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Effects of ABO Matching of Platelet Transfusions in Critically Ill Children

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Abstract

Objective: To determine if transfusing ABO compatible platelets has a greater effect on incremental change in platelet count as compared to ABO incompatible platelets in critically ill children.

Design: Secondary analysis of a prospective, observational study. Transfusions were classified as either ABO compatible, major incompatibility or minor incompatibility. The primary outcome was

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the incremental change in platelet count. Transfusion reactions were analyzed as a secondary outcome.

Setting: Eighty two pediatric intensive care units in 16 countries.

Patients: Children (3 days to 16 years of age) were enrolled if they received a platelet transfusion during one of the predefined screening weeks.

Interventions: None

Measurements and Main Results: Five hundred and three children were enrolled and had complete ABO information for both donor and recipient, as well as laboratory data. 342 (68%) received ABO-identical platelets, 133 (26%) received platelets with major incompatibility, and 28 (6%) received platelets with minor incompatibility. Age, weight, proportion with mechanical ventilation or underlying oncologic diagnosis did not differ between the groups. After adjustment for transfusion dose, there was no difference in the incremental change in platelet count between the groups; the median (IQR) change for ABO-identical transfusions was 28 (8–68) $x10^9$ cells/L, for transfusions with major incompatibility 26 (7–74) $x10^9$ cells/L, and for transfusions with minor incompatibility 54 (14–81) $x10^9$ cells/L ($p = 0.37$). No differences in count increment between the groups were noted for bleeding ($p=0.92$) and non-bleeding patients ($p=0.29$). There were also no differences observed between the groups for any transfusion reaction ($p=0.07$).

Conclusions: No differences were seen in the incremental change in platelet count nor in transfusion reactions when comparing major ABO incompatible platelet transfusions with ABO compatible transfusions in a large study of critically ill children. Studies in larger, prospectively enrolled cohorts should be performed to validate whether ABO matching for platelet transfusions in critically ill children is necessary.

Keywords

platelet transfusion; ABO compatibility; critical illness; pediatrics

INTRODUCTION

Platelet transfusions are frequently prescribed for critically ill children who are either bleeding (therapeutic transfusions) or at risk of bleeding (prophylactic transfusions). A recent large, international, observational study of both therapeutic and prophylactic transfusions in critically ill children demonstrated a high mortality rate (25%) for all children receiving a platelet transfusion for any indication, as well as an independent association between total platelet dose and mortality.[1] In children receiving platelet transfusions, each additional dose 10 mL/kg of platelets received was associated with a 2% increase in mortality, after accounting for severity of illness represented by organ dysfunction scoring on the day of transfusion, bleeding and the use of extracorporeal life support. Any modifiable determinants of platelet transfusions should therefore be explored given the potential morbidity and mortality that may be associated with this therapy.

Providing ABO-identical platelet transfusions is not always considered necessary. The requirement for matching ABO blood group for platelets are not as stringent as those for RBC transfusions. Platelets express ABO blood group antigens[2] and correspondingly the

plasma found in platelet products may contain antibodies against A or B antigens, depending upon the ABO type of the donor, that may be reactive with the recipient's antigens.[3] The practice of ABO matching of platelet transfusions in blood banks is variable with no consensus guidelines; approximately 20% of hospitals have no institutional written guidelines on this topic.[4] The proportion of critically ill children receiving ABO compatible platelet transfusions has not been reported. The transfusion of ABO incompatible platelets may have the benefit of effectively increasing the availability of platelet product options, which is considered a limited resource, especially in emergencies such as life-threatening hemorrhage. Increased availability also reduces waste of platelet products, given their short storage duration (5–7 days). However, ABO mismatching has been implicated in acute hemolysis[5], increased fever and alloimmunization[6], and reduced efficacy of platelet transfusions.[7]

Few studies have demonstrated the effects of ABO incompatibility in pediatric platelet transfusions[8] and no previous studies have reported the results in critically ill children. Therefore, as the primary objective of this study, we sought to describe the efficacy of ABO compatibility on the incremental change in platelet count following platelet transfusions in critically ill pediatric patients. As a secondary objective, we evaluated associations between the receipt of ABO incompatible platelet transfusions and the occurrence of transfusion reactions. Lastly, we evaluated patient variables associated with the receipt of compatible versus incompatible platelet transfusions.

