

Understanding Transfusion Reactions and How to Resolve

Lisa Anderson, MHSA, MT(ASCP)SBB
Armstrong Atlantic State University
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Objectives

- Describe clinical findings associated with different types of transfusion reactions.
- Assess clinical findings and laboratory values to determine mechanism of adverse events and clinical management of the patient.
- Discuss processes and policies to prevent unfavorable responses to transfusions.

Outline

- Initial Look....
- Definition of transfusion reaction
- Characteristics of specific types of transfusion reactions
- Evaluation of suspected transfusion reactions
- Case presentations

Case Presentation

- 62 year old male
- Severe trauma to pelvis & abdomen
- Unresponsive
- Radiology
 - Pelvis break, perforated small intestine and artery damage around pelvis
- Surgery required

Admission Lab Results

- Type & Screen
 - Type: AB pos
 - Antibody screen: Neg
- Hematology
 - Hgb: 9.3g/dL
 - Hct: 26%
- Urinalysis
 - Normal

Transfusion

- During surgery
 - 6 units AB pos RBCs
 - 7 units AB FFP
- No reactions noted while in surgery

After Surgery

- Symptoms of Acute Respiratory Distress (ARDS)
- Patient complaint of nausea
- Hemolyzed blood draws
- Darkened urine
 - 4+ blood
- Vital Signs
 - Temperature: 97.3
 - Pulse: 96
 - Blood Pressure: 128/74

What is a Transfusion Reaction?

- Unfavorable response by a patient to infusion of blood or blood products
- Adverse effect of transfusion therapy which occurs during or after administration of a blood product



Signs & Symptoms

- FEVER!!! ($\geq 1^{\circ}\text{C}$ or $\sim 2^{\circ}\text{F}$)
 - With or without chills
- Pain (infusion site, chest, back, abdomen)
- Nausea/vomiting
- Blood pressure changes
- Respiratory distress

Signs & Symptoms Cont.

- Skin changes (hives, itching, flushing)
- Loss of consciousness
- Generalized bleeding/DIC
- Darkened urine
- Apprehension/Sensation of impending doom
- ANY adverse manifestation should be considered!!!

Describing/Categorizing Transfusion Reactions

- Terms
 - Hemolytic vs. non-hemolytic
 - Acute vs. delayed
 - Immune mediated vs. non-immune mediated
 - Infectious vs. non-infectious
- Categories
 - Acute Immunologic and Non-Immunologic
 - Delayed Immunologic and Non-Immunologic

Immunologic Reactions

- | | |
|---|-------------------------------|
| ■ Acute | ■ Delayed |
| □ Hemolytic | □ Alloimmunization |
| □ Fever/Chill
nonhemolytic | □ Platelet refractory |
| □ Urticarial | □ Hemolytic |
| □ Anaphylactic | □ GVHD |
| □ Transfusion-related
acute lung injury
(TRALI) | □ Post-transfusion
purpura |

Hemolytic Transfusion Reactions

- What is happening?
- Why does it happen?
- Types of Hemolysis
 - Intravascular
 - Extravascular

Types of Hemolysis

- Intravascular
 - Antibody readily fixes complement
 - Severe clinical symptoms
- Extravascular
 - Complement activation incomplete
 - Milder clinical symptoms
- Chemical induced

Clinical Presentation

- | | |
|---|--|
| <ul style="list-style-type: none">■ Intravascular<ul style="list-style-type: none">□ Symptoms<ul style="list-style-type: none">■ Fever and/or chills (82%)■ Nausea/vomiting (12%)■ Pain (19%)■ Dyspnea (10%)■ Hypotension (12%)□ Complications<ul style="list-style-type: none">■ Renal failure (30%)■ DIC (8%) | <ul style="list-style-type: none">■ Extravascular<ul style="list-style-type: none">□ Symptoms<ul style="list-style-type: none">■ Fever and/or chills (50%)■ Jaundice (12%)■ Pain (13%)■ Dyspnea (1%)□ Complications<ul style="list-style-type: none">■ Renal failure (7%)■ DIC (1%) |
|---|--|

Hemolytic Transfusion Reactions

- Acute (immediate)
 - May be life-threatening
- Delayed
 - Milder reaction

Acute Hemolytic Reactions

- Causes
 - Incompatible red blood cells
 - ABO incompatible plasma products
- What Happens?
 - Recipient antibody + donor antigen
 - Antibody characteristics
 - Rapid RBC destruction
 - Hemoglobin released into circulation

