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Analysis of the hemotherapy support in an oncology hospital considering the COVID-19 pandemic

Análise do suporte hemoterápico em um hospital oncológico diante da pandemia de COVID-19

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ABSTRACT

Objectives: The purpose of this study was to analyze the impact of COVID-19 on the use of blood components in an oncology hospital. **Material and Methods:** Retrospective cross-sectional quantitative nature cohort, with comparative analysis of blood component requests by an oncology hospital in the city of Juiz de Fora, Minas Gerais, Brazil, in 2019 and 2020. **Results:** There was a reduction of 14.36% in the requests for blood components at the oncology service in 2020 (*p*-value = 0,002), with a reduction of 27.33% for platelet concentrate (*p*-value = 0,006). The rate of attendance of Hemominas to requests for blood components at the oncology hospital was 97.99% in 2019 and 94.36% in 2020. **Conclusion:** The pandemic affected blood collection and supply due to the decrease in blood donors' attendance. The suspension of elective surgeries and the rational prescription of blood components allowed the rate of attendance maintenance by the blood bank. In this scenario, it is important to monitor the supply and demand for blood components in hospitals and apply strategies that optimize their use.

Keywords: Blood transfusion; SARS-CoV-2; Oncology service, Hospital; Hemotherapy service; Surgical oncology.

RESUMO

Objetivos: O objetivo deste estudo foi analisar o impacto da COVID-19 no uso de hemocomponentes em um hospital oncológico. **Material e Métodos:** Coorte retrospectiva transversal de natureza quantitativa, com análise comparativa das solicitações de hemocomponentes por um hospital oncológico da cidade de Juiz de Fora, Minas Gerais, Brasil, em 2019 e 2020. **Resultados:** Houve redução de 14,36% nas solicitações de hemocomponentes no serviço de oncologia em 2020 (p-valor = 0,002), com redução de 27,33% para concentrado de plaquetas (p-valor = 0,006). A taxa de atendimento do Hemominas às solicitações de hemocomponentes no hospital oncológico foi de 97,99% em 2019 e 94,36% em 2020. **Conclusão:** A pandemia afetou a coleta e oferta de sangue devido à diminuição do atendimento de doadores de sangue. A suspensão de cirurgias eletivas e a prescrição racional de hemocomponentes permitiram a manutenção do índice de atendimento pelo banco de sangue. Nesse cenário, é importante monitorar a oferta e a demanda de hemocomponentes nos hospitais e aplicar estratégias que otimizem seu uso.

Descritores: Transfusão de sangue; SARS-CoV-2; Serviço de Oncologia, Hospital; Serviço de hemoterapia; Oncologia Cirúrgica.

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INTRODUCTION

In March 2020, the World Health Organization (WHO) upgraded the SARS-CoV-2 virus health status to the COVID-19 pandemic due to its high transmissibility rate.[1] The disease causes symptoms flu-syndrome-alike and it can evolve into severe acute respiratory syndrome (SARS), organ failure and death.[1,2] In SARS, a possible final rescue strategy is the implementation of extracorporeal membrane oxygenation (ECMO), a procedure with a high risk of haemorrhage and coagulopathy and, thus, potentially needing hemotherapy support. Convalescent plasma was also analyzed as a therapeutic measure against COVID-19 and studies suggested clinical benefits, including radiological improvement, viral load reduction and survival increase.[3,4] Doyle et al. (2020)[5] evaluated 265 patients, 30 of them undergoing ECMO. In total, 50 patients needed blood components during intensive care hospitalization and the most transfused blood component was packed red blood cells, with higher rates of use in patients on ECMO. DeSimone et al. (2021)[6] verified that the general blood components' transfusion rate in COVID-19 patients was 3.3%, with also a predominance of packed red blood cells. The specific treatment for SARS-CoV-2 infection and the vaccination are still two major challenges for medicine. The hemotherapy service suffered profoundly the impacts of the pandemic, the reduction in blood donors' attendance and, therefore, in blood collection, which led a decrease in available blood supply. Many non-emergency hospital activities were cancelled with the intention to optimize blood components' availability in blood banks, allowing meeting the demand in onco-hematologic patients, emergency surgeries and polytrauma patients.[7]