METHODS

This study, approved by the Institutional Review Board at Weill Cornell Medicine, is an a priori secondary analysis of a prospective, observational study examining the epidemiology of platelet transfusions in critically ill children ("Point Prevalence Study of Platelet Transfusions in Critically Ill Children," otherwise known as P^3T).[1] Eighty-two sites from sixteen countries contributed data. Each site was assigned six random weeks (between September 2016 to April 2017) during which they screened subjects for eligibility and enrollment. A child was enrolled if he/she was between the ages of 3 days and 16 years of age and received a platelet transfusion prescribed by the intensive care medical team during one of the screening days. Patients were excluded if life expectancy was considered to be less than 24 hours, gestational age of the patient was less than 37 weeks at the time of admission, or the patient had already been enrolled in a previous screening week. In addition, they were excluded from this analysis if they received multiple pooled platelet units with different ABO compatibility or if they received several platelet transfusions in the interval between laboratory assessments. In total, 16,934 patients were screened and 559 eligible patients receiving platelet transfusions were enrolled. Data for the P^3T study were recorded in the Research Electronic Data Capture (REDCap) web data application and extracted for this secondary analysis. Data regarding ABO compatibility was collected around the platelet transfusion at time of enrollment but did not include all data from every platelet transfusion received during the subject's PICU stay.

Data collected included patient demographics, reason for admission, any prior platelet transfusions during the current ICU admission, validated measures of organ dysfunction

(PELOD-2 scoring)[9], information regarding the platelet product (including the ABO type of the donor and recipient), and any adverse reactions that occurred during the transfusion. The adverse reactions documented included fever of ≥ 38.5C (or increase in temperature by 1 degree Celsius from baseline in a patient who was already febrile), hypotension, bronchospasm, urticaria, and hemolytic reactions. The total platelet count before and after the platelet transfusion was recorded if obtained as standard of care. The timing of the assays was determined by the medical team. The pre-transfusion platelet count was assayed within 36 hours of start of the transfusion and recorded according to the following time intervals: < 1 hour, 1–2 hours, 2–6 hours, 6–12 hours, 12–24 hours and 24–36 hours. The timing of the post-transfusion platelet count was recorded in relation to the completion of the transfusion of interest with the same time intervals as listed above.

ABO major incompatibility was defined as platelets from A, B or AB donors to O recipients, or from AB donors to A or B recipients. Transfusions with bidirectional incompatibility (A donor to B recipient or B donor to A recipient) were included in the major incompatibility group. Minor incompatibility was defined as platelets from O donors to A, B or AB recipients, or from A or B donors to AB recipients.

Demographic and clinical characteristics were described as counts and percentages or median and interquartile range (IQR) as appropriate. Categorical variables were compared using either Chi-squared or Fisher's exact test, depending on the size of the sample. Continuous variables were compared using Kruskal Wallis test. Two-sided p values below 0.05 were considered significant and there was no adjustment made for multiple comparisons. If the Kruskal Wallis test showed a statistical difference between groups, then one to one comparison was performed to determine which groups were significantly different. All analyses were conducted using SPSS version 25 (IBM Corp, Armonk, NY).

RESULTS

Of the 559 subjects enrolled in P^3T, five hundred and three (90%) had data on ABO compatibility and pre and post-transfusion platelet counts recorded. Of these, 342/503 (68%) were classified as ABO compatible, 133/503 (26%) had major incompatibility and 28/503 (6%) had minor incompatibility. Seven transfusions had bi-directional incompatibility and were classified along with the major incompatibility group.

The transfusions occurred across diverse locations: 351/503 (70%) in North America, 81/503 (16%) in Europe, 35/503 (7%) in Oceania, 21/503 (4%) in Asia, and 15/503 (3%) in the Middle East. There was variability in the percentage of compatible transfusions given in each region: 66% in North America, 70% in Europe, 71% in Oceania, 91% in Asia, and 67% in the Middle East ($p< 0.001$).

