

Platelet inventory and using out-of-group platelet suspension: A cost-effective strategy for a blood transfusion service

Abdulkerim Yıldız

Hitit University, Corum Erol Olcok Training and Research Hospital, Department of Hematology, Corum, Turkey, akerim@hotmail.com

Murat Dogan

Hitit University, Corum Erol Olcok Training and Research Hospital, Department of Internal Medicine, Corum, Turkey

Mehmet Yalvaç

Hitit University, Corum Erol Olcok Training and Research Hospital, Department of Anesthesiology, Corum, Turkey

Bilge Zihar

Hitit University, Corum Erol Olcok Training and Research Hospital, Blood Transfusion Service, Corum, Turkey

Follow this and additional works at: <https://www.hosct.org/hematology-oncology-and-stem-cell-therapy>



Part of the [Cancer Biology Commons](#), [Hematology Commons](#), and the [Oncology Commons](#)

Recommended Citation

Yıldız, Abdulkerim; Dogan, Murat; Yalvaç, Mehmet; and Zihar, Bilge (2022) "Platelet inventory and using out-of-group platelet suspension: A cost-effective strategy for a blood transfusion service," *Hematology/Oncology and Stem Cell Therapy*. Vol. 16 : Iss. 4 , Article 6.

Available at: <https://doi.org/10.56875/2589-0646.1041>

This Original Research Report is brought to you for free and open access by Hematology/Oncology and Stem Cell Therapy. It has been accepted for inclusion in Hematology/Oncology and Stem Cell Therapy by an authorized editor of Hematology/Oncology and Stem Cell Therapy.

ORIGINAL RESEARCH REPORT

Platelet Inventory and Using Out-of-group Platelet Suspension: A Cost-Effective Strategy for a Blood Transfusion Service

Abdulkerim Yıldız ^{a,*}, Murat Doğan ^b, Mehmet Yalvaç ^c, Bilge Zihar ^d

^a Hitit University, Erol Olcok Training and Research Hospital, Department of Hematology, Çorum, Türkiye

^b Hitit University, Erol Olcok Training and Research Hospital, Department of Internal Medicine, Çorum, Türkiye

^c Hitit University, Erol Olcok Training and Research Hospital, Department of Anesthesiology and Reanimation, Çorum, Türkiye

^d Hitit University, Erol Olcok Training and Research Hospital, Blood Transfusion Service, Çorum, Türkiye

Abstract

Background: Platelet (PLT) transfusions are essential for advanced hospitals, especially those with onco-hematology departments. However, platelet concentrates (PCs) have supply limitations and a shorter shelf life, which create difficulties for blood transfusion services (TSs).

Materials and methods: This retrospective study was conducted over a 4-year period between January 2017 and January 2021 in a tertiary referral hospital. From the beginning of 2020, as a new strategy of our TS, a PLT inventory was produced and ABO-identical transfusions were prioritized when the inventory allowed; when this was not possible, ABO and Rh incompatible transfusion was employed. The numbers of transfused and discarded PCs were compared for each year.

Results: In 2017, a total of 799 PCs were used and 70 PCs were discarded with the expiration ratio (ER) of 8.0%. In 2018, 1124 PCs were used and 99 PCs were discarded with the ER of 7.4%. In 2019, 726 PCs were used and 91 PCs were discarded with the ER of 11.1%. In 2020, 1100 PCs were used for 569 patients, of which 251 PCs were ABO and Rh incompatible without any severe transfusion reaction. A total of 56 PCs were discarded with the ER of 4.8%.

Conclusion: The results of the current study suggested that with the determination of the platelet stock level and the use of out-of-group PCs, the rate of discarded PLT could be reduced. Nevertheless, based on current literature and experience, each TSs should make their own strategies and policies to provide an adequate supply of PCs.

