Blood scarcity at the blood banks during COVID-19 pandemic and strategies to promote blood donations: current knowledge and futuristic vision

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ABSTRACT
The course of the coronavirus disease (COVID-19) pandemic has significantly affected the healthcare systems in multiple ways, the programs of control and the management of patients with other infectious diseases as well as with chronic and acute non-communicable diseases, including those conditions requiring blood transfusions. Blood donations have been decreasing over time in multiple countries with their expected consequences. Although the spread of SARS-CoV-2 has not been detected via blood transfusion, the increasing fear and anxiety among communities have led to a substantial decrease in blood donations. Several research groups have raised concerns about the consequences associated with the scarcity of blood. However, it is critical to understand the underlying causes of the sharp decline in blood donations, as well as the consequences. Hence, we discuss the impact of blood scarcity at the blood banks during the COVID-19 pandemic as well as strategies to promote blood donations, given the experience in some countries with this situation.

Introduction
Among various health-care sectors being affected, the outbreak of coronavirus disease (COVID-19) caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) posed a very negative impact on the blood donation campaigns volunteered by the Red Cross society worldwide. With the emergence of the
pandemic and the lockdowns imposed, the blood donation programs in 2020 have been halted worldwide [1], including Nepal, India, and Colombia. They have not been restarted yet in many places. Even though some campaigns have been conducted for blood donation while adopting the appropriate safety measures, very few people came forward for blood donation during the pandemic, affecting blood supply and use and posing significant implications for blood transfusion [2–6]. Furthermore, it has recently been discovered in the United States that the COVID-19 pandemic has resulted in severe blood scarcity for medical transfusions, aggravating an already precarious blood supply system, which in turn causes public health issues and raises new issues about emergency preparedness plans for assuring blood supplies [7].

Although not scientifically proven that the SARS-CoV-2 could transmit through blood transfusion [8–10], most medical institutions have kept the blood donation program on hold with concerns of transmission of COVID-19 in the overall transfusion process. The blood banks are struggling to cope up with the situation of the steady demand for blood. In addition, the presence of plasmatic SARS-CoV-2 RNA in some symptomatic patients with COVID-19 and the possibility of blood transmission as observed in very few cases or case series of mother-to-fetus vertical transmission from COVID-19-infected pregnant women raised concerns [11–13].

Moreover, many patients with COVID-19 can be asymptomatic carriers and transmit the virus and may also donate blood. Active infection cannot be confirmed without testing. Therefore, the absence of any symptoms of COVID-19 and screening the temperature with the thermal gun are not sufficient requirements for blood donation. SARS-CoV-2 RNA has been detected in the blood, serum, and plasma from several cases of COVID-19 patients, and blood donation might be a new transmission route though SARS-CoV-2 is not systematic. For this purpose, attempts are being made through detailed investigations to close gaps in our knowledge of the SARS-CoV-2 transmissibility during blood transfusions and to solve the query of whether a blood transfusion is safe during the COVID-19 pandemic [9,14]. A recent study suggested that a correlation between the identifying SARS-CoV-2 RNA in biologic samples including blood and virus infectivity warrants a minimal viral RNA load, which is very rarely observed in blood components/products and hence the risk of transmission of this pandemic virus by transfusion of blood seems to be only theoretical [8,10].

**Blood scarcity during COVID-19 pandemic**

Furthermore, numerous studies from various countries, including China, Hong Kong, and India, show that fear of receiving COVID-19 was a major factor in why people did not, or would not take an active part in blood donation [15,16]. Many blood collecting agencies (BCAs) reported a significant rise in donor cancellations, which when paired with the cancellation of mobile events, resulted in a substantial reduction in blood availability and raised serious concerns among the hospitals [17,18]. In contrast, a recent study reported a significant increase in registrations for blood donations following the implementation of countrywide preventive measures to reduce any harmful consequences of the health crisis. People with a greater risk profile for COVID-19 were over-represented among new registrations, which was surprising [19,20]. Thus, despite the related heightened health risks, the first peak of the current epidemic has resulted in an increase in new blood donor registrations. It will take time and further research to determine if these new donors are one-time ‘pandemic’ donations or remain regular and committed donors [19]. In this context, a comprehensive review of the literature was performed. Authentic scholarly databases such as ScienceDirect, PubMed, and Google Scholar were searched for relevant
research articles using keywords such as blood, Blood donation, Blood transfusion, Blood scarcity, SARS-CoV-2, COVID-19, Pandemic. Until 26 June 2021, research papers were screened and chosen by authors based on inclusion and exclusion criteria such as relevance to the current study. Finally, 50 articles were selected to apply to the current research, and the review article was written.

Amidst the chaos of COVID-19, the focus and the human resources have been mobilized mainly to contain and manage the health problems associated with COVID-19. However, the areas such as blood donation have been given less attention comparatively. Also, in the lack of appropriate blood collection facilities (mobile blood donation), clear tailored guidelines, and stringent measures for screening SARS-CoV-2 in volunteer blood donation or mass donation campaigns, people have hardly participated in such programs. The scenario seems to be expected, especially in the resource-limiting countries where COVID-19 testing is very costly and not affordable by the general population in the early and mid-phase of the pandemic. That has resulted in the scarcity of the blood supply in the blood banks, which has primarily affected many aspects of medical surgery, emergency, and regular treatments requiring blood, such as in thalassemia [4]. Moreover, blood transfusion is routinely needed in medical procedures to replace blood losses during surgery, injury, obstetrics and other operations as a life-saving option. In such situations, NGOs, INGOs, and developed countries may aid the less developed and marginalized countries worldwide for promoting blood donation campaigns.

