Available online freely at www.isisn.org

Bioscience Research

Print ISSN: 1811-9506 Online ISSN: 2218-3973

Journal by Innovative Scientific Information & Services Network

RESEARCH ARTICLE BIOSCIENCE RESEARCH, 2020 17(4): 2433-2438. **OPEN ACCESS**

A Review on Blood safety during COVID-19 pandemic

Abdullah Hamadi [1], Ali Mahzari [2], Abdulrahim Hakami [3], Reema Almotairi [4], Razan Alhefzi [5], Fawaz Hamdi [6], Afnan Baghdadi [7], Gasim Dobie [8], Rashid Mir [9] and Salwa Hindawi [10]

[1]Faculty of Applied Medical Sciences, Department of Medical Laboratory Technology, University of Tabuk, Tabuk, **Saudi Arabia**
[2]Faculty of Applied Medical Sciences, Department of Laboratory Medicine, Albaha University, Albaha, **Saudi Arabia**
[3] Faculty of Applied Medical Sciences, Department of Clinical Laboratory sciences, King Khalid University, Abha, **Saudi Arabia**
[4]Faculty of Applied Medical Sciences, Department of Medical Laboratory Technology, University of Tabuk, Tabuk, **Saudi Arabia**
[5]Faculty of Applied Medical Sciences, Department of Clinical Laboratory sciences, King Khalid University, Abha, **Saudi Arabia**
[6]Samtah General Hospital, Department of Clinical Laboratory, Ministry of health, Jazan, Saudi Arabia
[7] Prince Sultan Cardiac Centre, Department of Clinical Laboratory sciences, Armed Forced Hospital, Riyadh, **Saudi Arabia**
[8]Faculty of Applied Medical Sciences, Department of Medical Laboratory Technology, Jazan University, Jazan, **Saudi Arabia**
[9]Faculty of Applied Medical Sciences, Department of Medical Laboratory Technology, University of Tabuk, Tabuk, **Saudi Arabia**
[10]Department of Hematology, Faculty of Medicine king Abdulaziz University, **Saudi Arabia**

***Correspondence:** a.aldhafri@ut.edu.sa **Received 17-09-2020, Revised: 08-10-2020, Accepted: 18-10-2020 e-Published: 20-10-2020**

COVID-19 (SARS-CoV-2) is a pandemic disease characterized with respiratory infection and caused by coronavirus and spread worldwide after an outbreak began in Wuhan, China, in December 2019. This review covers general information on COVID 19 and the treatment options available through different trials. Specifically, we discussed blood safety during COVID-19 pandemic and the benefit using of convalescent plasma treatment. Blood donor, staff and patient safety are essential to reduce the risk of Corona virus (COVID 19) infection. There are many steps taken by countries worldwide to fight against this virus and blood safety is one of the major steps towards reaching their goal. The health of people has always the priority therefore, all blood donation centres and institutions should have high precautions, accuracy and maintenance to minimize the transmission of virus through blood transfusion.

Keywords: COVID-19, SARS-CoV-2, Blood Safety, Convalescent plasma.

INTRODUCTION

Once the World Health Organization (WHO) declared the coronavirus outbreak a pandemic, it was acknowledged that the virus would spread across the globe; with the number of affected countries, the number of overall cases, and the number of deaths exponentially increasing [Zhao, S., et al. 2020, Roser, M., et al. 2020]. A significant area of healthcare likely to experience adverse impacts is the blood banks and transfusion services. Particularly, donor recruitment is decreasing due to strict lockdown and social distancing requirements and the fear of catching the virus [Sohrabi, C., et al. 2020]. Consequently,

bloodstock inventory will diminish. It is in these regards that the American Association of Blood Banks (AABB) has designed and published guidelines on how to prepare, respond, and coordinate all blood transfusion services in the event of a pandemic [Hosseini-Motlagh, S.-M., et al. 2020]. Although it is known that respiratory viruses are generally not transmitted through blood transfusion, transmission modes of SARS-CoV-2 are still under study as extensive researches are conducted across the globe [Chang, L., et al. 2020]. Potential transmission of the virus through blood transfusion from asymptomatic, symptomatic, and resolved symptoms phases of the disease is still under study and currently unknown [Appassakij, H., et al. 2020]. Recently the US Food and Drug Administration (FDA) has confirmed that blood donation centers are competent in infection control, and as such, any willing donor can contact them for donation or information inquiry [Braendstrup, P., et al 2020].

