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ORIGINAL ARTICLE

Post-blood donation screening for acute infectious diseases at a regional blood center

Rastreamento pós-doação de sangue de doenças infecciosas agudas em um hemocentro regional

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ABSTRACT

Introduction: While blood transfusion is a relatively safe procedure, it is not without inherent risks. Adverse events may occur at any stage of the procedure. Hemovigilance is a set of monitoring protocols that accompany the entire cycle of blood use. The objective of hemovigilance is to collate and disseminate data on adverse events with a view to preventing their occurrence or recurrence, enhancing the quality of processes and products, and guaranteeing the safety of both donors and recipients. An indispensable element of hemovigilance is post-donation reporting. This encompasses the identification and removal of stored blood components that may be contaminated, in addition to the monitoring of recipients for the early detection of potential transfusion transmission. **Objective:** To analyze post-donation information on acute infectious diseases at the Montes Claros Regional Blood Center – Fundação Hemominas from January 2020 to December 2023. **Methods:** This is a documentary, analytical and quantitative epidemiological study in which data from the post-donation information report reported at the blood center were analyzed. The following variables were extracted from the instruments: total donors screened, total collections, cause of notification, year of notification, whether the blood component was distributed, whether the blood component was transfused, and the type of blood component transfused. **Results:** There were 76 post-blood donation reports of acute infectious diseases in the period studied, with an average of 19 ±6.4 notifications/year and an average of 1.6 notifications/month ±1.7. Of the 76 notifications, 35 (46.05%) were for conditions consistent with those associated with the novel coronavirus and influenza, 32 (42.11%) were for other unspecified acute infectious diseases, and nine (11.84%) were for arboviruses. The number of notifications for the coronavirus/flu syndrome exhibited an upward trend in 2022, followed by a decline in 2023. Concurrently, there was a notable surge in arbovirus notifications, rising from 0% in 2020 to 43.80% in 2023. **Conclusion:** It is imperative that blood centers adopt strict criteria for donor screening, especially for arboviruses, particularly in tropical countries such as Brazil, and it is essential to explore viable alternatives to ensure transfusion safety.

Keywords: Blood donation; Arboviruses; Hemovigilance; Blood transfusion.

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RESUMO

Introdução: A hemotransfusão é um procedimento seguro, porém não isento de riscos. Durante o procedimento, eventos adversos podem ocorrer em diversas etapas. A hemovigilância abrange uma série de protocolos de monitoramento que acompanham todo o ciclo de utilização do sangue. Seu propósito é coletar e disseminar dados sobre eventos adversos, com o intuito de prevenir sua ocorrência ou repetição, aprimorar a qualidade dos processos e produtos, e assegurar a segurança tanto do doador quanto do receptor. Um aspecto essencial da hemovigilância são as notificações pós - doação. Isso implica em detectar e eliminar qualquer componente sanguíneo armazenado que possa estar contaminado, além de monitorar os receptores para identificar precocemente qualquer possível transmissão transfusional. **Objetivo:** Analisar as informações pós-doação de sangue de doenças infecciosas agudas no Hemocentro Regional de Montes Claros - Fundação Hemominas no período de janeiro 2020 a dezembro de 2023. **Métodos:** Trata-se de um estudo epidemiológico documental, analítico e quantitativo onde foram analisados dados presentes no relatório de informações pós-doação notificadas no hemocentro. As variáveis, total de candidatos à doação triados, total de coletas, causa da notificação, ano de notificação, se o hemocomponente foi distribuído, se o hemocomponente foi transfundido e o tipo de hemocomponente transfundido, foram extraídas dos instrumentos. **Resultados:** Foram registradas 76 informações de pós-doação de sangue de doenças infecciosas agudas no período estudado, com uma média de 19 ±6,4 notificações/ano e com uma média de 1,6 notificações/mês ±1,7. Das 76 notificações, 35 (46,05%) foram por covid/síndromes gripais, 32 (42,11%) foram por outra doença infecciosa aguda não especificada e nove (11,84%) foram por arboviroses. Foi observado um aumento no número de notificações de coronavírus/síndromes gripais em 2022, seguido por uma redução em 2023. Paralelamente, houve um aumento significativo nas notificações de arboviroses, de 0% em 2020 para 43,80% em 2023. **Conclusão:** É essencial que os hemocentros adotem critérios rigorosos na triagem de doadores, principalmente para as arboviroses, especialmente em países tropicais como o Brasil, sendo fundamental explorar alternativas viáveis para garantir a segurança transfusional.