Considering blood banks' shortage, communication among blood centers and clinical staff of hospitals was expanded, with the aiming to assure effcient use and maintenance of minimum reserves.[8] In hospitals, there was greater rigor in the control of preoperative anemia and perioperative hemostasis, including intensified measures to minimize early postoperative bleeding. Priority was given to the use of anti-hemorrhagic drugs and venous iron[9,10] and packed red blood cells prescription was optimized, which consists of the three pillars of patient blood management (PBM). PBM proved to be a multimodal approach based in the timely application of medical practices that aim to improve the outcome of patients at risk, decreasing transfusions' rate and health costs, crucial aspects to health systems when resources are critical and limited.[9]

Brazilian blood centers adopted protocols to face the crisis to guarantee security of their staff and donors, including measures as internal training, virtual scheduling of the donation, application of questionnaires about risk of exposure and infection, and symptoms of COVID-19, measurement of body temperature, availability of agile contact channels in case the donor observed the appearance of symptoms of COVID-19, social distancing during blood collection, and distribution of health education materials to donors and professionals.[11,12] Blood banks also adhered to measures already foreseen in literature to minimize disposal, such as the temporary extension of the shelf-life of platelets and red blood cells. Pathogen inactivation systems used in some countries are being tested for effectiveness in reducing SARS-CoV-2 infection.[10,13]

Oncology services redoubled their concern both with the possibility of patients becoming infected with SARS-CoV-2 and the scarcity of blood components, therapeutic method used in neoplasm management. In the pandemic scenario, it was essential to optimize the utilization of available health resources and to adopt more restrictive transfusion practices.[14]

Instituto Oncológico de Juiz de Fora is a hospital specialized, for 48 year, in cancer prevention, diagnosis, and treatment. The hospital is equipped with 110 hospital beds and has clinical and surgical specialties, including pediatrics, pediatric surgery, and clinical oncology, being a reference in cancer treatment in Minas Gerais state. It is one of the two High Complexity in Oncology level II Centers (Cacon II) of the state and it received the title of best hospital for cancer treatment in Minas Gerais. The *Instituto* is supported by *Fundação Centro de Hematologia e Hemotoreapia do Estado de Minas Gerais – Hemominas*, which follows the technical and legal guidelines of the Ministry of Health and the National Health Surveillance Agency (ANVISA).

The aim of this study was to analyze COVID-19 impact on the utilization of blood components in an oncology hospital and the blood bank's rate of service to requests.

MATERIAL AND METHODS

A cross-sectional retrospective studied of quantitative nature was carried out with comparative analysis of blood components request forms by the *Instituto Oncológico de Juiz de Fora*, Minas Gerais, to *Fundação Hemominas* between 2019 and 2020.

Data was obtained through automated forms generated by HEMOTE PLUS®, a software system used by *Fundação Hemominas* that interconnects and manages all stages of blood donation the blood components transfusion process, strictly agreed with ANVISA standards and current legislation.[15] Information from reports of *Instituto Oncológico* hospitalization sector were also used.

Documental analysis of the reports was established according to Bardin (1977)[16] and the variables studied were: type of requested blood component, blood bank's rate of service and *Fundação Hemoninas* blood banks rate of service to hospitals requests in the historical series evaluated. Blood components included were packed red blood cell (PRBC), packed platelets (PP), and fresh frozen plasma (FFP). The number of hospitalizations and surgeries by specialty were also analyzed. All blood components' requested during the evaluated period were included in the study, excluding the requests of blood products and cryoprecipitate.

Information available was inserted in the SPSS software (20.0 version, SPSS Inc., EUA) and underwent statistical analysis by qui-square test. The study was approved by the research ethics committee of *Fundação Centro de Hematologia e Hemoterapia de Minas Gerais* under the number 4.028.103 (CAAE 31087720.2.0000.5118).