Acute Hemolytic Reactions

- Why do these reactions occur?
 - Process Errors (86%)
 - Specimen collection
 - Laboratory testing
 - Blood administration
- Frequency
 - 1:38,000 – 1:70,000
 - Fatal: 1:25,000

Acute HTR Signs & Symptoms

- Fever
- Chills
- Flushing
- Pain
- Hypotension
- Dyspnea
- Nausea/vomiting
- Shock
- Hemoglobinemia
- Hemoglobinuria
- Anemia
- Oliguria or anuria
- Generalized bleeding
- Coagulopathy (DIC)

Did our patient present with any of these?

Other Lab Values

- Decreased hematocrit, haptoglobin
- Increased LDH
- Increased serum bilirubin
 - Intravascular: 6-12 hours after
- DAT: Positive/Negative
- Coagulation

Treatment of Acute Hemolytic



- Protocol
- Supportive Care (treat symptoms)
 - Hypotension (fluids)
 - DIC
 - Renal failure

Prevention of Acute HTR

- Positive Patient Identification!
- Follow policies and procedures
 - Specimen collection
 - Testing
 - Issuing
 - Administration
- Storage of products

Delayed Hemolytic Transfusion Reaction

- Causes
 - Secondary (anamnestic) response
 - Primary alloimmunization
- What happens?
 - Antibody production
 - Sensitized cells
 - Cleared by RES

Delayed Hemolytic Transfusion Reaction

- Why do these occur?
 - Undetectable antibody in pretransfusion testing
 - Technology
- Frequency
 - Anamnestic – 1:11,000 – 1:5,000
 - Alloimmunization – 1:100 (1%)
 - Fatal – rare; 1:600,000

Delayed HTR Signs & Symptoms

- Common symptoms
 - Fever w/ or w/o chills
 - Anemia
 - Mild jaundice
- Uncommon symptoms
 - Hemoglobinemia/-uria
 - Renal failure

Treatment & Prevention of DHTR

- Treatment
 - Treat/monitor for severe
 - DIC or renal failure
 - Transfusion
- Prevention
 - Medical history
 - Transfusions and/or previous reactions

Other Acute Immune Reactions

- Febrile, nonhemolytic
- Urticarial
- Anaphylactic
- TRALI

Acute Febrile Nonhemolytic

- Causes
 - Recipient antibody to donor WBCs
 - Cytokine accumulation
- What happens?
 - Not fully explained

Acute Febrile Nonhemolytic

- Frequency
 - Increased in chronically transfused patients
 - RBCs 1:200 – 1:17 (0.5 – 6%)
 - Platelets 1:100 – 1:3 (1 – 38%)
 - Most common reaction seen

Acute Febrile Nonhemolytic

- Symptoms
 - Temperature increase (1°C)
 - During or delayed
 - Chills/rigors
 - Headache
 - Vomiting
- Any rise in temperature deserves attention

Acute Febrile Nonhemolytic

- Treatment
 - Stop transfusion
 - Rule out other causes of symptoms (acute HTR, sepsis)
 - Medication
- Prevention
 - Leukocyte reduced components (prestorage)
 - Recurrence of reaction

Urticarial Reactions

- Causes
 - Recipient antibody to donor plasma proteins
 - Hypersensitivity (allergic reaction)
- What happens?
 - Unknown
 - Related to passive transfer

Urticarial Reactions

- Frequency
 - 1:100 – 1:33 (1 – 3%)
 - 1st/2nd most common type of reaction
- Signs and Symptoms
 - Redness
 - Pruritus
 - Hives
 - Fever



Urticarial Reactions

- Treatment
 - Antihistamine
 - May not have to discontinue transfusion
- Prevention
 - Pre-medicate
 - Washed products
 - May not be preventable

Anaphylactic Reactions

- Causes
 - Antibody to donor plasma proteins (IgA)
- What happens?
 - Similar to allergic reactions
 - Transfusion of small amount of blood
- Frequency
 - Rare

Anaphylactic Reactions

- Signs and Symptoms
 - ***No Fever
 - Coughing
 - Dyspnea
 - Nausea
 - Chest pain
 - Hypotension
 - Abdominal cramps

