

# How Urgent are Blood Transfusions Provided in Emergency Service?

Yasemin Özgür, Seydahmet Akin, Gizem Gecmez,  
Nazire Aladağ, Özcan Keskin

Department of Internal Medicine,  
University of Health Sciences,  
Kartal Dr. Lütfi Kırdar Training and  
Research Hospital, Istanbul, Turkey

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Correspondence: Yasemin Özgür,  
SBÜ, Kartal Dr. Lütfü Kırdar Eğitim  
ve Araştırma Hastanesi, İç Hastalıkları  
Kliniği, İstanbul, Turkey  
E-mail: dryaseminozgur@gmail.com



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## ABSTRACT

**Objective:** A blood transfusion, defined as a procedure to replace lost blood, is actually a tissue transplantation, performed with consideration given to the impact profile, the potential development of complications, and the risk of anaphylaxis and rejection, which may lead to death. This study is an analysis of emergency blood transfusions in terms of symptoms and indications.

**Methods:** Hospital records of blood transfusions administered in the emergency service were retrospectively reviewed. The patients were categorized into 2 groups: emergency patients and non-emergency patients, based on the presentation.

**Results:** Over the course of 3 months, 1156 transfusions (2.18 per person) were performed in 528 patients (61.4% male). It was determined that the most commonly seen patient complaints were weakness (19%) and melena (14%), followed by cases in which the patient was asymptomatic, but there was laboratory pathology (12.9%). In all, 47% of all cases of blood transfusion were considered urgent.

**Conclusion:** No correlation was determined between urgency requirement and hemoglobin level. Aside from those administered for active bleeding, most blood transfusions were not performed due to an urgent indication. The establishment of separate, ambulatory par-enteral treatment units in could reduce the burden on emergency services to some extent and protect the priority status real emergency patients need.

## INTRODUCTION

The aim of a blood transfusion is to reduce the risks caused by anemia and to provide oxygen to tissues. Though the goal of a blood transfusion is to provide life-saving treatment, there are many studies indicating that the use of a blood transfusion has increased mortality and morbidity.<sup>[1]</sup> Transfusion-transmitted infections and transfusion-related immunomodulation have led to more discussion of the safety of blood transfusions.<sup>[2,3]</sup>

For many decades, the decision to transfuse red blood cells was based upon the "10/30 rule": a transfusion was used to maintain a blood hemoglobin (Hb) concentration above 10 g/dL (100 g/L) and a hematocrit above 30%.<sup>[4]</sup> In recent years, a large body of clinical evidence resulted in the publication of many guidelines for blood transfusion in

different settings according to the patient's clinical status and oxygen delivery needs.<sup>[5-7]</sup>

The objective of this study was to examine the blood transfusions performed in the internal medicine emergency service unit of a hospital in terms of symptoms and indications, and to investigate whether the factors affecting the decision for an urgent transfusion were the patient's clinical status or the Hb level.

## MATERIAL AND METHODS

### Study population

The records of blood transfusions done in the emergency service unit of the Internal Medicine Clinic at the at University of Health Sciences, Kartal Dr. Lütfi Kırdar

Training and Research Hospital between September 23 and December 23, 2015 were examined retrospectively. A total of 528 patients were included in the study. Sociodemographic data, diagnosis at the time of arrival, knowledge of known diseases, quantity of blood components requested and transfused from the blood bank, blood group, type of transfusion, and Hb and platelet (Plt) levels were examined. The hemograms were measured using a Coulter LH780 analyzer (Beckman Coulter, Inc. Inc., Brea, CA, USA). The study protocol was approved by the ethics committee of Kartal Dr. Lutfi Kırdar Training and Research Hospital, in accordance with the Declaration of Helsinki (2018/514/128/13).

## Definitions

The blood components transfused were analyzed in 3 sections: erythrocyte products, Plt products, and plasma. Erythrocyte products, that is, erythrocyte suspension (ES) and irradiated erythrocytes (IE); Plt products, namely, pooled Plt (PP), apheresis Plt (AP), and irradiated Plt (IP); and fresh frozen plasma (FFP) were examined separately.