The demographics and clinical characteristics are described in Table 1. The groups were comparable across various characteristics except for median PELOD-2 scoring being slightly higher in the ABO minor incompatibility group as compared to ABO-identical transfusions or major incompatibility groups ($p=0.04$). For patients weighing less than 15kg, 161 (67%) received ABO compatible transfusions, 65 (27%) received transfusions with

major incompatibility and 15 (6%) received transfusions with minor incompatibility. The admitting diagnoses of the subjects and the therapies they received are summarized in Table 2. There were no differences in admitting diagnoses (apart from those with septic shock and those with cardiac insufficiency not related to cardiac surgery), medications with antiplatelet effects, use of extracorporeal therapies, or median dose of platelet transfusions prior to enrollment in the study between the three groups. Patients received a median (IQR) platelet dose of 30 (13–86) mL/kg during their PICU admission prior to enrollment in the study. The total median (IQR) number of platelet transfusions received during their entire admission was 4 (2–11).

Table 3 describes the receipt of the three ABO compatibility for bleeding versus non-bleeding indications. The indication for the platelet transfusions (treatment of bleeding versus prophylaxis) differed between the three ABO compatibility groups (p=0.04). Thirty-two percent (110/342) of the ABO compatible transfusions were given to bleeding patients. Forty-two percent (56/133) of the transfusions with major incompatibility were given to bleeding patients and twenty-one percent (6/28) of the transfusions with minor incompatibility were given to bleeding patients. Table 4 illustrates the attributes of the platelet products transfused.

The breakdown of time intervals between the pre-transfusion platelet count and the start of the transfusion of interest are as follows (data was available for 501 transfusions): 36/501 (7%) within < 1 hour, 102/501 (20%) within 1–2 hours, 223/501 (44%) within 2–6 hours, 105/501 (21%) within 6–12 hours, 29/501 (6%) within 12–24 hours and 6/501 (<2%) within 24–36 hours. The breakdown of time intervals between the end of the transfusion of interest and the post-transfusion platelet count are as follows (data on timing is available in all of the transfusions): 43/503 (9%) within < 1 hour, 81/503 (16%) within 1–2 hours, 171/503 (34%) within 2–6 hours, 124/503 (25%) within 6–12 hours, 67/503 (13%) within 12–24 hours and 17/503 (<4%) within 24–36 hours. There was a wide variation in the interval changes in platelet count, corrected for a standard dose of 10 mL/kg, with the majority of interval changes occurring between −40 to +150 $\times 10^9$ cells/L. For all transfusions, there was a median (IQR) interval rise of 28 (8–70) $x10^9$ cells/L for every 10 mL/kg transfused. Figure 1 shows the interval change for each ABO compatibility group. These results were consistent when bleeding and non-bleeding patients were analyzed separately. In bleeding patients, the median (IQR) interval rise was 29 (8–64) $x10^9$ cells/L for every 10 mL/kg transfused for ABO compatible transfusions, 23 (7–105) $x10^9$ cells/L for transfusions with major incompatibility, and 35 (4–108) $x10^9$ cells/L for transfusions with minor incompatibility (p=0.93). Similarly, for non-bleeding patients, the median (IQR) interval rise was 27 (8–70) $x10^9$ cells/L for every 10 mL/kg transfused for ABO compatible transfusions, 26 (8–55) $x10^9$ cells/L for transfusions with major incompatibility, and 57 (17–78) $x10^9$ cells/L for transfusions with minor incompatibility (p=0.29). Figure 2 demonstrates the interval changes in total platelet count in bleeding versus non-bleeding subjects by ABO compatibility group.

Given the possibility that the presence of extracorporeal support may bias the results since it is known to affect the incremental change in platelet count due to adherence or destruction, a subgroup analysis was performed excluding those patients on ECLS. The results were

consistent. The median (IQR) interval rise was 28 (8–65) $x10^9$ cells/L for every 10 mL/kg transfused for ABO compatible transfusions, 22 (7–74) $x10^9$ cells/L for transfusions with major incompatibility, and 37 (4–78) $x10^9$ cells/L for transfusions with minor incompatibility (p=0.74).

