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Symptoms of acute transfusion reactions at a general referral hospital in Kinshasa, Democratic Republic of Congo: a cross-sectional study

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ABSTRACT

Objectives Blood transfusion is a life-saving procedure and is also associated with a range of risks including the occurrence of symptoms of acute transfusion reactions (ATRs). Very few studies in sub-Saharan Africa have reported on ATRs. The present study addresses this gap in the literature by documenting the prevalence of and factors associated with ATRs in the Democratic Republic of Congo (DRC).

Design This is a cross-sectional descriptive and analytical study using blood bank data from a general referral hospital.

Setting Centre Hospitalier Mère-Enfant (CHME) Monkole, a general referral hospital in Kinshasa, DRC.

Participants General population who have received blood transfusion in CHME Monkole between 2014 and 2019.

Results The data set included a total of 7166 patients; 3153 (44%) men and 4013 (56%) women. The overall prevalence of symptoms of ATRs was 2.6%; the lowest prevalence was in 2017 (2.34%) and highest in 2018 (2.95%) and 2019 (2.94%). The documented symptoms included 74 (39.6%) cases of dyspnoea/respiratory distress, 60 (32.1%) cases of fever, 36 (19.2%) cases of pruritus/urticaria and 17 (9.1%) cases of vomiting. None of the studied factors was associated with symptoms of ATRs.

Conclusion Symptoms of ATRs were not uncommon in the studied population. Dyspnoea and respiratory distress, fever and pruritus/urticaria were the most common symptoms of ATRs. This study highlights the need for a clinical and biological surveillance to detect, prevent and manage ATRs in the context of the DRC.

Strengths and limitations of this study

- This study is one of the few to report on the prevalence of acute transfusion reactions in the Democratic Republic of Congo (DRC).
- The present study is the largest in the DRC in terms of its sample size.
- One of the limitations of this study is that it is based on clinical record data which were not primarily collected for research purpose.
- The results of this study are based on data from a single hospital in Kinshasa; henceforth, the findings cannot be generalised in the whole Kinshasa.

INTRODUCTION

Blood transfusion is one of the most common and life-saving procedures in hospital settings, but it is also associated with a wide range of risks of diverse degrees of severity. These include mainly infectious, haemodynamic, immunological and metabolic complications.[1–3] Most high-income countries have set up surveillance systems to monitor and detect serious adverse events or reaction associated with blood transfusion as part of the national haemovigilance systems.[4–6] However, haemovigilance systems remain absent or poorly developed in sub-Saharan Africa (SSA), with the exception of few countries such as South Africa.[4 7] In most countries in SSA, haemovigilance activities are performed within individual hospitals or clinical settings.[4 7]

While policies, programmes and research related to blood transfusion safety in SSA have largely focused on reducing the transmission risk of HIV and other infectious pathogens since the 1980s[8–11]; there has been a less pronounced attention to other transfusion-related adverse events or reactions such as the acute transfusion reactions (ATRs). ATRs are defined as adverse events associated with transfusion that occur within 24 hours of the transfusion, with most occurring during or within 4 hours of a transfusion.[12 13] ATRs encompass a range of reactions including but not limited to acute haemolytic reactions, allergic reactions, febrile non-haemolytic reaction (FNHTR), transfusion-associated circulatory overload and transfusion-associated dyspnoea.[12 13] Symptoms of ATRs include but are not limited to fever, urticaria,

itching, headache, chills or anaphylactic reactions that occur during or following a blood transfusion.[14–16]

Studies reporting on the prevalence of ATRs are remarkably few in SSA, with prevalence ranging from less than 1% to as high as 60% among the published literature.[12 13 17–25] In the Democratic Republic of Congo (DRC), the setting of the present study, two previous studies have documented ATRs prevalence of 1.8%[24] and 2.9%[25]; both studies conducted in Kinshasa respectively in 2004 and 2015. The present study leverage data from the blood bank of a general referral care hospital to document the prevalence of, as well as, possible factors associated with, symptoms of ATRs in the DRC.

