

ABO, Rh, HLA Antibodies... Issues with Whole Blood

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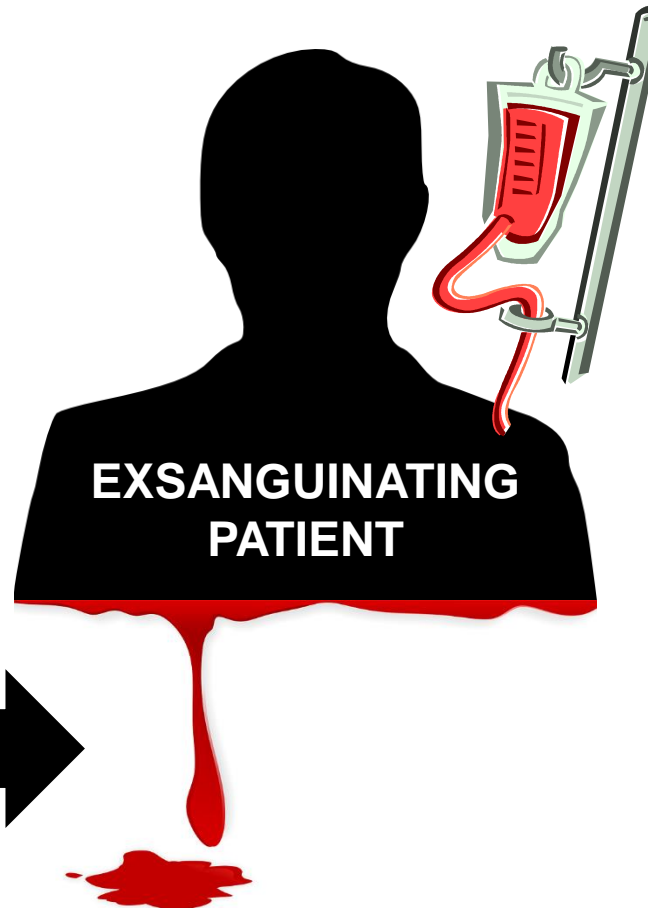
MEDICAL DIRECTOR, BLOOD BANK

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The Appeal of Whole Blood

Benefits of whole blood:

- Cold stored platelets might confer extra hemostatic properties
- Logistics greatly simplified
- Less dilution effect (no additive solution)



WHOLE BLOOD IN

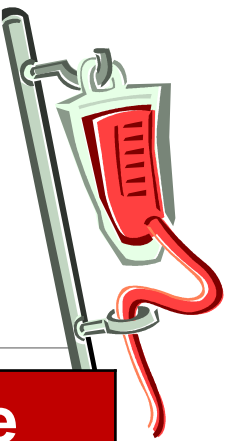
Risks of whole blood:

- Hemolysis
- RhD alloimmunization
- Transfusion related acute lung injury (TRALI)



Baby Steps
... ABOut ABO

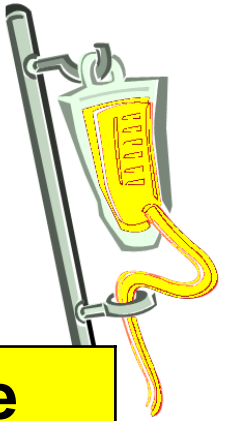
Red Cell Compatibility



- ✓ Group O is “Universal Donor” for red blood cells because the RBCs LACK A and B antigens.
- ✓ Group O people can ONLY receive group O red cells
- ✓ Group AB people can receive ANY type.

ABO Group	Compatible Red Cells
Group O	O
Group A	A, O
Group B	B, O
Group AB	AB, A, B, O

