Assessment of Transfusion Practices Among Doctors During COVID-19 Pandemic Using Questionnaire-Based Survey

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Abstract During COVID-19 pandemic, many doctors were redirected from various disciplines for care of COVID-19 patients. A survey was conducted among doctors involved, to assess transfusion practices during the pandemic. To assess the knowledge, attitude, and practices of blood transfusion among doctors involved in care of COVID-19 patients. A cross-sectional survey using an online questionnaire (Google form) was used to assess knowledge and need of transfusion, attitude towards modifications in transfusion process, and practices during pandemic. Analysis was done among subgroups based on experience (designation), user type (speciality) and frequency of blood usage in parent department. Of 1900 invitations, 437 responses were received from resident doctors and faculty members across various disciplines. Of these, 354 (81%) participants were included in analysis. Mean knowledge score was 6.2, majority 297(83.9%) had adequate knowledge scores (≥ 5 of total 12). Knowledge levels were higher among frequent blood users. Positive attitude towards changes in transfusion process was observed in 72.9% participants with similar scores in subgroups.

Practice was assessed in 222(62.7%) participants. Mean practice score was 6.9, wherein 57.7% participants had optimal scores (≥ 7 of total 14). Positive correlation was observed between attitude and practice, unlike knowledge and practice. Although most participants had demonstrated adequate transfusion knowledge levels and positive attitude, transfusion practices during pandemic were affected mainly due to shortage of blood components and modifications in transfusion requisition process due to stringent COVID-19 containment measures. Thus, indicating need for improvement in the basic understanding of the transfusion process.

Keywords Transfusion medicine · COVID-19 · Knowledge · Attitude and practice

Introduction

Emergence of Severe Acute Respiratory Corona virus type 2 (SARS-CoV-2) outbreak causing Corona virus disease 2019 (COVID-19) was recognised as a worldwide pandemic by World health organisation in March 2020 [1]. Since then, it has affected large parts of the world, straining the healthcare services globally. The transfusion services were no exception to this. In addition to the fear of infection among the common masses, measures imposed to check spread of infection resulted in reduced number of blood donors, leading to shortage of the overall availability of the blood components for both COVID-19 and non-COVID-19 patients.

Amidst the shortage of the blood components and surge in the number of COVID-19, there was great deal of apprehension amongst the clinicians and transfusion services, due to minimal information about transfusion requirements of these patients. Moreover, many health care professionals including doctors were also affected with the COVID-19 which
led to shortage of the staff required for the care of COVID-19 affected patients. As a result, manpower including clinical staff from various unrelated specialties were mobilized for management of COVID-19 patients. Many doctors who were posted for care of COVID-19 patients had minimal experiences regarding the transfusion management of these patients and have possibly impacted the overall process of transfusion process. Thus, we conducted a questionnaire-based survey to understand knowledge, attitude, and blood transfusion practices of doctors, posted in COVID-19 area during this pandemic. The primary objective of this study was to assess the bedside transfusion practices among the doctors who were involved in blood transfusion during their involvement in management of COVID-19 patients. Secondary objectives were to assess knowledge scores of blood transfusion process among the doctors and attitude of doctors towards transfusion requirement in COVID-19 patients.

Materials and Methods

Study Design

This study was a descriptive cross-sectional study, using an online self-administered questionnaire conducted among doctors at a tertiary care hospital. The study was conducted during the from 1st July 2021 till 31st January 2022. Ethical approval was obtained from the institutional ethics committee (IEC/PG/383/23.06.2021).

Study Participants: Inclusion and Exclusion Criteria

All the participants were medical doctors, including junior residents (JR), senior residents (SR), and faculty members from all departments, who were posted for care of COVID-19 patients. Doctors not posted for the management of COVID-19 patients were excluded from the study.

Study Process

Participants were invited through a mail/message, wherein a link for online questionnaire (Google form) was shared. The questionnaire was self-administered and included the participant information sheet and the consent for participation prior to the survey. The demographic details of the respondents were collected, participants who performed duties in COVID-19 areas were allowed to complete the survey. Participants who did not respond to the initial link or did not complete the survey were sent reminders at least 3 times with one month time gap. The link for the questionnaire was closed after 6 months of sending the last reminders.

