Platelet transfusion reaction rates: managing inventory while treating a complex patient population

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Disclosures

- None

Objectives

In the context of two retrospective single-institutional studies…

- Describe the role of ABO matching for platelet transfusions and the expected impact on transfusion-related adverse reactions
- Discuss the impact of permitting isolated peri-transfusion fever during platelet transfusion for patients with documented neutropenic fever secondary to hematolymphoid neoplasm

Platelet transfusion

- Leukoreduced
- Apheresis/single-donor (~60%) vs. random donor pooled
- Irradiated (~70%) vs. pathogen-reduced (psoralen + UV)

Platelet transfusion

Platelet ABO group	**AB**	**A**	**B**	**O**
Antigens expressed on platelet surface	A and B	A	B	None
Antibodies present in plasma	None	Anti-B	Anti-A	Anti-A and anti-B

ABO		**Platelet reoipient ABO group**			
		AB	**A**	**B**	**O**
Platelet donor ABO group	AB	Identical	Major	Major	Major
	A	Minor	Identical	Bidirectional	Major
	B	Minor	Bidirectional	Identical	Major
	O	Minor	Minor	Minor	Identical

Platelet transfusion

- Minor (~20%): risk hemolysis

- Major (~30%): risk…
  - decreased increment/refractory
  - increased reactions
  - and REDS-III database shows…

- Bidirectional: risk both

- Identical (~50%): risk inventory

Results: Following adjustment for possible confounding factors, no statistically significant association between ABO non-identical platelet transfusion and increased risk of mortality was observed in the overall cohort of 21,176 recipients. However, when analyzed by diagnostic category and recipient ABO group, associations with increased mortality for major mismatched transfusions were noted in two of eight subpopulations. Hematology/Oncology blood group A and B recipients (but not group O) showed a Hazard Ratio (HR) of 1.29 (95%CI: 1.03-1.62) and intracerebral hemorrhage group O recipients (but not groups A and B) showed a HR of 1.75 (95%CI: 1.10-2.80). Major mismatched transfusions were associated with increased odds of receiving additional platelet transfusion each post-transfusion day (through day 5) regardless of the recipient blood group.

ABO and product modification study

- Single-center, retrospective review of all adult platelet transfusions 2020-2022
  - Leukoreduced, single-donor
  - Large-volume delayed sampling +/- irradiation (cesium-137) OR pathogen-reduced (INTERCEPT)
  - Exclude: washed unit (11 transfusions), patient ABO type not determined/available (171 transfusions)
- Each transfusion classified by:
  - Patient age
  - Patient ABO
  - Unit ABO
  - [ABO compatibility]
  - Unit modification (irradiation, pathogen reduction)
  - Transfusion reaction evaluation, diagnosis, and imputability

ABO and product modification study

- 3,450 patients
  - Mean age = 56.3 years
  - ABO = 45.7% O; 38.9% A; 12% B; 3.5% AB
- 21,330 transfusions
  - ABO compatibility = 67.7% identical; 17.2% major, 13.8% minor, 1.4% bidirectional incompatible
  - Unit modification = 70.9% irradiated; 21.8% unmodified; 7.3% pathogen-reduced
- 285 (1.33%) reported reactions
  - 107 (0.5%) unrelated to transfusion
  - 178 (0.83%) at least possibly related to transfusion
  - 151 (0.7%) probably or definitely related to transfusion
  - 12 severe reactions (1 TRALI, 2 TACO, 9 Allergic)