Plasma Compatibility



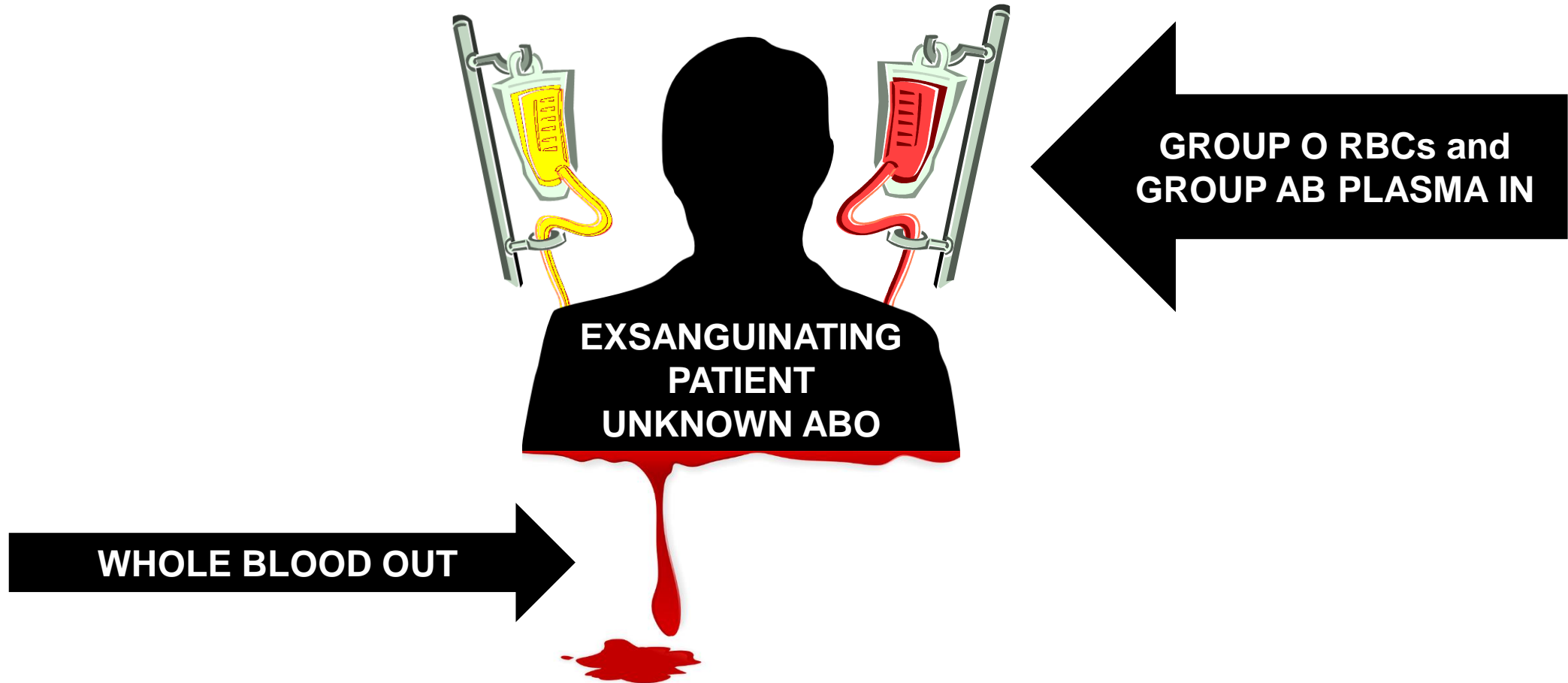
- ✓ Group AB is “Universal Donor” for plasma because it LACKS anti-A and anti-B antibodies.
- ✓ Group O people can receive ANY type of plasma
- ✓ Group AB can receive ONLY AB

