Assessing Impacts of Transfusion on HLA Sensitization in Pre-Hematopoietic Stem Cell Transplant Patients

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Introduction

Patients with various hematologic disorders including hematologic malignancies may need transfusion support during their treatment leading up to the hematopoietic stem cell transplantation. HLA sensitization secondary to exposure to foreign HLA antigens during transfusion is a significant challenge of transfusion therapy.[1] Increased HLA sensitization may lead to difficulty in identifying HLA antibody compatible HCT donors as well as platelet refractoriness, among others.[2] Blood product leukoreduction has been shown to decrease the incidence of HLA sensitization in general and many transplantation center offer pre-storage leukoreduced products throughout United States.[3]

The impact of HLA sensitization from transfusion of blood products in the pre-hematopoietic cell transplantation (HCT) period has not been well characterized to our knowledge. Patients with underlying hematologic disorders including hematologic malignancies may be immunosuppressed due to the underlying disease as well as the use of the chemotherapeutic regimens and radiation therapy. This could result in decreased risk of further HLA sensitization even in the setting of ongoing transfusion therapy.

This retrospective study was aimed to compare the changes in the HLA sensitization levels pre- and post-red blood cell (RBC) and/or platelet (PLT) transfusions in adult pre-HCT patients.

Methods and Materials

Adult patients who underwent HCT at Stanford Heath Care during a five years period (1/1/2018-12/31/2023) were identified to be screened for inclusion in the study. The patients were included in the study if they received transfusion at our institution and had both pre- and post-transfusion (performed at least 14 days after the last transfusion) anti-HLA antibody testing results.

The HLA antibody tests were performed using the LABScreen single antigen bead assay (Thermo Fisher Scientific). All the blood products transfused were pre-storage leukoreduced and additionally the patients with hematologic malignancies received blood product irradiation as per the institutional protocol.

Methods and Materials

The class I and class II HLA antibody cPRA changes between pre- and post-transfusion samples were compared for individual patients. The data obtained was stratified and analyzed based on the type of transfusions (RBCs only, platelets only, RBCs and platelets) as well as based on the patients' baseline HLA sensitization level.

