ACH Med J
(2025) 3: 101-107
ISSN:2822-5872
Doi : 10.5505/achmedj.2025.32032

RESEARCH ARTICLE

Frequency and indication of blood and blood product use in general surgery practice during the pandemic period compared to the pre-pandemic period

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Article Info

Received Date: 10.09.2025
Revision Date : 29.09.2025
Accepted Date: 29.09.2025

Keywords:
Blood products,
Blood transfusion,
Pandemic,
Surgical procedures

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Abstract

Introductıon: This study aims to investigate whether there has been a measurable change in the use and indications of blood and blood products during the COVID-19 pandemic compared to the pre-pandemic period

Methods: A total of 1,050 patients were retrospectively analyzed, including 563 in the pre-pandemic period and 487 during the pandemic. Patients monitored for emergency benign diseases, elective benign diseases, trauma, transplantation, and malignancy were included in the study, while those with bleeding due to coagulopathy or suicide attempts were excluded. The blood products used included erythrocyte suspension, fresh frozen plasma, platelet apheresis, and pooled platelet suspension.

Results: The mean hemoglobin threshold for transfusion was significantly lower during the pandemic (7.9 ± 1.3 g/dL vs. 8.7 ± 1.8 g/dL, $p < 0.001$). During the pandemic, there was a statistically significant shift in blood and blood product usage patterns among surgical patients. The proportion of patients receiving one-unit erythrocyte suspension increased (22.8% vs. 12.6%, $p < 0.001$), while two-unit transfusions decreased. FFP use declined, it increased significantly in emergency benign diseases, colorectal/GI surgery, surgical debridement, and transplantation. Apheresis platelet transfusions increased during the pandemic (3.1% vs. 0.7%, $p = 0.005$), while pooled platelet use remained unchanged. Mortality was higher during the pandemic (12.5% vs. 9.4%), but the difference was not statistically significant.

Conclusion: The COVID-19 pandemic was associated with measurable shifts in blood product utilization patterns in general surgery, influenced by changes in surgical priorities and healthcare constraints.

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Introduction

The COVID-19 pandemic, caused by the SARS-CoV-2 virus, has profoundly disrupted healthcare systems worldwide, influencing clinical practices, resource allocation, and patient management strategies across nearly all medical disciplines.[1-4] One of the less frequently highlighted but critical aspects affected by the pandemic is the utilization of blood and blood products.[5-7] Due to the widespread postponement of elective surgeries, reduction in trauma cases during lockdowns, and changes in hospital admission patterns, the overall demand for transfusion products underwent significant fluctuations.[5, 8, 9]

Simultaneously, blood donation activities faced considerable challenges due to public health restrictions, donor hesitancy, and logistical constraints, leading to variable and sometimes critically low blood supply levels.[10, 11] These dynamics prompted healthcare institutions to revise transfusion protocols, adopt more restrictive transfusion strategies, and re-evaluate the indications for blood and blood product usage.

Moreover, emerging evidence during the pandemic has suggested potential hematological complications associated with COVID-19, such as coagulopathies and increased thrombotic events, which may have influenced the clinical indications for transfusion in infected patients.[12-14] Understanding whether these changes represent transient adaptations or signal a long-term shift in transfusion practices is vital for informing future policies and preparedness.

This study aims to investigate whether there has been a measurable change in the use and indications of blood and blood products during the COVID-19 pandemic compared to the pre-pandemic period. By analyzing transfusion trends and clinical justifications across these two distinct periods, this research seeks to provide insight into the impact of a global health crisis on transfusion medicine.

Material and Methods

This study was conducted as a retrospective cross-sectional study at the General Surgery Clinic of Antalya Research and Training Hospital. Ethical approval was obtained from the hospital's Clinical Research Ethics Committee (Decision No: 11/5, Date: 02/06/2022). The study was designed in accordance with the Declaration of Helsinki and Good Clinical Practice guidelines.

Patients monitored for emergency benign diseases, elective benign diseases, trauma, transplantation, and malignancy before and during the pandemic period were included in the study. COVID-19 positive surgical patients and those with bleeding due to coagulopathy or suicide attempts were excluded.