Questionnaire Preparation and Validation

Questionnaire prepared consisted of four major sections. First section included information about the demographics and the professional background. The second section included assessment of the knowledge related to transfusion of blood and/or blood components. Third section was assessment of the attitude towards transfusion during the COVID-19 pandemic and lastly the fourth section included the assessment of the transfusion practice among the respondents. Questionnaire prepared was evaluated by 2 independent subject experts independently for the content, review of research, direct observations, extent to which questionnaire measured the objectives of interest and its meaningfulness to the respondents. It was then validated by administering to group of 2–3 JRs from other departments (such as medicine, surgery, anaesthesia, etc.) to assess if there was any confusion about any questions and incorporating suggestions for improvements of the items. The details of the validated questionnaire are mentioned as follows:

Demographics and Professional Backgrounds

Participants’ age, sex, designation (Faculty/JR/SR), specialty and involvement in blood transfusion (yes/no), frequency of transfusion (never, < 10 units/months, 10–50 units/month, > 50 units/month), whether posted for COVID duties and involvement in blood transfusion process for COVID-19 patients.

Knowledge

To assess their knowledge scores, total of 8 questions (including subsections) were included, 5 of which were about blood components, thresholds/indication for transfusion and choice of blood groups. Rest 3 questions were for assessment of transfusion needs, laboratory findings and role of transfusion services in COVID-19 patients. Correct response was scored as 1 and 0 for incorrect response. Maximum score was 12, based on which knowledge level was categorised as adequate (score ≥ 5) or inadequate (score < 5).

Attitude

Participants attitude was assessed using 5 questions, which included changes in requisition process, errors associated with paperless system, biosafety of blood samples, availability of blood components and necessity for transfusions in COVID-19 patients. Response of 4 questions were measured on a five-point Likert scale (1–5; strongly disagree, disagree, neutral, agree, strongly agree), whereas for 1 question was assessed using 3-point scale (1–3; disagree, neutral, agree), with maximum score of 23. Total attitude score...
for each participant was categorised as positive attitude for score $\geq 15$, neutral for scores between 10 and 14 and negative attitude for scores $\leq 9$.

**Practices**

Transfusion practice was assessed among participants involved in the transfusion process. This included 7 questions (with sub-sections) pertaining bedside transfusion administration, requirements of blood products, measures to reduce transfusion needs, alternative measure, modifications of blood components, adverse transfusion reactions and response of convalescent plasma in COVID-19 patients. Correct responses were scored as 1 and 0 for incorrect, totaling 14 as maximum score. Practice was categorised as optimal if score was $\geq 7$ and sub-optimal for scores $< 7$.

**Statistical Analysis**

Master sheet with data obtained from the participants was generated on Microsoft Excel 2019. The responses were then coded for further evaluation and descriptive analysis was done using SPSS (Version 20.0. Armonk, NY: IBM Corp). Comparison of knowledge, attitude and practice was performed amongst different groups based on the experience (designation of the participant), user type (speciality) and the frequency of the transfusion in their parent department, using chi-square tests.

**Results**

Total of 1900 invitations were sent, of which 437 (23%) participants responded to the survey. Total 354 (18.6%) participants posted for COVID duties were included and were assessed for knowledge and attitude items. Practice was assessed in 222 participants who were involved in the transfusion process during their COVID-19 posting (Fig. 1). The demographics and professional backgrounds of the participants has been shown in Table 1 and Fig. 2. Individuals response to the questionnaire items is shown in the supplementary tables (Tables 3, 4 and 5).

**Knowledge**

Overall mean knowledge score was $6.2 \pm 1.7$ (range 1–11), with majority participants 297 (83.9%) having adequate knowledge scores. Most participants (348; 98.3%) were aware of $\geq 3$ blood components. Threshold for RBC, platelets, and plasma transfusions were correctly answered by 132 (37.3%), 182 (51.4%) and 183 (51.7%) participants respectively. Total of 225 (63.6%) doctors were aware of the alternative compatible FFP in case of unavailability of group specific FFP. More than half (192; 54.3%) participants had knowledge of common haematological laboratory findings of COVID-19 patients. Coagulopathy 245 (69.2%), followed by thrombocytopenia 199 (56.2%) and underlying co-morbid condition 151 (42.7%) were indicated as the reason for transfusion in COVID-19 patients. Total 188 (53.1%) participants were aware of supportive therapy such as convalescent plasma, therapeutic plasma exchange, immunoadsorption, required for management of COVID-19 patients.

**Attitude**

The mean attitude score was calculated as $15.8 \pm 2.3$ (range 7–22), majority participants 258 (72.9%) demonstrated positive attitude, whereas 92 (26.0%) showed a neutral stand and rest 4 (1.1%) had negative attitude. In response to paperless/digitized process for ordering of blood components, majority participants 274 (77.4%) showed positive attitude, however 101 (28.6) pointed out that it may increase the errors in labelling and documentation. Most participants 196 (55.4%) strongly agreed that blood sample should be disinfected by the ward staff before sending it to blood centre. Most (254; 71.7%) doctors also agreed that shortage of blood components was affecting transfusion management of COVID-19 patients. Agreement to the role of deranged/abnormal results of coagulation test in COVID-19 patients necessitating blood transfusion was observed in 158 (44.6%) participants, whereas one third (118; 33.3%) disagrees or strongly disagree to it.

