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## Transfusion practices during the COVID-19 pandemic: An experience from a hematology daycare in India

Jayastu Senapati<sup>a</sup>, Mukul Aggarwal<sup>a,\*</sup>, Liji Louis<sup>b</sup>, Saleem A. Mirza<sup>a</sup>, Pradeep Kumar<sup>a</sup>,  
Rishi Dhawan<sup>a</sup>, Jasmita Dass<sup>a</sup>, Ganesh K. Vishwanathan<sup>a</sup>, Hem Chandra Pandey<sup>c</sup>,  
Poonam Coshic<sup>c</sup>, Seema Tyagi<sup>a</sup>, Tulika Seth<sup>a</sup>, Manoranjan Mahapatra<sup>a</sup>

<sup>a</sup> Department of Hematology, AIIMS, New Delhi, 110029, India

<sup>b</sup> Haematology Day Care, AIIMS, New Delhi, 110029, India

<sup>c</sup> Department of Transfusion Medicine and Blood Bank, AIIMS, New Delhi, 110029, India

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### ABSTRACT

The Coronavirus disease-19 (COVID-19) pandemic has in multiple ways affected healthcare delivery to non-COVID patients throughout the world. Adequate transfusion services are fundamental in ongoing therapy of patients with hematological ailments. We present the transfusion services in the hematology daycare under the department of Hematology and supported by the Blood Bank at our institution for the period 12th April 2020–30th June 2020, which saw the stringent lockdown and unlocking Phase I in India, declared in lieu of the pandemic. A 56 % reduction in total transfusion sessions was observed in 2020 (588 sessions given to 176 patients) compared to 1336 sessions in 516 patients over the same period in 2019. The reductions were seen across the different blood components (packed red blood cells [PRBC]: 585 vs. 1840, platelet rich plasma: 372 vs. 1313, single donor platelet 18 vs. 16), with a significant reduction in the mean PRBC transfused per PRBC transfusion session (1.11 vs 1.99,  $p < 0.001$ ) in 2020, compared to 2019. There were however no major differences in the transfusion practices across the different phases of the lockdown. Our study highlights the detrimental reduction in transfusion services due to the COVID-19 pandemic and related lockdown and showcases the remedial strategies taken to maximize transfusion support to patients during this period. Our observations might help to provide insights to adequately combat possible similar adverse situations in the future.

### 1. Introduction

The Corona virus disease-19 (COVID-19) pandemic has imposed never before seen challenges to healthcare delivery. Together with the diversion of healthcare resources towards the care of COVID-19 patients, the lack of easy commute to the hospital and reduced inpatient/outpatient services to ensure physical distancing had led to significant hurdles in the care of non-COVID patients [1]. The COVID pandemic and subsequent lockdown led to significant capsizing of transfusion support throughout the world leading to impediments in cancer care, delay in surgeries and increased morbidities in transfusion dependent patients [2,3]. This is especially relevant for patients with hematological disorders who need regular transfusion support as part of their ongoing

treatment for cancers, thalassemia, aplastic anemia etc. The nation-wide lockdowns in India started from 24th March 2020 with the Phase I lockdown extending till 14th April. Various phases of lockdown continued till May end, with increasing ease on restrictions followed by unlock phase.

We report the transfusion services provided by the Hematology day care from our centre during the period 12th April to 30th June 2020 and compare the transfusion services to the similar period in 2019. With the possibilities of a long-drawn pandemic and possibilities of similar future catastrophes, definitive plans should be formulated to render adequate transfusion services to this extremely vulnerable population.

\* Corresponding author.