Similarly, given the fact that subjects with an underlying oncologic diagnosis would have likely been exposed to more platelet transfusions and therefore have a less robust response in the incremental change in platelet count, we performed a subgroup analysis of the 295 subjects who did not have an underlying oncologic diagnosis. The results remained consistent. The median (IQR) interval rise was 36 (10–79) $x10^9$ cells/L for every 10 mL/kg transfused for ABO compatible transfusions, 34 (8–90) $x10^9$ cells/L for transfusions with major incompatibility, and 57 (37–81) $x10^9$ cells/L for transfusions with minor incompatibility (p=0.39).

Given the possibility of differences in those multiply transfused, a sub-group analysis was performed in the 92 subjects who had received ≥ 30 mL/kg of platelet transfusions during their admission, prior to enrollment in the study. In this group, 61/92 (66%) received ABO compatible transfusions, 27/92 (29%) received transfusions with major incompatibility, and 4/92 (5%) received transfusions with minor incompatibility. The median (IQR) interval rise in platelet count for every 10 mL/kg of platelets transfused for each group was as follows: 25 (9–68) $x10^9$ cells/L for ABO compatible transfusions, 28 (6–51) $x10^9$ cells/L for transfusions with major incompatibility and 61 (46–80) $x10^9$ cells/L for transfusions with minor incompatibility. There were no statistically significance differences between these median values (p=0.11).

Data on transfusion reactions were available in 493 subjects. Table 5 depicts the incidence of transfusion reactions. There was no significant difference in any transfusion reaction between the groups (p=0.07) or in any individual adverse event. There were no hemolytic reactions or septic reactions documented during any of the transfusions.

DISCUSSION

This study reports the count increment of platelet transfusions as it relates to ABO compatibility in the largest cohort of critically ill children published to date. It is the first study to report on the proportion of ABO compatible versus incompatible platelet transfusion received and the regional variability in practice. More than two-thirds of children received ABO-identical platelet transfusions. Though there were minor differences between the ABO compatibility groups regarding admitting diagnosis, the population represents a diverse cohort both in geography and pathophysiology. No patient characteristics were associated with the receipt of an ABO compatible platelet transfusion. No differences were seen in the incremental differences in platelet count following transfusion, between the compatibility groups. Likewise, no differences were seen in documented transfusion reactions, in any of the groups.

Our results should be interpreted in the context of ongoing uncertainty and controversy regarding reduced efficacy following the transfusion of ABO incompatible platelets. [10,11]

Several adult studies have reported a benefit to providing ABO compatible platelet transfusions. Increased post-transfusion platelet count increments have been reported in platelet survival studies in both healthy subjects[12] and adult hematology patients[13–15] for those who received ABO compatible as compared to platelet transfusions with major incompatibility. Randomized controlled trials have demonstrated that the differential increments in platelet count post transfusion are most pronounced in patients who have received multiple doses of platelets (generally defined as > 3 separate transfusions).[16] One hypothesis relates this to the development of high titer isoagglutinins, antibodies to human leukocyte antigens (HLA) or antibodies to human platelet antigens (HPA).[17] One study of six platelet refractory patients reported that these patients who received ABO incompatible platelets have circulating immune complexes of ABO antigens and their corresponding antibodies for at least several days.[18] Circulating ABO immune complexes have been shown to affect platelet function, red cell integrity and hemostasis in vitro.[19] Unfortunately, there was no control group in this study to determine if ABO immune complexes also occur in patients who do not have platelet refractoriness. No studies have been reported in critically ill adults.

In comparison to these studies in adults, we did not detect significant differences in post-transfusion platelet count increments when comparing ABO compatible platelet transfusions to those with major or minor compatibility in critically ill children. There are very limited published reports on the efficacy of ABO compatibility for platelet transfusions in children. One study on this topic was published by Julmy and colleagues in 2009 and focused on fifty children with hematologic malignancies, solid tumors or aplastic anemia who were receiving platelet transfusions (primarily for prophylactic indications) and who were prospectively enrolled.[19] The primary comparison was the post-transfusion platelet count (measured one hour after completion of the transfusion) between ABO-identical and major-mismatched groups. After comparing the laboratory results of 400 transfusions, the authors reported significantly worse efficacy of ABO major-mismatched transfusions as compared to matched transfusions. There was no analysis of clinical outcomes included in the study.

