Research Article / Araştırma Makalesi

Evaluation of Platelet Transfusions Practice: Results of at a Tertiary Healthcare Center in Turkey

Trombosit Transfüzyonu Uygulamasının Değerlendirilmesi: Türkiye'de Üçüncü Basamak Sağlık Merkezi Sonuçları

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Abstract

Background: Platelet transfusion is an effective method used to prevent and treat bleeding in thrombocytopenic patients. The impact of platelet transfusion without respecting the ABO compatibility on platelet transfusion refractoriness is debated. We aimed to evaluate platelet transfusions practice at our tertiary care hospital.
Materials and Methods: We analyzed 849 hematology-oncology patients who underwent platelet transfusion at Dokuz Eylül University Hospital between January 2014 and December 2020. Case under the age of 18 were excluded from the study. We retrospectively assessed the demographic data of selected cases, the types of transfusion products employed, and patients' laboratory parameters.
Results: Hematology-oncology patients accounted for 44.6% (n=849) of the transfusions. Much of the remainder is used in the emergency department 11.7% (n=224) and intensive care 6.8% (n=131). Eight hundred and forty-nine hemato-oncological patients were retrospectively identified between 2014 and 2020. The median age was 60 (18–91) years, with 44.6% women. ABO-identical platelet transfusions were 93.6%. Eighty-one percent of platelets were transfused to patients with counts < 25 × 10^6 µL. Post transfusion the next day, platelet count increment <10 × 10^6 µL was 31.6%, 37.5%, 30.0% for ABO compatible, ABO major incompatible, and ABO minor incompatible, respectively.
Conclusions: We conclude that platelet transfusions should always be made to only ABO identical platelets whenever possible. As with every blood product transfusion, comprehensive and practical national policies should be developed based on international guidelines for causing minimum side effects and maximum efficacy for platelet transfusion.

Key Words: Platelet transfusion, ABO blood group, Refractoriness, ABO compatibility

ÖZ.

Amaç: Trombosit transfüzyonu trombositopenik hastalarda kanamayı önlemek ve tedavi etmek için kullanılan etkili bir yöntemdir. ABO uyumluluğu gözetilmeksizin trombosit transfüzyonunun trombosit transfüzyon refrakterliği üzerindeki etkisi tartışılmalıdır. Üçüncü basamak hastanemizde ABO ile uyumlu olan ve olmayan trombosit transfüzyonu uygulamalarımızı değerlendirmeyi amaçladık.
Materyal ve Metod: Dokuz Eylül Üniversite Hastanesi'nde Ocak 2014 ile Aralık 2020 tarihleri arasında trombosit transfüzyonu yapılan 849 hematoloji-onkoloji hastasını analiz ettik. 18 yaş altı olgular çalışma dışı bırakıldı. Seçilmiş vakaların demografik verilerini, kullanılan transfüzyon ürünlerinin uygunlukları ve hastaların laboratuvar parametrelerini geriye dönük olarak değerlendirdik.
Bulgular: Transfüzyon yapılan hastaların %44,6'sını (n=849) hematoloji-onkoloji hastaları oluşturdu. Transfüzyon uygulamalarının %11,7'si (n=224) acil serviste ve %6.8'i (n=131) yoğun bakım ünitelerinde uygulandı. 2014 ve 2020 yılları arasında 849 hemato-onkolojik hasta geriye dönük olarak tarandı. Ortanca yaş 60 (18–91) idi ve %44.6'sı kadındı. ABO-tam uyumlu trombosit transfüzyonları %93,6 idi. Trombositlerin %81'i, sayısı < 25 × 10^6 µL olan hastalara transfüze edildi. Transfüzyondan bir sonraki gün, trombosit sayısı artışı <10 × 10^6 µL, sırasıyla ABO uyumlu, ABO majör uyumsuz ve ABO minör uyumsuz için sırasıyla %31.6, %37.5, %30.0 idi.
Sonuç: Trombosit transfüzyonlarının mümkün olduğunca sadece ABO ile uyumlu trombositlere yapılması gerektiği sonucuna vardık. Her kan ürünü transfüzyonunda olduğu gibi, trombosit transfüzyonunda da minimum yan etki ve maksimum etkinliğe neden olmak için uluslararası kılavuzlara dayalı kapsamlı ve pratik ulusal politikalar geliştirilmelidir.