## Separation of patients into groups

The patients were categorized into 2 groups: emergency patients and non-emergency patients, based on condition at presentation. The patients who presented at the hospital due to complaints of intraabdominal acid, diabetic foot complications, nausea, diarrhea, constipation, vomiting, inappetency, weakness, faintness, itching, edema, coughing, falling, dysmenorrhea, dysuria, abdominal pain, widespread pain, icterus, hyperglycemia, hypoglycemia, epigastric pain, scrotal edema, decubitus ulcer, sore throat, petechia, oliguria, fever, and patients who were examined before a biopsy or tooth extraction, surgery, or in the case of a catheter dysfunction, were classified in the non-emergency group.

Patients with active bleeding, such as cases of hematochezia, melena, hematuria, hemoptysis, hematemesis, gingival bleeding, petechia, ecchymosis, tracheostomy bleeding, mucosal bleeding, conjunctival hemorrhage and epistaxis, and patients who presented with complaints of chest pain, dizziness, dyspnea, exertional dyspnea, syncope, tachycardia, impaired consciousness, anuria, hypotension, and seizures were included in the emergency group.

## Statistical analyses

IBM SPSS Statistics for Windows, Version 24.0 (IBM Corp., Armonk, NY, USA) was used to perform the statistical analysis. One-way analysis of variance was applied for multiple intergroup comparisons. After distribution of the variables was controlled using the Kolmogorov-Smirnov test, the independent samples t-test was used in paired comparisons of normally distributed quantitative variables. The

Mann-Whitney U test was used for abnormally distributed groups, and a chi-square test was used to compare qualitative variables. A paired samples t-test was used for the intergroup comparison of continuous parameters, and a post-hoc least significant difference test was used to determine whether there was a statistically significant relationship between the groups. Pearson correlation analysis was performed for normally distributed parameters and Spearman correlation analysis was conducted for abnormally distributed parameters. Receiver-operating characteristic curves were used to determine the optimal urgency cut-off values of Hb. The results were calculated with a 95% confidence interval with a significance level of  $p < 0.05$ .

## RESULTS

The records of 528 patients (61% men), received blood transfusion in the emergency service of an internal medicine clinic over the course of 3 months were examined. The average age of the patients, whose ages ranged from 16 to 94 years, was  $61 \pm 16$  years; 44% were geriatric patients. The average Hb level of the patients was  $7.12 \pm 1.17$  g/dL, and the average Plt level was  $19 \pm 1210^9$ /L at the time of arrival.

The mean age of the patients was  $61.27 \pm 15$  years among the men and  $60.89 \pm 18$  years in the women. The average Hb level was  $7.25 \pm 1.71$  g/dL in men and  $6.93 \pm 1.68$  g/dL in women, and the average Plt level was  $19 \pm 11 \times 10^9$ /L in men and  $17 \pm 14 \times 10^9$ /L in women. There was no statistically significant difference between the groups in these parameters.

A total of 1505 different blood components were requested for these patients, and 1156 transfusions were performed. That is, 76% of the requests from the blood bank for blood components were ultimately determined to be necessary and subsequently administered: an average of 2.18 blood components per person.

The blood components transfused were erythrocyte products (70%), Plt products (10.7%), and plasma (19.3%). It was observed that 307 patients received ES, 62 patients received IE, 42 patients received PP, 8 patients received AP, 7 patients received IP, and 102 patients received FFP. The average Hb level in the patients who received ES was 6.69 g/dL. The average Plt level in the patients who received TS was  $36 \times 10^9$ /L. The blood group distribution of the patients is shown in Figure 1.

The 3 most common complaints/conditions at the time of arrival were weakness (19%), melena (14%), and being asymptomatic (only laboratory pathology) (13%). Other complaints and symptoms observed are provided in Table 1.