E-mail addresses: [jsalwaywins@gmail.com](mailto:jsalwaywins@gmail.com) (J. Senapati), [mukulmanc@gmail.com](mailto:mukulmanc@gmail.com) (M. Aggarwal), [liji\\_louis@yahoo.com](mailto:liji_louis@yahoo.com) (L. Louis), [nargissaleem2004@gmail.com](mailto:nargissaleem2004@gmail.com) (S.A. Mirza), [doctorpkgmu@gmail.com](mailto:doctorpkgmu@gmail.com) (P. Kumar), [julesconstant@gmail.com](mailto:julesconstant@gmail.com) (R. Dhawan), [drjasmita@gmail.com](mailto:drjasmita@gmail.com) (J. Dass), [ganeshpgi@gmail.com](mailto:ganeshpgi@gmail.com) (G.K. Vishwanathan), [pandeyhmc@outlook.com](mailto:pandeyhmc@outlook.com) (H.C. Pandey), [poonamcoshic@gmail.com](mailto:poonamcoshic@gmail.com) (P. Coshic), [drseematyagi@hotmail.com](mailto:drseematyagi@hotmail.com) (S. Tyagi), [drtulikaseth@gmail.com](mailto:drtulikaseth@gmail.com) (T. Seth), [mrmahapatra@hotmail.com](mailto:mrmahapatra@hotmail.com) (M. Mahapatra).

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## 2. Materials and methods

### 2.1. Study settings

The study included patients who presented to the hematology daycare at our institute for routine and emergency transfusion practices during the period of the lockdown and early unlocking phase. Prior to the lockdown transfusions occurred in two batches in the daycare with 6 patients per batch and no cutoff to the component numbers transfused. The patient cohort includes the entire spectrum of benign and malignant hematology patients including those post stem cell transplantation. The thresholds for transfusion vary according to the diagnosis, but is usually a pre transfusion of Hb of 9 gm/dl for packed red blood cells (PRBC) transfusion in thalassemia and 8 gm/dl for other diseases. Platelet transfusions {platelet rich plasma (PRP) or single donor platelets (SDP)} are done at a threshold of  $10 \times 10^9/L$  and at higher levels in those requiring concurrent PRBC transfusion or those with active bleeding. Platelets and fresh frozen plasma (FFP) were transfused in the afternoon batch.

During the period of lockdown in order to facilitate physical distancing, the number of beds in the daycare were reduced to 3 per batch, the number of batches increased to 3 from the previous two batches per day. The transfusion thresholds for PRBC were decreased in the absence of any significant clinical manifestations of anemia (pre-transfusion Hb of 8 gm/dl for thalassemia, 6 gm/dl for aplastic anemia, while 8 gm/dl for other diseases) in an effort to have more equitable distribution of blood products amongst the shortage in inventory. A lower threshold for transfusion was maintained in patients who were symptomatic for their anemia at the present laid down thresholds or at the clinician's discretion.

### 2.2. Study time period and data collection

We collected retrospective data of patients who underwent blood product transfusion at the Hematology daycare from 12th April 2020 to 30th June 2020 from the daycare transfusion records and from 12th April 2019 to 30th June 2019 from blood bank transfusion records. We compared these data to see the differences in the transfusion practices over the same months last year to avoid any seasonal variations in transfusions as well as between the different phases of lockdown (Phase I transfusion services: 12th April-14th April, Phase 2: 15th April – 3rd May, Phase 3: 4th May- 17th May, Phase 4: 18th may- 31st May) and Phase I of unlocking (1st June-30th June) this year.

For the present year, we assessed the cumulative patient numbers who were transfused, age and gender distribution, underlying hematological ailment, the total blood products administered, the median hemoglobin at which transfusion was done in patients with thalassemia and bone marrow failure syndromes like aplastic anemia. The data was tabulated and analysed on Microsoft Excel (version 14.1.0). A two-sided *t*-test was used for comparing dual variables and one-sided ANOVA for multiple variables. A *p* value < 0.05 was considered significant. The study has been approved by Institutional Ethics committee.

## 3. Results

During the earlier part of first lockdown period, the Hematology day care services were closed as an emergency measure and it restarted from 12th April 2020. As mentioned above, the changes to the transfusion practices in daycare were instituted to enable physical distancing as per hospital administration guidance.