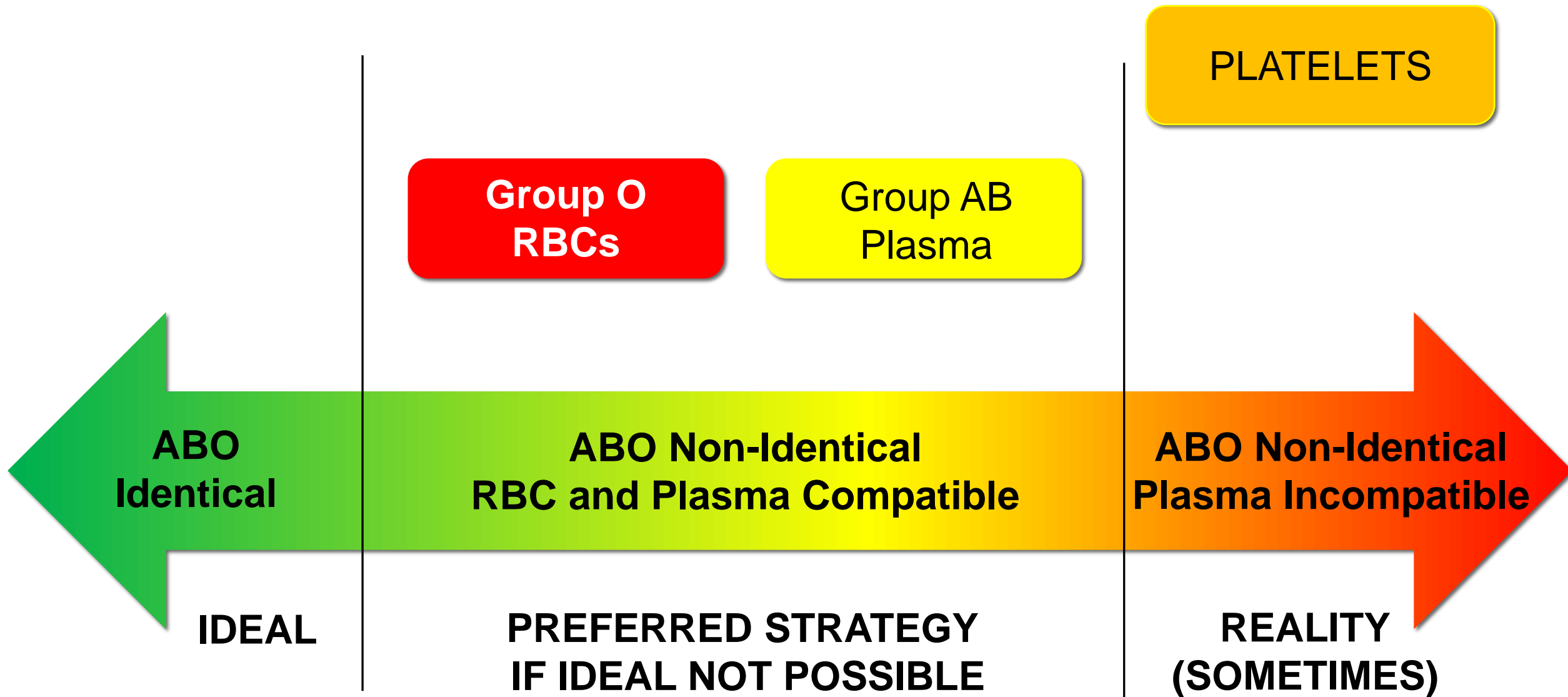
ABO Group	Compatible Plasma
Group O	AB, A, B, O
Group A	AB, A
Group B	AB, B
Group AB	AB

Practical Teaching

Patient ABO Group	COMPATIBLE RED CELLS	COMPATIBLE PLASMA	COMPATIBLE WHOLE BLOOD
O	O	AB, A, B, O	O
A	A, O	AB, A	A
B	B, O	AB, B	B
AB	AB, A, B, O	AB	AB

Modern Component Therapy





ORIGINAL ARTICLE

Risks of hemolysis due to anti-A and anti-B caused by the transfusion of blood or blood components containing ABO-incompatible plasma

Olle Berséus, Kjell Boman, Shawn C. Nessen, and Lars A. Westerberg

Transfusion 2013;53:114S-123S

- 25 published case reports describing 30 patients with severe hemolytic transfusion reactions following platelet transfusion
- Vast majority of cases are group O platelet units transfused to group A or group AB patients

Risk Reduction Strategies for Platelet Transfusions

- 1. Limit volume of incompatible plasma**
2. Use whole blood derived platelets
- 3. Screen for high titer anti-A and/or anti-B**
4. Volume reduce or wash incompatible platelets
5. Use platelet storage media

TRANSFUSION PRACTICE

A practical strategy to reduce the risk of passive hemolysis by screening plateletpheresis donors for high-titer ABO antibodies

*Karen Quillen, Sherry L. Sheldon, Jennifer A. Daniel-Johnson, A. Hallie Lee-Stroka,
and Willy A. Flegel*

TRANSFUSION 2011;51:92-96.