Clinical, demographic, laboratory findings, blood product usage amounts, and indications of the included patients were recorded retrospectively from medical records. Patients were categorized into five diagnostic groups: emergency benign diseases, elective benign diseases, trauma, transplantation, and malignancy. Surgical procedures were classified as abscess drainage, appendectomy, bariatric surgery, bridectomy, cholecystectomy, colorectal/gastrointestinal surgery, hernia surgery, soft tissue surgery, splenectomy, surgical debridement, transplantation surgery, trauma surgery, and tumor resection. Emergency benign diseases included acute surgical conditions requiring urgent intervention (appendicitis, acute cholecystitis, perforated viscus, strangulated hernia, etc.), whereas elective benign diseases referred to scheduled, non-malignant procedures such as bariatric surgery or planned hernia repair. Gastrointestinal bleeding cases were included under colorectal/GI surgery.

The blood products used included erythrocyte suspension, fresh frozen plasma, platelet apheresis, and pooled platelet suspension.

Statistical analysis

All data were analyzed with IBM SPSS Statistics for Windows 20.0 (IBM Corp., Armonk, NY, USA). Numerical data determined to be normally distributed based on the results of Kolmogorov-Smirnov tests are given as mean ± standard deviation (SD) values while non-normally distributed variables are given as median (25th-75th quartile) values. Comparisons between the pre-pandemic and pandemic groups were performed using independent-sample tests or Mann-Whitney U tests for continuous variables and Chi-square tests for categorical variables. Significance was accepted at $P < 0.05$ (*) for all statistical analyses.

Results

Table 1 demonstrates the demographic and clinical characteristics of patients who received blood and blood products before and during the COVID-19 pandemic. The mean age of patients was similar between the two periods (60.4 ± 15.4 years before the pandemic vs. 58.8 ± 16.7 years during the pandemic, $p = 0.577$). Gender distribution also did not differ significantly ($p = 0.070$), although a slight

increase in female patients was observed during the pandemic period. A significant change was noted in the distribution of primary diagnoses. The proportion of patients treated for emergency benign diseases increased markedly during the pandemic (from 17.4% to 28.3%, p < 0.001), while the rates of transplant-related cases and elective benign diseases decreased. This shift likely reflects the widespread deferral of elective procedures and transplant programs due to pandemic-related healthcare constraints.

Table 1. Demographic characteristics of patients who used blood and blood products before and during the pandemic

Variables	Before pandemic	Pandemic period	P-value
Age, years	60.4 ± 15.4	58.8 ± 16.7	0.577
Gender, n (%)			
Male	287 (51.0)	221 (45.4)	0.070
Female	276 (49.0)	266 (54.6)	
Diagnosis, n (%)			
Emergence benign diseases	98 (17.4)	138 (28.3)	<0.001*
Elective benign diseases	107 (19.0)	69 (14.2)	
Trauma	19 (3.4)	20 (4.1)	
Transplant	43 (7.6)	19 (3.9)	
Tumor	296 (52.6)	241 (49.5)	
Surgery types, n (%)			
Abscess drainage	7 (1.2)	11 (2.3)	0.011*
Appendectomy	5 (0.9)	5 (1.0)	
Bariatric surgery	42 (7.5)	25 (5.1)	
Bridectomy	21 (3.7)	35 (7.2)	
Cholecystectomy	36 (6.4)	49 (10.1)	
Colorectal / GI surgery	58 (10.3)	59 (12.1)	
Hernia surgery	12 (2.1)	6 (1.2)	
Soft tissue surgery	1 (0.2)	2 (0.4)	
Splenectomy	14 (2.5)	7 (1.4)	
Surgical debridement	9 (1.6)	8 (1.6)	
Transplantation surgery	43 (7.6)	19 (3.9)	
Trauma	19 (3.4)	20 (4.1)	
Tumor resection	296 (52.6)	241 (49.5)	

Data were shown as mean ± SD, or median (IQR) or number (percentages). * P-value <0.05 shows statistical significance.

Regarding surgical interventions, a statistically significant difference was observed in the types of surgeries performed (p = 0.011). Procedures such as bridectomy and cholecystectomy were more frequently performed during the pandemic, whereas bariatric surgery and transplantation surgeries decreased. Table 2 presents the clinical findings related to blood and blood product usage before and during the COVID-19 pandemic. Blood type distributions remained statistically similar between the two periods (p = 0.459).