At the time of emergency service presentation, the pre-diagnosis was most often related to the specialties of gas-

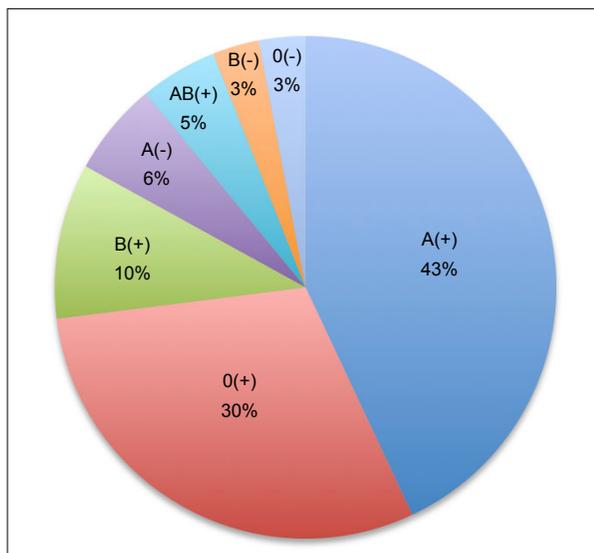


Figure 1. Blood group distribution.

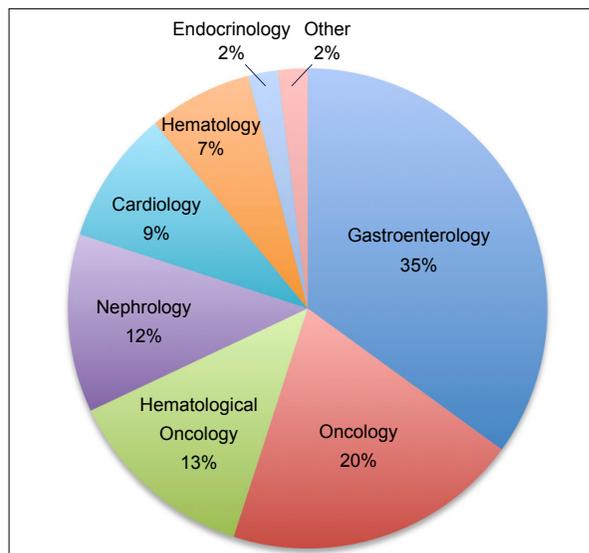


Figure 2. Prediagnosis.

troenterology (34%), oncology (19%), and hematological oncology (13%), as shown in Figure 2. The only statistically significant difference in terms of urgency was in the gastroenterology patients (Fig. 5).

As in both the clinic and polyclinic setting, it was determined in this emergency service of internal medicine that patients often have a number of chronic diseases, rather than a single isolated disease. When the additional diseases of the patients in our study were examined by branch, excluding acute hemorrhage, it was determined that the

most frequent accompanying diseases were nephrological (21%), hematological (16%), oncological (15%), and cardiological (15%) disorders (Fig. 3). Examination in more detail revealed that chronic renal disease (21%) was most common, followed by hypertension (17%) and diabetes mellitus (13%) (Table 2).

Excluding 23 patients (4.4%) referred from another hospital, only 50% of the patients who received a transfusion of blood components had urgent complaints. The average Hb level of the 200 patients who received ES replacement and

Table 1. Patient condition at hospital admission

Symptom/Condition	Frequency	Percent	Symptom/Condition	Frequency	Percent
Weakness	101	19.1	Anorexia	6	1.1
Melena	74	14.0	Paleness	6	1.1
Asymptomatic	68	12.9	Diarrhea	5	.9
Dyspnea	56	10.6	Preparation for tooth extraction	5	.9
Hematemesis	46	8.7	Angina	5	.9
Another hospital	18	3.4	Hemoptysis	4	.8
Abdominal pain	18	3.4	Vomiting	4	.8
Syncope	14	2.7	Gingival bleeding	3	.6
Epistaxis	13	2.5	Bleeding	3	.6
Hematochezia	10	1.9	Preoperation	3	.6
Widespread pain	10	1.9	Tachycardia	2	.4
Dizziness	9	1.7	Epigastric pain	2	.4
Unconsciousness	8	1.5	Catheter dysfunction	2	.4
Hematuria	8	1.5	Petechiae	2	.4
Ecchymosis	7	1.3	Fever	1	.2
Edema	7	1.3	Sore throat	1	.2
Nausea	6	1.1	Dysmenorrhea	1	.2