- 25% of group O and 5% of group A donors were classified as high titer

BLOOD COMPONENTS

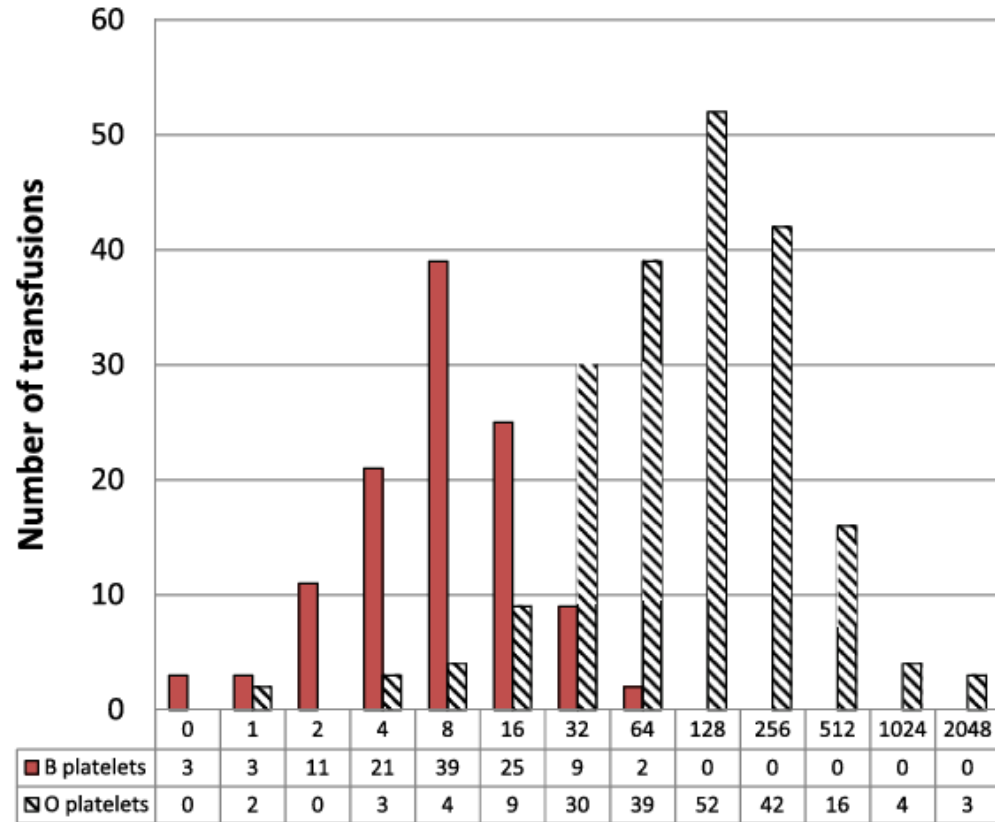
ABO antibody titers are not predictive of hemolytic reactions due to plasma-incompatible platelet transfusions

*Matthew S. Karafin, Lorraine Blagg, Aaron A.R. Tobian, Karen E. King, Paul M. Ness,
and William J. Savage*

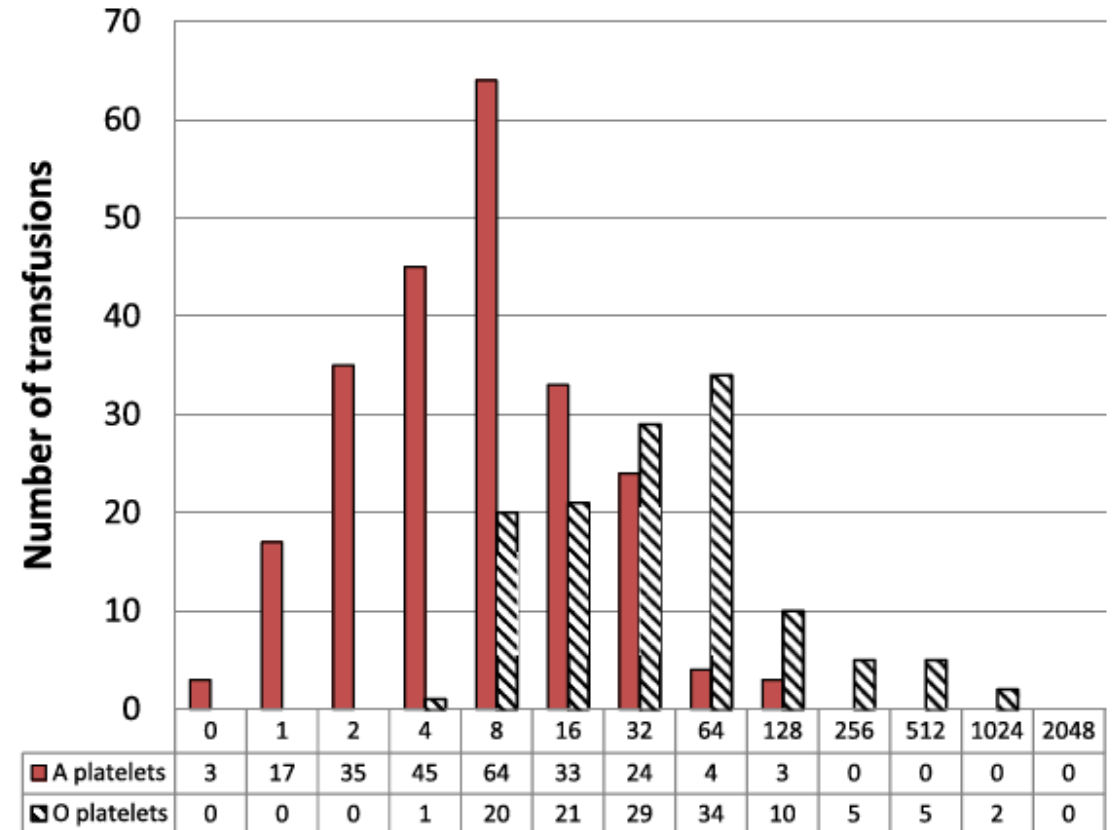
TRANSFUSION 2012;52:2087-2093.