Palavras-chave: Doação de Sangue; Arboviroses; Hemovigilância; Transfusão de sangue.

INTRODUCTION

While blood transfusion is a relatively safe process, it is not without inherent risks. It is important to note that adverse events associated with the use of blood can occur at any stage of transfusion therapy. It is therefore essential to have a comprehensive understanding of these events in order to prevent any harm to users, including patients, donors, and healthcare professionals, and to improve processes related to the blood cycle. The monitoring of adverse events associated with the use of blood products commenced with the identification of transfusion-transmitted infections. However, the surveillance of non-infectious adverse reactions and other unintended consequences of transfusion therapy has become a priority to mitigate the risks of process failures and to ensure the benefits of using blood components[1].

Thus, hemovigilance is a set of surveillance procedures that covers the entire blood cycle, with the aim of obtaining and making available information on adverse events occurring in its different stages, in order to prevent their appearance or recurrence, improve the quality of processes and products and increase donor and recipient safety[2]. Since its conception in the early 1990s, hemovigilance has gradually progressed and improved its safety, moving from a concept centered on the surveillance of reactions and adverse events in patients to a comprehensive system that monitors the entire transfusion chain, from donor recruitment to transfusion[3].

To do this, the entire system must be integrated, articulated and fed back throughout the process with the information needed to make decisions and trigger actions. It contributes significantly to the implementation of procedures aimed at preventing risks and identifying and treating adverse reactions quickly and effectively. This in turn increases the effectiveness and efficiency of blood transfusion[3].

The initial stage of the system is the donor interview. This screening process is designed to prevent individuals who may be at risk of untested infections from entering the blood donation process and to minimise the likelihood of false negative results occurring during the early stages of infection (known as the "immunological window"). Despite the effectiveness of the blood donor screening process, it is possible that some donors may develop symptoms after donating blood[4].

In this sense, when the donor reports any clinical symptoms that occurred up to 14 days after donation, this is considered post-donation information (PDI). The management of these reports is an extremely challenging, complex and sensitive situation, especially given the need to follow up on this patient and the prior distribution of most of the blood components obtained. Given that most blood recipients are high-risk patients, the potential transmission of infectious diseases can have serious clinical consequences[5].

The causes of post-donation information are correlated with the presence of diseases in the general population, such as arboviruses and coronavirus/COVID-19. Due to the COVID-19 pandemic, there has been an underreporting of arbovirus cases among donors and an increase in the incidence of coronavirus. Thus, the prevalence of arbovirus infections including dengue virus (DENV), chikungunya virus (CHIKV) and zika virus (ZIKV) in blood donors is a tangible phenomenon, particularly in regions where the disease is endemic, such as certain areas of Brazil[6,7].

Thus, arboviruses represent a constant threat to public health, especially for recipients of blood transfusions and in cases of organ donation, due to the high incidence of asymptomatic infections. The presence of viremia, which precedes the onset of symptoms, allows the contaminated blood of donors to serve as a vehicle for the transmission of the virus. However, it is probable that the clinical impact of transfusion transmission of these agents is underestimated, given the occurrence of significant adverse outcomes in critically ill patients[8].

It is likely that outbreaks of arboviruses will continue to occur in tropical and subtropical regions where ecological conditions are conducive to the reproduction of mosquito vectors. Despite ongoing efforts to control these vector populations, individual protection strategies, and recent advances in dengue vaccine development, infections remain a persistent public health challenge[9].

Screening for CHIKV, DENV, and ZIKV is not systematic in all countries and is intermittent and controversial in countries such as the United States and Singapore. In endemic regions, outbreaks of these viruses persist even with vector control measures and vaccines, such as for dengue. Asymptomatic donors may be infected, posing a risk of transmission by transfusion. Screening for these viruses may enhance the safety of the blood supply, particularly in endemic areas, depending on the epidemiologic situation and local resources[9].