**Practice**

Mean practice scores was calculated as $6.9 \pm 1.7$ (range 2–12), and 128 (57.7%) of 222 participants scored $\geq 6$ and were categorised as optimal transfusion practices. Total of 78 (35.1%) participants reported increased requirement of blood components. Common problems in the transfusion process reported included inappropriately labelled blood units 181 (81.5%), sub-optimal documentation 165 (74.3%) and difficulties in timely return of unused blood 135 (60.8%). Apart from these, difficulties in identifying adverse reactions 61 (27.5%), administering blood components 47 (21.2%) and patient identification were reported by 27 (12.2%) participants. In view of shortage of group identical blood components, while 117 (52.7%) participants opted for alternative compatible group, rest either waited for availability of group identical blood components or resorted to other measures such as referring the patients to other centres. Apart from this, alternatives measure that were adopted to decrease the need for blood transfusion included use of restrictive thresholds for transfusion (45; 20.3%), oral/IV iron therapy (6; 2.7%), erythropoietin (1; 0.5%), single unit transfusions (9; 4.1%).
Multiple strategies were adopted by 146 (65.8%) participants. Modification of blood components were reported by 48 (21.6%) participants. No changes in adverse transfusion reaction were reported by 218 (98.2%) participants. Convalescent plasma was used as off-label by 110 (49.5%), wherein, 9 (4.1%) reported it to effective and 66 (29.7%) reported equivocal responses.

Comparison of knowledge, attitude and practice among subgroups based on designation, speciality and frequency of blood usage is shown in Table 2. No correlation was observed between knowledge and practice scores (correlation coefficient -0.097 and p value of 0.148). Unlike the knowledge scores, attitude scores showed a minimal but positive correlation with the practice scores (correlation coefficient -0.147 and p value < 0.029).

**Discussion**

Good theoretical and practical transfusion knowledge along with a positive attitude/behaviour is essential to ensure safety of the transfusion process and improving patient outcome. It also helps in ensuring better utilisation of existing resources to meet patients' needs and reducing the overall cost of the healthcare. In our study, response to the online survey was lower than the response rates (20–80%) observed for similar KAP surveys during the COVID-19 pandemic [2–4]. Since this survey was targeted to a specific population of healthcare workers, lower response could be due to lesser degree of interest or non-availability of the participants due to their busy schedule or higher rate of COVID-19 infection among healthcare workers [5–8].
Inadequate knowledge of several day-to-day aspects of blood transfusion are not uncommon among medical students, resident physicians, and practicing physicians of different specialties [9–11]. Findings from this study indicated knowledge scores were significantly higher for alternate compatible FFP for group O patients, approximately 63.6% participants answered correctly. Nwogoh et al. has reported a higher (98.6%) knowledge of common blood groups among physicians at a teaching hospital in Nigeria [17]. This difference could be attributed to the variable work experience among the study participants, in our study majority participants were JRs who were undergoing training and larger number of participants from non-clinical specialties unlike the study by Nwogoh et al. which included trained physicians [17]. Knowledge of haematological findings and need/rationale for blood transfusions in COVID-19 patients was adequate only among 50% participants in this study. During the survey none/minimal information was available regarding the need/rationale for blood transfusions in COVID-19 patients most decisions to transfuse were largely based on the known haematological findings of COVID-19 patients at that time [18].

In this study, knowledge scores were significantly higher among the frequent blood users, unlike the subgroups based on the designation (JR, SR and faculties) and the specialties (medical/surgical and non-clinical). Similar knowledge levels have been reported by various authors, wherein they compared postgraduate students at various levels, or compared resident and consultant or from different backgrounds [11, 19–22]. Contrary to this, Arinsburg et al. and Gharehbaghian et al. have reported higher knowledge levels among pathologists, haematologist and oncologists [11, 22]. Even though the baseline education for all our study participants was similar, subsequent experience of transfusion practices in ward seems to positively impact the knowledge of the study participants.

During the COVID-19 pandemic many changes, especially regarding the policies or procedures were made, which were frequently modified or updated, sometimes within hours, which was often challenging for all healthcare professionals [23]. Despite this, most participants (77.4%) showed positive attitude towards a change in the protocol/procedure for ordering of blood components. During the COVID duties, health care staff have been overburdened due to various reasons, additional work with regards to disinfection could have resulted in disagreement to the disinfection by the ward staff before sending it to blood centre [23].