However, significant changes were observed in hematological parameters and transfusion practices. The mean hemoglobin level at the time of transfusion was significantly lower during the pandemic period (7.9 ± 1.3 g/dL) compared to the pre-pandemic period (8.7 ± 1.8 g/dL) (p < 0.001). Although platelet counts appeared numerically lower during the pandemic, this difference was not statistically significant (p = 0.413). A marked difference was also noted in the amount of blood products administered. The proportion of patients receiving one unit of erythrocyte suspension (ES) increased significantly during the pandemic (22.8% vs. 12.6%), while those receiving two units decreased (32.0% vs. 41.0%) (p < 0.001) (Table 2).

Table 2. Clinical findings of patients who used blood and blood products before and during the pandemic.

Variables	Before pandemic	Pandemic period	P-value
Request blood type, n (%)			
0 Rh-	16 (2.8)	14 (2.9)	0.459
0 Rh+	163 (29.0)	141 (29.0)	
A Rh-	24 (4.3)	19 (3.9)	
A Rh+	237 (42.1)	200 (41.1)	
AB Rh-	7 (1.2)	1 (0.2)	
AB Rh+	36 (6.4)	26 (5.3)	
B Rh-	8 (1.4)	6 (1.2)	
B Rh+	72 (12.8)	80 (16.4)	
Hemoglobin, g/dL	8.7 ± 1.8	7.9 ± 1.3	<0.001*
Platelets, x103	121 (65-149)	87 (49-139)	0.413
Erythrocyte suspension, n (%)			
0	30 (5.3)	35 (7.2)	<0.001*
1	71 (12.6)	111 (22.8)	
2	231 (41.0)	156 (32.0)	
3	231 (41.0)	185 (38.0)	
Fresh frozen plasma, n (%)			
0	305 (54.2)	213 (43.7)	<0.001*
1	50 (8.9)	83 (17.0)	
2	100 (17.8)	95 (19.5)	
3	108 (19.2)	96 (19.7)	
Apheresis platelet, n (%)	4 (0.7)	15 (3.1)	0.005*
Pooled platelet suspension, n (%)	17 (3.0)	14 (2.9)	0.999
Place of transfusion, n (%)			0.393
In operation	434 (77.1)	386 (79.3)	
In operation and service	129 (22.9)	101 (20.7)	
Mortality, n (%)	53 (9.4)	61 (12.5)	0.106

Data were shown as mean ± SD, or median (IQR) or number (percentages). * P-value <0.05 shows statistical significance.

Similarly, fresh frozen plasma (FFP) usage patterns changed, with a higher percentage of patients receiving 1–2 units during the pandemic, and fewer patients receiving no FFP at all ($p < 0.001$). Additionally, the use of apheresis platelets significantly increased during the pandemic (3.1% vs. 0.7%, $p = 0.005$), while pooled platelet usage remained unchanged ($p = 0.999$). No significant difference was observed in the place of transfusion ($p = 0.393$), with the majority of transfusions occurring intraoperatively in both periods. Mortality rates showed an increase during the pandemic period (12.5% vs. 9.4%), although this was not statistically significant ($p = 0.106$) (Table 2).

Table 3 illustrates the comparison of blood product usage across different diagnoses and surgical procedures before and during the COVID-19 pandemic. The blood products evaluated include ES, FFP, apheresis platelets, and pooled platelet suspension. There was no statistically significant change in the use of ES across most diagnostic groups or surgical procedures between the two periods ($p > 0.05$ for all groups). A significant increase in FFP usage was observed in several categories during the pandemic: Emergency benign diseases (from 46.9% to 63.8%, $p = 0.012$), bridectomy (from 28.6% to 68.6%, $p = 0.006$), colorectal/GI surgery (from 52.2% to 80.0%, $p = 0.041$), surgical debridement (from 22.2% to 87.5%, $p = 0.015$). Significant increase was noted only in transplantation surgeries during the pandemic (from 2.3% to 21.1%, $p = 0.028$). Although some increases were observed numerically (e.g., in emergency benign diseases), no statistically significant differences were found in the use of pooled platelets across the groups ($p > 0.05$). While erythrocyte usage remained stable, the use of plasma and platelets, particularly in emergency and high-risk surgeries, showed an upward trend during the pandemic.

Table 3. Changes in the use of blood products during the pandemic compared to before the pandemic.

