



SIOP PODC Supportive Care Education

Presentation Date: 30th May 2016

Recording Link at [cure4kids.org](https://www.cure4kids.org)

https://www.cure4kids.org/ums/home/conference_rooms/enter.php?room=p56iihjy4cw

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Acute Transfusion Reactions: Prevention, Recognition & Response



Conflicts of Interest

- None to declare



Outline/Objectives

At the end of this session participants will be able to:

1. Identify the most common causes of acute transfusion reactions (ATRs) and their definitions
2. Use an evidenced based approach to ATR prevention
3. Develop a management plan for ATRs




Clinical case

- 11 year old girl admitted with auto-immune hemolytic anemia
 - DAT negative, PCH, Donath Landsteiner +
- Fatigue, pallor, tachycardia
- Hemoglobin 65g/L
- Transfusion of RBCs ordered
- Clear ABO, negative antibody screen



Case con't

- Crossmatch compatible blood issued
- Recommended warming blood
- 5 minutes into transfusion patient complains of back pain...



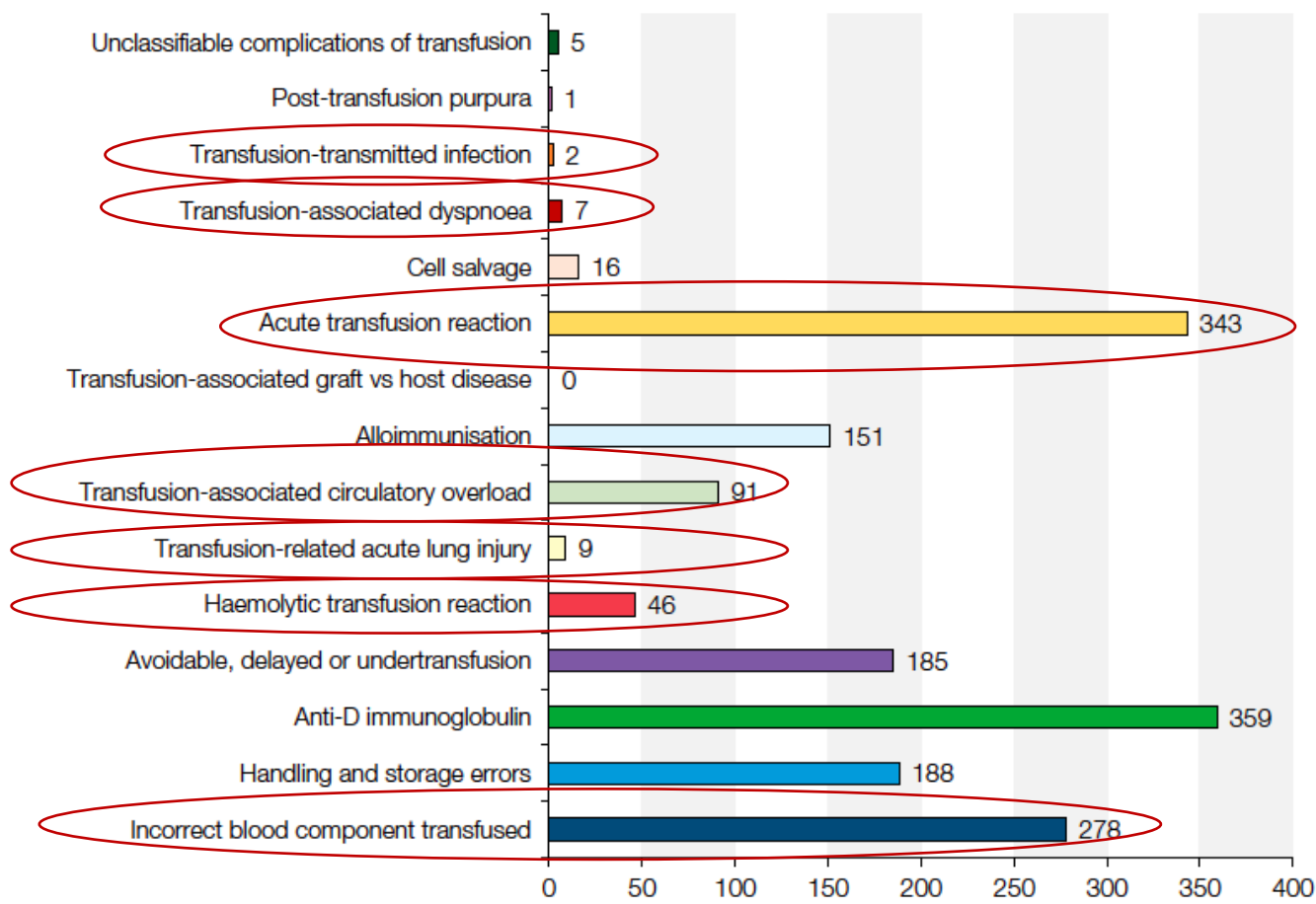
Acute Transfusion Reactions

- Adverse reactions occurring within 24 hours of a transfusion
 - Can be¹:
 - Doubtful
 - Possible
 - Probable
 - Definite