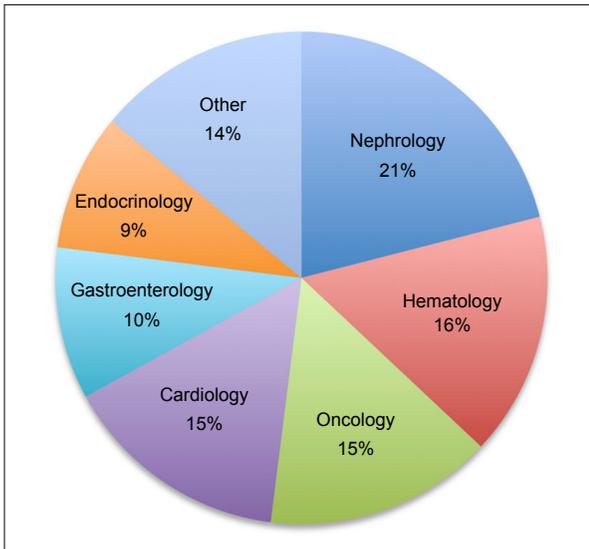


Figure 3. Additional diagnosis.

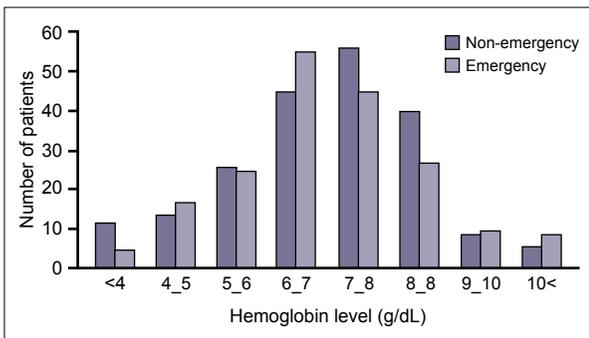


Figure 4. Emergency classification and hemoglobin level.

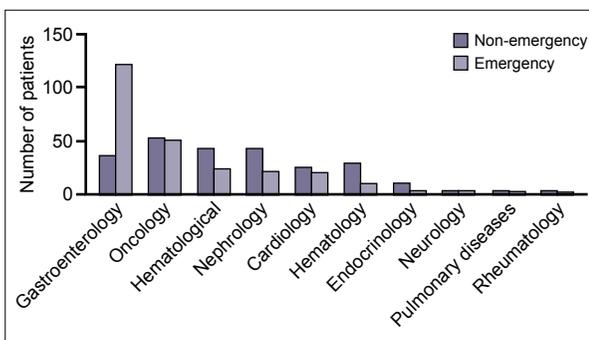


Figure 5. Emergency classification and prediagnosis.

presented at the hospital with non-urgent complaints was  $7.03 \pm 1.65$  g/dL; the average of Hb level of the 185 patients in the emergency group was  $7.13 \pm 1.65$  g/dL. Similarly, the average Plt level of the 53 patients in the non-emergency group who received Plt replacement was  $18 \times 10^9/L$ , and the average of the 4 patients in the emergency group was  $25 \times 10^9/L$ .

Analysis of the Hb level at the time of arrival indicated that a transfusion of blood components of between 6 and 8 g/dL was administered to many patients. However, no cor-

relation was observed between Hb level and the degree of urgency (Fig. 4).

The area under the curve (AUC) was calculated for different threshold levels of Hb based on the level of urgency. Using Hb cut-off levels of 5 g/dL, 6 g/dL, 7 g/dL, 8 g/dL, 9 g/dL, and 10 g/dL, the AUC was 0.523, 0.534, 0.486, 0.497, 0.504, and 0.503, respectively. No statistical significance was found.