- For group O APs, 73 had titers of 256 or greater (26%), and 27 had titers of 512 or greater (10%).
- No HTRs were reported to any plasma-incompatible AP transfusion during the study period.

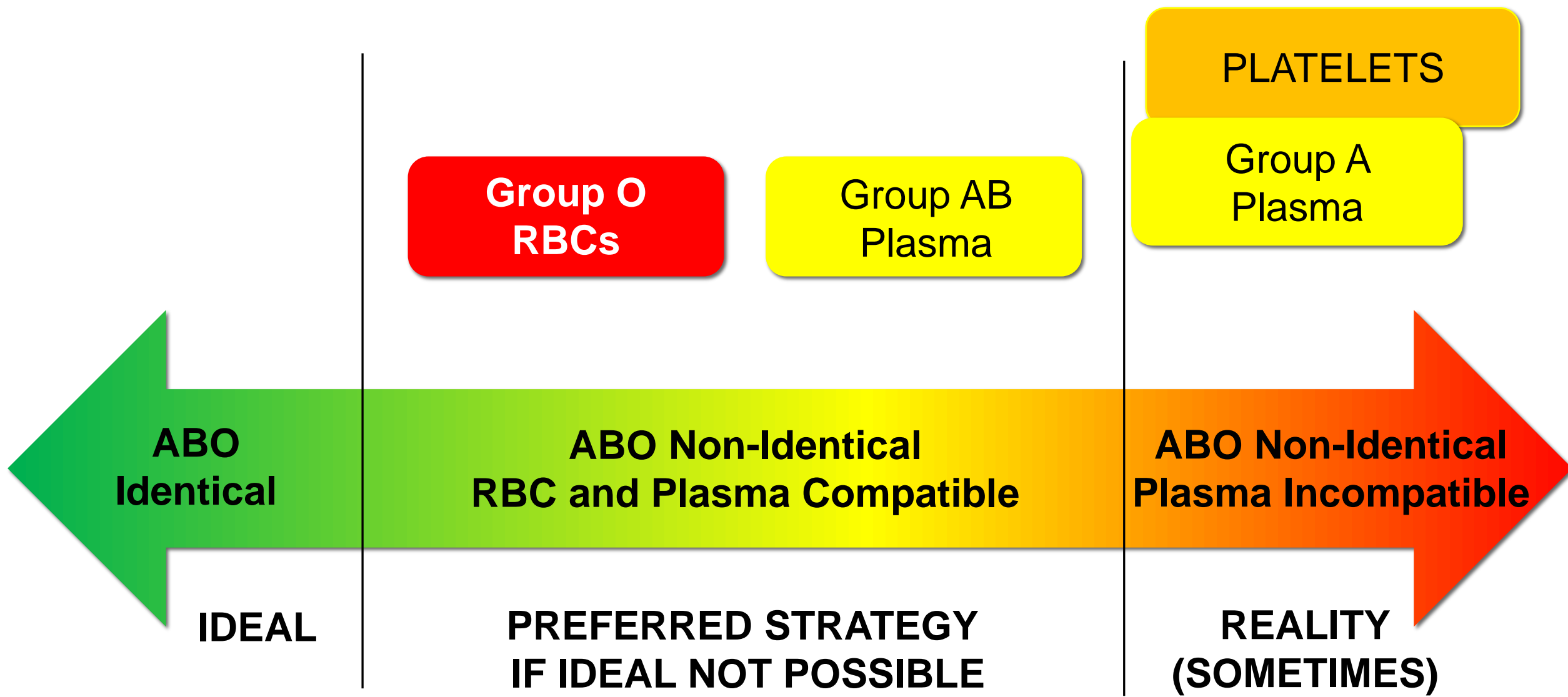
Anti-A Titers



Anti-B Titers



- Group O apheresis platelets had significantly higher anti-A and anti-B titers than group A or B ($p < 0.0001$)