SHOT 2014

Figure 4.1:
Cases reviewed in
2014 n=1681





Severity

- Grade 1: Non severe
- Grade 2: Severe
- Grade 3: Life-threatening
- Grade 4: Death



Recent Review

Transfusion reactions: prevention, diagnosis, and treatment



Meghan Delaney, Silvano Wendel, Rachel S Bercovitz, Joan Cid, Claudia Cohn, Nancy M Dunbar, Torunn O Apelseh, Mark Popovsky, Simon J Stanworth, Alan Tinmouth, Leo Van De Watering, Jonathan H Waters, Mark Yazer, Alyssa Ziman, for the Biomedical Excellence for Safer Transfusion (BEST) Collaborative

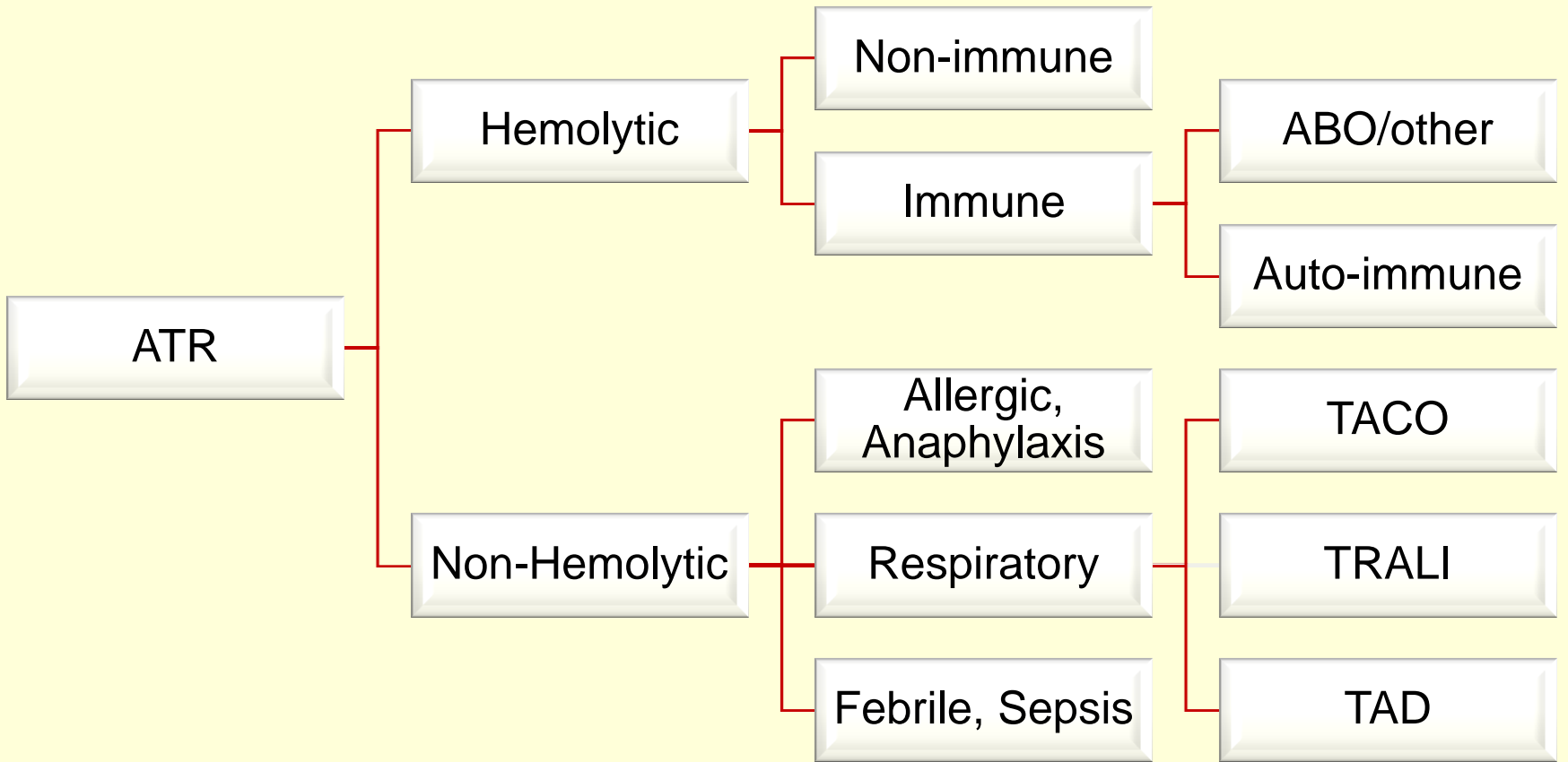
Blood transfusion is one of the most common procedures in patients in hospital so it is imperative that clinicians are knowledgeable about appropriate blood product administration, as well as the signs, symptoms, and management of transfusion reactions. In this Review, we, an international panel, provide a synopsis of the pathophysiology, treatment, and management of each diagnostic category of transfusion reaction using evidence-based recommendations whenever available.