Keywords: Platelet transfusion, ABO compatible, Transfusion service

1. Introduction

Platelet (PLT) transfusion is essential for advanced hospitals, especially those with onco-hematology departments. Blood transfusion services (TSs) of hospitals have to meet the needs of patients as quickly as possible. However, unlike red blood cell (RBC) suspensions, platelet concentrates (PCs) have supply limitations and a shorter shelf life, leading to challenges and difficulties for TSs [1,2]. Many hospital TSs prioritize ABO plasma compatibility in PLT transfusion to minimize risk for acute hemolytic transfusion reactions. However, a policy of

transfusing only ABO-identical PLTs may increase the number of discarded products due to expiration dates [3]. Some TSs allow the use of ABO incompatible (ABOi) suspensions with the knowledge that PLTs, unlike RBCs, do not constitute a risk for intravascular hemolysis when transfused out-of-group.

Recent data have shown that about one-third of platelet transfusions in the USA are major incompatible [4]. However, there is the disadvantage that the accompanying plasma may cause hemolysis when ABOi is transfused with recipient RBCs [5]. Although PLTs do not express Rh antigens, they may contain small numbers of RBCs or fragments, which

Received 30 April 2021; revised 12 February 2022; accepted 8 March 2022.
Available online 23 May 2023

* Corresponding author at: Hitit University, Çorum Erol Olcok Training and Research Hospital, Department of Hematology, Çorum, Turkey.
E-mail address: Abdulkerim.yildiz@saglik.gov.tr (A. Yıldız).

<https://doi.org/10.56875/2589-0646.1041>

2589-0646/© 2023 King Faisal Specialist Hospital and Research Centre. This is an open access article under the CC-BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

can lead to alloimmunization [5]. However, some studies have suggested that transfusion of ABOi PLTs is associated with reduced PLT recovery [3].

Each hospital TSs determines its own strategy, taking into account the conflicting information in the literature. Some prefer to supply only compatible products, while others allow the use of incompatible products, taking shelf life into consideration. The aim of this study was to analyze the effectiveness of our hospital strategy, which was changed at the beginning of 2020.

2. Materials and methods

This retrospective study was conducted covering the 4-year period between January 2017 and January 2021, in Hitit University Training and Research Hospital. The annual data of transfused and discarded PCs for each of the 4 years were recorded from the TS database. Until 2020, it was only permitted to transfuse ABO and Rh identical PCs; then the decision was made at the beginning of 2020 for the new strategy of determining the PLT stock level and creating a PLT inventory. This inventory was composed of only pooled PCs (PPCs) as obtaining apheresis (APCs) was reserved for emergent conditions when no PPCs were available. There was no threshold level for determining that the inventory is “critically low”. The use of nonidentical PCs was arranged depending on platelet inventory availability and clinician preference. ABO-identical transfusions were prioritized when the inventory allowed, and when this was not possible, a strategy was implemented of ABO and Rh incompatible transfusion to decrease the risk of expiration. The only restriction was the transfusion of Rh-positive product to an Rh-negative recipient. All transfusion reactions reported to the TS were systematically evaluated, and hard copies of the laboratory investigations were available for review.

2.1. Statistical analysis

Excel 2013 software (Microsoft Corporation) was used for statistical analysis. A bar graph was used to visually represent the data with bars of different heights or lengths. A line graph was used to show changes over time.

2.2. Compliance with ethical standards

All procedures performed in the study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later

amendments or comparable ethical standards. This study was approved by the Local Ethics Committee (decision no: 419, dated: 10/03/2021).

3. Results

The number of transfused and expired products for each year is shown in Fig. 1, and the expiration ratio for each year is shown in Fig. 2. In 2017, for 206 patients, 644 PPCs were used and 62 PPCs were expired; 155 APCs were used for 93 patients with 8 expired APCs. A total of 70 PPCs were expired with the expiration ratio (ER) of 8.0% (70/869).

In 2018, for 326 patients, 1162 PPCs were used and 94 PPCs were expired; 78 APCs were used for 53 patients with 5 expired APCs. A total of 99 PPCs were expired with the ER of 7.4% (99/1339).