Post-donation information plays a key role in ensuring the safety of the blood supply. The effectiveness of this system depends largely on close cooperation between blood services, hospital blood banks, physicians, donors, and continuous surveillance[10].

Thus, studying post-donation information is a way to monitor and understand the epidemiologic pattern of processes, track possible transfusion risks, and maintain the safety of donors and recipients. Therefore, this study aims to analyze post-donation information on acute infectious diseases at the Montes Claros Regional Blood Center – Fundação Hemominas from January 2020 to December 2023.

Methods

This is an epidemiological study of a documentary nature, with a quantitative design, evaluating the processes of post-blood donation notifications of acute infectious diseases at the Montes Claros Regional Blood Center (Hemominas Foundation). The study sample consisted of post-blood donation notifications of acute infectious diseases received between January 2020 and December 2023.

The data were collected in a secondary and retrospective manner using the Statistical Bulletin and Acute Infectious Disease Post-Donation Information Sheets, which were completed by donors and submitted to the Blood Center. All properly completed post-donation information sheets pertaining to acute infectious diseases were included in the analysis, while post-donation information sheets for other reasons were excluded. The following variables were extracted from the instruments: the total number of donors screened, the total number of collections, the cause of notification, the year of notification, the distribution of blood components, the transfusion of blood components, and the type of transfused blood component.

In this study, post-donation information related to acute infectious diseases was categorized into three groups: (1) COVID-19/flu-like syndromes, which included both confirmed cases of coronavirus infection and the presence of symptoms typical of acute respiratory illness; (2) arboviruses, including Zika, Chikungunya, and Dengue; and (3) other unspecified infectious diseases, which included non-specific symptoms such as fever, headache, and diarrhea.

The identified data were stored and analyzed using the Statistical Package for the Social Sciences (SPSS) software for Windows and Excel 12.0 (Office 2007). The results were discussed in accordance with non-parametric and non-probabilistic simple descriptive epidemiology.

In addition, data were collected on a secondary basis using the Statistical Bulletin and post-donation information reports, which may limit the scope and detail of the variables analyzed. Incomplete information or inconsistent records may affect the interpretation of results.

The study was approved by the Research Ethics Committee of the Fundação Hemominas, under opinion no. 6.625.037.

Results

From January 2020 to December 2023, the Montes Claros Regional Blood Center - Hemominas Foundation recorded a total of 83,662 candidates undergoing clinical screening for blood donation. Of these, 67,354 (80.51%) underwent whole blood collection. Among the years under consideration, 2023 was the year with the highest number of applicants undergoing clinical screening for blood donation and whole blood collection (Table 1).

Between 2020 and 2023, we received 76 post-blood donation reports of acute infectious diseases, with an average of 19 ±6.4 notifications/year and an average of 1.6 notifications/month ±1.7. In terms of years, 2022 was the year with the highest number of notifications (39.5%), followed by 2021 and 2023 (21.1%) and 2020 (18.4%), as shown in table 2. Of these 76 reports, 35 (46.05%) were for COVID/flu-like syndromes, 32 (42.11%) were for other unspecified infectious diseases and nine (11.84%) were for arboviruses.

In 2020, four reports (28.57%) were attributed to coronavirus/flu-like syndromes, 10 (71.42%) were classified as another unspecified infectious disease, and zero were identified as arboviruses. In 2023, there were two (12.50%) cases of coronavirus/flu-like syndromes, seven (43.80%) of other unspecified infectious diseases, and seven (43.80%) of arboviruses. A comparison of these two years reveals an increase in reports of arboviruses. In 2022, there were 22 reports (73.30%) of coronavirus/flu-like syndromes, seven reports (23.30%) of other unspecified infectious diseases, and one (3.30%) of arboviruses. The number of notifications pertaining to coronavirus/flu-like syndromes reached a peak in 2022, followed by a decline in 2023. Furthermore, there was a notable surge in the incidence of arbovirus notifications, rising from 0% in 2020 to 43.80% in 2023 (Figure 1).

Of the 76 notifications that were screened, blood components were distributed in 43 cases, while in 33 cases, they were not distributed. The highest number of blood components distributed was in the year 2022, with a total of 14 distributed, as illustrated in Table 3.

