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Original Article

Management of blood supply and demand during the COVID-19 pandemic in King Abdullah Hospital, Bisha, Saudi Arabia



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ABSTRACT

Background: Maintaining blood supply is essential since blood transfusions are lifesaving in many conditions. The 2003 infectious outbreak of SARS-CoV had a negative impact on blood supply. This study aimed to measure donor attendance and blood demand in order to help find efficient ways of managing blood supply and demand during the COVID-19 pandemic and similar public emergencies in the future.

Materials and methods: Data from donor attendance, mobile blood drives and blood inventory records were retrospectively obtained for the period between 1 September 2019 and 1 May 2020 to assess the impact of COVID-19 on donor attendance and the management of blood supply and demand in King Abdullah Hospital, Bisha, Saudi Arabia. Data were analysed using SPSS statistics, version 25.0. Categorical variables were described using frequencies and percentages.

Results: After imported cases of COVID-19 were reported in Saudi Arabia, donor attendance and blood supply at blood bank-based collections showed a drop of 39.5%. On the other hand, blood demand during the same period was reduced by 21.7%.

Conclusions: The COVID-19 pandemic had a negative impact on donor attendance and blood supply and adversely affected blood transfusion services. Guidelines that prioritize blood transfusion should prepare at the beginning of emergencies similar to this pandemic. Close monitoring of blood needs and blood supply and appropriate response is essential for avoiding sudden blood shortage. An evidence-based emergency blood management plan and flexible regulatory policy should be ready to deal with any disaster and to respond quickly in the case of blood shortage.

1. Background

In December 2019, an unknown viral infection was discovered in Wuhan city, China [1]. The virus rapidly spread worldwide [2,3], and many patients reported symptoms of pneumonia [4]. In late December, the World Health Organization (WHO) identified the pathogen causing this pneumonia as a new strain of coronavirus; this novel coronavirus was named by the International Committee on Taxonomy of Viruses as 'severe acute respiratory syndrome coronavirus 2' (SARS-CoV-2), and its associated disease was named by the WHO as 'coronavirus disease 2019' (COVID-19). On 31 January 2020, the WHO announced the outbreak of COVID-19 as a Public Health Emergency of International Concern; it has since become a pandemic [5]. As of 26th May, 5,611,597 cases have been documented worldwide, and 348,330 patients have died due to the COVID-19 pandemic according to numbers updated daily by the WHO. This pandemic has had a profound effect on health services, including blood donation (BD) and blood supply. BD has

remained the primary source of blood and blood components worldwide. The availability of safe and adequate blood and blood components is critical for the treatment of many patients [6]. The blood transfusion services (BTS) in the study area are dependent on hospital blood banks that are responsible for blood supplies and blood testing. The primary sources of donated blood are direct donation (mainly patients' relatives), voluntary non-remunerated donors, and mobile blood drives [7]. Maintaining blood supply is essential because blood transfusions are lifesaving in many situations. The 2003 infectious outbreak of SARS-CoV had a negative impact on BD and blood supply [8]. In a pandemic situation like COVID-19, BTS face challenges to delivering a stable and adequate supply of blood due to decreasing blood donations. Fortunately, the transmission of SARS-CoV through transfusion has not been reported [9–12], and the Food and Drug Administration (FDA) does not recommend testing donors or donated blood for SARS-CoV-2. However, blood banks should take precautionary measures to minimize any chance for transmitting SARS-CoV-2 between the blood bank staff

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and donors and between donors themselves because there is still a theoretical chance of blood transmitting SARS-CoV [13,14]. These precautions include appropriate personal protective equipment, physical distancing between the donors [15], checking donor body temperature, public health measures, and standard laboratory biosafety practices [16,17]. Blood and blood components are continuously needed during the pandemic for patients with blood diseases, cancers, trauma, and emergency surgeries. Without proper management of blood supply and demand, hospitals will face a shortage of blood, with the result that many patients may die or suffer unnecessarily. The information provided by this study will be vital in planning for proper management of blood supply and demand to avoid blood shortage and to help donors donate blood safely during a pandemic. This study aimed to measure donor attendance and blood demand in order to help find efficient ways of managing blood supply and demand during the COVID-19 pandemic and similar public health emergencies in the future.

