.9
Anemia	472	62.7
Others	262	34.8
Transfused blood product		
Red blood cell count	259	34.4
Whole blood	494	65.6
Post-transfusion outcome		
Clinical improvement	674	89.5
Transfer	17	2.3
Death	62	8.2

Table 4: Admission diagnosis, transfused blood product, post-transfusion outcome.

Table 4 shows that three main diagnoses were associated with the indication for transfusion: malaria (76.8%), sepsis (65.9%) and anemia (62.7%). The most commonly transfused blood product was whole blood in 65.6% of children. Clinical improvement was observed in 89.5% of transfused children and 8.2% of transfused children died.

DISCUSSION

The data collected in our study reveal that 753 children were transfused out of a total of 2,097 pediatric admissions, a frequency of 35.9%. Our observation is similar to that of Padonou and Agbeille in Benin which reported 40% and 35% respectively [3,6]. It also corroborates that of Kiguli et al who reported 45% in their series [7]. Our frequency appears high according to recent results from numerous authors, notably Mimbila and Demaret, who found a transfusion frequency of 17.1% respectively in Gabon and Canada [8,9], Traoré, known as Niambélé, and Simaga separately reported a frequency of 8% and 29% in Mali [10,11]. The differences in frequency between studies may be related to the specificities of transfusion practices, the profile of pediatric morbidity in each region, and the positioning of the health facility on the healthcare pyramid. In relation to the latter, the health facilities that provided the data for this study are reference hospitals. Nevertheless, the high frequency observed in our study should raise questions about the quality of transfusion practices in our country.

Males accounted for 53.5% of the transfused children in our study. These results are consistent with those reported by several authors. Indeed, Simaga et al. [11] in Mali observed a male predominance of 58% among transfused children; Fukiau et al. [12] in Kinshasa reported a male proportion of 53%; Padonou et al. [3] reported 55.7% of boys among transfused children. These results suggest a general trend of male predominance in pediatric hospital morbidity [13].

The average age of the children transfused in our study was 4 years, and 64.5% were under 5 years old. However, by weighting, children aged 5 to 10 years were those who required a transfusion the most, representing 42.8% of all admissions in the age group. Our results are similar to those of other studies, notably those conducted by Fukiau in Kinshasa, Padonou in Benin, Mimbila in Gabon [3,8,12]. These figures corroborate the arguments of the WHO, which estimates that in low-income countries, children under 5 years of age are the most transfused compared to other age groups. They are estimated to consume up to 54% of all blood transfusions performed in these regions [1]. Research should be conducted to explore the reasons for the high need for transfusion in children aged 5 to 10 years in our setting by weighting.

Analysis of monthly data reveals three significant peaks in the number of children transfused. These are April to May, July, and December to January. July recorded the highest weighted proportion of children transfused, accounting for 51.3% of the month's admissions. July falls within the dry season in the DRC, while the other months with peaks in the number of transfusions fall within the rainy season [4]. For the latter, our observations

corroborate those of Niambélé in Mali who observed a high frequency of transfusions during the rainy season and attributable to the peak of malaria [10]. These data can be superimposed on the peaks of anemia cases observed in April, May and December in a study that we conducted on this same study population [14]. These periods also correspond to an increase in the incidence of pediatric admissions in the hospitals selected for our study [13]. However, the weighted peak observed in July can be explained by the certain existence of other causes of anemia in children apart from malaria, which can see their prevalence increase during the dry season [15]. This is the case for certain winter septic conditions and hemoglobinopathies, the attacks of which can worsen during the dry season. Further study is needed to substantiate this evidence.

In our series, 80% of transfused children are on their first transfusion. The notion of transfusion history has been reported in the pediatric population in the DRC at a rate of 15% [13]. Among anemic children, transfusion history is reported by Amuri and Essola respectively at 14% and 26.3% [14,16]. The frequency of transfusion history observed in our series, 20%, is higher than the 6.5% reported by Fukiau [12]. This observation would be linked to an increasingly increasing, and sometimes dispensable, use of blood products in the treatment of morbid conditions in children. The presence of a history of transfusion in the child who is a candidate for a new transfusion requires a thorough analysis of the risk of immediate or delayed transfusion accident.

The main indications for transfusion in our study were malaria (76.8%), sepsis (65.9%) and anemia (62.7%). These results are consistent with those reported in several studies in sub-Saharan Africa, which highlight the predominant role of malaria and sepsis in pediatric transfusion needs [3,8,12,17]. Sarah Kiguli et al conducted a clinical trial in East Africa in which they found that 76% of children hospitalized with severe febrile illness (mainly malaria and sepsis) had anemia and 45% of them received a transfusion [7]. According to the WHO, the main indications for blood transfusion in the pediatric population are linked to situations of severe anemia, acute blood loss, or specific diseases.

Whole blood was the most commonly transfused blood product in our study, accounting for 65.6% of cases. This result is different from those reported by other authors for whom whole blood was used very little in transfusions performed precisely in the order of 2% in Benin and 30% in a previous study carried out in Kinshasa [3,12]. Whole blood was the primary blood product used with 84.5 in Chelo's series which further found that whole blood use was a risk factor for death in transfused children [18]. The findings in our series reflect poor compliance with the required standards in terms of the choice of blood product to be transfused [1]. This may be due to the unavailability of means of separating blood into its other labile products. The WHO believes that blood can be used more efficiently if it is separated into its components such as red blood cell concentrates, platelet concentrates, plasma and cryoprecipitate. This separation can thus allow a good response to the needs of several patients and minimize the occurrence of certain transfusion accidents [1]. Chelo et al. in Cameroon, found that whole blood transfusion was among the factors significantly associated with post-transfusion death [18]. It is imperative to strengthen the

technical and logistical capacities of blood banks across the country to optimize the quality of transfusion care in general and pediatrics in particular.

Mortality among transfused children in our study was 8.2%. Our result is slightly higher than those found by Sarah Kiguli and Fukiau, which were 4% and 1.6% respectively [7,12]. On the other hand, in the Chelo series, post-transfusion mortality reaching 25.5% was reported [18]. Many factors have been reported in the literature as potentially contributing to the occurrence of death in children following transfusion. These factors include inadequate treatment of the underlying pathology, transfusion of whole blood, limited availability of blood products for transfusion, and serious transfusion accidents [12,18]. An in-depth analysis of mortality factors among children transfused in our country remains an avenue to explore.

CONCLUSION

This study shows that transfusion use in pediatric care remains high. Peaks in transfusion needs occur throughout the year. Whole blood is the most widely used product, despite its immunological risks. To optimize the benefits of transfusion in children, the authors recommend the dissemination of international and national standards for transfusion practices, the advance scheduling of blood product collections based on peak needs, and the implementation of blood processing facilities for the production of diverse blood products. The authors recommend also conducting numerous future studies that will allow for ongoing exploration of national specificities in pediatric transfusion practices.

CONFLICTS OF INTEREST

The authors do not acknowledge any existing competition regarding their participation in this study.

AUTHORS' CONTRIBUTION

Amuri K.P conducted the literature review and drafted the manuscript. Abdala K.A designed the study, supervised the collection, performed the analyses and wrote it up. Shindano M.E supervised all stages of the study. All authors reviewed and approved the final version.

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