### 3.1. Patient demographics

From 12th April to 30th June 2020 a total of 588 transfusion sessions were administered to 176 patients compared to 1336 sessions in 516 patients during the same dates in 2019 (Table 1). The median age for a

patient in a transfusion session in 2020 was 14 years (6 months- 74 years) compared to 18 years (5 months to 87 years) in 2019 (Table 1). Sixty eight percent (403) of transfusion sessions were male patients in 2020 compared to 79.5 % (1062) sessions in 2019. Sixty one percent (359) and 47 % (638) sessions were in patients <18 years old in the 2020 and 2019 respectively. The total amount of blood components transfused in the 588 sessions in 2020 were 1041 (585 PRBC, 372 PRP, 18 SDP, 60 FFP and 6 cryoprecipitate) versus 3294 blood products (1840 PRBC, 1313 PRP, 16 SDP, 120 FFP and 5 cryoprecipitate) over 1336 sessions during the similar period in 2019. The median number of patients transfused were 10 per day in 2020 (1–15) compared to 21 (8–34) in 2019.

### 3.2. Transfusion practices in 2020

Of the total transfusion sessions, 41 % were administered to patients with thalassemia (major and intermediate), 39 % with bone marrow failure syndromes (majority being aplastic anemia), 9% to patients with hematological malignancy and the rest 11 % included patients with bleeding diathesis and other miscellaneous conditions. The 239 (of the total 588) transfusion sessions for thalassemia patients accounted for 263 of the 585 PRBCs transfused, with a median of 1 PRBC per session (Range 1–2). The median hemoglobin concentration at transfusion was 5.8 g/dl for thalassemia patients (range 1–8.5 g/dl), significantly lower than the usual threshold of 9 gm/dl for transfusion at normal times. Amongst the patients with aplastic anemia who received PRBCs, the median hemoglobin was 4.8 g/dl (range 1.7–7.9 g/dl), with a median of 1 PRBC transfused per session (range: 1–2) and a median PRP of 1 per session (range 1–3).

### 3.3. Comparative analysis during different lockdown phases

Of the 588 transfusion sessions in 2020, 44.2 % (260) happened over the Phase I of unlocking (30 days), with Phase 2 (19 days), 3 (14 days) and 4 (14 days) of lockdown seeing 19.5 %, 14.3 % and 18.2 % of transfusion sessions respectively (Fig. 1a).

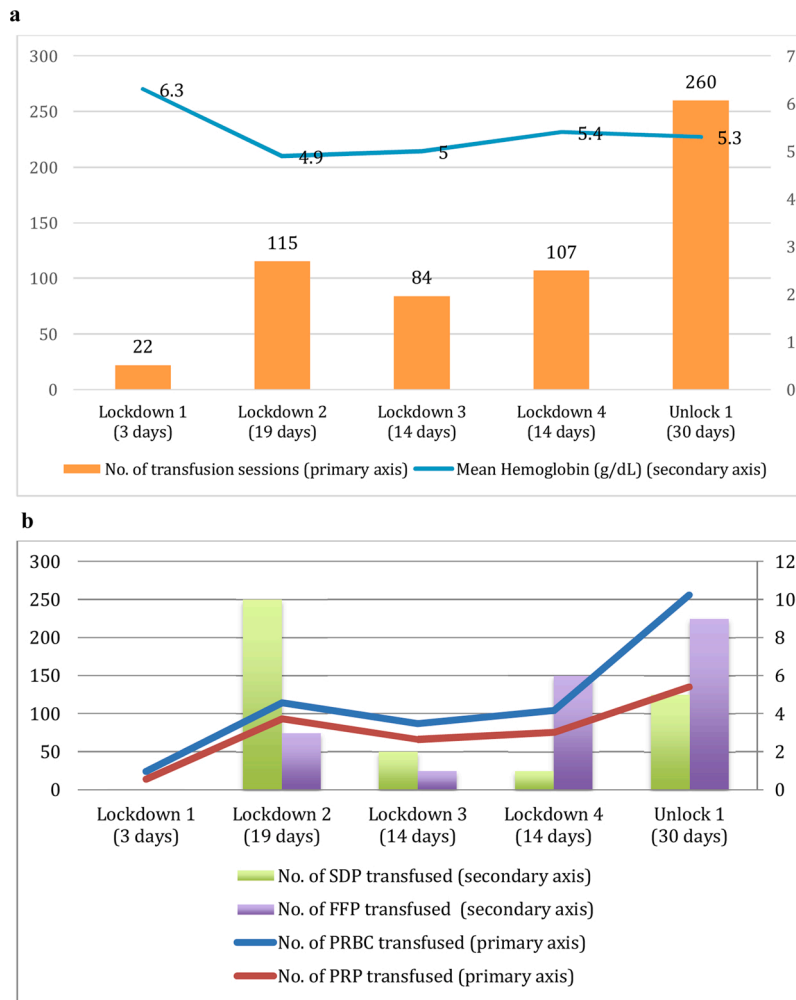
The total number of different blood products transfused across various phases is shown in Fig. 1b. Median number of PRP transfused per