Diagnosis/Surgery	Erythrocyte suspension		P-value	Fresh frozen plasma		P-value	Apheresis platelet		P-value	Pooled platelet suspension		P-value
	Before pandemic	Pandemic period		Before pandemic	Pandemic period		Before pandemic	Pandemic period		Before pandemic	Pandemic period	
Tumor resection	284(95.9)	230(95.4)	0.832	144(48.6)	127(52.7)	0.386	-	4(1.7)	0.085	4(1.4)	5(2.1)	0.524
Emergence benign diseases	88(89.8)	122(88.4)	0.834	46(46.9)	88(63.8)	0.012*	-	7(5.1)	0.043*	2(2.0)	8(5.8)	0.201
Abscess drainage	6(85.7)	10(90.9)	0.732	5(71.4)	5(45.5)	0.367	-	-	-	-	-	-
Appendectomy	3(60.0)	3(60.0)	0.999	5(100.0)	3(60.0)	0.444	-	-	-	-	-	-
Bridectomy	20(95.2)	33(94.3)	0.999	6(28.6)	24(68.6)	0.006*	-	3(8.6)	0.284	-	3(8.6)	0.284
Cholecystectomy	21(84.0)	28(75.7)	0.534	13(52.0)	17(45.9)	0.796	-	1(2.7)	0.999	1(4.0)	2(5.4)	0.999
Colorectal / GI surgery	22(95.7)	33(94.3)	0.999	12(52.2)	28(80.0)	0.041*	-	1(2.9)	0.999	1(4.3)	2(5.7)	0.999
Hernia surgery	6(100.0)	2(100.0)	0.999	1(16.7)	1(50.0)	0.464	-	-	-	-	-	-
Splenectomy	1(50.0)	5(100.0)	0.286	2(100.0)	3(60.0)	0.999	-	2(40.0)	0.999	-	1(20.0)	0.999
Surgical debridement	9(100.0)	8(100.0)	0.999	2(22.2)	7(87.5)	0.015*	-	-	-	-	-	-
Elective benign diseases	103(96.3)	65(94.2)	0.713	32(29.9)	28(40.6)	0.192	2(1.9)	-	0.521	4(3.7)	-	0.156
Bariatric surgery	41(97.6)	25(100.0)	0.999	12(28.6)	12(48.0)	0.123	-	-	-	-	-	-
Cholecystectomy	10(90.9)	10(83.3)	0.999	4(36.4)	6(50.0)	0.68	-	-	-	-	-	-
Colorectal / GI surgery	35(100.0)	23(95.8)	0.407	10(28.6)	8(33.3)	0.777	1(2.9)	-	0.999	1(2.9)	-	0.999
Hernia surgery	4(66.7)	3(75.0)	0.999	1(16.7)	2(50.0)	0.5	-	-	-	2(33.3)	-	0.467
Soft tissue surgery	1(100.0)	2(100.0)	0.999	-	-	-	-	-	-	-	-	-
Splenectomy	12(100.0)	2(100.0)	0.999	5(41.7)	-	0.505	1(8.3)	-	0.999	1(8.3)	-	0.999
Trauma	19(100.0)	19(95.0)	0.999	13(68.4)	18(90.0)	0.127	1(5.3)	-	0.487	-	1(5.0)	0.999
Transplantation surgery	39(90.7)	16(84.2)	0.757	23(53.5)	13(68.4)	0.403	1(2.3)	4(21.1)	0.028*	7(16.3)	-	0.093

Data were shown as mean ± SD, or median (IQR) or number (percentages). * P-value <0.05 shows statistical significance. GI, gastrointestinal.

Discussion

This retrospective study aimed to analyze the impact of the COVID-19 pandemic on blood and blood product usage, focusing on the clinical indications and surgical procedures associated with transfusion practices before and during the pandemic.

The changes in the frequency and indications of blood and blood product usage in surgical patients during the pandemic can be attributed to several factors.[5-7] Firstly, elective surgeries were widely postponed to allocate healthcare resources to COVID-19 patients, leading to a decrease in blood use associated with these procedures.[15, 16] Meanwhile, emergency and oncological surgeries were prioritized due to their urgent nature and higher bleeding risk, which altered blood demand patterns.[17] Additionally, hospital admissions and surgical volumes declined overall, further impacting blood utilization. Blood supply shortages caused by reduced donor turnout necessitated stricter transfusion criteria and more cautious use of blood products.[5, 18] Moreover, treatment protocols were adapted during the pandemic to minimize unnecessary transfusions. Lastly, the reallocation of healthcare resources, including intensive care beds and staff, toward COVID-19 care limited the capacity for surgical interventions, thereby influencing blood product consumption.[19-21] Collectively, these factors reflect the dynamic shifts in clinical priorities, patient profiles, and healthcare system pressures that affected transfusion practices in surgical settings during the pandemic.