ABO and product modification study

Distribution of reported reactions

	Compatibility				Unit type			
Diagnosis	ABOid	ABOmin	ABOmaj	ABObi	nSDP	prSDP	iSDP	**Total**
Underlying disease	73 (42%)	15 (39.5%)	16 (24.6%)	3 (37.5%)	8 (29.6%)	4 (26.7%)	95 (39.1%)	107 (37.5%)
Allergic	51 (29.3%)	13 (34.2%)	34 (52.3%)	4 (50%)	11 (40.7%)	7 (46.7%)	84 (34.6%)	102 (35.8%)
FNHTR	39 (22.4%)	9 (23.7%)	10 (15.4%)	1 (12.5%)	5 (18.5%)	3 (20.0%)	51 (21.0%)	59 (20.7%)
TACO	6 (3.4%)	0	2 (3.1%)	0	2 (7.4%)	1 (6.7%)	5 (2.1%)	8 (2.8%)
TRALI	1 (0.6%)	0	0	0	1 (3.7%)	0	0	1 (0.3%)
HyTR	2 (1.1%)	0	2 (3.1%)	0	0	0	4 (1.6%)	4 (1.4%)
TTI	2 (1.1%)	0	1 (1.5%)	0	0	0	3 (1.2%)	3 (1.1%)
AHTR	0	1 (2.6%)	0	0	0	0	1 (0.4%)	1 (0.3%)
Total	174	38	65	8	27	15	243	285

ABO and product modification study

Reactions related to transfusion as a proportion of total transfusions

	Compatibility				
Unit type	ABOid	ABOmin	ABOmaj	ABObi	Total
nSDP	7/3138 (0.22%)	2/649 (0.31%)	10/826 (1.21%)	0/42 (0%)	19/4655 (0.41%)
prSDP	5/1059 (0.47%)	3/228 (1.32%)	3/253 (1.19%)	0/16 (0%)	11/1556 (0.71%)
iSDP	89/10230 (0.87%)	18/2067 (0.88%)	36/2583 (1.40%)	5/239 (2.11%)	148/15119 (0.98%)
Total	101/14427 (0.70%)	23/2944 (0.78%)	49/3662 (1.34%)	5/297 (1.68%)	178/21330 (0.83%)

ABO and product modification study

Logistic regression

- Holm's adjustment for multiplicity

- Compatibility and unit type were independent (no statistically significant evidence of interaction)

- B unit status was significant on univariate analysis on the probable/definite subset (not by multivariate analysis - confounding)

	Comparison	Univariate, Odds ratio (95% CI)
Compatibility	ABObi vs ABOmin	2.19 (0.83,5.80)
	ABOmin vs ABOid	1.12 (0.71,1.76)
	ABOmaj vs ABOmin	**1.72 (1.05,2.83)***
	ABObi vs ABOid	2.44 (0.99,6.04)
	ABObi vs ABOmaj	1.27 (0.50,3.21)
	ABOmaj vs ABOid	**1.92 (1.36,2.71)***
Unit Type	iSDP vs prSDP	1.39 (0.75,2.58)
	prSDP vs nSDP	1.74 (0.83,3.66)
	iSDP vs nSDP	**2.42 (1.50,3.91)***

*Maintained significance in multivariate analysis

ABO and product modification study

Distribution of transfusions by compatibility and modification

	Compatibility			
Unit type	ABOid	ABOmin	ABOmaj	ABObi
nSDP	3138 (21.8%)	649 (22.0%)	826 (22.6%)	42 (14.1%)
prSDP	1059 (7.3%)	228 (7.7%)	253 (6.9%)	16 (5.4%)
iSDP	10230 (70.9%)	2067 (70.2%)	2583 (70.5%)	239 (80.5%)
Total	14427	2944	3662	297

	Unit type		
Compatibility	nSDP	prSDP	iSDP
ABOid	3138 (67.4%)	1059 (68.1%)	10230 (67.7%)
ABOmin	649 (13.9%)	228 (14.7%)	2067 (13.7%)
ABOmaj	826 (17.7%)	253 (16.3%)	2583 (17.1%)
ABObi	42 (0.9%)	16 (1.0%)	239 (1.6%)
Total	4655	1556	15119

ABO and product modification study

Distribution of reactions as a proportion of total transfusions by unit and patient ABO

	Patient ABO				
Unit ABO	AB	A	B	O	Total
AB	4/238 (1.7%)	2/588 (0.3%)	3/397 (0.7%)	2/132 (1.5%)	11/1355 (0.8%)
A	2/267 (0.7%)	41/5874 (0.7%)	★2/140 (1.4%)	13/1562 (0.8%)	58/7843 (0.7%)
B	4/166 (2.4%)	3/157 (1.9%)	6/1242 (0.5%)	★29/983 (3.0%)	42/2548 (1.6%)
O	0/65 (0%)	12/1667 (0.7%)	5/779 (0.6%)	50/7073 (0.7%)	67/9584 (0.7%)
Total	10/736 (1.4%)	58/8286 (0.7%)	16/2558 (0.6%)	94/9750 (1.0%)	178/21330 (0.8%)