Published Online
April 12, 2016
[http://dx.doi.org/10.1016/S0140-6736\(15\)01313-6](http://dx.doi.org/10.1016/S0140-6736(15)01313-6)
Bloodworks NW, Seattle, WA, USA (M Delaney DO); University

The Lancet, published online April 12, 2016



Causes of ATR





Febrile (non-hemolytic)

- Fever $\geq 38^{\circ}\text{C}$ oral or equivalent AND change of $\geq 1^{\circ}\text{C}$ from pre-transfusion
 - Severe: $\geq 39^{\circ}\text{C}$, change of $\geq 2^{\circ}\text{C}$ & chills
- Chills/rigors
- 1% - 3% of transfusion episodes¹
 - 36% of reported adverse transfusion events²
- During or within 4 hours of end of Tx

*****80% of AHTR present with fever*****

1. The Lancet, published online April 12, 2016

2. NHSN TRAE 2010-2012, Transfusion. 2015 Apr;55(4):709-18.

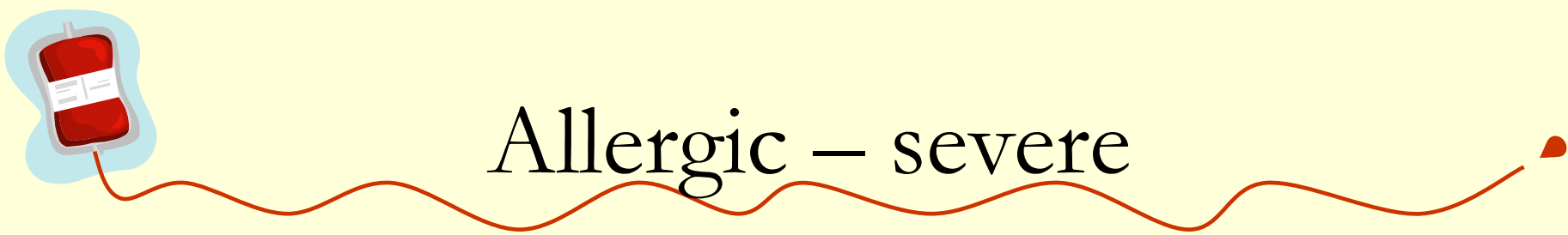


Allergic - minor

- 56% of TRAE¹
- 112 per 100 000 units²
- Presentation
 - Morbiform rash with pruritis
 - Urticaria
 - Localized angioedema
 - Periorbital pruritis, erythema and edema

1. NHSN TRAE 2010-2012, Transfusion. 2015 Apr;55(4):709-18.

2. The Lancet, published online April 12, 2016



Allergic – severe

- Anaphylaxis, involves respiratory and/or cardiovascular systems
- 8 per 100 000 units²
- Within 4h of end of Tx



Hemolytic

- Immune or Non-Immune

Clinical Signs/symptoms (any one of)	Lab findings (2 of)
<ul style="list-style-type: none">• Back/flank pain• Chills/rigors• Disseminated intravascular coagulation (DIC)• Epistaxis• Fever• Hematuria (gross visual hemolysis)• Hypotension• Oliguria/anuria• Pain and/or oozing at IV site• Renal failure	<ul style="list-style-type: none">• ↓ Haptoglobin• ↑ Bilirubin• ↑ LDH• Hemoglobinemia• Hemoglobinuria• Plasma discoloration c/w hemolysis• Spherocytes on blood film

- Within 24h of end of Tx



Hemolytic

- 80% due to ABO incompatibility¹
- ABO incompatible red cell transfusion
 - 10 of 1,966,866 units in 2014 SHOT²
 - 2.5 – 7.9 per 100 000 units reported in US
 - Estimated at 1 in 40 000 Canada³
 - 1 in 26 200 in tertiary care center North India³