In 2019, for 247 patients, 600 PPCs were used and 76 PPCs were expired; 126 APCs were used for 84 patients with 15 expired APCs. A total of 91 PPCs were expired with the ER of 11.1% (91/726).

In 2020, for 555 patients, 1083 PPCs were used and 56 PPCs were expired; 17 APCs were used for 14 patients with no expired APCs. A total of 56 PPCs were expired with the ER of 4.8% (56/1100). Of the PPCs used, 251 were ABO incompatible and no transfusion reactions were recorded. The distribution of transfused and discarded (expired) PCs according to the years is provided in Table 1. The average number of PPCs transfused per patient was 2.67, 3.27, 2.19, and 1.93, respectively, for the years 2017–2020.

4. Discussion

The usage of PCs is mandatory for most tertiary centers, especially those with hematology and oncology departments. However, there is the challenging issue that making a PLT inventory is difficult for blood banks or TSs because of the shorter half-life. The expiration date is usually reported to be approximately 5 days as accepted for the PCs in our center [6]. Hospital TSs and blood banks have their own different strategies based on their experience and literature data. One of the main strategies is the use of out-of-group PLT, despite concerns about the possibility of hemolytic reactions. Platelets do not express Rh antigens, but some PCs may contain residual RBCs or fragments that can result in alloimmunization [7]. The true incidence of hemolytic transfusion reactions associated with plasma-incompatible PLT transfusion is unknown, although it can cause significant morbidity and mortality [8,9]. In a recent study, 13447 PLT transfusions to patients aged >1 year were analyzed.

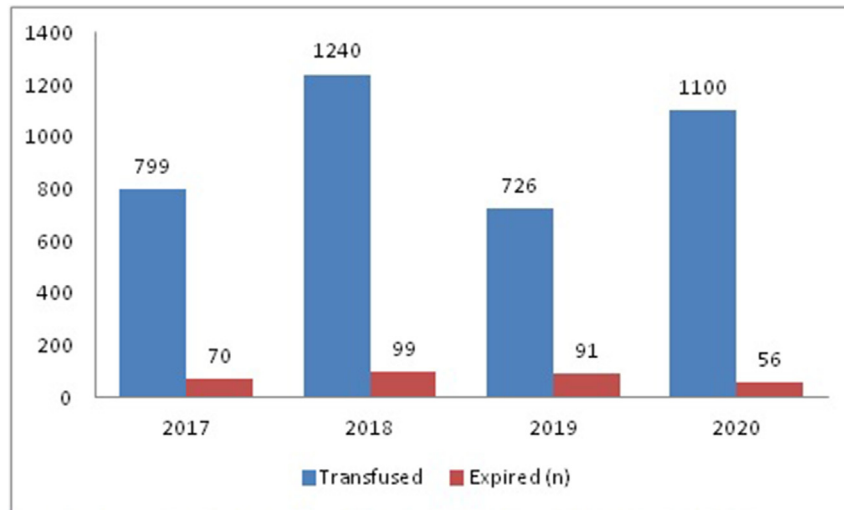


Fig. 1. The number of transfused and expired platelet products according to year.

Approximately 40% were ABOi, and the overall rate of hemolytic transfusion reactions from plasma-incompatible platelet units was found to be 0.12%. The transfusion reaction rate in the ABOi platelet group was 1.7%, which was greater than that of the ABO compatible group [6].

Another concern about using ABOi PCs is the possibility of inadequate increments. In 2019, a prospective, observational study of critically ill children reported no difference in the incremental change in platelet count and in transfusion reactions when comparing major ABOi PLT transfusions with ABO compatible transfusions [10]. Another prospective observational study of predominantly non-oncology patients found a slight superiority in post-transfusion PLT count increments in ABO-compatible transfusions, but the authors suggested that it may not be clinically significant [11].