Anahtar kelimeler: Trombosit transfüzyonu, ABO kan grubu, refrakterlik, ABO uyumluluğu

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Introduction

Platelet transfusion is a standard and effective therapy for preventing and treating bleeding in different thrombocytopenic patients. Indications for platelet use vary. Cameron et al. showed that hematology-oncology patients accounted for 67% of the platelet transfusions (1). Much of the remainder is used in cardiac surgery (7–10%) and intensive care (5–9%) (2). Two forms of platelet products for transfusion are whole blood platelets and apheresis platelets. Apheresis Platelet concentrates are obtained from single donor apheresis platelets (SDAP). Random donor platelets (RDP) are obtained from 4 to 6 units of pooled donor whole blood with the use of Buffy-coat (BC) and platelet-rich plasma (PRP) method. The main reason for preferring RDP use is the low cost and recycling of blood resources. Patients receiving SDAP have significant amounts of donor plasma that can cause a higher risk of hemolytic reactions and acute lung injury but a lower risk of transmitting infectious disease due to fewer donor exposures. Both RDP and SDAP can be preserved in plasma or special platelet additive solutions (PAS) (3). Consensus remains elusive on the best transfusable platelet product. Refractoriness to platelet transfusion is the inability to reach the platelet count with transfusion. The two causes of refractoriness are immune and non-immune. Among immune-related refractoriness, antibodies against HLA antigens are the primary cause. Non-immune causes implicate splenomegaly, fever, and ABO incompatibility (4, 5). Ogasawara K. et al. genetically determined ABO antigens on the surface of platelets (6). Human platelets do not express any rhesus (Rh) antigens. The Rh type of a platelet product causes no problem for transfusion incompatibility directly; however, potential sensitization to Rh antigens on residual red cells in the platelet product should be avoided. There is no unanimity of the clinical significance of ABO-incompatible platelet transfusion. Several studies have shown the superiority of the transfusion response with ABO identical platelets to ABO-incompatible (7–9), though it is currently not standard of procedure. A survey of a high number of North American laboratories reported a lack of a clear policy regarding the use of ABO-incompatible platelets by 17% of transfusion services (10). We evaluated platelet transfusions practice at the 9 Eylul University Hospital in Turkey.

Materials and Methods

Eight hundred forty-nine (platelet-transfused hematology-oncology patients) were analyzed from January 2014 to December 2020 at the 9 Eylul University Hospital in Turkey. Case under the age of 18 were excluded from the study. The selected cases' demographics data, the types of transfusion products used, and patients' laboratory parameters were retrospectively evaluated. Platelet ABO matching categories were as defined below: ABO-identical platelet, donor and recipient have the same ABO platelet antigens and plasma antibodies; ABO minor mismatch, donor's plasma ABO antibodies show incompatibility with recipient's platelet ABO antigens, and ABO major mismatch, incompatibility of donor's platelet ABO antigens with recipient's plasma ABO antibodies. The study protocol was approved by Dokuz Eylul University Ethics Committee (01/02/2021, 2021/03–48).

Statistical Analysis

Data were analyzed statistically using Windows software SPSS v24.0. Descriptive statistics were made. Parametric data are presented as mean ±standard deviation, non-parametric data as median, categorical data as a percentage.

Results

Hematology-oncology patients accounted for 44.6% (n=849) of the transfusions. Much of the remainder is used in the emergency department (11.7%, n=224) and intensive care (6.8%, n=131) (Table 1).