1. <http://www.phac-aspc.gc.ca/hcai-iamss/tti-it/risks-eng.php>

2. <http://www.shotuk.org/wp-content/uploads/report-2014.pdf>

3. <https://blood.ca/sites/default/files/RedBloodCellsLeukocytesReduced.pdf>

4. Clin Chem Lab Med. 2012 Nov;50(11):1935-43



Errors

- Transfusion errors
 - Order error (patient, product)
 - Patient mis-identification at collection
 - Wrong blood in tube
 - Typing error in lab
 - Issuing error (product, patient)
 - Mis-identifying patient at time of administration



System fixes

- Move toward electronic methods
 - Computerized order entry
 - Positive patient ID with barcode technology
 - Remote fridge systems
- Difficult to implement in resource poor areas
- Education and surveillance?



TRALI

- Transfusion Related Acute Lung Injury
 1. Hypoxemia:
 - $\text{PaO}_2/\text{FiO}_2 \leq$ to 300 mm Hg, or
 - O_2 sat $<$ 90% on room air, or
 - Other clinical evidence
 2. Xray with bilateral infiltrates
 3. No Cardiac Overload
- 0.4 -1 per 100 000 units
- Within 6 hours of end of Tx



TACO

- Transfusion Associated Circulatory Overload
- 1-8% of transfused patients (10.9 per 100 000 units)
- 3 of:
 - Acute respiratory distress (dyspnea, orthopnea, cough)
 - ↑ brain natriuretic peptide (BNP)
 - ↑ central venous pressure (CVP)
 - Evidence of left heart failure
 - Evidence of positive fluid balance
 - Radiographic evidence of pulmonary edema
- Within 6 hours of end of Tx (4h for SHOT)



Hypotensive TR

- Adults: ↓ systolic BP of ≥ 30 mmHg & systolic BP ≤ 80 mmHg.
- Children: $>25\%$ ↓ systolic BP from baseline (or mean for <1 year, 12kg)
- More likely in patients with;
 - Hypertension
 - Ace inhibitors
- Within 1 hour of end of Tx



TAD

- Transfusion associated dyspnea
- Acute respiratory distress (no other cause)
- One ped study reported 45% of events (6.7/100 platelet tx)¹
- Others question whether distinct entity²
- Within 24h of end of Tx



Prevention

- Transfuse *only* when indicated
 - Use of a restrictive Tx strategy^{1,2,3}
- System factors
 - Blood component preparation methods⁴
 - Leukoreduction
- Patient factors

1. TRICC, Hébert et al, NEJM, 1999;340:409-17
2. TRIPICU, Lacroix et al, NEJM, 2007;356:1609-19
3. TRAE in PLADO, Transfusion. 2015 Jan;55(1):144-53.
4. Transfusion. 2012 Dec;52(12):2683-91. Epub 2012 Jun 28.



Prevention – AHTR, immune

System

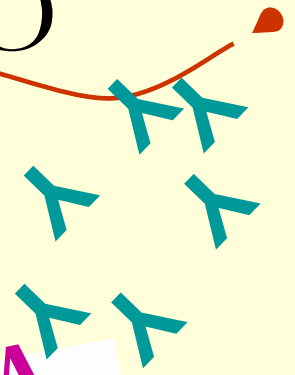
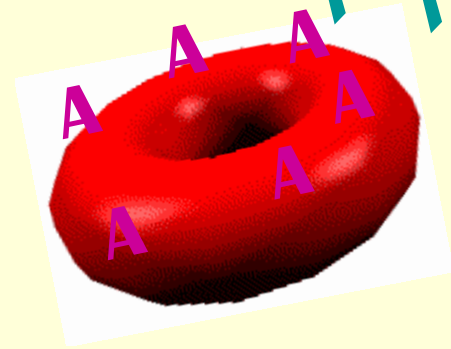
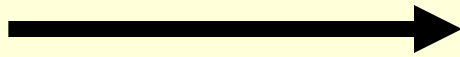
- Patient identification!
 - Prior to collection
 - Specimen labelling
 - Testing
 - Issuing
 - Transfusion
- ? Policies for plasma incompatibility or high titre anti-A & anti-B

Patient

- Identification
- Avoid incompatible plasma
- Understand the ABOs...