During the period studied, 38 blood components (50%) were transfused, including red blood cell concentrates and platelet concentrates. The years 2022 and 2023 were the years with the most cases of transfused blood components, 11 in all (Figure 2). It should be noted that no plasma or cryoprecipitate was transfused in these cases. With regard to the specific type of blood component transfused on an annual basis, the majority of transfused blood components were platelet concentrates across all years under examination (Figure 3).

Recipients are monitored on the basis of clinical data provided by the health services and passed on to the blood center. During the 14-day follow-up conducted by the blood center, no complications were identified in the patients' state of health associated with the transfusion of contaminated blood components, including infections with arboviruses or covid.

Table 1. Candidates for blood donation at the Montes Claros Regional Blood Center-Fundação Hemominas.

Variable	N	Monthly Average (Standard Deviation)
Year	**Submitted to Clinical Screening**	
2020	18,762	1,563.5 (±163.7)
2021	20,299	1,691.5 (±190.0)
2022	20,219	1,684.9 (±121.8)
2023	24,382	1,031.8 (±256.4)
TOTAL	**83,662**	**1,742.9 (±257.5)**
Year	**Submitted to Whole Blood Collection**	
2020	15,098	1,258.1 (±119.5)
2021	16,280	1,356.6 (±153.0)
2022	16,059	1,338.2 (±117.0)
2023	19,917	1,659.7 (±219.1)
TOTAL	**67, 354**	**1,403.2 (±219.4)**

Table 2. Number of post-blood donation reports of acute infectious diseases between 2020 and 2023 at the Montes Claros Regional Blood Center - Fundação Hemominas.

Variable	N	Monthly Average (Standard Deviation)
Year		
2020	14 (18.4%)	1.17 (± 0.98)
2021	16 (21.1%)	1.33 (± 1.49)
2022	30 (39.4%)	2.50 (± 2.06)
2023	16 (21.1%)	1.33 (± 1.74)
TOTAL	**76 (100%)**	**1.58 (±1.72)**

Table 3. Number of blood components distributed in post-donation information for acute infectious diseases between 2020 and 2023 at the Montes Claros Regional Blood Center – Fundação Hemominas

Year	Distributed	Non-Distributed
2020	8 (57.1%)	6 (42.9%)
2021	10 (62.5%)	6 (37.5%)
2022	14 (46.7%)	16 (53.3%)
2023	11 (68.7%)	5 (31.3%)
TOTAL	**43 (56.6%)**	**33 (43.4%)**

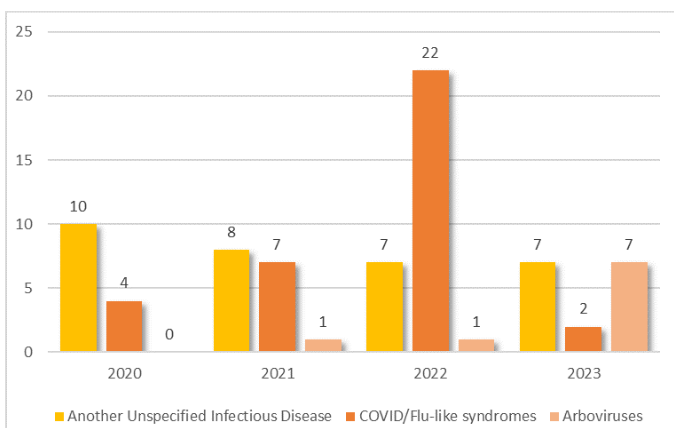

Figure 1. Analysis of the 76 post-blood donation reports on acute infectious diseases in relation to the type of report from 2020 to 2023.

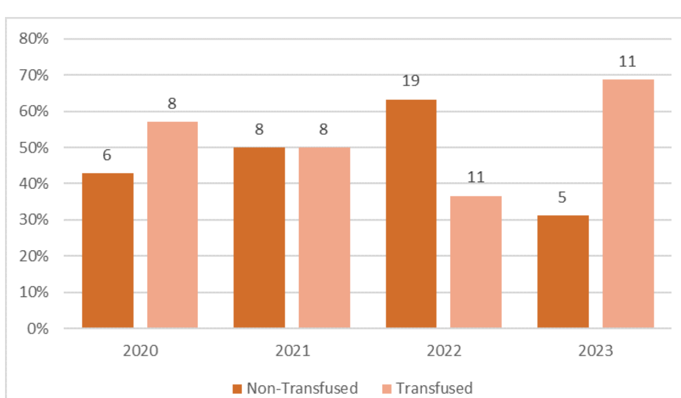

Figure 2. Analysis of the 38 non-transfused blood components and 38 transfused blood components in the post-blood donation information for acute infectious diseases from 2020 to 2023.