Table 1. Total percentage of patients by clinics

Clinics	No. (%)
Hemato-oncology	849 (44.6)
Emergency department	224 (11.7)
Intensive care unit	131 (6.8)
Cardio-vascular surgery	98 (5.1)
Gastroenterology	66 (3.4)
Others	535 (28.1)
Total	1903 (100)

Eight hundred and forty-nine hemato-oncological patients were identified between 2014 and 2020 retrospectively. The median age was 60 (18–91) years with 379 (44.6%) women and 470 (55.4%) men. The most common group aged 50-69 years (47.8%) was transfused with platelets. A total of 381 (44.9%) apheresis and 468 (55.1%) whole blood-derived cases were transfused. According to the ABO blood group, 385 (45.3%) patients were A, 145 (17.1%) were B, 64 (7.5%) were AB, and 255 (30%) patients were in the O group. Seven hundred and seventy 770 (90.7%) patients were Rh-positive, and 79 (9.3%)were Rh-negative. Table 2 shows further details about demographic characteristics. Of these, 795/849 (93.6%) patients were classified as ABO compatible, 30/849 (3.5%) as major incompatibility, and 24/849 (2.8%) as minor incompatibility. Table 3 lists characteristics of patients regarding whether they received ABO and Rh compatibility of platelet transfusions. Eighty-one percent of PLTs were transfused to patients with counts < 25 × 10^6 µL; 4.5% of patients had counts > 50 × 10^6 µL. Routine monitoring of next-day platelet count increment for all patients is illustrated in Table 4. Post transfusion next day, platelet count increment < 10 × 10^6 µL was 31.6%, 37.5%, 30.0% for ABO compatible, ABO major incompatible, and ABO minor incompatible, respectively. Table 5 lists the distribution of post platelet transfusion increment for ABO compatibility.

Table 2. Baseline patient characteristics

Baseline patient characteristics	No. (%)
Sex	
Female	379 (44.6)
Male	470 (55.4)
Age, y	
18-29	59 (6.9)
30-49	181 (21.3)
50-69	406 (47.8)
≥70	203 (23.9)
Platelet source	
Apheresis	381 (44.9)
Whole blood–derived	468 (55.1)
Primary diagnosis	
Acute leukemia	256 (30.2)
Myelodysplastic syndrome	71 (8.4)
Lyphoma	206 (24.3)
Others	316 (37.2)
Patient ABO type	
A	385 (45.3)
B	145 (17.1)
AB	64 (7.5)
O	255 (30.0)
Patient Rh type	
Rh (+)	770 (90.7)
Rh (-)	79 (9.3)

Table 3. Platelet transfusions by ABO and Rh product type

ABO blood type of recipient	ABO compatibility No. (%)		
	ABO-identical	Minor mismatch	Major mismatch
A	371 (43.7)	9 (1.1)	5 (0.6)
B	130 (15.3)	5 (0.6)	10 (1.2)
AB	54 (6.4)	10 (1.2)	-
O	240 (28.3)	-	15 (1.8)
Rh blood type of recipient	**Rh compatibility No. (%)**		
	Rh (+)		**Rh (-)**
Rh (+)	751 (88.5%)		19 (2.2%)
Rh (-)	10 (1.2%)		69 (8.1)

Table 4. Routine monitoring of next-day platelet count increment on all patients

Platelet count (µL)	Pre-transfusion No. No.(%)	Post-transfusion No. (%)	Post-transfusion increment No.(%)
<10 x10^6	216 (25.4)	50 (5.9)	**268 (31.6)**
10-24 x10^6	474 (55.8)	272 (26.7)	**272 (32.0)**
25-49 x10^6	121 (14.3)	353 (41.6)	**242 (28.5)**
>50 x10^6	38 (4.5)	219 (25.8)	**67 (7.9)**

Table 5. Post platelet transfusion next day platelet count increment by ABO compatibility