PLATELETS

Group O RBCs

Group AB Plasma

Group A Plasma

ABO Identical

ABO Non-Identical RBC and Plasma Compatible

ABO Non-Identical Plasma Incompatible

IDEAL

PREFERRED STRATEGY IF IDEAL NOT POSSIBLE

REALITY (SOMETIMES)

BRIEF REPORT

A possible new paradigm? A survey-based assessment of the use of thawed group A plasma for trauma resuscitation in the United States

Nancy M. Dunbar,^{1,2} and Mark H. Yazer,^{3,4}

on behalf of the Biomedical Excellence for Safer Transfusion (BEST) Collaborative⁵

Transfusion 2016;56:125-9

- The majority of Level 1 trauma centers maintain thawed plasma inventories and use group A plasma for trauma recipients of unknown ABO group
- Most centers do not limit the amount of group A plasma used in this situation or titer the anti-B

TRANSFUSION PRACTICE

Safety of the use of group A plasma in trauma: the STAT study


Nancy M. Dunbar¹ and Mark H. Yazer,² on behalf of the Biomedical Excellence for Safer Transfusion (BEST) Collaborative and the STAT Study Investigators[†]

Transfusion 2017;57:1879-1884

- 354 B/AB and 809 A trauma patients receiving at least one unit of group A plasma
- Use of group A plasma was not associated with increased in-hospital mortality, early mortality, or hospital LOS for group B and AB patients compared to group A patients

ORIGINAL RESEARCH

Soluble antigens in plasma allow mismatched transfusion without hemolysis

*James Sikora ¹, Jason Gregory,² Alan George,² Simon Clayton,³ Baiming Zou,⁴
Matthew Robinson,⁴ Faisal Mukhtar,¹ and Joseph P. Pelletier¹*

TRANSFUSION 2018;00;00–00

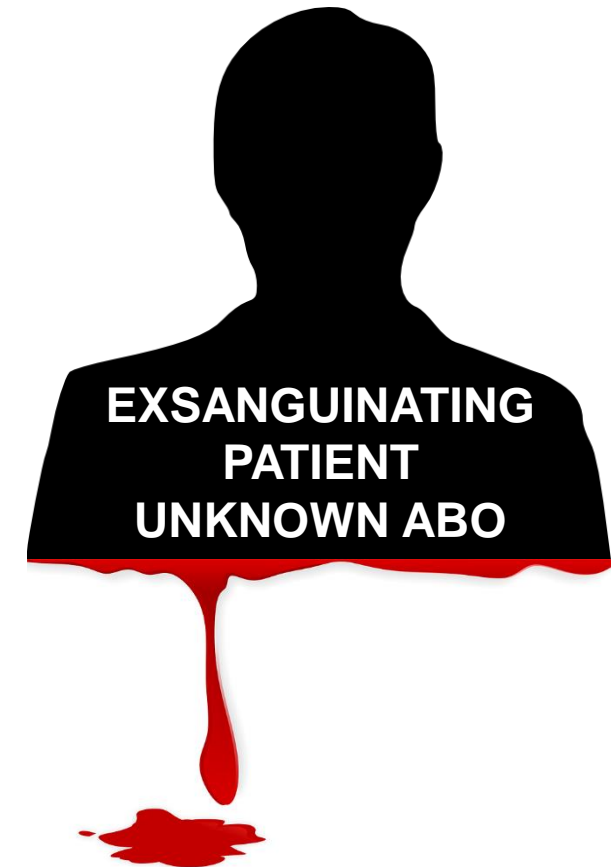
- 80% of the population are known to be “secretors”
- Soluble ABH antigens in the secretor patient plasma binds to, and neutralizes, the soluble antibodies present in the transfused plasma

ABO Incompatibility Risk Mitigation

AABB Standards 31st Ed


5.15.1

*Recipients shall receive ABO group-compatible Red Blood Cell components, **ABO group-specific WB, or low titer group O WB (for non-group O or for recipients whose ABO group is unknown)***



ORIGINAL RESEARCH

Safety profile of uncrossmatched, cold-stored, low-titer, group O+ whole blood in civilian trauma patients

Jansen N. Seheult ¹, Marshall Bahr,² Vincent Anto,³ Louis H. Alarcon,^{4,5} Alain Corcos,^{4,5} Jason L. Sperry,^{4,5} Darrell J. Triulzi,^{1,6} and Mark H. Yazer^{1,6}

TRANSFUSION 2018;00;00–00

- 102 non–group O recipients of 1 to 4 LTOWB units analyzed
- No clinical or biochemical evidence of hemolysis detected



**Get
Outside
the Box
...Rh!**

What about RhD?