Red Cell Compatibility-ABO

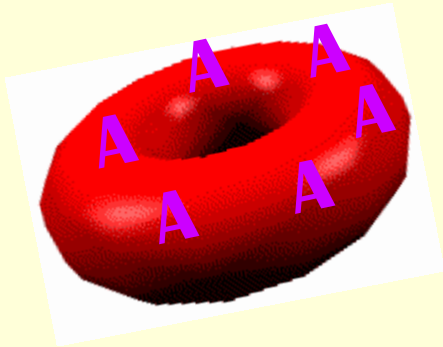


Group O

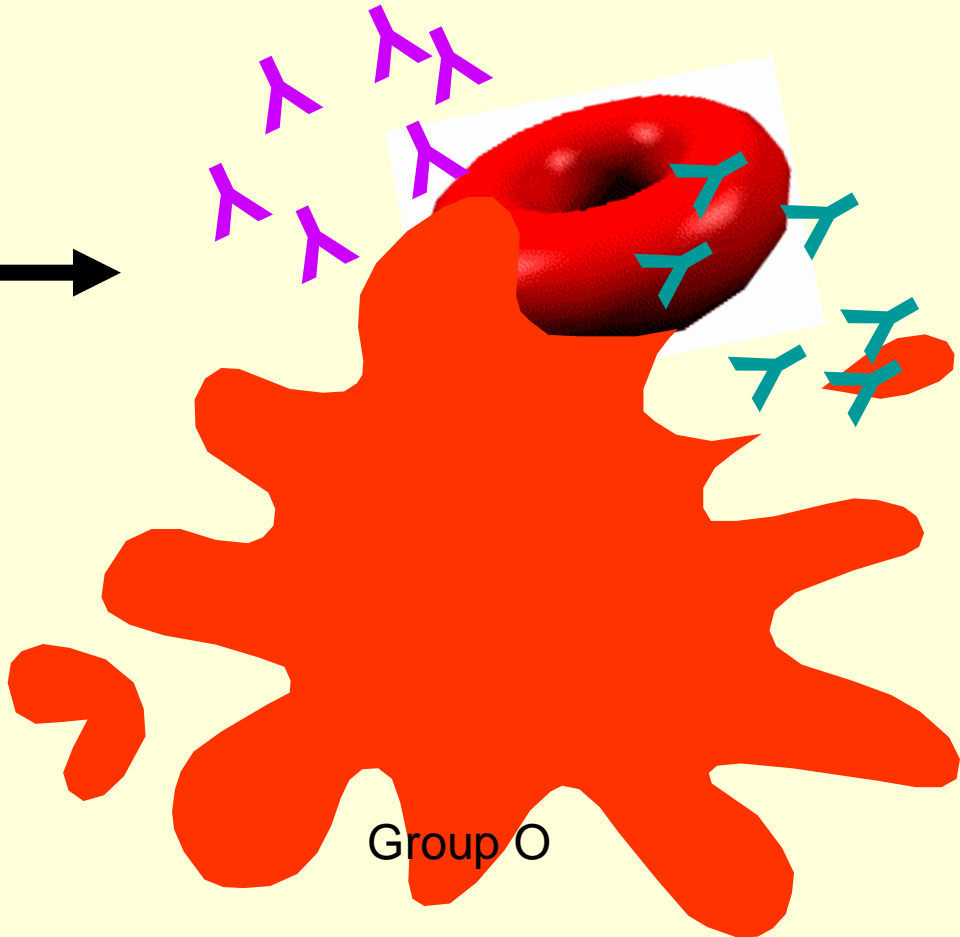
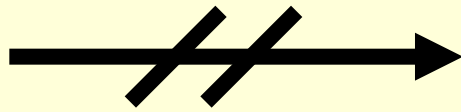
Group A