2. Materials and methods

2.1. Study design and setting

A cross-sectional study was conducted in the blood bank department at King Abdullah Hospital, Bisha, Saudi Arabia, between 1 September 2019 and 1 May 2020. King Abdullah Hospital is the tertiary hospital in Bisha and serves a wide range of populations in 240 villages. Blood donor attendance, the volume of blood supply, and blood demand before and during the COVID-19 pandemic were estimated and assessed to aid proper management of blood supplies to avoid blood shortage during this pandemic.

2.2. Data collection and procedure

Data were retrospectively obtained from donor attendance records, mobile blood drives and blood inventory records between 1 September 2019 and 1 May 2020 (four months before and four months after the beginning of the COVID-19 pandemic). The data included the number of donated units of blood, sources of donated blood, and the number of blood units released for transfusion.

2.3. Data analysis

Data were analysed using SPSS Statistics, version 25.0, to assess donor attendance and the management of blood supply and demand. Categorical variables were described using frequencies and percentages.

2.4. Ethical clearance

This study was approved by the Institutional Review Board of King Abdullah Hospital, Bisha, Saudi Arabia.

3. Results

The blood bank department monitors the monthly donated blood in the King Abdullah Hospital. The amount of blood collected in the last four months before the pandemic spread outside China was 1350 units. All the collected blood was from blood bank-based collections except for September, in which 117 units were collected from mobile blood drives that collected at donors' homes to cover the drop in blood supply (Table 1). In January and February 2020, collected blood numbered 252 and 267 units, respectively. All collected blood was from blood bank-based collections. The blood collected from blood bank-based collections in March and April 2020 after COVID-19 arrived in Saudi Arabia numbered 234 and 116 units, respectively, while the blood collected by mobile blood drives at donors' homes numbered 26 and

Table 1

The volume and sources of blood supply before COVID-19 pandemic.

Month	Blood supply/unit	
	Blood bank-based collections	Mobile blood drives
September 2019	310	117
October 2019	317	0
November 2019	328	0
December 2019	288	0

Table 2

The volume and sources of blood supply during COVID-19 pandemic.

Month	Blood supply/unit	
	Blood bank-based collections	Mobile blood drives
January 2020	252	0
February 2020	267	0
March 2020	234	26
April 2020	116	114

114 units, respectively (Table 2). The mean \pm standard deviation amount of blood collected by blood bank-based collections before COVID-19 arrived in Saudi Arabia was 293.7 ± 29.9 units per month while the mean \pm standard deviation amount of blood collected after COVID-19 arrived in Saudi Arabia on 2 March 2020 was 175 ± 83.4 units per month (Fig. 1). This notable drop in blood supply was equivalent to 39.5 % of pre-COVID-19 levels. All collected blood was released and delivered for transfusion (Fig. 2). The mean \pm standard deviation amount of blood utilized in the period before COVID-19 was 313.2 ± 62.8 units per month, while the mean \pm standard deviation amount of blood utilized after COVID-19 arrived in Saudi Arabia was 245 ± 21.2 units per month (Fig. 3). The reduction in blood demand during this time period was equivalent to 21.7 %.

4. Discussion

Blood and blood components are an essential part of emergency preparedness, and neither can be synthesized nor stored for long periods, especially platelets. The shelf life of red blood cells is up to 42 days, while the shelf life of platelets is only five days [18,19]. So, continuous replenishment of the blood supply is crucial. Proper planning of blood supply management is essential during pandemics. In the present study, month-to-month blood supply and blood demand were analysed for the four months before and four months after COVID-19 arrived in Saudi Arabia. The blood collected in the blood bank department in the last four months before the COVID-19 pandemic covered demand except for September 2019, in which demand exceeded BD by 117 units; this gap was covered by mobile blood drives that collected at donors' homes. Most of the donors in this study were voluntary non-remunerated donors who are likely to be motivated to continue donations during pandemics. Two months after the beginning of the pandemic in Wuhan city in late December 2019, the blood collected by blood bank-based collections did not show any deficit, because COVID-19 had not yet been imported to Saudi Arabia.