Blood Donation and Donor Recruitment

Donor selection, testing, pre and post donation information on COVID 19 are essential elements for blood safety [Chen, J., et al. 2020]. Donor's health questionnaire including having any respiratory symptoms, the travel history of donors or their potential contacts with known infected or suspicious cases [Kumar, D., et al. 2020]. Blood donor recruitment through awareness, giving specific appointment for each donor, and reaching donors in their home can help in keeping up with blood inventory [Merchant, R.M., et al. 2020].

Availability of Blood Components and the Needs for Certain Patients

The need for blood products like blood, platelet, and Plasma is constant [Schallmoser, K., et al. 2020]. Even in the current coronavirus crisis, blood products are still on high demand, with crucial organizations like the American Red Cross emphasizing their appeal for individuals to keep their donation schedules and to make new appointments [Goette, L., et al. 2020]. Considering that coronavirus is a family of viruses, potential viremia conditions of COVID-19 are estimated based on research from the other coronaviruses [Wang, L.-s., et al. 2020]. The present pandemic is reminiscent of past outbreaks like MERS, SARS, or Zika. Research about the Zika virus led to the provision of guidelines about safe and adequate blood supply by WHO [Kaid, C., et al. 2020]. The two main guidelines by WHO include: ensuring blood supply through reinforcing blood collection in non-affected areas or collecting blood in areas with the active transmission but reducing the risk of transmission (World Health Organization 2) [Khan, N., et al. 2020]. If the entire country is affected or when it is logistically impossible to source blood from non-affected areas, the WHO proposes several measures: Temporary donor deferral, pathogen reduction of blood components, testing blood for the virus, or quarantining blood components (World Health Organization 2) [Weinkove, R., et al. 2020]. The guidelines provide a basis for balancing between safety and donating blood in the affected regions. Experts appreciate the fact that different regions have unique local circumstances that may require the WHO guidelines to be relaxed a bit, especially in emergency situations [Albright, K., et al. 2020]. Patient blood management program including the use of alternative to blood transfusion, management of preoperative anaemia and autologous blood transfusion can minimize the need of blood transfusion [Fujiwara, S.-i., et al. 2020].

Safety of Blood transfusion for COVID-19 Patients

WHO emphasizes that the novel coronavirus studies still experience knowledge gaps like insufficient knowledge about clinical virus detection, immunity and immune diagnostics, and clinical processes [Seah, I., et al. 2020]. In this regard, extensive ongoing research still continues to understand transmissibility, including analysis of clusters, viral shedding studies, and estimation of transmission parameters form diverse locations' epidemiological data. However, some crucial information has been developed after close monitoring of the virus [Ferretti, L., et al., 2020]. Firstly, on the first or third day following the onset of symptoms, viral RNA in serum/plasma can be detected [Artika, I.M., et al. 2020]. Secondly, young people experience milder symptoms than elderly ones [Artika, I.M., et al. 2020]. Thirdly, individuals with underlying medical conditions like diabetes, cancer, or hypertension are more susceptible to severe coronavirus disease [Wu, Z., et al. 2020]. Finally, there are many asymptomatic patients who are carriers but without any development of symptoms [Lai, C.-C., et al. 2020]. With these facts in mind, it is possible to determine the most appropriate age and health status of adults who can participate in blood donation or organ transplants in the midst of the outbreak. Notably, it would be unsafe to encourage geriatrics, individuals with underlying chronic conditions,

symptomatic patients, or those who have tested positive for viral RNA in serum/plasma. However, even as more research continues, an effective assessment must be established before declaring a COVID-19 patient safe for blood donation or organ transplant [9].

Use of Convalescent Plasma Treatment for COVID-19 Patients

Convalescent plasma treatment was used in patients with SARS who had shown poor outcomes following treatment with pulsed methylprednisolone [Wu, Z., et al. 2020]. With the outcomes showing lower mortality and shorter hospital stay in SARs patients, the treatment has drawn significant attention in the current global health threat of COVID-19, especially as an optimistic rescue option for severe cases [Liu, C., et al. 2020].