- This antibody is NOT “naturally occurring”
- 85% of Caucasians are RhD positive
- 20-25% of RhD negative patients who receive an RhD positive RBC unit will form anti-D antibodies
- 20% of pregnancies where maternal anti-D is detectable will have severe hemolytic disease of the newborn

RhD Compatibility Chart

Rh Type	RBCs	PLASMA	PLATELETS	CRYO
POS	ANY Rh TYPE			
NEG	<p><u>NEG</u> <i>Unless you run out, then POS</i></p>	ANY	<p>NEG <i>POS → give Rhogam</i></p>	ANY

- Rh negative red blood cells are generally used for women of childbearing age (< 50) if Rh type is unknown and urgent transfusion is needed

TRANSFUSION PRACTICE

A case for stocking O D+ red blood cells in emergency room trauma bays

Erin Meyer and Lynne Uhl

TRANSFUSION 2015;55:791–795.

- 498 ED O– RBC units were transfused to 268 patients
- 88% were given to patients who qualified for group O, D+ RBCs per institutional policy
- 39 patients were D-, 18 eventually required transfusion with D+ RBCs
- 4 (1.5%) were D- patients were of child bearing potential (<50 yrs), only 3 survived to discharge

Prehospital low-titer cold-stored whole blood: Philosophy for ubiquitous utilization of O-positive product for emergency use in hemorrhage due to injury

Ashley C. McGinity, MD, Caroline S. Zhu, Leslie Greebon, MD, Elly Xenakis, MD, Elizabeth Waltman, MBA, Eric Epley, Danielle Cobb, MD, Rachelle Jonas, Susannah E. Nicholson, MD, Brian J. Eastridge, MD, Ronald M. Stewart, MD, and Donald H. Jenkins, MD, San Antonio, Texas

J Trauma Acute Care Surg
Volume 84, Number 6, Supplement 1

- In 124 total MTP patients, only one female of childbearing age that received an MTP was RhD-negative.
- Utilization of low-titer cold-stored O RhD-positive whole blood would be safe and best serve our community

RhD Alloimmunization Risk Mitigation

AABB Standards 31st Ed

5.15.2

Rh-negative recipients shall receive Rh-negative Whole Blood or Red Blood Cell components.

5.15.2.1 The transfusion service shall have a policy for the use of Rh-positive red-cell containing components in Rh-negative recipients.