After confirmation of the first COVID-19 case in Saudi Arabia on 2 March 2020, the blood bank department noticed a drop in blood supply of 39.5 %. This finding is consistent with a recent study conducted by the American Red Cross [20]. This drop, combined with the ongoing need for blood to maintain emergency and urgent care services for patients and the planned use of convalescent plasma for the treatment of patients of COVID-19 as announced by the FDA, could trigger a critical blood shortage. The drop in blood supply in this study may be explained by the reduction in donors arriving for scheduled appointments due to donor fear of exposure to SARS-CoV-2 at a hospital blood

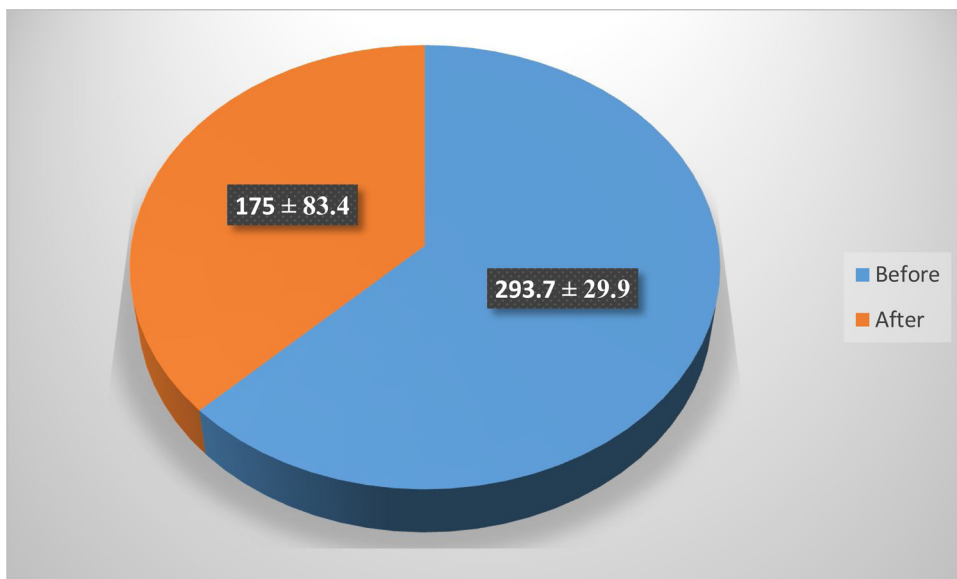


Fig. 1. The mean ± standard deviation units per month of blood bank-based collections before and after the COVID-19 arrived in Saudi Arabia.

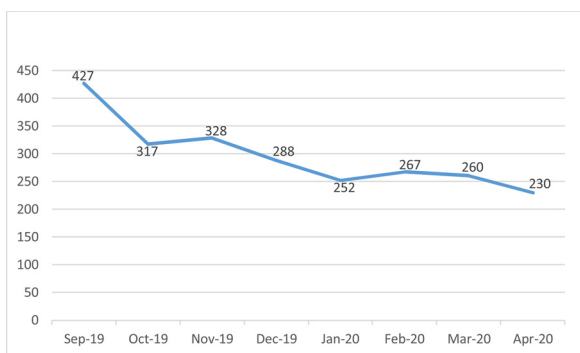


Fig. 2. Blood demand in units by month before and during the COVID-19 pandemic.

bank [21,22], as well as cancellation of many mobile blood drives due to the closed educational system and employment campuses [23]. Fortunately, this drop in blood supply was balanced by the reduction in blood demand, communication with regular volunteer donors through their private social media encouraging them to donate at the blood bank, and organization of mobile blood drives at donors' homes after coordination with the donors and application of all COVID-19 safety precautions. All collected blood was released and delivered for transfusion. The release of all donated blood for transfusion indicates that no reserve blood remains in the blood bank, so that any emergency need for blood will be solved either by the allocation of blood stocks of neighbouring hospitals' blood banks or direct donation/mobile blood drives at donors' homes after coordination through social media. The blood bank team makes requests to the community to donate blood regularly to help maintain the blood supply and to cover the gap between blood supply and blood demand. The mobile blood drives target donors at their homes as major mobile drive sites are closed, such as high schools, universities, and offices. With the primary finding that blood demand dropped by 21.7 % units per month. This reduction in