Table 1: Outcomes of using convalescent plasma (CP) to treat COVID-19 patients

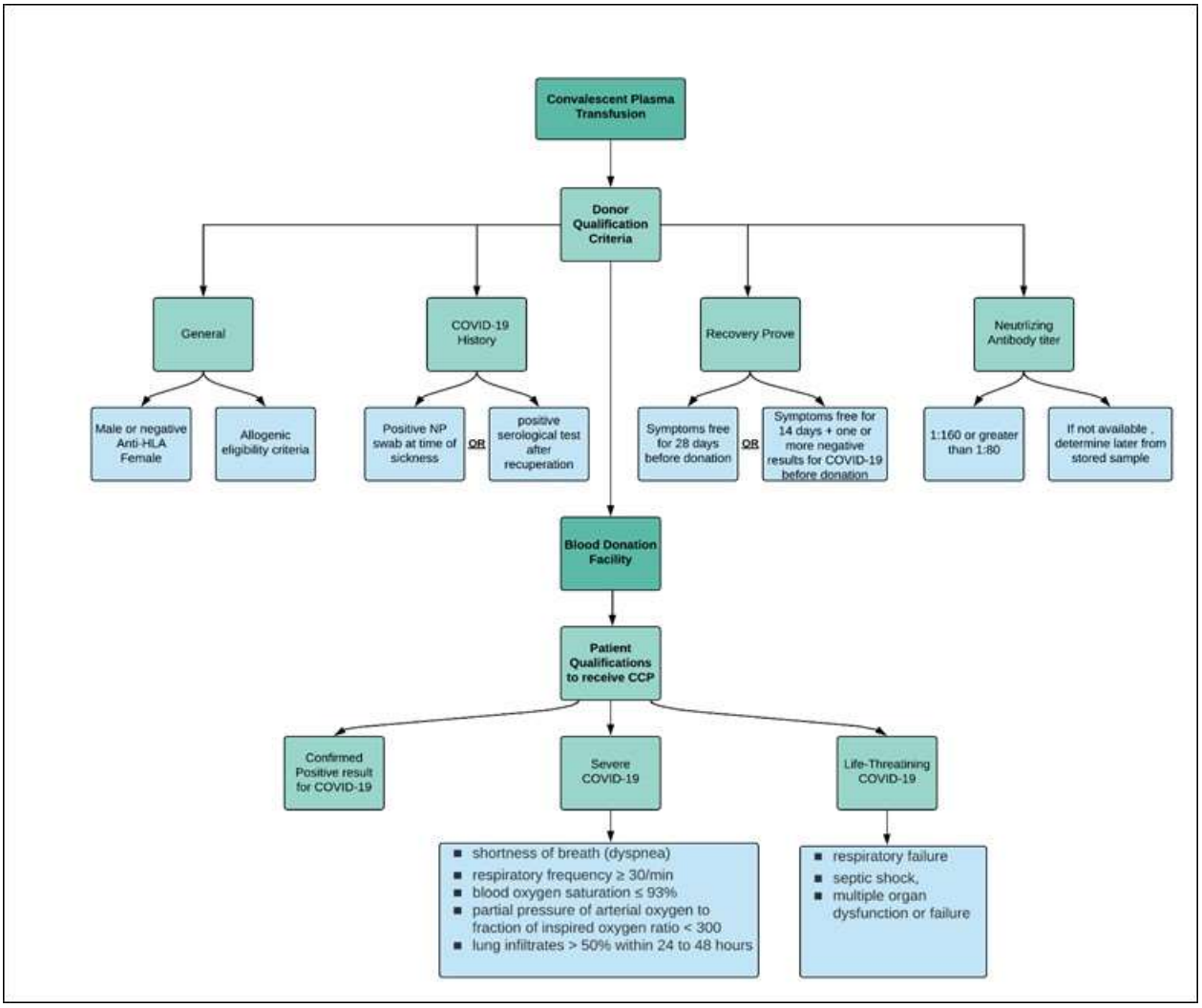
Number of patients	CP dosage	CP received after admission	Results	Ref.
10	Single dosage of 200 mL	16 days	- undetectable viral load within 7 days - improved clinical symptoms within 3 days - increased oxygen saturation within 3 days. - two patients were weaned from mechanical ventilation - improved paraclinical parameters (increased lymphocyte counts and decreased C-reactive protein) - reduction of pulmonary lesions within 7 d	(Duan et al., 2020)
5	Two consecutive dosages of 200-250 mL (400 mL in total) on the same day it was obtained from 5 donors	10 - 22 days	- reduced viral load within 12 days - shortening of the duration of symptoms - improve oxygen levels - declined body temperature within 3 days - decreased SOFA score12 days following post-transfusion - increased PAO2/FIO2 within 7 days - ARDS resolved in 4 patients - gradual reduction o f pulmonary lesions - mechanical ventilation discontinued in 3 patients within 2 weeks	(Shen et al., 2020)