**Strategies to promote blood donations**

Blood transfusion is one of the crucial factors during various medical procedures in medical, surgical, and emergencies. The scarcity of blood in the blood banks is a huge concern during the ongoing COVID-19 pandemic. Such challenges need to be addressed for benefits of blood banking, transfusion medicine, and therapeutic fields based on various blood products [21–24]. Studies have shown that the SARS-CoV-2 infection does not transmit through blood, rather person-to-person transmission preferably occurs through respiratory tracts during close contact with a symptomatic patient (droplets generated during sneezing, coughing) and airborne during direct virus exposure. Blood donation campaigns can be continued during the pandemic as every drop of blood counts for those who are in need. In addition, setting out blood donor selection guidelines while adopting precautionary measures can help to prevent the spread of COVID-19 and to ensure the safety of blood products. Proper awareness is essential to enable the donors to perform personal assessment and to self-defer if they are exposed to SARS-CoV-2 or symptomatic patients. They should also inform the authorities if they have developed COVID-19-related symptoms within 28 days of blood donation. In such a scenario, both COVID-19 patients or those exposed to COVID-19 patients need to self-defer for at least 28 days and the blood products need to be quarantined until donor is regarded as safe (no subsequent illness). Furthermore, the blood donated need to be investigated if the donor turns up symptomatic or contacted with a confirmed COVID-19 case within 14–28 days of blood donation [24–30].

However, such precautions cannot rule out the feasibility of having blood donations from asymptomatic patients. Screening tests have some limitations and are not fully met at the donor or blood donation level. More recently, a novel RT-PCR system targeting SARS-CoV-2 nucleocapsid protein (N) and open reading frame 1ab (ORF 1ab) has been reported to be developed for confirmatory and quick screening of SARS-CoV-2 in blood donor specimens [31,32]. Optimum safety
checkpoints need to be followed to ensure that the transfused blood is not contaminated with SARS-CoV-2.

In addition, according to a recent survey, the anxiety and fear of COVID-19 hospital infection risk and hospital admission were statistically significant across all age groups eligible for blood donation, regardless of where the participants lived. So, clear and committed efforts to improve blood donation across all communication modes must sustain blood donation during the COVID-19 pandemic. Furthermore, the measures should contain information about implementing safety precautions to minimize COVID-19 transmission at the blood centers and that blood donation does not raise the risk of transmission of illness to the family [18,20].

**Recommendations for blood donors**

Since it is difficult to predict the asymptomatic patients who have contracted SARS-CoV-2 unknowingly, so the total number of reported COVID-19 cases may not be in true sense [33–37]. This makes the main difficulty among blood donors in the COVID-19 era as the donors are healthy and not reporting health issues may be unknowingly and might have recovered from COVID-19 earlier [38]. Therefore, it is not possible for the Blood Bank or Red Cross authorities to identify and collect the samples. However, SARS-CoV-2 was detected in blood in few cases, but still, there are no confirmed/ suspected reports or recommendations of its transmission from donor products [39]. The recommendations for blood donors [40] are discussed in Table 1. To date, respiratory viruses such as SARS-CoV-2 are usually not transmitted through blood transfusions. Also, for other types of CoVs, no cases are reported for transfusion-related transmissions. However, Chang and coworkers have studied 2430 blood donations in the Wuhan blood center. One donor was positive for SARS-CoV-2 but displayed no symptoms at the time of donation. However, his plasma samples are positive, and the virus was still detectable [41]. Hence, it is highly recommended to follow the pathogen inactivation strategy with a clear understanding [42–48].

**Conclusion and future prospects**

Viruses such as SARS-CoV-2 are spread mainly through respiratory droplets and direct contact. So far, there has been no recorded example of COVID-19 being transmitted by blood transfusion, even among patients who have received blood from donors who have been determined to be positive for COVID-19 [49,50]. However, healthcare personnel still worry about the processing of COVID-19 blood samples, which is understandable [20]. If the SARS-CoV-2 screening test is made free of cost for volunteer blood donation, people would be encouraged to donate blood, and asymptomatic COVID 19 infected people can be easily identified. The futuristic strategy should investigate how long SARS-CoV-2 infected person is to be considered unfit for blood donations by conducting large-scale population studies, carrying out prospective trials for SARS-CoV-2 testing of the blood recipients, and assessing the blood recipients the blood of donors to determine virus infectivity. The existing fears among the blood donors will pose a significant challenge to sustain blood donation during the ongoing pandemic. Therefore, strategies have to be formulated after identifying the fears that hinder blood donation among potential donors. In addition, the governments and public health organizations should focus on eliminating the misinformation about different COVID-19 transmission routes among potential blood donors. This will also help to eliminate the fear of contracting COVID-19 during blood donation. The government should also review the national blood transfusion strategy based on the current scenario...
to avoid future blood shortages by collaborating with the transfusion specialists, blood banks, and physicians.

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Authors’ contribution

All the listed author(s) have made a substantial, direct, and intellectual contribution to the work, and approved it for publication.

Ethics statement

This article does not contain any studies with human participants or animals performed by any of the authors.
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