RESULTS

Considering the total number of hospitalizations at *Instituto Oncológico de Juiz de Fora* in 2020 (n=1,115), when compared to the total quantitative of 2019 (n=1,200) there was no statistical relevance identified (less than 7.1%). The general number of surgeries in the same period decreased in 34.1% (638 occurred in 2019 and 420 in 2020) reduction was also not statistically significant (*p*=0.4).

Graphic 1 presents the sum of surgeries performed in 2019 and 2020.

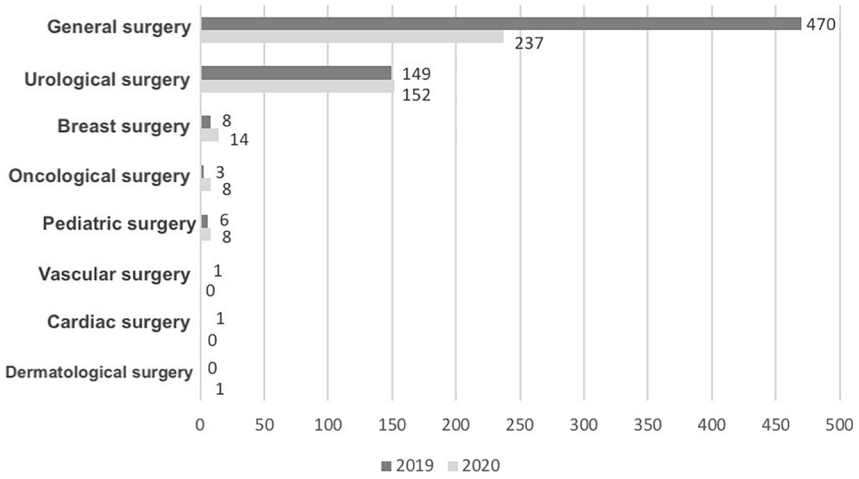
Table 1 presents data concerning the analysis of the forms of each blood component request in 2019 and 2020. There was a reduction with statistical relevance of 14.36% in total quantitative. Analysis by type of blood component showed a decrease of 28.93% in PP and 12.01% in PRBC requests in the same period. It was also observed an increase of 70% in the number of FFP requests, without any statistical significance.

The rate of *Fundação Hemominas* fulfillment of blood components requested by *Instituto Oncológico de Juiz de Fora* was 97.99% in 2019 and 94.36% in 2020. The number of requests fulfilled by blood component is shown in Graphic 2.

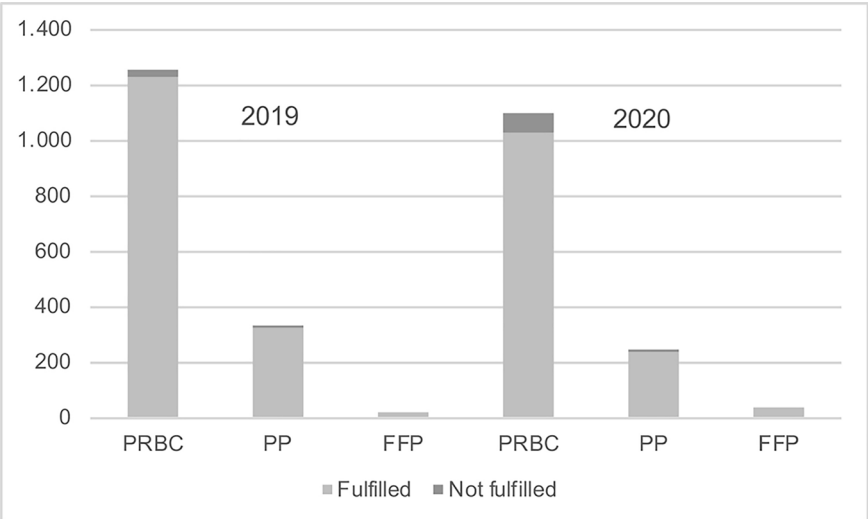
Table 1. Requests by type of blood component.