In comparison to the previously reported results in children, we did not detect significant differences in post-transfusion platelet count increments when comparing ABO compatible platelet transfusions to those with major or minor compatibility. Our subjects had generally been multiply transfused and our subgroup analysis showed no differences in platelet increment after transfusion for those who had received ≥ 30 mL/kg of platelet transfusions during their admission, prior to enrollment. In addition, in contrast to most other published studies, our population was quite diverse geographically and reports on regional differences. Since no accepted standard for ABO matching of platelet transfusions exists, practice varies significantly. In some European countries, the titers of antibodies to the A and B antigens are routinely measured in platelet units and then labeled as “high titer negative.”[20] This allows for selection of these units specifically when incompatible platelets are transfused, thus theoretically minimizing the negative consequences. Similarly, there are regional differences in product preparation; for example, some platelet products are suspended in additive solution versus plasma.[4] These variations may also affect the incremental changes in platelet counts observed.

Despite differences seen in platelet counts following transfusion of the ABO compatible versus ABO incompatible products, many argue that there is little evidence of differences in clinical outcomes shown in adults receiving platelet transfusions.[9,10] A recently published systematic review evaluating both randomized controlled trials and observational studies regarding ABO incompatibility of platelet transfusions concluded that the clinical benefit of ABO matching was unclear since there is inconclusive data.[21] Similarly, in a retrospective examination of the platelet transfusions administered during the Platelet Dose (PLADO) study, ABO matching was not predictive of the time to bleeding, if bleeding was to occur.[22] We did not detect any differences in the rates of transfusion reactions between compatibility groups. An association between ABO compatibility and bleeding was not possible since our study did not include bleeding scores due to the lack of consensus regarding their value in children and the difficulty in obtaining these scores in an unfunded international study.

This study reports on ABO compatibility of platelet transfusions in the largest cohort of children to date. The analysis is the first to report the proportion of ABO compatible transfusions received in critically ill children. Additional strengths of our study relate to the population which represents a diverse cohort both in geography and pathophysiology. More than two-thirds of children received ABO-identical platelet transfusions. No patient characteristics were associated with the receipt of an ABO compatible platelet transfusion.

However, some limitations to our study exist. Although we reported on differences in the rates of transfusion reactions between compatibility groups, we did not assess for bleeding. Due to the inherent design of a point prevalence study, compatibility data was collected around one platelet transfusion and not around every platelet transfusion received by each enrolled subject during his/her admission; it is therefore unknown whether subjects received all ABO compatible versus a combination of compatible and incompatible transfusions. Some evidence suggests that ABO incompatible transfusions can affect the incremental platelet change following subsequent transfusions.[23] As an observational study, post-transfusion platelet counts were assessed at the medical team’s discretion and thus not limited to a one hour post-transfusion assessment. We did not collect information on the variation of platelet count analyzers that was likely present between the hospitals. Additionally, each platelet transfusion contains a different number of platelets and we did not collect information on the number of platelets in each transfused aliquot. We also did not collect information on the ABO titer status of units transfused in Europe. We did not collect information on hemolysis (apart from acute hemolytic reactions during that transfusions) which may have occurred following the transfusion. Splenomegaly, an important clinical characteristic that can affect the post transfusion platelet counts, was not recorded.

CONCLUSIONS

In this large observational study in critically ill children, no differences were seen in incremental platelet count or transfusion reactions following the transfusion of ABO compatible platelets as compared to incompatible platelets. Because of limitations inherent to the study design, no definitive statement can be made. These results demonstrate that larger prospective studies must be performed to inform the need for ABO matching in critically ill children requiring platelet transfusions. Further confirmatory studies are needed

that may require assessment of additional outcomes such as organ failure and clinical bleeding in critically ill children.