Errors during blood transfusion are quite common and can be fatal. Any suboptimal practices, especially with regards to documentation can lead to adverse outcomes in the patient and can also lead to medico-legal implications [24, 25]. As a result, introduction of paperless system for blood request, led to disagreement by majority participants due to fear of errors in labelling and documentation.

As there was none to minimal information on the transfusion requirement of COVID-19 patients, apprehension with regards to changes in the haematological profile, risk profile of COVID-19 patients and reduced number of blood donors, could have led to most doctors (71.8%) believing that shortage of blood components could also affect the transfusion management of COVID-19 patients [26–29].

No differences in the attitude were observed amongst different groups based on the experience (designation of the participant), user type (speciality) and the frequency of the transfusion in their parent department.

Doctors from different clinical and non-clinical specialties were posted for care of COVID-19 infected patients.

### Table 1 Demographic and professional background of study participants

| Variables                  | Number (n = 354) | Percentage (%) |
|----------------------------|------------------|----------------|
| **Mean age in years (Range)** | 29.8 ± 5.6 (23–50) |                |
| **Age group**              |                  |                |
| 20–30                      | 219              | 61.9           |
| 30–40                      | 123              | 34.7           |
| 40–50                      | 12               | 3.4            |
| **Gender**                 |                  |                |
| Male/female                | 243/111          | 68.6/31.4      |
| **Designation**            |                  |                |
| Junior Resident            | 202              | 57.1           |
| Senior Resident            | 129              | 36.4           |
| Faculty                    | 23               | 6.5            |
| **Speciality**             |                  |                |
| Medical                    | 191              | 54             |
| Surgical                   | 84               | 23.7           |
| Non-clinical               | 79               | 22.3           |
| **Blood users (units transfused/month)** |              |                |
| Nil                        | 102              | 28.8           |
| < 10                       | 74               | 21             |
| 10–50                      | 107              | 30.2           |
| > 50                       | 71               | 20             |


Fig. 2 Parent department of the study participants

Table 2 Comparison of knowledge, attitude, and practice among study participants

| Knowledge scores (354) | Attitude scores (354) | Practice scores (222) |
|------------------------|-----------------------|-----------------------|
| Adequate (≥ 5)          | Positive (≥ 15)       | Optimal (≥ 7)         |
| n = 297                | n = 258               | n = 128               |
| Inadequate (< 5)       | Neutral (10–14)       | Suboptimal (< 7)      |
| n = 57                 | n = 92                | n = 94                |

| Designation          | Knowledge scores | Attitude scores | Practice scores |
|----------------------|------------------|-----------------|-----------------|
|                       | Adequate (≥ 5)   | Positive (≥ 15) | Optimal (≥ 7)   |
|                       | n = 297          | n = 258         | n = 128         |
|                       | Inadequate (< 5) | Neutral (10–14) | Suboptimal (< 7)|
|                       | n = 57           | n = 92          | n = 94          |

| Specialty        | Knowledge scores | Attitude scores | Practice scores |
|------------------|------------------|-----------------|-----------------|
| Medical          | Adequate (≥ 5)   | Positive (≥ 15) | Optimal (≥ 7)   |
|                  | n = 297          | n = 258         | n = 128         |
| Surgical         | Inadequate (< 5) | Neutral (10–14) | Suboptimal (< 7)|
|                  | n = 57           | n = 92          | n = 94          |
| Non-clinical     | Adequate (≥ 5)   | Positive (≥ 15) | Optimal (≥ 7)   |
|                  | n = 297          | n = 258         | n = 128         |
|                  | Inadequate (< 5) | Neutral (10–14) | Suboptimal (< 7)|
|                  | n = 57           | n = 92          | n = 94          |