Based on the current knowledge, many centers have recently started to use out-of-group PLT. In a retrospective analysis of PLT use in 12 US hospitals, all PLT transfusions from 2013 to 2016 given to patients aged ≥ 18 years were included in the analysis. A total of 28,843 inpatients and 2987 outpatients were transfused with 163,719 platelet products. Only half of the platelet transfusions were ABO identical, and 60.6% of platelet transfusions given to Rh-negative patients were Rh positive [4].

At the beginning of 2020, the TSs of our hospital implemented a new strategy. First, the PLT stock level was identified based on PLT daily usage, and then a PLT inventory was produced. Compatible transfusions were prioritized if available on the inventory, otherwise out-of-group PCs were allowed to be used; the only restriction was for Rh-positive product not to be given to an Rh-negative patient. In

2020, 251 out-of-group PCs were used, which constituted 21% of the total. Compared with the previous 3 years, with the new strategy in 2020 it was possible to reduce both the number and rates of discarded products. No significant adverse events were recorded, which also provided a cost benefit.

On the other hand, our results showed variance in the total number of PPC utilization over the 4 years of study period. While our center was a 630-bed hospital in 2017, we moved to a new 750-bed hospital in 2018. As we are in an endemic region for Crimean-Congo Hemorrhagic Fever (CCHF), the number of patients with CCHF was increased in 2018 with respect to 2017. These can explain the 30% increase in platelet use in 2018. Also, there was no hematology specialist in our hospital in 2019; therefore this may have caused a decrease in platelet use (40%). However, the average number of PCs transfused per patient was 2.67, 3.27, 2.19, and 1.93, respectively, for the four years of 2017–2020. Although the total number of transfused PCs increased in 2020, the number of PCs per patient reduced. New hematologist with a new strategy in 2020 may have played a major role in the increased number of transfused products with lower per patient ratio. Another advantage is the availability of the hematologist for consultation about transfusions. This prevented unnecessary requests from other clinicians simply as a precaution. In addition, the number of transfused APCs was the lowest in 2020, which could have been due to the fact that the PLT inventory was mostly composed of PPCs supplied from our regional supplier (Türk Kızılay), or that out-of-group PCs were used when ABO identical suspension was not available for the patient.

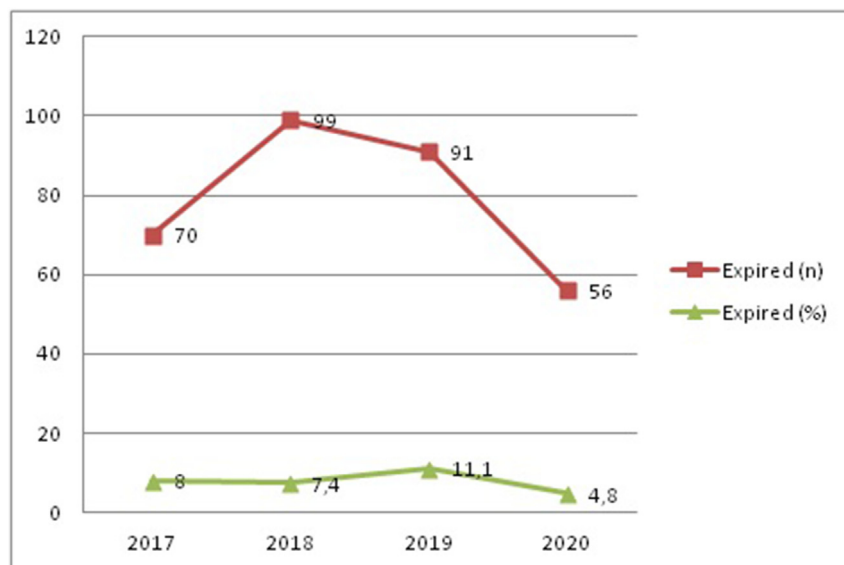


Fig. 2. The rate of discard for platelet products according to year.

Table 1. The distribution of transfused and discarded (expired) platelet products according to year.