**Table 1**

comparing the transfusion details between 12th April -30th June 2019 with the similar period in 2020. The mean PRBC transfused per day in 2020 was significantly lower than in 2019 in both the pediatric and adult population.

Characteristics	Study period in 2020 (n = 588)	Study period in 2019 (n = 1336)	P value
<b>Overall population</b>			
Total transfusion sessions	588	1336	<0.001
No of patients transfused per day, median (range)	10 (1–15)	21 (8–34)	NS
Age, median (range)	14 (0.5–74) yrs.	18 (0.6–87) yrs.	NS
Male, n (%)	403 (68.5 %)	1062 (79.5 %)	<0.001
Total no. of PRBC transfused	585	1840	<0.001
Total no. of PRP transfused	372	1313	<0.001
Total no. of SDP transfused	18	16	NS
Total no of FFP transfused	60	120	NS
Mean PRBC units transfused per PRBC transfusion session	1.11 ± 0.15	1.99 ± 0.3	<0.001
Mean PRP units transfused per patient per day	2.11 + 0.85	1.99 + 0.37	0.214
<b>Patients &lt; 18 years</b>			
Mean PRBC units transfused per PRBC transfusion session	1.08 ± 0.18	1.50 ± 0.32	< 0.001
<b>Patients ≥ 18 years</b>			
Mean PRBC units transfused per PRBC transfusion session	1.18 ± 0.34	2.46 ± 0.39	< 0.001

NS- not significant.

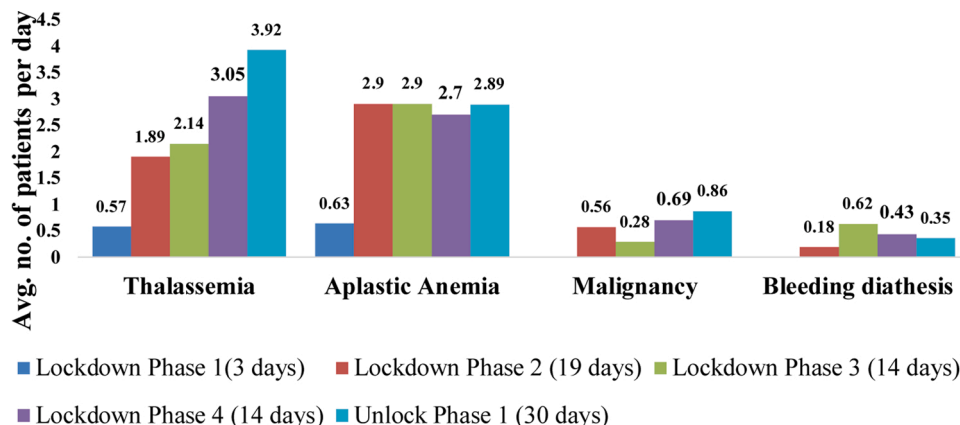


**Fig. 1.** Total transfusion sessions and mean hemoglobin at transfusion (across all diagnoses) during the different phases of lockdown and phase I of unlocking. Variation in total number of different blood components transfused during different phases of the lockdown and unlocking Phase I.

session ( $p = 0.0001$ ) varied significantly across phases and increased during unlocking, while increase in median PRBC transfusion per session and other products did not varied significantly. There were no significant differences in the daily average number of patients with different hematological diagnosis transfused between the last 3 phases of lockdown and phase I of unlocking (Fig. 2).