In their study, Duan, Kai et al, reviewed results from 10 severe COVID-19 adult cases, which indicated that a dose of convalescent plasma (200mL) was well tolerated, hence leading to the improvement of clinical symptoms within three days and the disappearance of viremia in 7 days [Duan, K., et al. 2020] (Table 1). It is crucial to explore further studies regarding the medical effectiveness and feasibility of the treatment intervention. Notably, clinical trials should be used to determine convalescent plasma's empirical use, with the relevant regulatory bodies ensuring ethical conduct during the collection and use of the plasma or serum. Although currently, the COVID-19 disease has no approved specific antiviral agents, it is crucial to facilitate rapid and carefully designed studies that can greatly impact treatment and patient outcomes [Guo, Y.-R., et al. 2020]. Ultimately, any treatment strategy should determine the benefit/ risk analysis of the agent in COVID-19 [Gautret, P., et al. 2020].

Protocols and trials of using convalescent plasma for COVID-19 treatment

The use of convalescent plasma therapy was first proposed in the 1890s to treat severe epidemics before a vaccine is developed, such as

Chart 1: The protocol of using convalescent plasma transfusion.



haemorrhagic fever, severe acute respiratory syndrome (SARS), avian influenza and Ebola virus [Marano, G., et al. 2016]. As a response to this pandemic, the U.S. Food and Drug Administration officials have approved the use of two investigational therapies for COVID-19; convalescent plasma and hyper-immune globulin [Tobaiqy, M., et al. 2020]. These antibody-rich blood products were donated from people who have recovered from the virus and transfused into critically ill patients who have no other treatment options with certain criteria.

Recent preliminary data from China raise the possibility that convalescent plasma may have benefit in the COVID-19 illness [Duan, K., et al. 2020]. In this study, a single dose of 200 mL of convalescent plasma was administered to 10 adult COVID-19 patients with severe or life-threatening symptoms [Duan, K., et al. 2020]. The enrolment criteria were i) respiratory distress, (RR) >30 beats/min; ii) O2 saturation level in resting-state < 93%; and iii) arterial O2 partial pressure (PaO2)/ fractional inspired O2 (FiO2) ≤ 300 mmHg. Overall, the patients witnessed significant improvement

with the disappearance of the viremia within seven days [Duan, K., et al. 2020].

In another trial, antibody-rich plasma was injected into 5 critically ill patients with COVID-19 and acute respiratory distress syndrome (ARDS). In this study, 400 mL of convalescent plasma in two consecutive doses of 200 to 250 mL was given to the patients. The patients in this trial met the following criteria; i) severe viral pneumonia ii) PaO2/FiO2 ≤ 300 mmHg, and iii) patients had been supported with mechanical ventilation [30]. Clinical outcomes of the patients were compared before and after convalescent plasma administration. The results showed that the transfusion of convalescent plasma was followed by an improvement in clinical symptoms of the patients within 12 days [Shen, C., et al. 2020] (Chart 1).

CONCLUSION

Blood donor, staff and patient safety are essential to reduce the risk of Corona virus (COVID 19) infection. There are many steps taken by countries worldwide to fight against this virus and blood safety is one of the major steps towards reaching their goal. The health of people has always the priority therefore, all blood donation centres and institutions should have high precautions, accuracy and maintenance to minimize the transmission of virus through blood transfusion.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

AUTHOR CONTRIBUTIONS

All authors shared in the writing of manuscript. AH, AM, ARH, GD and SH wrote the manuscript. RA and FH designed the table. RH and AB designed the chart. SH and MR reviewed the last version. All authors read and approved the final version.

REFERENCES

Albright, K., et al., *Systematic review of facilitators of, barriers to, and recommendations for healthcare services for child survivors of human trafficking globally.* Child Abuse & Neglect, 2020. 100: p. 104289.

Appassakij, H., et al., *The Potential Impact of Chikungunya Virus Outbreaks on Blood Transfusion.* Transfusion medicine reviews, 2020. 34(1): p. 23-28.

Artika, I.M., A. Wiyatno, and C.N. Ma'roef, *Pathogenic viruses: Molecular detection and characterization.* Infection, Genetics and Evolution, 2020: p. 104215.

Braendstrup, P., B.L. Levine, and M. Ruella, *The long road to the first FDA-approved gene therapy: chimeric antigen receptor T cells targeting CD19.* Cytotherapy, 2020.

Chang, L., Y. Yan, and L. Wang, *Coronavirus disease 2019: coronaviruses and blood safety.* Transfusion medicine reviews, 2020.

