Alterations in blood component utilization in a tertiary care hospital in eastern India in the COVID-19 pandemic

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Abstract:

BACKGROUND: With shortages of blood globally in the COVID-19 pandemic, many hospitals and blood centers have successfully implemented blood conservation strategies and strategies to maintain blood donations and blood inventory. Here, we reported our experience of utilization of blood components for transfusion in the current COVID-19 pandemic and discussed the patient blood management (PBM) methods and importance of judicious blood usage in any pandemic.

MATERIALS AND METHODS: The retrospective study of 8 months was divided into pre-COVID and COVID periods. Parameters that included number of blood requisitions, blood components reserved and transfused, clinical speciality wise blood usage in both the periods were analysed. Blood utilization indices were computed using recommended equations.

RESULTS: We observed an unusual pattern of blood utilization with significant disruption on blood supply and demand chain in this pandemic. A mean drop of 50.7% blood requisitions was observed in the COVID period. The period observed transfusion of 3608 units of blood components with a mean drop of 49.7% when compared to pre-COVID period. Mean drop of 46.6%, 54.4%, 53.4% and 52.7% were observed in packed red blood cell, fresh frozen plasma, platelet concentrate and cryoprecipitate transfusions in the COVID period. Blood component utilization was significantly reduced in most clinical specialities. The mean cross match to transfusion ratio in the COVID period was 1.28 with a mean increase in transfusion probability and transfusion index by 18.2% and 22.2% respectively.

CONCLUSION: Although a constant transfusion support was needed in few clinical specialities throughout the pandemic, strict adherence to PBM protocols and practice of first in, first out method of blood dispensing helped the blood centre to support all patients needing blood transfusion.

Keywords: Blood transfusion, blood utilization index, COVID-19, pandemic, patient blood management

Introduction

The global health care facilities have undergone a significant disruption due to the present severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic. Though stringent measures like social distancing could effectively contain the virus, it had a profound impact on the blood transfusion services (BTS) in terms of blood donation, blood inventory and clinical transfusion management.[1] The rise of asymptomatic infection in normal population also posed a challenge in the recruitment of voluntary blood donors. The challenges have been even more in the compulsory lockdown period due to lack of transportation and restricted blood donation camps caused by closure of schools and offices and prohibition of mass gathering. With shortages of blood globally many hospitals and BTS...
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have successfully implemented blood conservation strategies as well as strategies to maintain blood donations and blood inventory. The novel coronavirus disease (COVID‑19) pandemic equally observed a reduction in patient occupancy in the hospitals. Deferrals of nonurgent intervention, immobilisation of patients with increased risk of infection and suspension of transplantation programs have reduced the demand of all blood components. In addition patient blood management (PBM) such as restricted blood utilization, rationalization of blood transfusion, cell salvage strategies, use of transfusion alternatives and presurgical correction of anaemia have been found to be saviours of blood shortages in the pandemic. Ours being a multi-speciality tertiary care hospital with dedicated beds for COVID patients we observed an unusual pattern of blood utilization with significant disruption on the blood supply and demand chain during the COVID‑19 pandemic. Here we reported our experience of utilization of blood components for transfusion in the current COVID‑19 outbreak and discussed the PBM methods and importance of judicious blood usage in any pandemic.

Materials and Methods

The retrospective observational 8 months study was performed from November 16, 2019 to July 15, 2020 in our BTS which is an integral part of our 750 bedded tertiary care hospital. Due ethical clearance was obtained from the hospital Ethics committee. The study time was divided into two periods where initial 4 months from November 16, 2019 to March 15, 2020 was considered as the pre-COVID period and later 4 months from March 16, 2020 to July 15, 2020 was considered as COVID period. The study included facts and figures of various parameters related to blood transfusion in the BTS and all data were retrieved from the hospital information system software. Data were then analysed and compared between the pre-COVID and COVID-periods. Parameters that included number of blood requisitions, blood cross match and reservation, component wise blood transfusion, clinical speciality wise blood utilization, blood wastage and blood utilization indices were tabulated on a spreadsheet and analysed. In the initial months of mandatory lockdown in India (March 25, 2020–May 17, 2020) all elective surgeries, transplantation program and hospitalization of patient at risk of infection were stopped or restricted. Patients with multiple admissions and multiple blood transfusions for different indications were also included in the study. For all patients requiring blood component transfusion; complete blood requisition with appropriate blood samples for pretransfusion testing was received in the BTS. After mandatory testing compatible blood/component units were reserved for patient for subsequent transfusion. As per national guidelines details of testing and blood issue were documented accordingly.