#### 4. Discussion

We aimed to study the effect of the COVID-19 pandemic and lockdown on transfusion services in the Hematology daycare. The COVID 19 pandemic led to reduction in blood bank inventory throughout the world in view of reduced voluntary blood donations and secondary to the deferral of elective orthopedic and surgical procedures due to the pandemic [4]. against which significant replacement donations are done



**Fig. 2.** showing average number of patients transfused per day with different hematological ailments during the different phases of lockdown and unlock phase I.

in the blood bank. Similar pattern was observed in our blood bank as well.

Our data shows that there was a significant reduction in the transfusion sessions as well as the number of blood product transfused per session compare to 2019. Given the requirement for stringent physical distancing the transfusion slots were reduced in the daycare. Voluntary and replacement donations to the blood bank had also ebbed. In an effort to ensure transfusion to the maximum number of patients we tried the following measures:

- 1) Increasing the transfusion batches in daycare from 2 to 3 by careful time management as has been mentioned under the study setting before. This enabled to maintain physical distance during any batch (by reducing the slots per batch to 50 %), yet transfusing the maximum number of patients in a given 24 -h cycle.
- 2) The threshold for transfusion in thalassemia and aplastic anemia were changed as well to accommodate more patients, albeit deviating from laid down transfusion guidelines [5].
- 3) Patients who were not able to commute due to restrictions were encouraged to take transfusions at their local hospitals and were provided telephonic consultations to guide their transfusion needs.
- 4) Directed single donor platelet apheresis and transfusion was encouraged for patients with life threatening thrombocytopenia and those with active bleeding to ensure adequate platelet recovery and depletion of random donor platelet rich plasma stock in the blood bank.
- 5) Multiple voluntary donation drives were conducted by the blood bank to ensure blood component availability and maintain back up stock.

The reduction in blood donations and hence availability of blood components has been observed throughout the world, but due to deferment of elective surgical procedures, the demand for transfusion products had also decreased [6,7]. This could also lead to overall decrease in blood components utilization across the hospital departments, as reported by 75 % respondents in a worldwide survey, though the situation may vary in centres where a significant number of hematology/oncology patients undergo treatment routinely [8]. Murphy C et al. reported 42 % drop in usage of PRBC, FFP and cryoprecipitate (not for PRP) mostly limited to general operating rooms, while their outpatient transfusions remained steady [9].

We believe that hematology patients with aplastic anemia or thalassemia who need continuous transfusion support to maintain quality of life, as well as hematological malignancies patients who need blood product support to maintain continuity of chemotherapy regimens were bound to be adversely affected by this pandemic. As a department policy, induction of AML/ALL and consolidation of AML are given as inpatient ward, so their data is not included with daycare statistics. Transfusions in other phases of ALL and other hematological malignancies are done in daycare. This explains overall low number of malignancy patients in the study. Indeed, despite these directives and efforts, the transfusion services for hematology patients suffered a hit due to the reduced inventory of blood products at certain times and reduction in the transfusion capacity of the daycare as well as difficulties in patient/donor movement across cities. We were able to provide less than half the transfusion sessions (588 vs. 1336, 44 %) at our daycare, as compared to the same time last year, despite remedial measures. But as travel restrictions eased during unlock period, the number of transfusions of all blood products increased in comparison to that during lockdowns.

The World Health Organization has devised guidelines to ensure proper donor screening and adequate blood product inventory in the blood banks during this pandemic [10]. The Ministry of health and family welfare (MoHFW), Government of India's guidelines directed uninterrupted care of patients with cancer and those needing recurrent blood products like thalassemia, hemophilia, sickle cell disease amongst

others [11]. However, the rapidity of the situation prevented seamless transfusion services to be provided, often despite corrective measures. The unprecedented alterations that this pandemic imposed and the need to provide uninterrupted essential healthcare during such times has provided us great insights to fight such challenges in future.

## 5. Conclusion

The present pandemic has posed challenges to non-COVID healthcare delivery across the world. Streamlining transfusion services to cater to critical healthcare demands during such periods is important for preventing treatment interruption of hematology/oncology patients who are dependent on them for routine life and continuation of disease specific therapy. Our study highlighted the significant reduction in blood components administered during the lockdown and early unlocking period compared to a similar period last year.