Chen, J., et al., *Clinical study of mesenchymal stem cell treating acute respiratory distress syndrome induced by epidemic Influenza A (H7N9) infection, a hint for COVID-19 treatment.* Engineering, 2020.

Duan, K., et al., *Effectiveness of convalescent plasma therapy in severe COVID-19 patients.* Proceedings of the National Academy of Sciences, 2020.

Ferretti, L., et al., *Quantifying SARS-CoV-2 transmission suggests epidemic control with digital contact tracing.* Science, 2020.

Fujiwara, S.-i., et al., *Clinical significance of autologous blood transfusions in bone marrow harvest from unrelated donors.* International Journal of Hematology, 2020: p. 1-7.

Gautret, P., et al., *Hydroxychloroquine and azithromycin as a treatment of COVID-19: results of an open-label non-randomized clinical trial.* International journal of antimicrobial agents, 2020: p. 105949.

Goette, L. and A. Stutzer, *Blood donations and incentives: Evidence from a field experiment.* Journal of Economic Behavior & Organization, 2020.

Guo, Y.-R., et al., *The origin, transmission and clinical therapies on coronavirus disease 2019 (COVID-19) outbreak–an update on the status.* Military Medical Research, 2020. **7**(1): p. 1-10.

Hosseini-Motlagh, S.-M., M.R.G. Samani, and S. Homaei, *Blood supply chain management: robust optimization, disruption risk, and blood group compatibility (a real-life case).* Journal

of Ambient Intelligence and Humanized Computing, 2020. **11**(3): p. 1085-1104.

Kaid, C., et al., *Safety, tumor reduction and clinical impact of Zika virus injection in dogs with advanced-stage brain tumors.* Molecular Therapy, 2020.

Khan, N., et al., *Quarantine Role in the Control of Corona Virus in the World and Its Impact on the World Economy.* Available at SSRN 3556940, 2020.

Kumar, D., et al., *COVID-19: A Global Transplant Perspective on Successfully Navigating a Pandemic.* American Journal of Transplantation, 2020.

Lai, C.-C., et al., *Asymptomatic carrier state, acute respiratory disease, and pneumonia due to severe acute respiratory syndrome coronavirus 2 (SARSCoV-2): Facts and myths.* Journal of Microbiology, Immunology and Infection, 2020.

Liu, C., et al., *Research and development on therapeutic agents and vaccines for COVID-19 and related human coronavirus diseases*. 2020, ACS Publications.

Marano, G., et al., *Convalescent plasma: new evidence for an old therapeutic tool?* Blood Transfusion, 2016. 14(2): p. 152.

Merchant, R.M., *Evaluating the Potential Role of Social Media in Preventive Health Care.* JAMA, 2020.

Roser, M., H. Ritchie, and E. Ortiz-Ospina, *Coronavirus Disease (COVID-19)–Statistics and Research.* Our World in data, 2020.

Schallmoser, K., et al., *Production and quality requirements of human platelet lysate: a position statement from the working party on cellular therapies of the international society of blood transfusion.* Trends in biotechnology, 2020. **38**(1): p. 13-23.

Seah, I. and R. Agrawal, *Can the coronavirus disease 2019 (COVID-19) affect the eyes? A review of coronaviruses and ocular implications in humans and animals.* Ocular immunology and inflammation, 2020: p. 1-5.

Shen, C., et al., *Treatment of 5 critically ill patients with COVID-19 with convalescent plasma.* Jama, 2020

Sohrabi, C., et al., *World Health Organization declares global emergency: A review of the 2019 novel coronavirus (COVID-19).* International Journal of Surgery, 2020.

Tobaiqy, M., et al., *Therapeutic Management of COVID-19 Patients: A systematic review.* medRxiv, 2020.

Wang, L.-s., et al., *A review of the 2019 Novel Coronavirus (COVID-19) based on current evidence.* International Journal of Antimicrobial Agents, 2020: p. 105948.

Weinkove, R., et al., *Managing haematology and oncology patients during the COVID-19 pandemic: interim consensus guidance.* The Medical Journal of Australia, 2020. 212(10): p. 1.

Wu, Z. and J.M. McGoogan, *Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: summary of a report of 72 314 cases from the Chinese Center for Disease Control and Prevention.* Jama, 2020.

Zhao, S., et al., *Preliminary estimation of the basic reproduction number of novel coronavirus (2019-nCoV) in China, from 2019 to 2020: A data-driven analysis in the early phase of the outbreak.* International journal of infectious diseases, 2020. 92: p. 214-217.