METHOD

Design and study setting

This is a cross-sectional descriptive and analytical study using blood bank data collected from 2014 to 2019 at the Centre Hospitalier Mère-Enfant (CHME) Monkole. The CHME Monkole is located in Mont-Ngafula, a western township of the capital city Kinshasa which is home to around 500 000 population. The hospital however attracts populations from all other health zones of Kinshasa. The hospital currently has a bed capacity of 110 beds, and is structured around the following services: (1) medical services (department of obstetrics and gynaecology, surgery, paediatrics, internal medicine, intensive care unit and outpatient department); (2) diagnostic and treatment services (pharmacy, medical imaging, clinical biology and pathology, blood bank, medical oxygen manufacturing unit) and (3) administrative and basic services.[26] The CHME Monkole operates on a hospital information management system allowing electronic retrieval of the medical and administrative data.

Patient and public involvement

It was not possible to involve patients or the public in the design, or conduct, or reporting, or dissemination plans of our research given that this study is based on a secondary data analysis.

Study variables

The data set included anonymised records of the blood bank data and was automatically retrieved from the electronic medical record of the hospital. All the individuals having received blood transfusion within the specified period were included in the study. The outcome of interest was symptoms of ATRs (defined as the occurrence of the following symptoms within 24 hours of the transfusion: pruritus, urticaria, fever, dyspnoea/respiratory distress, vomiting). The covariates consisted of: (1) age, (2) sex and (3) socioeconomic category (this is an in-house categorisation of the patients' economic level for billing purposes. Category A: low; category B: medium; and category C: above average); type of blood transfusion (whole blood, packed cell, fresh frozen plasma, platelet rich plasma); donor/recipient blood group (A+, A–, B+, B–, AB+, AB–, O+, O–); and history of previous transfusion.

Statistical analysis

The analysis was performed using SPSS (PASW) for Windows V.17.0. Univariate analysis was conducted to obtain descriptive statistics of all the variables. Logistic regression was performed to assess the association of selected variables (age, sex, socioeconomic level, type of transfusion, history of transfusion, number of transfusion and year of transfusion) with ATRs. Statistical significance level was considered at $p<0.05$.

RESULTS

Characteristics of participants

The data set included a total of 7166 patients, including 3153 men (44%) and 4013 women (56%). Slightly over half of the sample were classified in the 'hospital category A', meaning they were relatively of low socioeconomic status (table 1). As shown in table 2, 29.2% of patients were located in Mont-Ngafula township, the setting of the CHME Monkole, while the remaining patients were from diverse townships of Kinshasa such as Ngaliema (1039, 14.5%), Kisenso (993, 13.9%), Selembao (963, 13.4%), Lemba (386, 5.4%), Makala (361, 5%), Kimbaseke (265, 3.7%) and Limete (223, 3.1%). Online supplemental figure 1 displays the number of patients in townships of Kinshasa city.

Symptoms of ATRs

From 2014 to 2019, 7166 blood transfusion were performed, of which 4660 (65.1%) were packed red cell transfusions, 2053 (28.7%) whole blood transfusions, 3318 (4.7%) transfusion of platelet rich plasma and 111 (1.5%) transfusion of fresh frozen plasma (table 1). There were in total 187 (2.6%) cases with symptoms of ATRs, including 74 (39.6%) cases of dyspnoea/respiratory distress, 60 (32.1%) cases of fever, 36 (19.2%) cases of pruritus/urticaria and 17 (9.1%) cases of vomiting. The lowest prevalence was in 2017 (2.34%) and highest in 2018 (2.95%) and 2019 (2.94%) (table 3). None of the variables included in the analysis was significantly associated with symptoms of ATRs (table 4).

DISCUSSION

The current descriptive study is one of the few that examines the prevalence of symptoms of ATRs in the DRC. We found a relatively low prevalence of symptoms of ATRs (2.6%) over the period from 2014 to 2019; with the lowest prevalence documented in 2017 (2.34%) and the highest in 2018 (2.95%). Our findings concur with results from two previous studies in Kinshasa showing low prevalence of symptoms of ATRs in Kinshasa; 1.8% and 2.9%, respectively, in 2004[24] and in 2015.[25] Other studies in SSA have instead reported on diagnosis, rather than of symptoms of ATRs.[12 13 17–23] Prevalence rates of ATRs have ranged