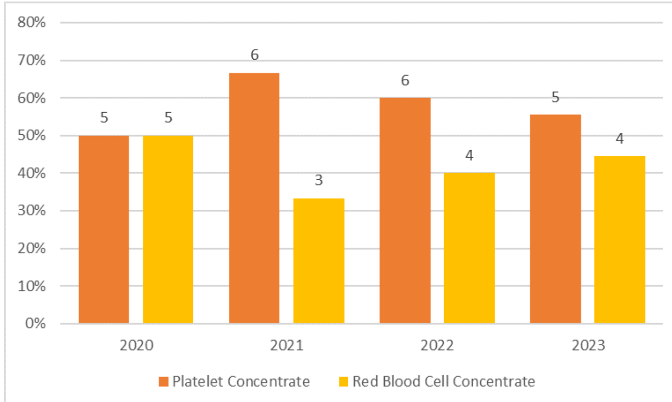

Figure 3. Analysis of the 38 blood components transfused, considering the type of blood component, in the post-blood donation information for acute infectious diseases from 2020 to 2023.

Discussion

Post-donation information on acute infectious diseases aims to block and dispose of stored donation components and to monitor recipients in order to identify possible transfusion transmission at an early stage and to adopt appropriate measures to prevent and treat the disease, where appropriate[1].

The post-donation information process entails the donor's self-reporting of any symptoms or signs that may have manifested up to 14 days following the donation, which could potentially be indicative of an acute infectious disease, to the hemotherapy service where the donation was conducted. Following each donation, the donor is instructed by the relevant service to report any symptoms that manifest. It is of the utmost importance that this procedure be carried out[1].

Post-donation information (PDI) is part of hemovigilance, defined as a set of surveillance procedures that covers the entire transfusion chain, from the collection of blood and its components to the follow-up of recipients[11]. Its purpose is to collect and evaluate information about the entire transfusion process, from donor selection to post-transfusion outcomes in patients. Hemovigilance programs gather various data on transfusion-related outcomes, which can be classified into three categories: blood collection, preparation for transfusion and post-transfusion monitoring[12].

In this study, post-donation information on acute infectious diseases was classified into 3 categories: covid/flu-like syndromes (confirmed cases of coronavirus infection or the presence of flu-like symptoms), arboviruses (Zika, chikungunya, dengue), and other unspecified infectious diseases (non-specific symptoms such as fever, headache, and diarrhea). This classification is related to the epidemiological aspects of Brazil, which has favorable conditions for the emergence and re-emergence of infectious diseases such as COVID and arboviruses, as well as being the country with the highest number of cases of these three arboviruses[13,14].

During the period studied, 76 post-donation reports were identified, which represents 0.11% of the total number of collections made, a low percentage compared to the number of donations. These figures are in line with the incidence of post-donation information found in the literature. In a French study, 14,346 PDIs were recorded in more than 3,000,000 blood donations collected in 2009, with an incidence of 0.44%[15]. In another study covering a two-year period (2017-2018), 492 PDIs were recorded, while a total of 207,038 donations were collected during that period, resulting in an incidence of 0.24%[16].

However, estimating the incidence of PDIs is difficult due to the lack of data in the literature and the limited dissemination of this content, which is consistent with what some authors have said about the need for publications on hemovigilance reports. These publications emphasize the scientific aspect of this process, share the results with the public, and enable changes in public policies, practices, and clinical research, resulting in improved safety for donors and recipients[17].

Regarding the type of post-donation information, almost half of the cases were related to COVID-19 and flu syndromes, with the highest number of occurrences in 2022. This increase is directly related to the global epidemiological context of the COVID-19 pandemic during this period. Similar research has indicated a new wave of cases in several countries, such as Hong Kong and Finland, attributed to the spread of the Omicron variant and the progressive return to normality[18,19].