## DISCUSSION

This study examined the complaints, prediagnoses, tests, and examinations performed, as well as any additional diseases diagnosed in patients who received a transfusion of blood components in the emergency service of internal medicine at a hospital with significant experience performing blood transfusions. The factors affecting the decision to provide a blood transfusion were analyzed.

The transfusion of blood components is a deceptively complex form of tissue transplantation in which the ABO rH compatibility between donor and recipient must be considered and cross-matching is performed to avoid a hemolytic transfusion reaction. All possible risks to the patient should be evaluated before performing a transfusion, as well as the advantages/disadvantages for the patient, the contribution to the present condition of disease that can be expected, the potential to address existing symptoms, and alternative treatment methods.

In our study, the patient's Hb level at the time of arrival did not have a significant correlation with the urgency of their symptoms. AUC analysis calculated for different Hb cut-off levels was not statistically significant, and the ideal threshold level for transfusion was determined to be 6 g/dL (AUC: 0.534 [0.477-0.591];  $p=0.211$ ).

Therefore, the Hb level of the patient at the time of arrival should not be a sole determinant for the administration of a blood transfusion. However, a decreased Hb level in the follow-up period, or more importantly, the development of symptoms of anemia and the impairment of vital findings, are indications for a blood transfusion.

We found that the patients 76% of the blood components requested for the patients were necessary, while 24% of the blood products were not ultimately necessary.

A review of the literature confirms that while a blood transfusion is done in the expectation that it will benefit the patient, paradoxically, it may add to the complication rate or ultimately provide no particular advantage. A study examined the Hb threshold level for ES replacement in 921 patients with acute gastrointestinal bleeding in terms of efficacy and safety and it was determined that a restrictive strategy ( $Hb < 7$  g/dL) resulted in less need for a transfusion (therefore, it is cost-effective), a lower rate of complica-

**Table 2.** Additional diseases of patients receiving emergency blood transfusion

Diagnosis	Frequency	Diagnosis	Frequency
Gastrointestinal bleeding	122	Idiopathic thrombotic purpura	5
Chronic renal failure	109	Breast cancer	5
Hypertension	92	Pancreas cancer	5
Diabetes mellitus	70	Rheumatoid arthritis	5
Coronary artery disease	63	Hodgkin's lymphoma	4
Congestive heart failure	51	Chronic lymphocytic leukemia	4
Gastric carcinoma	36	Larynx cancer	4
Liver cirrhosis	29	Myelofibrosis	4
Coumadin overdose	27	Pulmonary hypertension	4
Lung cancer	25	Cervix cancer	4
Cerebrovascular disease	25	Non-Hodgkin's lymphoma	4
Esophageal varices	24	Fistula	3
Myelodysplastic syndrome	24	Familial Mediterranean fever	3
Chronic obstructive respiratory disease	23	Cholelithiasis	3
Iron deficiency anemia	23	Peptic ulcer	3
Acute myeloid leukemia	20	Psychosis	3
Urinary bladder cancer	18	Gall bladder cancer	3
Multiple myeloma	16	Ulcerative colitis	3
Valve op.	15	Pulmonary embolism	3
Colon cancer	14	Hyperthyroidism	2
Prostate cancer	12	Mental retardation	2
Asthma	11	Mesothelioma	2
Brain tumor	11	Overian cancer	2
Hemorrhoid	10	Pnomototaks	2
Menometrorrhagia	10	Renal cell cancer	2
Atrial fibrillation	9	Pre-operation	2
Gastritis	9	Acute kidney disease	1
Chronic myeloid leukemia	8	Brucellosis	1
Goiter	7	Cerebral palsy	1
Amyloidosis	6	Crohn's disease	1
Benign prostatic hyperplasia	6	Febrile neutropenic fever	1
Deep vein thrombosis	6	Kaposi's sarcoma	1
Epilepsy	6	Osler-Weber-Rendu	1
Hepatitis B (+)	6	Osteosarcoma	1
B12 deficiency	5	Paraplegia	1
Dementia	5	Parkinson's disease	1
Etilizm	5	Psychosis	1
Factor V Leiden mutation	5	Primary indeterminate cancer	1
Hepatitis C (+)	5	Thyroid cancer	1
		Thalassemia	1