Results

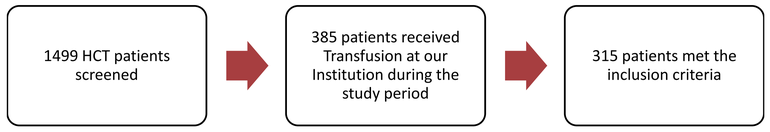

Figure 1

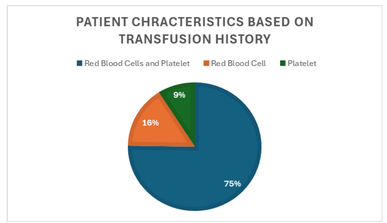

Figure 2

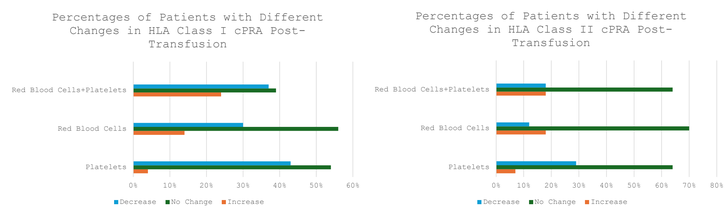

Figure 3

PLT Transfusion Only								
cPRA		No. of Patients	cPRA			Platelets Unit Transfused		
			Decrease	No Change	Increase	Min	Median	Max
<20%	Class I	19 (100%)	4 (21%)	14 (74%)	1 (5%)	1	2	11
	Class II	21 (100%)	4 (19%)	15 (71%)	2 (10%)	1	2	11
20-80%	Class I	5 (100%)	4 (80%)	1 (20%)	0	1	3	8
	Class II	4 (100%)	2 (50%)	2 (50%)	0	1	2	8
>80%	Class I	4 (100%)	4 (100%)	0	0	1	3	8
	Class II	3 (100%)	2 (67%)	1 (33%)	0	1	3	3
RBC Transfusion Only								
cPRA		No. of Patients	cPRA			Red Cell Units Transfused		
			Decrease	No Change	Increase	Min	Median	Max
<20%	Class I	34 (100%)	5 (15%)	25 (74%)	4 (12%)	1	2	110
	Class II	36 (100%)	0	31 (86%)	5 (14%)	1	2	110
20-80%	Class I	10 (100%)	6 (60%)	1 (10%)	3 (30%)	1	2	5
	Class II	8 (100%)	3 (38%)	2 (25%)	3 (37%)	1	2	6
>80%	Class I	7 (100%)	4 (57%)	2 (29%)	1 (14%)	1	2	9
	Class II	7 (100%)	3 (42%)	2 (29%)	2 (29%)	2	2	9
PLT+RBCs Transfusions								
cPRA		No. of Patients	cPRA			PLT units	Red Cell Units	
			Decrease	No Change	Increase	Median (Range)	Median (Range)	
<20%	Class I	162 (100%)	34 (21%)	90 (56%)	38 (23%)	7 (1-125)	7 (1-42)	
	Class II	185 (100%)	11 (6%)	143 (77%)	31 (17%)	8 (1-125)	7 (1-46)	
20-80%	Class I	56 (100%)	37 (66%)	4 (7%)	15 (27%)	9 (1-48)	9 (1-46)	
	Class II	41 (100%)	27 (66%)	7 (17%)	7 (17%)	8 (1-104)	9 (1-60)	
>80%	Class I	18 (100%)	16 (89%)	0	2 (11%)	10 (2-104)	8 (1-60)	
	Class II	10 (100%)	6 (60%)	1 (10%)	3 (30%)	10 (2-42)	8 (1-15)	

Table 1

Results

Of the total 1499 HCT patients screened during the five years study period, 385 patients had transfusion records at our institution, among whom 315 patients met the inclusion criteria (**Figure 1**). Of the 315 patients included in the study, 237 (75%) received both RBC and PLT transfusions, 50 (16%) received only RBC transfusions, and 28 (9%) received only PLT transfusions (**Figure 2**). The median duration between most recent transfusion and the last post-transfusion HLA testing was 131, 91 and 115 days for RBC and PLT, RBC alone, PLT alone, respectively.

The percentages of patient with different types of cPRA changes after each category of transfusion products are summarized in **Figure 3**. Within each category, no cPRA change accounts for the highest percentage for both class I (39-56%) and II (64-70%) cases. For HLA CI, 30-43% and 4-24% of patients had decrease and increase in their cPRA values, respectively. For HLA CII, 12-29% and 7-18% of of patients had decrease and increase in their cPRA values, respectively.

The CI/CII cPRA changes post-transfusion are further stratified based on the patients' baseline HLA sensitization status (**Table 1**): mild (cPRA<20%), moderate (20-80%), and high (>80%). For all three categories of transfusion products, the predominance of no change in cPRA is seen in patients with cPRA<20%, which applies to both CI and CII results. However, the trend is different for moderately and highly sensitized patients, for whom the cPRA is more likely to decrease compared to increase or no change. For moderately and highly sensitized patients, although no case of increase in cPRA is seen in the platelet only category, 17-37% and 14-30% increases in cPRA are seen in the other two categories, respectively.

Conclusions and Future Directions

In this single center retrospective study, transfusion of RBC and/or platelet products led to no change or decrease of cPRA in majority of pre-HCT patients. In a minor subset of patients (11-37%), HLA sensitization increased post-transfusion, which could pose challenges in HCT donor selection. These results provide evidence for the impact of transfusion on HLA sensitization in pre-HCT patients and support post-transfusion HLA antibody assessment to confirm donor compatibility.

Contact

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References

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