Table 1 Characteristics of participants and transfusion-related information

	Symptoms of acute transfusion reactions			
	Yes	No		
	n (%)	n (%)	Total	P value
Sex				0.907
Male	81 (2.6)	3072 (97.4)	3153 (100)	
Female	106 (2.6)	3907 (97.4)	4013 (100)	
Age				0.343
(Mean=31.8; SD=23.5)				
0–4	30 (2.3)	1280 (97.7)	1310 (100)	
5–14	31 (3.6)	825 (96.4)	856 (100)	
15–24	24 (2.9)	790 (97.1)	814 (100)	
25–39	40 (2.6)	1505 (97.4)	1545 (100)	
40–64	47 (2.5)	1835 (97.5)	1882 (100)	
≥65	15 (2)	744 (98)	759 (100)	
Socioeconomic level				0.982
A (low)	104 (2.6)	3918 (97.4)	4022 (100)	
B (medium)	75 (2.6)	2778 (97.4)	2853 (100)	
C (above average)	8 (2.7)	283 (97.3)	291 (100)	
Type of transfusion				0.943
Whole blood	56 (2.7)	1997 (97.3)	2053 (100)	
Packed cell	118 (2.5)	4542 (97.5)	4660 (100)	
Fresh frozen plasma	3 (2.7)	108 (97.3)	111 (100)	
Platelet rich plasma	10 (3)	328 (97)	338 (100)	
Donor blood group				0.743
A+	39 (2.5)	1499 (97.5)	1538 (100)	
A–	0 (0)	34 (100)	34 (100)	
B+	34 (2.8)	1182 (97.2)	1216 (100)	
B–	0 (0)	29 (100)	29 (100)	
AB+	5 (1.8)	269 (98.2)	274 (100)	
AB–	0 (0)	4 (100)	4 (100)	
O+	106 (2.8)	3745 (97.2)	3851 (100)	
O–	3 (1.4)	217 (98.6)	220 (100)	
Recipient blood group				0.227
A+	43 (2.5)	1668 (97.5)	1711 (100)	
A–	0 (0)	44 (100)	44 (100)	
B+	36 (2.5)	1383 (97.5)	1419 (100)	
B–	0 (0)	38 (100)	38 (100)	
AB+	4 (1.1)	365 (98.9)	369 (100)	
AB–	1 (10)	9 (90)	10 (100)	
O+	100 (2.9)	3323 (97.1)	3423 (100)	
O–	3 (2)	149 (98)	152 (100)	
History of transfusion				0.143
No	57 (2.2)	2510 (97.8)	2567 (100)	
Yes	130 (2.8)	4469 (97.2)	4599 (100)	
Number of transfusion				0.449
1	57 (2.2)	2510 (97.8)	2567 (100)	
2	58 (2.9)	1914 (97.1)	1972 (100)	

Continued

Table 1 Continued

	Symptoms of acute transfusion reactions			
	Yes	No		
	n (%)	n (%)	Total	P value
3	27 (2.6)	1002 (97.4)	1029 (100)	
≥4	45 (2.8)	1553 (97.2)	1598 (100)	
Year of transfusion				0.907
2014	23 (2.8)	806 (97.2)	829 (100)	
2015	34 (2.5)	1350 (97.5)	1384 (100)	
2016	40 (2.5)	1556 (97.5)	1596 (100)	
2017	35 (2.3)	1458 (97.7)	1493 (100)	
2018	33 (3)	1085 (97)	1118 (100)	
2019	22 (2.9)	724 (97.1)	746 (100)	

from 0.6% in a regional referral hospital in Uganda[21] to approximately 60% in a prospective study conducted from 1994 to 1998 in a teaching hospital in Cameroon.[23] A significant limitation of the current studies on ATRs in SSA is that most are largely based on fragmented data from individual or limited number of hospital setting and often use different definitions for ATRs. National haemovigilance systems need to be put in place by countries so as to capture national-level and subnational-level data on ATRs. To date, only few countries such as South Africa, Namibia and Rwanda have set up haemovigilance systems.[4]

In our study, dyspnoea and respiratory distress (39.6%) were the most common symptoms of ATRs, followed by fever (32.1%) and pruritus/urticaria (19.2%). This concurs with findings reported by Mulumba *et al*[24] and Nshimba *et al*.[25] For example, pruritus/urticaria represented 40% of symptoms of ATRs in the study by Nshimba *et al* and 27% in Mulumba *et al*. Similarly, fever accounted for 40% of symptoms in the study by Mulumba *et al*. FNHTRs appear to be one of the most common ATRs in SSA, accounting for 29%–91% of ATRs.[12 13 17–19 22 23] These proportions are higher than those reported in industrialised countries and could in part be explained by high presence of risk factors such as previous transfusions and pregnancies (recipients' antibodies reacting to donor antigens), transfusion of blood units without prestorage leucoreduction and non-adherence to temperature control for the storage and transport of blood units leading to the production of leuco-derived cytokines contributing to FNHTR.[2 27] In our study, although history of previous transfusion was not associated with symptoms of ATRs, 64.2% of transfusions were given to those with history of previous transfusion and 76.7% of cases of fever occurred in patients with history of previous transfusion. Similarly, in Waiswa *et al* 70% of recipients of blood transfusion had previous history of transfusion and pregnancy and 82% of ATRs occurred in patients with history of previous transfusion and pregnancy.[12]