Blood utilization indices in surgical patients were computed using the following equations:

i. **Cross match to transfusion ratio (C/T ratio)** = number of units of packed red blood cell (PRBC) crossmatched/number of units transfused. A ratio of 2.5 and below is considered indicative of significant blood usage.

ii. **Transfusion probability (TP)** = number of patients transfused/number of patients crossmatched ×100. A value of 30% and above was considered indicative of significant blood usage.

iii. **Transfusion index (TI)** = number of units transfused/number of patients crossmatched. A value of 0.5 or more was considered indicative of significant blood utilization.

Statistical analysis

Statistical analysis was done using the SPSS statistical package (IBM SPSS, 2015, USA). All results were calculated as mean ± standard deviation and a “P” value of <0.05 was considered statistically significant. Mean values were compared using the paired Student’s t-test as appropriate.

Results

We observed an unusual pattern of blood utilization with significant disruption on blood supply and demand chain in this pandemic. The study period received a total of 5728 blood requisitions in the BTS. A mean drop of 50.7% requisitions was observed in the COVID period (P = 0.103). Where 10,787 units of blood components were reserved for patients in the pre-COVID period; only 5491 reserved units were noted in the COVID period showing a mean drop...
of 49.1% ($P = 0.007$). Out of 10787 units of blood components reserved for patient in the pre-COVID period 7181 (66.6%) units were issued for transfusion. The COVID period observed transfusion of 3608 units of blood components with a mean drop of 49.7% when compared to the pre-COVID period ($P = 0.046$). A total of 2968 PRBC were crossmatched for surgical patients in the COVID period of which 2318 (84.3%) units were transfused calculating a mean C/T ratio of 1.28. In contrast the mean C/T ratio in the pre-COVID was found to be 1.63 ($P = 0.924$) [Figure 1]. Figure 2 describes the utilization of blood components in the pre-COVID and COVID periods. While comparing the COVID with the pre-COVID period mean drop of 46.6%, 54.4%, 53.4% and 52.7% were observed in PRBC, fresh frozen plasma (FFP), platelet concentrate and cryoprecipitate transfusions with significant drop in blood components like PRBC ($P = 0.001$), FFP ($P = 0.010$) and platelet concentrates ($P = 0.028$). Blood component utilization in the COVID period was significantly reduced in almost all clinical specialities such as clinical hematology ($P = 0.046$), gastroenterology ($P = 0.028$), nephrology and dialysis ($P = 0.004$), intensive care unit (ICU) ($P = 0.003$), cardiac sciences ($P = 0.007$) thalassemia clinic ($P = 0.033$) and surgical unit ($P = 0.013$) [Figure 3]. Blood utilization indices in the pre-COVID and COVID periods are described in Figure 4. Where a mean drop in C/T ratio was observed in the COVID period; the same period witnessed a mean increase in TP and TI by 18.2% and 22.2% respectively.

**Discussion**

The COVID-19 pandemic has caused a worldwide health crisis and threatened the blood supply significantly. Though it is believed that SARS-CoV-2 is not transfusion-transmissible however all BTS globally have implemented the guidelines of blood donor selection laid down by the local or national authorities in the light of the COVID-19 pandemic. With reduction in blood collection in the BTS; a profound decrease in patient admission was also observed in the pandemic. With cancellation of elective surgeries, suspension of transplantation program poor attendances in thalassemia, sickle cell, onco-hematology and medical oncology clinics the blood utilization was low. We observed a significant reduction in number of blood requisitions, blood component reservation and blood component transfusion during the COVID period ($P < 0.05$). Where the mean patient occupancy in the hospital was below 25% in April 2020; this gradually increased above 50% in the later part of June 2020. Although reduction in blood supply has been met in part by a reduction in demand in the mandatory lockdown period; the post lockdown period observed a remarkable increase in patient attendance with a poor blood inventory.