Red Cell Compatibility-ABO



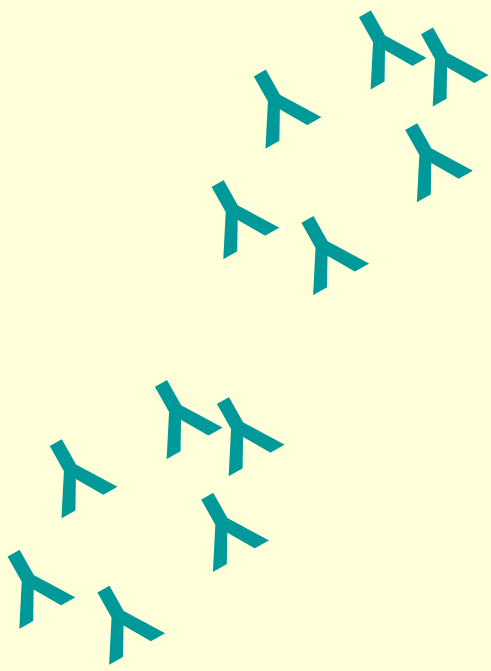
Group A



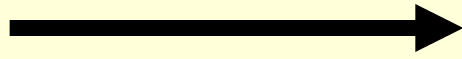
Group O



Plasma Compatibility -



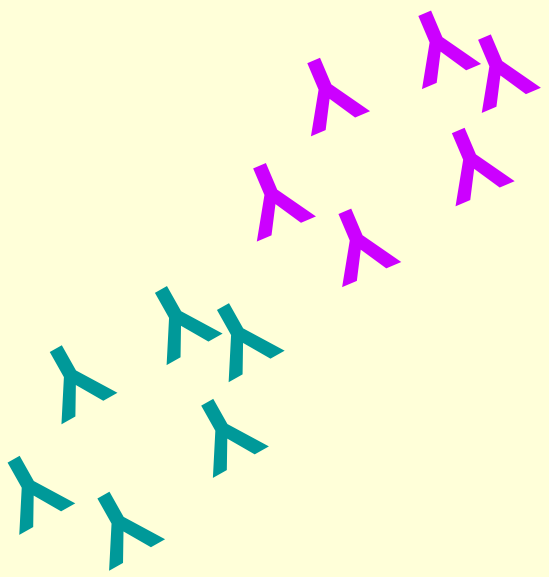
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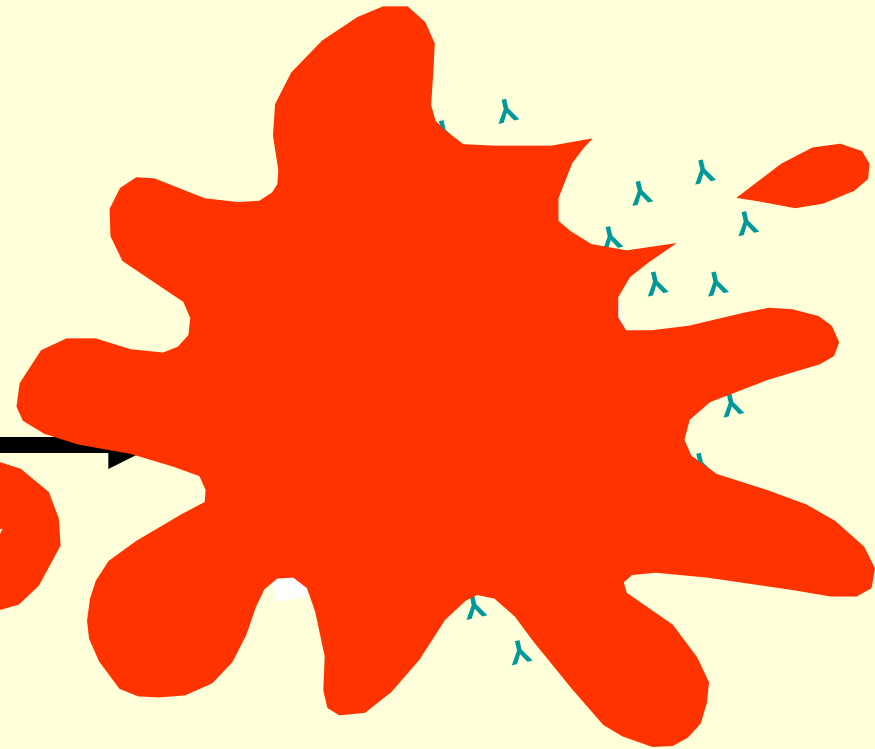
Group O



Plasma Compatibility -



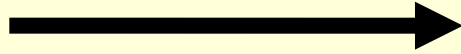
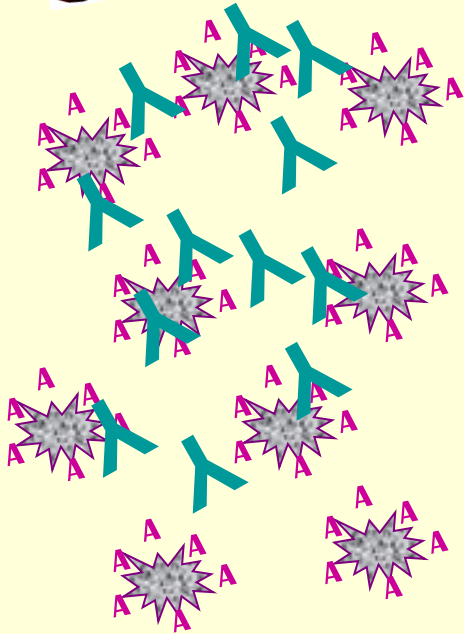
Group O