tions and recurrence of bleeding, and a lower rate of death with uncontrolled bleeding and other reasons when compared with a more liberal strategy (Hb<9 g/dL).<sup>[8]</sup> On the

other hand, Carson et al.<sup>[9]</sup> reported that a liberal transfusion strategy has been associated with a trend of fewer major cardiac events and deaths than a more restrictive

strategy. Another study showed that a liberal transfusion strategy did not reduce the rate of death or the inability to walk independently at a 60-day follow-up, or reduce in-hospital morbidity in elderly high-risk patients who underwent hip surgery.<sup>[10]</sup> An analysis of 12 observational studies that included 653 anemic patients with advanced cancer who were given a transfusion found a subjective response rate of 31% to 70%.<sup>[11]</sup> Thus, we believe the use of a transfusion in oncology patients should be made on a case-by-case basis.

In fact, other studies have come to the same conclusion, which indicates that rather than the present use of Hb level, the symptoms of the patient should be a primary consideration in indication for a blood transfusion. In the presence of anemic symptoms, a blood transfusion may be considered regardless of the Hb value. The symptoms of anemia are usually defined based on a decrease in oxygen delivery to the tissues and an increase in hypovolemia as a result of active bleeding. The symptoms of anemia are indicated as follows:

1. Myocardial ischemia findings or
2. Orthostatic hypotension or
3. Tachycardia unresponsive to fluid replacement or
4. Dyspnea at rest.<sup>[12]</sup>

These symptoms may be significant if they cannot be explained by another condition, such as a massive pulmonary embolism, and furthermore, it should be noted that some patients may not display the typical symptoms of anemia, such as those with diabetic neuropathy.

The impact of a red blood cell transfusion on outcomes in patients with acute coronary syndrome is controversial. A red blood cell transfusion has been associated with an increased risk of short- and long-term mortality, as well as myocardial reinfarction. However, a transfusion appeared to have beneficial or neutral effects on mortality at Hb levels below 8.0 g/dL, and harmful effects above 10 g/dL.<sup>[13,14]</sup>

The symptoms of chronic anemia are tiredness, weakness, headache, vertigo, angina, exercise intolerance, and dyspnea. The underlying cause is most likely iron deficiency anemia or anemia based on other nutritional deficiencies. Chronic anemia develops slowly as the body adapts via various mechanisms over the long term. Rather than breaking this chain rapidly with the transfusion of blood components, it has been suggested that the deficiency should be corrected in a controlled manner while treating the underlying disease.<sup>[15]</sup>

In our study, unfortunately, the first 3 conditions that led to the administration of a transfusion of blood components were weakness (19%), melena (14%), and asymptomatic with laboratory pathology. Unnecessary transfusions may be one reason for density experienced in emergency ser-

vices. It should not be forgotten that impatience of both patients and physicians in the treatment of anemia and efforts made to increase the Hb level immediately may provide disadvantages as well as advantages to the patients. If the bone marrow is healthy, it may be sufficient to wait and provide only any necessary components.

In a study conducted in New York between 2008 and 2010 to reduce the growing use of blood components and the rates of mortality and morbidity, a more limited blood transfusion threshold was implemented based on continuous monitorization of the patient's clinical condition. As a result, the ES transfusion decreased by 30.1%, the Plt transfusion rate decreased by 24.3%, the use of FFP decreased by 41.8%, and the use of cryoprecipitate decreased by 38.7% in the first year.<sup>[16]</sup> These results provide us with insight on potential benefits to be obtained by decreasing the rate of unnecessary transfusions and instituting a more controlled approach to both increase patient safety and decrease hospital costs.