In this study, none of the variables was associated with symptoms of ATRs in both the bivariate and multivariable analysis. Most of the studies on ATRs in SSA have not examined factors associated ATRs or symptoms of ATRs, and the few that did, were limited to the bivariate

Table 2 Distribution of the patients by townships, Kinshasa capital city

Township	Frequency	%
Mont-Ngafula	2093	29.2
Ngaliema	1039	14.5
Kisenso	993	13.9
Selembao	963	13.4
Lemba	386	5.4
Makala	327	4.6
Kimbanseke	265	3.7
Ndjili	248	3.5
Limete	223	3.1
Ngiri-Ngiri	197	2.7
Gombe	138	1.9
Kalamu	105	1.5
Kasa-Vubu	69	1
Matete	38	0.5
Masina	34	0.5
Ngaba	33	0.5
Other	15	0.2

Table 3 Types of symptoms of acute transfusion reactions

Symptoms of acute transfusion reactions	n	%
Dyspnoea/respiratory distress	74	39.6
Fever	60	32.1
Pruritus/urticaria	36	19.2
Vomiting	17	9.1
Total	187	100

Table 4 Factors associated with symptoms of acute transfusion reactions

	Adjusted OR	95% CI	P value
Age	0.99	0.98 to 1	0.122
Sex			
Male	Ref		
Female	0.98	0.73 to 1.33	0.932
Socioeconomic level			
A	Ref		
B	1	0.74 to 1.36	0.967
C	1.06	0.51 to 2.20	0.868
Type of transfusion			
Whole blood	Ref		
Packed cell	0.91	0.65 to 1.28	0.616
Fresh frozen plasma	0.98	0.29 to 3.21	0.973
Platelet rich plasma	1.11	0.55 to 2.23	0.756
History of transfusion			
No	Ref		
Yes	1.32	0.88 to 1.98	0.166
Number of transfusion			
1	Ref		
2	1.38	0.94 to 2	0.092
3	1.24	0.77 to 1.98	0.365
≥4	1.32	0.88 to 1.98	0.166
Year of transfusion			
2014	Ref		
2015	0.87	0.50 to 1.49	0.615
2016	0.89	0.53 to 1.51	0.681
2017	0.84	0.49 to 1.44	0.535
2018	1.06	0.61 to 1.85	0.814
2019	1.08	0.60 to 1.97	0.779

Ref, reference.

analysis of possible factors related to ATRs.[17 18] Waiswa *et al*, however, found that patients' age and blood component type were associated with ATRs in the bivariate analysis; but no association was documented in the multivariable analysis.[12] Results from bivariate analysis in Gwaram *et al*[17] and Arewa *et al*[18] have identified history of previous transfusion and multiple transfusions within a short time interval as risk factors for ATRs.

One of the key limitations of this study is that it is based on clinical record data which were not primarily collected for research purpose. Therefore, we could only use information that was available and retrievable from the electronic medical record. A number of variables such as the severity, duration of symptoms of ATRs and their outcomes were not available in the medical record. It is also important to highlight that we cannot rule out the possibility that symptoms of ATRs in this study could be attributed to other pathological conditions. Future research on this topic should employ prospective study designs to capture both ATRs and symptoms of ATRs, as well as to rule out other potential contributing factors of symptoms occurring after blood transfusion. The results of this study are based on data from a single hospital in Kinshasa; henceforth, the findings cannot be generalised in the whole Kinshasa. However, this study is the largest in DRC in terms of its sample size, which included patients from most parts of the Kinshasa.

In summary, symptoms of ATRs were not uncommon in the studied population. Dyspnoea/respiratory distress, fever and pruritus/urticaria were the most common types of symptoms of ATRs. This study highlights the need for a clinical and biological surveillance to detect, prevent and manage ATRs in the context of the DRC.

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