Group A



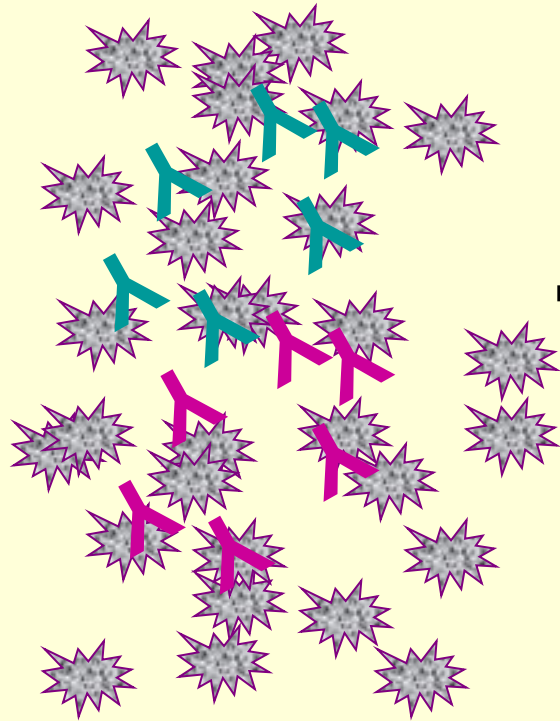
Platelet Compatibility



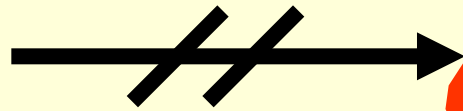
Group A

Group A

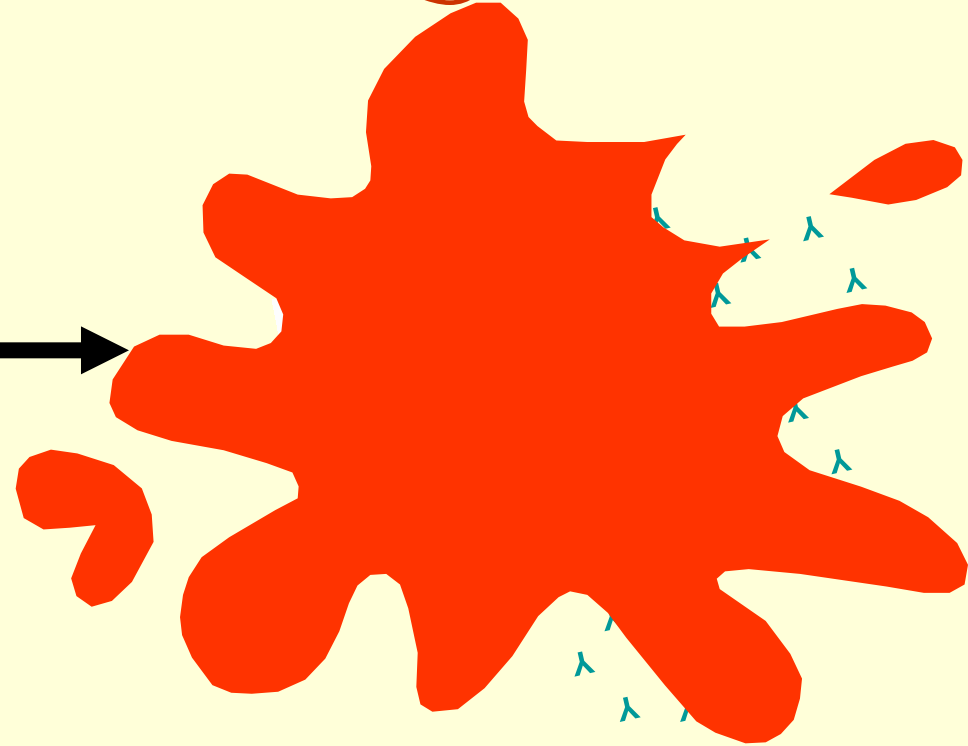
Platelet Compatibility



Group O

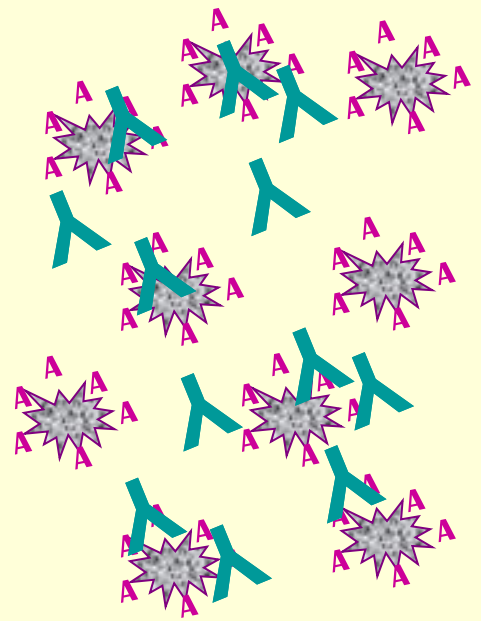
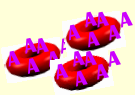