Gastroenterology patients, including a relatively large number with gastrointestinal bleeding, were the most frequent emergency service patients to receive a transfusion, followed by oncology patients and hematological oncology patients. Our hospital is a kind of oncology center for the region. Excluding the patients with active gastrointestinal bleeding, it was determined that fewer than 50% of the patients in these groups required an emergency transfusion of blood components. Ambulatory parenteral treatment units could provide treatment for such patients and decrease the density experienced in emergency services and thereby ensure that patients with a genuine emergency receive priority (Fig. 5).

A limitation of this study is that analysis of vital findings and follow-up could not be performed.

## CONCLUSION

In conclusion, the transfusion of blood components is a very serious intervention and has serious potential complications, though it seems simple and routine. Therefore, the foreseeable risks should be considered when the level of Hb falls below a certain threshold value, rather than performing a transfusion immediately. The advantages and disadvantages to the patient, the expected contribution to the present condition of disease, the possibility to resolve symptoms, and alternative treatment methods should be carefully analyzed before making a decision to provide a blood transfusion.

The decision to administer a transfusion should be made evaluating not just the Hb level, but the patient's clinical condition, the underlying reasons for anemia, and important morbidity and mortality considerations.

## Ethics Committee Approval

Approved by the local ethics committee.

## Informed Consent

Retrospective study.

## Peer-review

Internally peer-reviewed.

## Authorship Contributions

Concept: Y.Ö.; Design: Y.Ö., S.A.; Data collection &/or processing: S.A., G.G.; Analysis and/or interpretation: Y.Ö.; Literature search: N.A.; Writing: Y.Ö., G. G.; Critical review: Ö.K.

## Conflict of Interest

None declared.

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## Acil Servisteki Kan Transfüzyonları Ne Kadar Acil?

**Amaç:** Kan transfüzyonu eksik olanın yerine konulmasıdır; etki profili, komplikasyon gelişimi, anafilaksi riski, ölüme kadar gidebilen rejeksiyon epizotları ile beraber düşünüldüğünde aslında bir doku transplantasyonudur. Klinik pratiğimizi dahiliye gözüyle semptom ve endikasyon açısından gözden geçirmek amacıyla acil dahiliye servisinde yapılan kan transfüzyonlarını derlemeyi amaçladık.

**Gereç ve Yöntem:** Hastanemiz acil dahiliye servisinde yapılan kan transfüzyonları geriye dönük olarak hastane bilgi sistemi üzerinden tarandı. Hastalar başvuru şikayetlerine göre aciliyet gerektirenler ve aciliyet gerektirmeyenler diye iki gruba kategorize edildi.

**Bulgular:** Üç ayda dahiliye acil servisinde %61.4'ü erkek toplamda 528 hastaya 1156 adet transfüzyon gerçekleştirildi (kişibaşı ortalama 2.18 adet). Başvuru şikayetlerinde ilk üç sırada halsizlik (%19), melena (%14), yakınmasız (sadece laboratuvar patolojisi) (%12.9) yer alıyordu. Aktif kanamaya gelen gastrointestinal sistem kanamaları hariç tutulduğunda ne onkoloji ne hematolojik onkoloji ne de diğer hasta gruplarının temel başvuru şikayetlerine bakıldığında aciliyet gerektiren şikayet oranları %50 dahi değildi. Tüm hastaların %47'sini ancak acil hastalar oluşturmaktaydı.

**Sonuç:** İstanbul Anadolu yakasının en kalabalık hastanelerinden biri olan hastanemiz yoğun bir transfüzyon deneyimine sahiptir. Sonuç olarak aciliyet gereksinimi ile hastaların geliş hemoglobin düzeyleri arasında bir korelasyon olmadığı gibi; aktif kanama haricinde acilde yapılan kan ürünleri transfüzyonlarının çoğunun acil endikasyonla yapılmadığı görüldü. Acil servislerin yükünü bir nebze azaltılması ve gerçek acil hastaların önceliğinin korunması adına hastanelerde ayakta parenteral tedavi ünitelerinin kurulması düşünülebilir.

**Anahtar Sözcükler:** Acil kan transfüzyonu endikasyonları; eritrosit, iç hastalıkları; trombosit.