ABO and product modification study

Distribution of compatibility and unit modification by unit ABO

		Unit ABO				Total
		AB	A	B	O	
Compatibility	ABOid	238 (17.6%)	5874 (74.9%)	1242 (48.7%)	7073 (73.8%)	14427
	ABOmin		267 (3.4%)	166 (6.5%)	2511 (26.2%)	2944
	ABOmaj	1117 (82.4%)	1562 (19.9%)	983 (38.6%)		3662
	ABObi		140 (1.8%)	157 (6.2%)		297
Unit type	nSDP	273 (20.1%)	1763 (22.5%)	470 (18.4%)	2149 (22.4%)	4655
	prSDP	82 (6.1%)	617 (7.9%)	171 (6.7%)	686 (7.2%)	1556
	iSDP	1000 (73.8%)	5463 (69.7%)	1907 (74.8%)	6749 (70.4%)	15119
Total		1355	7843	2548	9584	21330

<u>Drivers</u>

AB: irradiation

B: irradiation + comp.

(XM/HLA + outdate risk)

Considerations for ABO matching

- We already know: A and O platelets are golden!
- It is not as simple as: more ABO identical and less ABO major mismatch
- Reducing up front waste of platelet products (i.e. outdating) with a blanket policy may lead to greater total usage of platelet products (e.g. reduced – refractory increments, partial transfusions for reactions) for certain patient populations
- Efforts to preserve platelet products will have a greater proportional effect on the primary recipients of platelet products (i.e. those receiving irradiated platelets due to hematolymphoid neoplasms)
- This study is too limited to serve as the basis for substantial policy changes

Peri-transfusion fever study

- Patient inclusion: essentially, adult neutropenic Heme/Onc inpatients receiving chemotherapy
  - Neutropenia = absolute neutrophil count <1000 cells/mm^3 (IDSA)
  - Neutropenic fever = $\geq$ 38°C point temperature (IDSA modification)
  - Isolated peri-transfusion fever: $\geq$ 38 ˚C and < 39 ˚C AND temperature elevation $\geq$ 1 ˚C and < 2 ˚C from proximal pretransfusion temperature without any additional signs/symptoms concerning for transfusion reaction
- Intervention: isolated peri-transfusion fever will be treated with acetaminophen and monitored without cessation of transfusion

Peri-transfusion fever study

Pre- and post-intervention waste and outcomes

*30-day mortality data only complete for 2021-2022

	2020-2021	2022	Total
Patients, n	732	403	1135
Average age, years	58	60	59
***30-day mortality, n (% for 2021 and 2022)**	101 (25)	101 (25)	202 (25)
Transfusions, n (n/patient)	7875 (10.8)	4740 (11.8)	12615 (11.1)
Volume transfused, L (mL/transfusion)	1811 (230)	1031 (218)	2842 (225)
Volume wasted, L (mL/transfusion)	16 (2.03)	4.7 (0.98)	20.7 (1.64)
Total reactions, n (% of transfusions)	150 (1.9)	48 (1.0)	198 (1.5)
Febrile reactions, n (% of transfusions)	96 (1.2)	23 (0.5)	119 (0.9)

Transfusion reaction considerations

- A wide net captures just as many boots as fish
- Significant time and resources implicated by every suspected transfusion-associated reaction (e.g. partial/repeat transfusions, treatment, monitoring, work up/evaluation, care delays, etc.)
- Clinical collaborations may provide additional avenues to safely reduce waste beyond Heme/Onc platelet transfusions
- May consider other outcomes (length of hospital stay, platelet count increment, etc.)

Final considerations

- All of this information represents a relatively small snapshot of a dynamic time at a single institution subjected to retrospective analysis of selected data
- We cannot capture all of the factors influencing product use/waste (e.g. shifts in donor supply, sourcing, storage, institutional geography, workflow, changes in regulations or treatment algorithms, that one new clinician, PANDEMICS, etc.)
- Today's solution may be tomorrow's problem

Questions or comments?

Thank you for your time!

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