**Make the Leap
...HLA!**

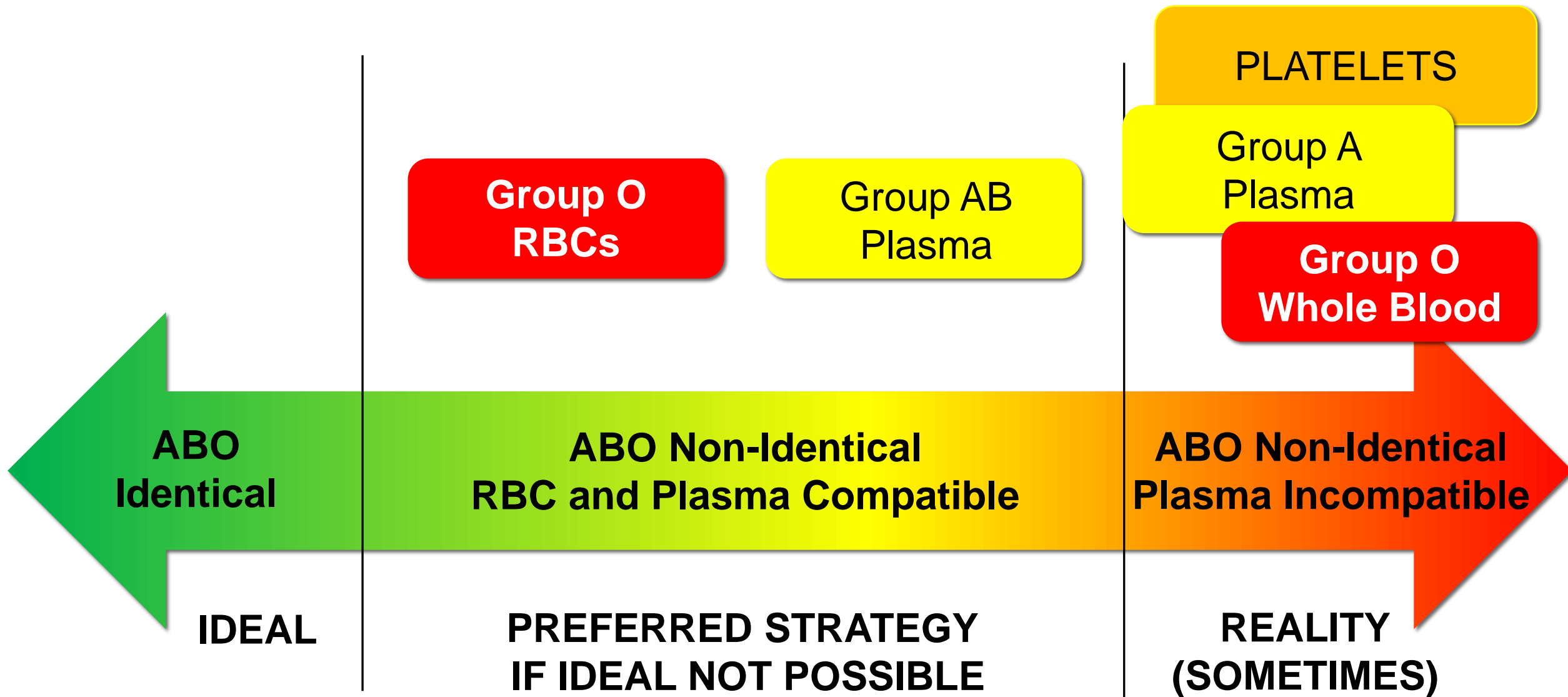
Transfusion Related Acute Lung Injury (TRALI) Risk Mitigation

AABB Standards 29th Ed.

5.4.1.2

Plasma and whole blood shall be from males, females who have not been pregnancy, or females who have been tested since their most recent pregnancy and results interpreted as negative for HLA antibodies.





Conclusions

Risk of clinically significant hemolysis due to ABO incompatibility from transfusion of LTOWB appears to be low.

One can make a case for providing RhD+ LTOWB to all traumatically injured adult patients.

LTOWB should be risk reduced for TRALI (i.e. collected from males, never pregnant females, or females tested negative for HLA antibodies).

HOW DO I . . . ?

How do I implement a whole blood program for massively bleeding patients?

Mark H. Yazer,¹ Andrew P. Cap,² Philip C. Spinella,³ Louis Alarcon,⁴ and Darrell J. Triulzi¹

TRANSFUSION 2018;58;622–628

ABO Incompatibility Risk Mitigation

Develop policies that guide the practice of transfusing group O WB to patients of unknown ABO group, including “low titer” threshold:

- Pittsburgh: less than 50 (immediate spin saline)
- Mayo Clinic: less than 200 (immediate spin)
- US Army: less than 256



ABO Incompatibility Risk Mitigation

Develop policies that specify the maximum quantity of WB per patient:

- Pittsburgh: up to 6 units per adult trauma patient
- San Antonio: No upper limit, consult with Transfusion Medicine after 8 units issued



ABO Incompatibility Risk Mitigation

Consider active surveillance for complications related to incompatibility:

- Pittsburgh and San Antonio Military Medical Center: measure lactate dehydrogenase, total bilirubin, and haptoglobin on the day of WB receipt and for the next 2 days



Rh Alloimmunization Risk Mitigation

Develop policies that guide the practice of transfusing group O WB to patients of unknown Rh type:

- Pittsburgh: Adult Level 1 or 2 hospitals stock only D+ WB; females under the age of 50 are not eligible to receive WB; Pediatric Level 1 stocks D– WB
- San Antonio: stocks only D+ WB for all patients



Transfusion Related Acute Lung Injury (TRALI) Risk Mitigation

Develop policies minimize risk for TRALI:

- Pittsburgh: only collects WB units from male donors
- San Antonio: only collects WB units from male donors