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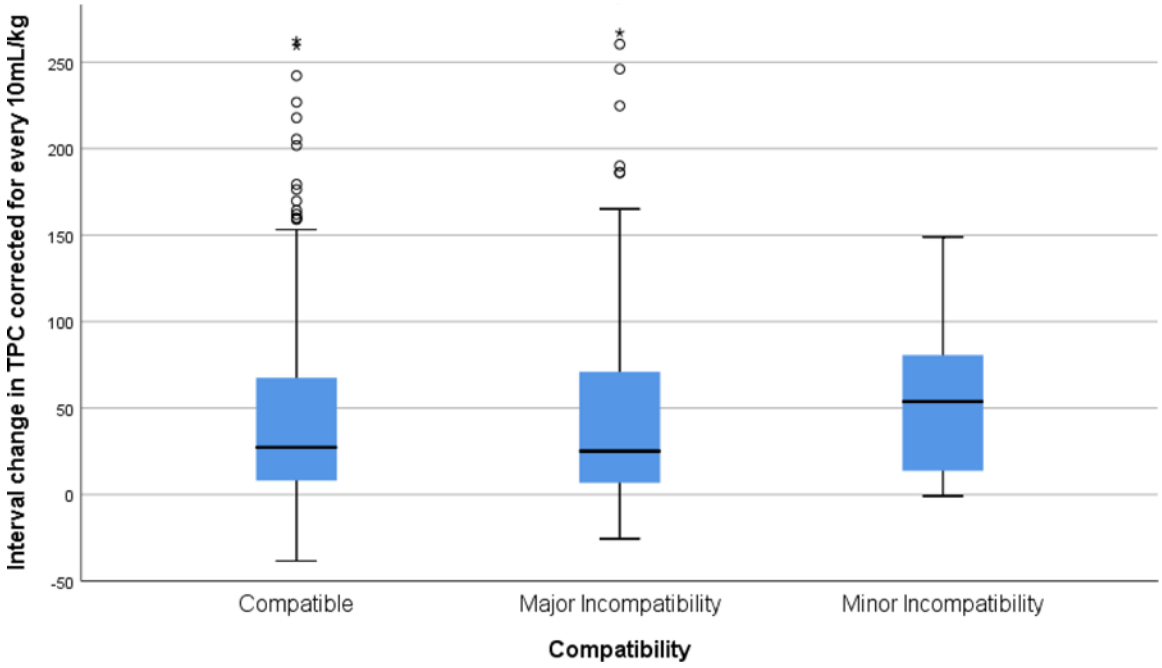