With PBM programs in place we could manage blood utilization in the hospital following established transfusion protocols. Methods like modifications in surgical and anaesthesia techniques, practice of cell salvage, uses of alternatives to blood transfusion, changes in transfusion triggers, the “one” unit PRBC transfusion practice, avoiding unnecessary transfusions.
and optimizing red cell mass were implemented in the hospital judiciously in the pandemic. In the current study three PBM protocols like a) “one” unit PRBC transfusion practice, b) cell salvages particularly in cardiac and oncological surgeries and c) modification in transfusion triggers to hemoglobin 7 g/dL in medical patients and 8 g/dL in surgical patients helped the BTS to manage the blood inventory and their utilization. Significant drop in PRBC, FFP, platelet concentrate and cryoprecipitate transfusions were observed in the COVID period. Where a drop of 46.6% was observed in PRBC transfusion; this was 54.4% in FFP transfusion. Clinical speciality wise the highest drop (66.7%) of blood utilization was observed in the thalassemia clinic (P = 0.033) followed by cardiac sciences (65.7% drop, P = 0.007) due to their poor attendances during the essential lockdown periods. Moreover it was observed that many thalassemia patients visited the nearest district or sub‑divisional hospitals to receive blood transfusion due to the reluctance or fear of getting admitted in COVID hospitals. As high as 61.7% of the total PRBC were utilized in clinical hematology, thalassemia clinic, dialysis unit and ICU during the COVID period. Mean drop in blood usage (31.7%) was low in the medical oncology where a considerable patient attendance was observed throughout the pandemic. It has been documented that increased need for blood components during a pandemic is unlikely and there may be a decrease in the blood demand as healthcare capacity is shifted towards providing the basic healthcare support, and nonurgent clinical interventions are usually deferred.[38] Drops in demand of blood components in previous and present pandemics were also reported by previous workers.[18,19] A blood component wise reduction of 14%, 11% and 1.6% for PRBC, FFP and platelets (PLT) respectively was observed by Raturi and Kusum amid the COVID‑19 outbreak.[19]

Proper inventory management should be implemented in any pandemic to reduce the wastage of blood and blood components.[14] The first in, first out (FIFO) policy of blood dispensing should be strictly followed after verifying the inventory physically every day.[20] We followed the FIFO policy strictly in the current pandemic and could reduce the blood wastage efficiently. Where only 1 PRBC unit was wasted in the pre‑COVID period; a total of 79 PRBC units were discarded in the COVID period. Fifty eight units were wasted in the month of April 2020 which reduced to 21 units in May 2020 (P = 0.0004) after applying the strict FIFO policy from the last week of April 2020.

Different evaluation methods have been developed to assess efficiency of blood requesting as compared to its utilisation. In 1970s Boral and Henry first used C/T ratio and considered appropriate blood usage if the ratio was 2.5 and below.[40] Discussing the blood utilization indices in surgical patients in the present study there was a drop in C/T ratio from 1.63 in the pre‑COVID period to 1.23 in the COVID period. This indicated that appropriateness of blood utilization was more in the COVID period although this was not statistically significant (P = 0.924).

Using C/T ratio as a parameter, studies across the world observed variable inappropriateness of blood usage.[21‑25] Although useful for appraising the tendency to over order, this ratio neither defines the probability that a transfusion will be required for a particular procedure, nor resolves whether the number of units ordered for a procedure is appropriate.[10] However we suggest appropriate blood ordering to reduce blood wastages, consumables and manpower and advice to follow the maximum surgical blood ordering schedule established by the hospital.

Another blood usage index is TP which was described in 1980.[10] TP in the current study was found to be 65.2% and 74.8% respectively in the pre‑COVID and COVID periods which indicated appropriate blood request and usage. An overall TP of 20%, 11.1%–25%, 36.9% and 47% were reported from various hospitals.[22,24‑26]

TI which indicates average number of units used per patients cross matched is considered to be a useful blood utilization index.[11] Although overall TI reports varied across different studies, we observed TI of 1.4 and 1.8 in the pre‑COVID and COVID periods respectively which indicated efficient blood usages in both the periods with a better blood utilization in the COVID period.[22,24‑25]

Disparities in efficiency of blood utilisation in emergency and elective procedures were reflected in different studies. In studies in Ethiopia, Egypt and Nigeria, C/T ratios were better in emergency than elective surgeries.[22,24‑27] Belayneh et al. did a cross sectional study in 2013 and reported that overall C/T ratio, TP, and TI indices were 2.3, 47%, and 0.77, respectively.[22] In the present study the blood utilization indices in both the pre‑COVID and COVID periods were found to be within the normal values or range described by previous authors. Strict adherence to hospital PBM protocols by the physicians has helped our BTS to support all patients requiring blood component transfusion with a poor blood inventory particularly in the COVID period. In addition the values of blood utilization indices found in the present study very well depicted the effective utilization of blood in both the periods with more appropriateness in the COVID period.

**Conclusion**

We conclude that with scarcity of blood donation in the COVID pandemic there was also a significant reduction in blood utilization. Although a constant
transfusion support was needed in few clinical specialities throughout the pandemic, initiation of PBM in the hospital and strict adherence to the PBM protocols helped the BTS to support all needy patients with the right component at the right time. In addition the practice of FIFO method of blood dispensing should be followed more strictly to prevent wastages of blood and blood components. Therefore judicious utilization of blood components in any pandemic is essential to ensure the blood inventory, reduce blood wastages, maintain stock of important resources and enable timely blood transfusion to critical and needy patients.

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Conflicts of interest
There are no conflicts of interest.

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