		2019	2020	p-value
Blood components	PRBC	1.253	1.098	0,065
	PP	322	234	0,006
	FFP	20	34	0,21
	Total	1.595	1.366	0,002

Note: PRBC = Packed red blood cells; PP = Packed platelets; FFP = Fresh frozen plasma. Data obtained through HEMOTE PLUS®.



Graphic 1. Surgeries performed by surgical specialty.
Source: Hospitalization sector of Instituto Oncológico.



Graphic 2. Rate of requests fulfilled by blood component.
Note: PRBC = Packed red blood cells; PP = Packed platelets; FFP = Fresh frozen plasma. Data obtained through HEMOTE PLUS®.

DISCUSSION

The decrease in the number of blood donations can be explained mainly by the donors' fear of being infected by SARS-CoV-2. Donation centers adopted many measures to prevent the virus's transmission, such as body temperature check before entering the center, social distancing, periodic disinfection of equipment and surfaces, facial masks use and hand hygiene before and after the donation process.[11,17]

Patients with malignant and hematological neoplasms are more vulnerable to SARS-CoV-2 infection due to multiple risk factors, for example senility, comorbidities, need for hospitalizations and frequent hospital visits, in addition to immunosuppression induced by the disease itself and by the treatment.[18,19]

European Society for Medical Oncology (ESMO), National Institute for Health and Clinical Excellence (NICE) and French guidelines opted for layered approach to categorize patients into different levels of priority to receive active cancer therapy.[14,20-22] The Brazilian Society of Oncological Surgery suggested that the elective oncological procedures were carefully evaluated, with analysis of the risks and benefits of each surgical intervention, sharing the responsibility of performing or postponing the surgery with the patient and/or guardian.[23]

The reduced availability of blood components, caused by the decreased number of blood donations registered since the beginning of the pandemic, was associated to difficulty in treatment, with a significant increase in the risk of recurrence and mortality in cancer patients.[24] Oncology services in the United States of America (USA) used about 15% of resources destined for blood transfusion in the country due to the presence of anemia in more than half of cancer patients being an independent prognostic factor of short- and long-term adverse outcomes. PRBC transfusion is vital to cancer treatment.[25,26]

The American Red Cross, responsible for 80% of blood supply in the USA, reported that 2,700 blood donations campaigns were cancelled throughout the country, resulting in 86,000 fewer donations in the first months of the pandemic.[27] Nieto-Calvache et al. (2020)[17] verified a reduction of 45.88% in blood supply, with the lowest level registered in April 2020 and Al-Riyami et al. (2021)[28] reported a drop from 26 to 50%, reaching 75% in the first month of the pandemic.[17,28] Reduction in blood components' store were observed in 70% of centers evaluated by Saab et al. (2020)[29] with delaying in 62% of the centers' surgeries and in 47% of radiotherapy.

Study carried out by Silva-Malta et al. (2021)[11] showed a decrease of 17% in the general mean of blood donors' attendance and blood components production from March until June 2020 at *Fundação Hemominas*. In this casuistry, an increase in blood donors' return rate was observed due to recruitment of repeat donors, an important measure to mitigate the effect of the pandemic on blood stocks.[11]

A study by Lopes et al. (2020)[30] analyzed the blood components' request by a philanthropic hospital in Juiz de Fora and the rate of fulfillment by *Fundação Hemominas*. Statistical analysis evidenced that the rate of fulfillment was 98.05%. Comparing to the total number of transfusions, PRBC was the main blood component used, making up 57.26% of transfusions ($p<0.05$),[30] a similar finding observed in the present study, in which the fulfillment rate went from 97.99% in 2019 to 94.36% in 2020.