Figure 1.
Interval change in Total Platelet Count for each compatibility group

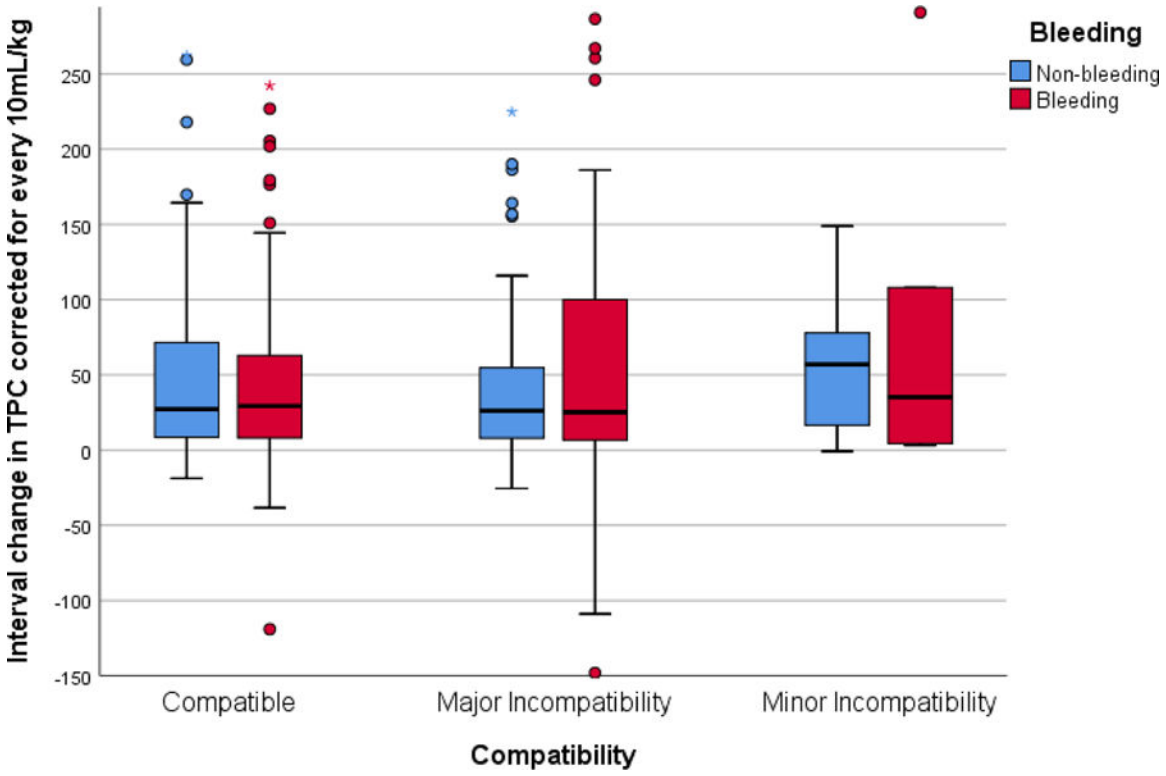

Figure 2.
Interval change in Total Platelet Count in bleeding versus non-bleeding subjects for each compatibility group

Table 1.

Demographics and Clinical Characteristics of Patients

Patient Variable	Compatible (n = 342)	Major Incompatibility (n = 133)	Minor Incompatibility (n = 28)	p-Values
Age (yr), median (IQR)	4.5 (0.7–11.1)	3.1 (0.4–10.3)	3.1 (0.2–10.7)	0.38
Sex (male), n (%)	183 (54)	85 (64)	13 (46)	0.07
Weight (kg), median (IQR)	16.8 (7.2–35.6)	15.7 (5.4–32.2)	13.0 (4.1–41.5)	0.37
Days since admission, median (IQR)	3 (0–7)	2 (0–7)	2 (1–6)	0.93
Mechanical ventilation, n (%)	224 (66)	84 (63)	22 (79)	0.28
Underlying oncologic diagnosis, n (%)	148 (43)	56 (42)	12 (43)	0.97
PELOD-2 Score prior to transfusion, median (IQR)	7 (4–9)	7 (5–9)	9 (6–10)	0.04
ABO blood type of recipient				
O	155 (43)	93 (70)	0 (0)	
A	127 (37)	16 (12)	14 (50)	
B	43 (13)	24 (18)	6 (21)	
AB	17 (5)	0 (0)	8 (29)	

p-values comparing medians using Kruskal Wallis test and categorical variables using Chi-square test

Table 2.

Admitting Diagnoses and Therapies Received

Admitting Diagnoses	Compatible (n = 342)	Major Incompatibility (n = 133)	Minor Incompatibility (n = 28)	p-values
Reason for PICU Admission, n (%):				
Organ Failure				
Respiratory insufficiency/failure	141 (41)	53 (40)	10 (36)	0.83
Renal failure	32 (9)	16 (12)	1 (4)	0.36
Hepatic failure	18 (5)	7 (5)	1 (4)	0.93
Shock				
Septic shock	88 (26)	18 (14)	7 (25)	0.02
Hemorrhagic shock	21 (6)	7 (5)	1 (4)	0.82
Other shock	15 (4)	6 (5)	0 (0)	0.52
Trauma	8 (2)	5 (4)	0 (0)	0.46
Cardiac				
Cardiac surgery-bypass	39 (11)	18 (14)	3 (11)	0.80
Cardiac surgery-no bypass	6 (2)	4 (3)	0 (0)	0.50
Cardiac – non-surgical	27 (8)	16 (12)	6 (21)	0.04
Post-operative				
Emergency surgery	14 (4)	7 (5)	0 (0)	0.45
Elective surgery	14 (4)	10 (8)	0 (0)	0.14
Post-op liver transplant	10 (3)	2 (2)	1 (4)	0.64
Neurosurgical				
Traumatic brain injury	5 (2)	3 (2)	0 (0)	0.65
Intracranial bleed/intracranial hypertension	9 (3)	3 (2)	0 (0)	0.68
Neurologic				
Seizure	9 (3)	2 (2)	2 (7)	0.23
Encephalopathy	29 (9)	8 (6)	2 (7)	0.66
Meningitis	4 (1)	1 (1)	0 (0)	0.72
Veno-occlusive disease	4 (1)	2 (2)	0 (0)	0.80
New leukemia/hyperleukocytosis	14 (4)	2 (2)	2 (7)	0.23
Hemophagocytic lymphohistiocytosis	5 (2)	1 (1)	0 (0)	0.68
Other	25 (7)	6 (5)	4 (14)	0.16
Therapies Received, n (%)				
Medications				
Milrinone	55 (16)	26 (20)	4 (14)	0.62
Non-steroidal anti-inflammatories	5 (2)	5 (4)	0 (0)	0.20
Aspirin	9 (3)	4 (3)	0 (0)	0.66
Devices				
Extracorporeal Membrane Oxygenation	60 (18)	18 (14)	7 (25)	0.29
Continuous renal replacement therapy	31 (9)	18 (14)	3 (11)	0.36
Intermittent hemodialysis	3 (1)	3 (2)	0 (0)	0.54