Year	Platelet suspension				Total Transfused (n)	Total Discarded (n)	Total Discarded (%)
	Pooled		Apheresis				
	Transfused	Discarded	Transfused	Discarded			
2017	644	62	155	8	799	70	8.0
2018	1162	94	78	5	1240	99	7.4
2019	600	76	126	15	726	91	11.1
2020	1083	56	17	0	1100	56	4.8

Despite many other hospitals use of a similar strategy, some centers still avoid the use of out-of-group PCs. This may be due to lack of current knowledge and sometimes due to the lack of hematology specialists within hospitals. The result of our study demonstrated again, as with many previous studies, that the use of mismatched PLT transfusions is safe. Therefore, we support previous findings that can encourage more clinicians and transfusion centers in this regard.

Limitations of the current study could be the retrospective design and short period of analysis. Stronger results could have been obtained with the use of more detailed data about ABOi PCs.

5. Conclusion

The transfusion of PCs is mandatory for most hospitals, especially those with hematology and oncology departments. The supply does not always allow for provision of ABO and Rh identical PCs, particularly when the hospital is geographically distant from PLT suppliers. To overcome this challenging issue, a PLT inventory should be

established. However, managing a PLT inventory is difficult for the TSs due to the shorter half-life. In order to optimize the inventory, transfusion of PLTs can be considered without regard for ABO compatibility. Nevertheless, based on the recent literature and past experience, each TSs should establish their own strategies and policies to ensure an adequate supply of PCs.

Conflict of interest

None declared.

References

- [1] Curtis BR, Edwards JT, Hessner MJ, Klein JP, Aster RH. Blood group A and B antigens are strongly expressed on platelets of some individuals. *Blood* 2000;96(4):1574–81.
- [2] Vollmer T, Hinse D, Diekmann J, Knabbe C, Dreier J. Extension of the storage period of platelet concentrates in Germany to 5 days by bacterial testing: is it worth the effort? *Transfus Med Hemotherapy* 2019;46(2):111–3.
- [3] Jackups Jr R, Kymes S. Comparison of two platelet transfusion strategies to minimize ABO-nonidentical transfusion, outdated, and shortages using a computer-simulated "virtual blood bank. *Transfusion* 2015;55(2):348–56.

- [4] Gottschall J, Wu Y, Triulzi D, Kleinman S, Strauss R, Zimrin AB, et al. The epidemiology of platelet transfusions: an analysis of platelet use at 12 US hospitals. *Transfusion* 2020;60(1):46–53.
- [5] Dunbar NM. Does ABO and RhD matching matter for platelet transfusion? *Hematology Am Soc Hematol Educ Program* 2020;2020(1):512–7.
- [6] Malvik N, Leon J, Schlueter AJ, Wu C, Knudson CM. ABO-incompatible platelets are associated with increased transfusion reaction rates. *Transfusion* 2020;60(2):285–93.
- [7] Cid J, Harm SK, Yazer MH. Platelet transfusion - the art and science of compromise. *Transfus Med Hemotherapy* 2013; 40(3):160–71.
- [8] Dunbar NM, Katus MC, Freeman CM, Szczepiorkowski ZM. Easier said than done: ABO compatibility and D matching in apheresis platelet transfusions. *Transfusion* 2015;55(8): 1882–8.
- [9] Josephson CD, Castillejo MI, Grima K, Hillyer CD. ABO-mismatched platelet transfusions: strategies to mitigate patient exposure to naturally occurring hemolytic antibodies. *Transfus Apher Sci* 2010;42(1):83–8.
- [10] Nellis ME, Goel R, Karam O, Cushing MM, Davis PJ, Steiner ME, et al. Effects of ABO matching of platelet transfusions in critically ill children. *Pediatr Crit Care Med* 2019;20(2):e61–9.
- [11] Pavenski K, Warkentin TE, Shen H, Liu Y, Heddle NM. Posttransfusion platelet count increments after ABO-compatible versus ABO-incompatible platelet transfusions in noncancer patients: an observational study. *Transfusion* 2010;50(7):1552–60.