On the other hand, reports of arboviruses were quite low in the first three years studied, with only 4 reports identified, suggesting an anomaly in the pattern of arboviruses in the country. This fact correlates with what has been described in the literature about the underreporting of arboviral cases due to the coronavirus pandemic[7].

Thus, as discussed by some authors, there is evidence of a possible underreported epidemic of arboviruses that occurred simultaneously with COVID-19 cases. This scenario can be attributed to several factors, including the reduction in seeking medical care for other illnesses and the restructuring of health systems to prioritize care for COVID-19 cases[20,21].

In 2023, there were 7 reported cases of arboviruses, representing 43.80% of the reports for that year, a notable increase compared to previous years. This can be explained by the epidemic of arbovirus cases in Montes Claros in 2023, and according to studies carried out in French Polynesia, there is a correlation between the outbreak of ZIKV and CHIKV in donors and the incidence of the disease in the general population. In addition, the climate and environmental and sanitary conditions make the North of Minas Gerais susceptible to these infections, and it has been the focus of outbreaks and epidemics over the years[22,23].

Increasing information about arboviruses highlights the risks associated with transmission through blood transfusion, especially in regions that have experienced major epidemic outbreaks. Many donors are asymptomatic but may be infected with high levels of viremia. The nucleic acid amplification (NAT) methods used for screening are complex and require a significant infrastructure of physical and human resources that not all blood banks have[24].

In addition, the route of transmission through blood donation is a threat to the safety of transfusions and can considerably affect the lives of these recipients. In one study, 74 reported cases of suspected transfusion-transmitted arboviral infections were analyzed, of which 63.5% were symptomatic and 18.9% were fatal[25].

In contrast, in the present study, there were no cases of deterioration or contamination among transfused blood components. With regard to arbovirus-contaminated blood components, a similar situation was observed in French Polynesia, where no cases of transfusion-associated arbovirus infection were observed in transfused patients[22].

Nevertheless, the potential for transmission of arboviruses by blood transfusion and the occurrence of cases of such transmission have been documented in several studies in different countries[25,26]. Therefore, although no cases of transfusion-associated arbovirus infection were reported in this study, the possibility of infection by this route is worthy of attention[27].

In this context, the relationship between the efficiency of arbovirus transmission through blood transfusion is a complex issue, dependent on a number of individual factors and a minimum infectious load that is currently unknown[28]. Thus, arbovirus infections transmitted by blood transfusion may not be identified due to underreporting and the possibility of greater pathogenicity of mosquito saliva compared to an intravenous transfusion of an infected blood component[25].

With regard to the novel coronavirus disease 2019 (Covid-19), no cases of infection with the virus were identified among patients who had undergone transfusion. This result is consistent with the findings of previous studies that have demonstrated the lack of transmission of coronavirus infection by transfusion[29].

This study has some limitations that should be taken into account when interpreting the results obtained. First, as this is a documentary and retrospective epidemiological study, there is a possibility of recall bias, since the post-donation information was provided by the donors themselves and recorded later. This bias may affect the accuracy and completeness of the data, especially with regard to the reporting of symptoms and acute infectious diseases.

Conclusion

It can be concluded that monitoring post-donation information reports is of the utmost importance for both donors and recipients and is a crucial public safety measure. Therefore, despite the absence of documented cases of transfusion-related arbovirus infection in the study population, the potential for transfusion transmission remains. The emergence of this information underscores the necessity for enhanced monitoring and follow-up of transfusion recipients and donors, particularly in regions experiencing significant epidemic outbreaks. The examination of this data allows for the enhancement of transfusion safety and the advancement of public health initiatives. It is therefore recommended that donors be encouraged to report any symptoms that manifest subsequent to the donation.

Moreover, it is imperative that blood centers implement rigorous screening criteria for donors, particularly for arboviruses, in tropical countries like Brazil. It is imperative that blood centers implement continuous molecular screening tests and explore additional viable alternatives, such as vector control and population awareness initiatives, to ensure the safety of transfusions.

Author's Contributions

We describe contributions to the papers using the taxanomy (CRediT) provided above:

Conceptualization, Investigation, Methodology, Visualization & Writing – review, editing &translation: CNMS; KMA; RMSP. *Data curation & Formal Analysis*: CNMS; RMSP

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