The findings reveal significant alterations in patient profiles and surgical case types, which directly influenced blood utilization patterns during this unprecedented global health crisis. In parallel, significant changes were observed in the types of surgical interventions performed. Procedures such as abscess drainage, bridectomy, cholecystectomy, and colorectal or gastrointestinal surgeries increased in frequency, whereas bariatric and transplant surgeries decreased. This shift reflects the prioritization of urgent and oncologic surgical cases over elective and complex surgeries during the pandemic. Emergency surgeries tend to be associated with higher transfusion requirements due to the acuity and complexity of the cases, which may have contributed to fluctuations in blood product demand.

These evolving clinical patterns emphasize how the COVID-19 pandemic forced healthcare systems to adapt rapidly, reallocating resources and modifying surgical practices.[16, 22, 23] The reduction in elective and transplantation surgeries likely contributed to a decreased demand for blood products in those categories, whereas the increase in emergency procedures may have offset this decrease to some extent.[24] Such dynamics underscore the need for flexible blood management strategies that can respond to shifting clinical priorities during public health emergencies.[8]

Our demographic analysis showed no statistically significant differences in age or gender distribution between the pre-pandemic and pandemic periods. This suggests that the demographic characteristics of patients requiring transfusions remained relatively stable despite the systemic disruptions caused by the pandemic. However, the diagnostic categories of patients showed notable shifts. Specifically, there was a marked increase in emergency benign disease cases during the pandemic period (28.3% vs. 17.4%, $p < 0.001$), while elective benign diseases and transplantation cases decreased. This trend is likely attributable to the widespread postponement and cancellation of elective surgeries and transplantation procedures aimed at reducing hospital occupancy and minimizing exposure risks during the pandemic, in line with recommendations from health authorities worldwide.

This study investigated how the COVID-19 pandemic affected blood and blood product usage and its clinical indications. Results indicated a significant increase in emergency benign diseases and a concurrent decrease in elective benign diseases and transplantation surgeries during the pandemic. These findings align with global trends where elective procedures were postponed to prioritize urgent and oncologic surgeries, which generally require more blood transfusions. The reduction in transplantation activities, likely due to donor shortages and resource constraints, also impacted blood product demand. Additionally, the pandemic caused challenges in blood supply due to decreased donations, necessitating adaptive blood bank management strategies to meet changing clinical needs. These shifts underscore the importance of coordinated multidisciplinary approaches and patient blood management to optimize transfusion practices.

Despite the valuable insights, this study has limitations. Its retrospective design and single-center setting may restrict the generalizability of the findings. Additionally, the study did not evaluate the exact quantities of blood products used per patient or clinical outcomes related to transfusion, which could

provide further depth to understanding pandemic-related changes in transfusion practices. During the pandemic, surgical case selection was significantly influenced by Ministry of Health regulations, which restricted elective interventions and prioritized urgent and oncologic procedures. This external factor likely contributed to the observed shifts in transfusion practices. Given the heterogeneity of surgical indications, we restricted our statistical analysis to descriptive and univariate comparisons. Multivariate models were not performed, which may limit adjustment for potential confounders. Future prospective multicenter studies are warranted to validate these findings and explore long-term trends in blood utilization as the healthcare landscape continues to evolve post-pandemic.

Conclusion

In conclusion, the COVID-19 pandemic significantly influenced the clinical landscape of blood product use, driven by changes in patient diagnoses and surgical priorities. Compared with the pre-pandemic period, erythrocyte transfusions during the pandemic became more restrictive, with lower hemoglobin thresholds and more frequent one-unit usage. While overall FFP use decreased, it rose significantly in urgent and complex surgical procedures. Apheresis platelet transfusion increased, whereas pooled platelet use remained stable. These findings underscore how transfusion practices adapted to pandemic-related challenges. Understanding these trends is critical for optimizing blood supply management, ensuring patient safety, and maintaining healthcare system resilience during ongoing and future crises.

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