## Credit author statement

**Jayastu Senapati (First Author):** Data curation; Formal analysis; Investigation; Methodology; Project administration, Writing- Original draft, Review and editing

**Mukul Aggarwal (Corresponding Author):** Conceptualization; Formal analysis; Methodology; Project administration; Validation Writing- Review and editing

Liji Louis: Data curation; Investigation

Salim Mirza: Investigation

Pradeep Kumar: Writing- Review and editing

Rishi Dhawan: Writing- Review and editing

Jasmita Dass: Writing- Review and editing

Ganesh K. Vishwanathan: Writing- Review and editing

Hem Chandra Pandey: Data curation; Validation; Writing- Review and editing

Poonam Coshic: Writing- Review and editing

Seema Tyagi: Writing- Review and editing

Tulika Seth: Writing- Review and editing

Manoranjan Mahapatra: Validation; Writing- Review and editing

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## Informed consent

The Institutional ethics committee approved the study in its present form.

## Declaration of Competing Interest

None.

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Dr. Abhirup Sarkar, Senior Resident, Department of Laboratory Medicine, AIIMS, New Delhi-110029 Email id: abhirupsa@gmail.com  
Ms. Jyotsna Kapoor

## References

- [1] Dore B. Covid-19: collateral damage of lockdown in India. *BMJ* 2020. m1711.
- [2] Alhalabi O, Subbiah V. Managing Cancer care during the COVID-19 pandemic and beyond. *Trends Cancer* 2020;6:533–5.
- [3] Arcot PJ, Kumar K, Mukhopadhyay T, Subramanian A. Potential challenges faced by blood bank services during COVID-19 pandemic and their mitigative measures: the Indian scenario. *Transfus Apher Sci* 2020;102877.

- [4] Raturi M, Kusum A. The blood supply management amid the COVID-19 outbreak. *Transfus Clin Biol* 2020 [Internet]. [cited 2020 Jul 14]; Available from: <https://linkinghub.elsevier.com/retrieve/pii/S1246782020300677>.
- [5] [https://nhm.gov.in/images/pdf/in-focus/NHM\\_Guidelines\\_on\\_Hemoglobinopathies\\_in\\_India.pdf](https://nhm.gov.in/images/pdf/in-focus/NHM_Guidelines_on_Hemoglobinopathies_in_India.pdf).
- [6] Fan BE, Ong KH, Chan SSW, Young BE, Chong VCL, Chen SPC, et al. Blood and blood product use during COVID-19 infection. *Am J Hematol* 2020;95:E158–60.
- [7] Rouka E. The effect of the COVID-19 pandemic on the adequacy of blood supply: specialists in Transfusion Medicine need to establish models of preparedness. *Transfus Apher Sci* 2020. <https://doi.org/10.1016/j.transci.2020.102960> [Internet]. [cited 2020 Oct 2]; Available from..
- [8] Lozano M, Yazer M, Jackson B, Pagano M, Rahimi-Levene N, Peer V, et al. Vox sanguinis international forum on hospital transfusion services' response to COVID-
19. *Vox Sang* 2020 [Internet].; Available from: <http://europepmc.org/abstract/MED/32403155>.
- [9] Murphy C, Jackson B, Fontaine M. Tools for rapid analysis of blood usage and inventory during the COVID-19 pandemic. *Transfusion (Paris)* 2020. <https://doi.org/10.1111/trf.15996> [Internet] [cited 2020 Aug 24];n/a. Available from:..
- [10] World Health Organization. Guidance on maintaining a safe and adequate blood supply during the coronavirus disease 2019 (COVID-19) pandemic and on the collection of COVID-19 convalescent plasma: interim guidance. 10 July 2020 [Internet] Available from: Geneva: World Health Organization; 2020. <https://apps.who.int/iris/handle/10665/333182>.
- [11] <https://www.mohfw.gov.in/pdf/EssentialservicesduringCOVID19updated0411201.pdf>.