At *Instituto Oncológico de Juiz de Fora*, the authors observed a reduction of 14.36% in blood components' request ($p=0.002$), of 7.1% in hospitalizations and of 34.1% in surgeries between 2019 and 2020, without statistical relevance. Velázquez-Kennedy et al. (2021)[31] reported a 17.6% reduction in requests for transfusion, with a decrease of 50.2% in blood component's demand by the surgery sector, slight reduction in the hematology and oncology sectors (7.7%) and a large increase in blood prescriptions in the intensive care unit (116%).[31] Al-Riyami et al. (2021)[28] observed that 75% of researched hospitals presented a reduction in the number of blood transfusions mainly due to elective surgery's cancellations, hospital admissions' reduction (63%) and hospital's closures (50%), while Hemingway et al. (2020)[32] reported a 71.7% drop in the number of surgeries.[28,32] Raturi and Kasum (2020)[33] also described a decrease in the demand for blood components, with a 14% drop.

Ngo et al. (2020)[27] reported an increase of 25% in blood components' disposal in the week following cancellation of elective surgeries and of non-urgent medical procedures after pandemic decree by WHO, reaching 54% in April 2020, meanwhile Pandey et al. (2021)[34] did not observe any increase. Measures for bettering the use of blood components were adopted by 63% of the blood centers evaluated by Al-Riyami et al. (2021),[28] with the redistribution of blood to high-complexity centers, active store management, the extension of platelets' lifespan and the recruitment of donors whose blood type were needed at the moment.[28]

At *Instituto Oncológico*, the blood component which suffered greater reduction in the number of requests was the was PP (28.93%, $p=0,006$), followed by PRBC and a 70% increase in FFP's demand, without statistical significance.

Drop in the demand of PRBC was observed by Hérnandez-Maraver et al. (2020),[35] with a 26% reduction in March 2020 and a 5% decrease in April, same year. Nieto-Calvache et al. (2020)[17] reported a drop of 38.8% in PRBC's transfusion in April 2020 comparing to the previous years' monthly mean. Raturi and Kasum (2020)[33] verified a reduction in the request for PRBC of 14%, for FFP of 11% and for PP of 1.6% and Wang et al. (2020)[36] described a decrease in the transfusion of PRBC of 28.98% and of PP of 38.71%, and a 0.9% increase in FFP's transfusion, similar to the pattern described in this study.

High rates of non-rational blood components' utilization were observed in literature. Study by Ranganathan et al. (2012)[37] verified that 51% of patients who underwent oncological surgery were hyper-transfused with hemoglobin exceeding 10g/dL after transfusion. Borchardt et al. (2020)[38] reported that only 54.9% of blood components' request in an orthopedic hospital evaluated were aligned with the current hemotherapy's recommendation. Many hemotherapy centers and nosocomial institutions have implemented measures to reduce the disposal of blood components, including the temporary extension of the shelf life of these products and the use of PBM practices.[9,36] PBM's conception was introduced for the first time in 2008 and it has been defined as the timely application of evidence-based medical and surgical concepts designed to maintain hemoglobin concentration, to optimize hemostasis, and to minimize blood loss in an effort to improve patient outcome. Its practice depends on a multidisciplinary approach and the patient is the main focus in decisions concerning the need for blood transfusion, consisting of three pillars: correction of anemia with hematinic medication, reduction of erythrocyte loss and anemia tolerance. These practices result in not only better application of resource and cost's reduction, but also in the decrease of patients' morbimortality.[7,9,11,14]

COVID-19 pandemic had a negative repercussion in blood component's storage and in blood transfusion's service. Restrictive measures adopted by governments, cancellation of blood donation campaigns and donors' fear of being infected by SARS-CoV-2 had an unfavorable impact on the availability of blood components. However, stock deficit had less impact on oncology services due to cancellation and postponement of elective surgeries and to rational use of existing blood products. Strict monitoring of supply and demand for blood components in hospitals is essential to avoid sudden shortages, and PBM strategies must be applied to make the best resources' utilization.

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