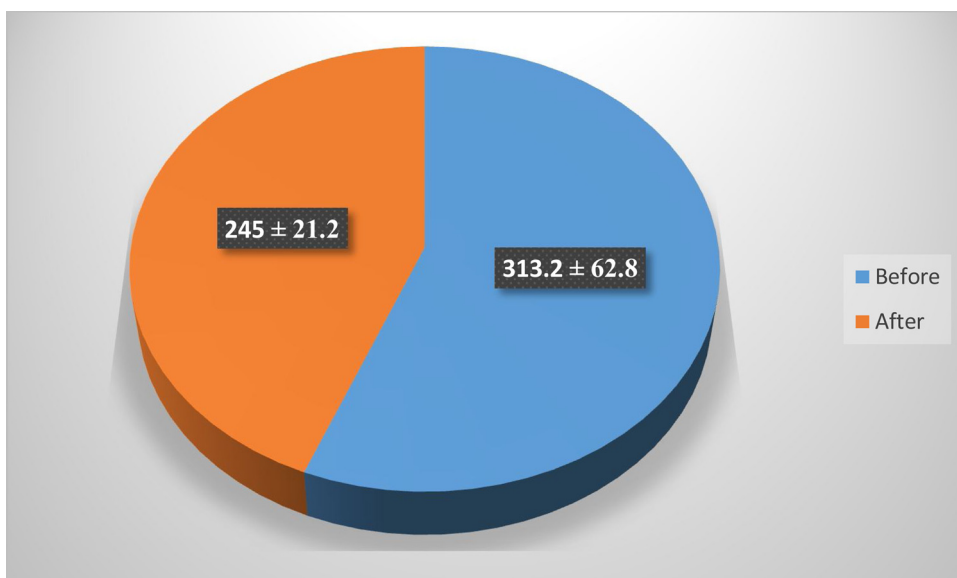


Fig. 3. The mean ± standard deviation units of blood demand per month before and after COVID-19 arrived in Saudi Arabia.

blood demand during the pandemic is consistent with what was observed in the SARS epidemic in Beijing (April to June 2003) and in Toronto, Ontario, Canada (2003). The reduction in blood demand during the current pandemic is primarily due to reduced hospital admissions, decreased number of trauma injuries due to lockdown and social distancing, postponed elective surgeries, and reserving blood transfusions for lifesaving only.

This study revealed that donor attendance and blood supply are negatively affected by the COVID-19 pandemic. Hospitals face many challenges in maintaining stable and adequate blood supply, as shown in previous outbreaks of other coronaviruses [8,24–26]. Many measures should be implemented to overcome these challenges to ensure a stable and adequate blood supply. These measures may include using public media to educate and motivate people for BD and to reassure donors about the availability of safe and accessible options for BD through an appointment system, mobile blood drives at donors' homes, monitoring of emergency blood supplies, proper management of the available blood, appropriate management of coagulopathy, treatment of anaemias with appropriate pharmacological agents, postponement of elective surgeries where that would not lead to more complex and urgent medical situations, utilization of blood only for emergency conditions and using effective blood conservation methods [27] such as patient blood management (PBM) [28,29]. PBM involves improved blood utilization [30] and reducing the need for blood transfusions while producing similar or better clinical outcomes. Thus, the practice of PBM methods will help safeguard blood stocks and is highly advisable [31]. Blood bank specialists must communicate with clinicians to ensure that blood is only used in emergency and urgent conditions. Hospitals' plans for maintaining BTS during a pandemic need to include protecting the staff and blood donors, recruiting and motivating voluntary non-remunerated donors to regularly donate until emergency conditions pass, and maintaining enough stock of reagents and consumable items. In the case where a blood shortage happens even after these measures, the shortage can be managed by allocation of blood stocks of neighbouring hospitals' blood banks [32].

5. Conclusions

In conclusion, this study revealed that the COVID-19 pandemic had a negative impact on donor attendance and blood supply and adversely affected BTS, with the result that the blood transfusion staff faced challenges in maintaining the balance between blood demand and blood supply through the organization of mobile blood drives at donor's homes and communication with regular volunteer donors through their private social media to come to the blood bank for donation. Effective communication strategies between the blood bank staff, suppliers, clinicians, donors and the public about pandemic-related news and bloodstock are needed. Guidelines that prioritize blood transfusion during a disaster should focus on preparing at the beginning of any emergency like this pandemic. Close monitoring of blood needs and blood supply and appropriate response are needed to avoid sudden blood shortage, particularly for blood components with a short shelf life, such as platelets. BTS should be integrated into the national COVID-19 planning system to work in coordination. The blood transfusion department should make an evidence-based emergency blood management plan and have flexible regulatory policies in place to be ready for disasters and to respond quickly if a blood shortage happens. Regular public awareness campaigns on COVID-19, the safety of the BD process, and the need for regular BD to maintain stable and adequate reserves of the blood are recommended.

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Declaration of Competing Interest

None.

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