Next day platelet Count increment (µL)	ABO compatible No. (%)	ABO minor compatibility No. (%)	ABO Major compatibility No. (%)
<10 x10^6	252 (31.6)	7 (37.5)	9 (30.0)
10-24 x10^6	254 (32.0)	9 (37.5)	9 (30.0)
25-49 x10^6	226 (28.5)	6 (25.0)	10 (33.3)
>50 x10^6	63 (7.9)	2 (8.3)	2 (6.7)

Discussion

The transfusion of blood products is a critical process that should be performed after proper analysis of the profit-loss balance. We employ platelet transfusion for therapeutic or prophylactic purposes. The practical and safe threshold for prophylactic platelet transfusion in a clinically stable patient is a platelet count of 10 × 10^6 µL because it adequately prevents spontaneous bleeding (11–13). The threshold for platelet transfusions to control bleeding, such as multi-lumen catheter insertion, was 25 × 10^6 µL; for an invasive procedure such as major surgery, liver, or lung biopsy, the threshold was <50 × 10^6 µL (14). Sixty-three percent of our patients had a platelet count of <25 × 10^6 µL for platelet transfusion, and nearly all patients had multi-lumen catheter insertion. RDP is used commonly in many European centers, while in the USA, between two--thirds and three--quarters of all transfusions given are SDAP (14–17). We used 55% RDP and 45%SDAP in our hospital. PAS's use decreases the amount of plasma in platelets to 20% compared to plasma's use, so that plasma-related adverse effect is low. PAS cannot be used due to its prohibitive costs (17). Platelet transfusion refractoriness (PTR) is multifactorial and can be divided into immune or non-immune. Among immune-related refractoriness, antibodies against human leukocyte antigens (HLA) or less often against human platelet specific antigens (HPA) are the primary causes. Non-immune causes constitute approximately 80% of PTR and are implicated in infection-sepsis, splenomegaly, fever,and ABO incompatibility (4, 5, 18). Whether each of these factors can affect post-transfusion platelet increments remains unclear. One study revealed the presence of ABO blood antigens on the surface of platelets (10). There is little information about the clinical outcome of ABO compatibility in platelet transfusions in current clinical practice and commonly transfused without respect for AB0 compatibility. Carr et al. reported that a greater incidence of early refractoriness in patients receiving ABO-incompatible platelets (19) particularly leads to an increased risk of morbidity and mortality (20). Jimenez et al. demonstrated that ABO major incompatible platelet transfusions yielded one-third of the platelet recovery of ABO identical transfusions (21). Heal JM et al. reported a possible survival advantage

for adult leukemia patients on ABO identical platelet transfusions (22). On the contrary, few studies suggest that transfusion of ABO non-identical platelets does not impact clinical outcomes (19, 23). Several studies detected anti-D alloimmunization when RhD-negative patients were transfused with RhD-positive platelets from single-donor apheresis (24–26); this may be a vital ıssue, especially when receiving RhD-positive platelet transfusions to RhD-negative childbearing women and pediatric patients. Following our hospital's transfusion policy, most platelet transfusions performed in our patients were ABO-Rh compatible products. However, a few patients received ABO-Rh incompatible platelet transfusions. Hence, we made no intergroup statistical comparisons. The present study had a few limitations. It was a retrospective study on patients with different clinical conditions based on single-center data. The platelet transfusion's adverse effect and long-term outcome could not be evaluated. Data from the pediatric population was excluded.

To our knowledge, the current study is the first one to report on the proportion of ABO compatible versus incompatible platelet transfusion received with hematology-oncology patients who require platelet transfusions in Turkey. Believably, platelet transfusions should always be made to only ABO identical platelets whenever possible. As with every blood product transfusion, effective national policies should be developed based on international guidelines for ensuring minimum side effects and maximum efficacy for platelet transfusion.

Ethical Approval: The study protocol was approved by Dokuz Eylul University Ethics Committee (01/02/2021, 2021/03–48).

Author Contributions:
Concept: A.S, I.A
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Data acquisition: C.C, A.S
Analysis and interpretation: A.S, I.A,G.H.O
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