Admitting Diagnoses	Compatible (n = 342)	Major Incompatibility (n = 133)	Minor Incompatibility (n = 28)	p-values
Molecular adsorbent circulating system	2 (0.6)	3 (2)	0 (0)	0.26
Median (IQR) dose (mL/kg) platelet transfusions received prior to enrollment	30 (12–77)	58 (22–108)	19 (11–29)	0.06

p-values calculated using Chi-squared for large samples and Fisher's Exact for small samples

Table 3.

Distribution of ABO compatibility groups for bleeding versus non-bleeding indications

Indication	Compatible (342)	Major Incompatibility (133)	Minor Incompatibility (28)	p-Values
Bleeding	110 (32)	56 (42)	6 (21)	0.04
Non-bleeding (prophylaxis)	232 (68)	77 (58)	22 (79)	0.04

p-values calculated variables using Chi-square test (or Fisher's Exact for small samples).

Table 4.

Attributes of Platelet Products Transfused

Transfusion Variable	Compatible (342)	Major Incompatibility (133)	Minor Incompatibility (28)	p-Values
Apheresed platelets	288 (84)	128 (96)	27 (96)	0.001
Whole blood derived platelets	54 (16)	5 (4)	1 (4)	0.001
Leukoreduction	320 (94)	128 (96)	27 (100)	0.61
Irradiation	267 (78)	111 (84)	22 (79)	0.39
HLA-matched	2 (1)	0 (0)	0 (0)	0.87
Volume reduced (washed)	23 (7)	11 (8)	4 (15)	0.19
Pathogen inactivated	16 (5)	5 (4)	2 (7)	0.20
Storage duration	4 (3–5)	5 (4–5)	5 (4–5)	0.10

All variables reported as n (%) except for storage duration which is reported as median (IQR). p-values comparing medians using Kruskal Wallis test and categorical variables using Chi-square test (or Fisher's Exact for small samples). There was missing data on leukoreduction in 3 cases, irradiation in 6 cases, HLA matching in 17 cases, volume reduction in 46 cases, pathogen inactivation in 38 cases, and storage duration in 44 cases. For all analyses, complete-case analysis approach was applied.

Table 5.

Transfusion Reactions

Reactions	Compatible (332)	Incompatible (161)	p-Values
Any transfusion reaction n (%)	**25 (7)**	**5 (3)**	**0.07**
New fever	9 (3)	2 (1)	0.36
Increase in temp by 1C if already febrile	2 (0.6)	1 (0.6)	0.66
Urticaria	2 (0.6)	1 (0.6)	0.99
Bronchospasm	1 (0.3)	0 (0)	0.99
Hypotension	12 (4)	1 (0.6)	0.07
Transfusion stopped	2 (0.6)	1 (0.6)	0.99

All variables reported as n (%). There were no hemolytic reactions reported for any of the transfusions. p-values calculated using Chi-squared for large samples and Fisher's Exact for small samples.