Minor Mismatch

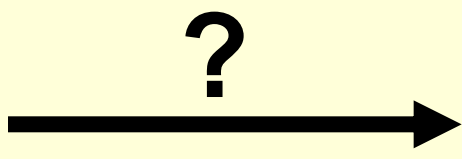


Group A

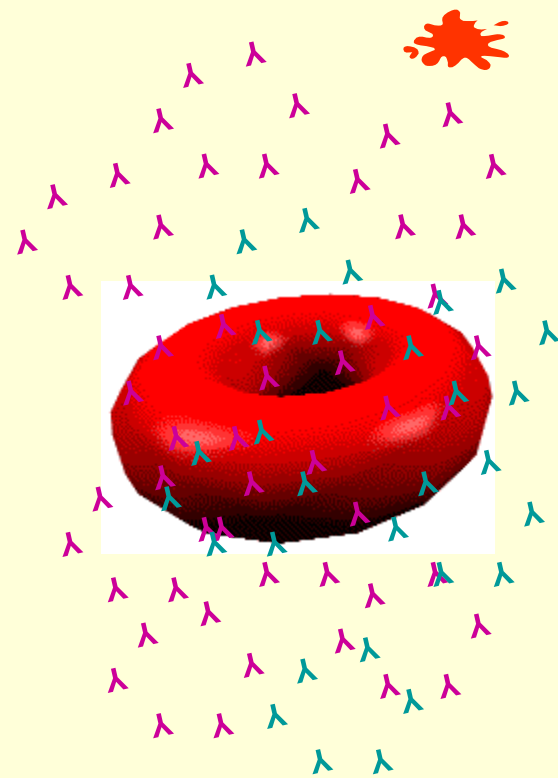
Platelet compatibility 2



Group A



Major Mismatch



Group O



Prevention – AHTR, non-immune

System

- Storage temperature and other (expiry)
- Administration guidelines

Patient

- IV solution (hypotonic)
- IV, tubing, filters
- Blood warmer



Prevention - Fever

System

- Prevent immune hemolysis!
- Pre-storage leukocyte reduction¹
- Diversion pouch²

Patient

- Pre-med (anti-pyretic) NOT effective³
 - May be useful if
 - already febrile
 - Multiple prior reactions

1. Transfusion. 2002; 42:556-66
2. Transfus Med. 2011 Dec;21(6):365-0
3. Br J Hem. 2005; 130:781-87




Prevention - Allergic

System

Patient

- Pre-med (anti-histamine)
NOT effective for mild
- For severe or recurrent
 - Washed product
 - Plasma reduced
 - Pre-med anti-histamine
+/- corticosteroid

1. Transfusion. 2002; 42:556-66
2. Transfus Med. 2011 Dec;21(6):365-0
3. Br J Hem. 2005; 130:781-87



Prevention - TRALI

System

- Use of low-TRALI risk plasma¹

Patient

- Avoid unnecessary transfusion



Prevention - TACO

System

- Transfusion guidelines
- Prescription for rate
- Further research is needed

Patient

- Slow transfusion
- Minimum volume
- Pre-med with diuretic¹



Treatment

- STOP THE TRANSFUSION
- Keep the vein open with 0.9% Saline
- Investigation
 - Clerical check
 - Lab investigations if severe or life-threatening
 - Consider bacterial contamination if persistent fever



Treatment con't

- Supportive treatment
 - Anti-pyretic for fever
 - Anti-histamine for mild allergic reaction
 - Lancet review – fever do not restart, send labs, allergy if mild, no labs and ok to restart
 - BCSH guidelines suggest ok to restart Tx if no severe signs/symptoms of sepsis or anaphylaxis
 - Cardio-respiratory support
 - Consider diuretic if TACO suspected



Treatment con't

- Report the reaction!
- Data is often from passive reporting and may underestimate frequency of events
- Identification of errors
 - Root cause analysis
 - Education
 - System changes to improve safety



Key messages

- Transfuse only when clearly indicated
- Errors can occur anytime in the transfusion process, and play a major role in transfusion related adverse events
- Routine pre-medication not shown to be of benefit
- Patient evaluation is key in prevention and treatment



Questions?

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