| Frequency of blood usage | Knowledge scores | Attitude scores | Practice scores |
|--------------------------|------------------|-----------------|-----------------|
| Nil                      | Adequate (≥ 5)   | Positive (≥ 15) | Optimal (≥ 7)   |
|                         | n = 297          | n = 258         | n = 128         |
|                         | Inadequate (< 5) | Neutral (10–14) | Suboptimal (< 7)|
|                         | n = 57           | n = 92          | n = 94          |
| < 10 units/month        | Adequate (≥ 5)   | Positive (≥ 15) | Optimal (≥ 7)   |
|                         | n = 297          | n = 258         | n = 128         |
|                         | Inadequate (< 5) | Neutral (10–14) | Suboptimal (< 7)|
|                         | n = 57           | n = 92          | n = 94          |
| 10–50 units/month       | Adequate (≥ 5)   | Positive (≥ 15) | Optimal (≥ 7)   |
|                         | n = 297          | n = 258         | n = 128         |
|                         | Inadequate (< 5) | Neutral (10–14) | Suboptimal (< 7)|
|                         | n = 57           | n = 92          | n = 94          |
| > 50 units/month        | Adequate (≥ 5)   | Positive (≥ 15) | Optimal (≥ 7)   |
|                         | n = 297          | n = 258         | n = 128         |
|                         | Inadequate (< 5) | Neutral (10–14) | Suboptimal (< 7)|
|                         | n = 57           | n = 92          | n = 94          |
During their care they were also involved in the transfusion care, even though some of them (29% of the study participants in our study) had nil/minimal experience of blood transfusion. During the pandemic, paperless systems, and restricted staff movement from COVID-19 and non-COVID-19 zones were adopted at our hospital, due to the fear of widespread transmission of the virus through contaminated papers and mixing of staff from COVID-19 and non-COVID-19 areas. In case of need, images of these request slips were sent to the blood centre, following which blood components were kept in orange zone from where the ward staff would collect it and notify its receipt to the blood centre. Such arrangements for containment of COVID areas, led to sub-optimal documentation and may have resulted in difficulties faced by the doctors. Apart from these limited contact with patients and use of additional PPE could have resulted in difficulties such as patient identification, blood component administration and identifying adverse transfusion reactions [23].

In our study, shortage of blood components led to arrangement for alternate group compatible blood components by most of the participants. Patient blood management strategies such as use of restrictive thresholds, single units RBC transfusion, use of pharmacologic alternatives (oral/IV iron therapy, erythropoietin) were also adopted by more than 2/3rd of the participants to decrease the need for blood transfusion in COVID-19 patients. Various modification of blood components was required, mainly for the patients with underlying co-morbidities.

Although there was an apprehension for an increase in the pulmonary complications following blood transfusion, in COVID-19 patients, majority participants (98.2%) did not observe any increase in transfusion reactions in COVID-19 patients after transfusion of blood components. This was also supported by the fact that transfusion of convalescent plasma was also found to be safe without any increase in the number of transfusion reactions [30]. Convalescent plasma was transfused as an off-label indication by 49.5% participants in COVID-19 patients whereas only 4.1% reported it as effective. Convalescent plasma treatment was not significantly associated with clinical benefits when compared with standard therapy as reported by various metaanalysis and Randomised Control Trials for use of convalescent plasma [31, 32].

Knowledge and attitude towards transfusion are thought to be predictive for good transfusion practices [33]. In our study we observed a small (correlation coefficient) but positive correlation of participants attitude with the transfusion practice. However, we could not elicit a positive relationship of the knowledge with the transfusion practice, which could be the result of role of the consultant, team leader role who could overridden/guided the decision to transfusion or use other alternatives during the COVID-19. Similar findings have also been reported by Susanne et al. [34].

Strengths and Limitation of the Study

As an anonymous online questionnaire was used for the study, thus participants had the liberty to answer truthfully without the concern of judgment and included everyone ranging from Junior Residents to faculties. However, the limitations of the study were lower response rate resulting in fewer study participants, secondly there was no guarantee on the originality or genuineness of the answers given. Lastly, some of the questions were based on the case vignettes specific for some specialties, hence causing bias in the answers.

Conclusion

Majority of the participants had adequate knowledge of blood transfusion and its need in COVID-19 patients. Knowledge scores were higher among major users of blood components. Most study participants demonstrated positive attitude towards modifications in the transfusion process, irrespective of the experience (designation of the participant), user type (speciality) and frequency of blood usage in their parent department. Transfusion practices were largely affected due to shortage of blood components, necessitating use of alternate/compatible blood components, adoption of restrictive threshold, single unit transfusions. Sub-optimal documentation, return of unused blood components, difficulties in patient identification, and blood component administration were common issues faced during the pandemic. Use of convalescent plasma was considered as “off-label indication” by most participants. This study indicated need for improvement in the basic understanding of the transfusion process, which will help in modifying the existing practices at their parent department and help in preparedness for such future pandemics.

Author Contributions

RC: designed, supervised the research, and reviewed the manuscript. BK: designed, performed the research, acquired the data, analysed, and wrote the first draft of the manuscript. GKP: designed the study, and reviewed the manuscript. HCP: reviewed and approved the manuscript.

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Declarations

Conflict of Interest

The authors have no conflicts of interest to declare.
Ethical Approval The study was approved by the institutional ethics committee of AIIMS, New Delhi (IEC/PG/383/23.06.2021).

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