Anaphylactic Reactions

- Treatment
 - STOP transfusion
 - Epinephrine
 - Maintain airway
- Prevention
 - Remove all plasma
 - IgA deficient donor

Transfusion Related Acute Lung Injury (TRALI)

- Causes
 - HLA or WBC antibodies in donor reacting with recipient leukocytes
- What happens?
 - Capillary damage to lungs
 - Not fully understood

TRALI

- Frequency
 - 1:5,000 – 1:100,000
 - Under-reported
- Deaths
 - 13% of transfusion fatalities
 - Third leading cause of transfusion death

TRALI – Signs & Symptoms

- Respiratory distress/failure
- Hypoxemia
- Hypotension
- Chills
- Cough
- Fever
- Cyanosis
- Risk factors
 - Pneumonia
 - Sepsis
 - Bypass surgery



TRALI

- Treatment
 - Stop transfusion
 - Supportive
- Prevention
 - Patient antibodies
 - Donor antibodies

Other Delayed Immune Reactions

- Alloimmunization
 - RBC antibodies
 - Platelet refractoriness
- TA-GVHD
- Infectious

Acute Non-Immunologic TRXNs

- Transfusion associated sepsis
 - Bacterial contamination
- Circulatory overload (TACO)
 - Volume overload
 - Not very common
- Physical or chemical destruction
 - "Abused" red cells



Delayed Non-Immunologic TRXNs

- Iron overload
 - Multiple transfusions in chronic diseases (sickle cell anemia; thalassemia)

Relative Occurrence

Type of Reaction	Common	Less Common	Unusual
Febrile	X		
Urticarial	X		
Alloimmunization	X		
DHTR		X	
IHTR			X
Bacterial Contamination			X
TRALI			X
Anaphylactic			X
Others			X

Evaluation of Suspected TRXNs

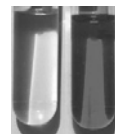
- Awareness of signs and symptoms
 - Detailed instructions
- Immediate
- Protocol
- Correlation of clinical presentation and laboratory results
 - Investigate clinical data
 - Questions about transfusion

Evaluation of Hemolytic Reactions

- Role of Clinician
 - STOP THE TRANSFUSION!
 - Recheck patient identification
 - Notify BB
 - IV access
 - Notify physician for evaluation
 - Collect post sample; send everything to BB

Evaluation of Hemolytic Reactions

- Role of Laboratory
 - Check for clerical errors
 - Right sample
 - Right unit
 - Right patient
 - Hemolysis comparison between pre- and post-samples



Evaluation of Hemolytic Reactions

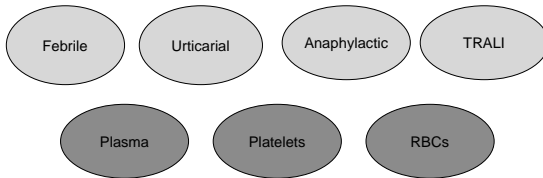
- Role of Laboratory Cont.
 - Perform ABO/Rh and DAT on post-sample
 - Compare ABO/Rh to pre
 - If DAT positive compare to pre
 - Transfused cells coated with antibody – pos
 - RBCs rapidly destroyed – neg
 - Non-immune - neg

Evaluation of Hemolytic Reactions

- If initial checks suspicious....follow with more tests
 - ABO/Rh on pre-sample and donor unit(s)
 - Antibody screens
 - Repeat crossmatch; include AHG
 - Others
 - H&H
 - Bilirubin
 - Haptoglobin
 - Urine

Evaluation of Non-Hemolytic Reactions

- Rule out hemolytic reactions
- Depends on type of reaction



Let's look at some cases!!!

Case Study #1

- 62 year old male
- Severe trauma to pelvis & abdomen
- Unresponsive
- Radiology
 - Pelvis break, perforated small intestine and artery damage around pelvis
- Surgery required

Admission Lab Results

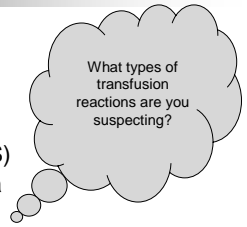
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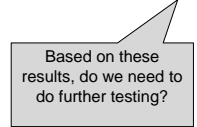


Transfusion Reaction Workup

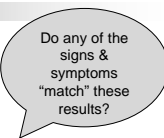
- Clerical Check
 - All blood bags discarded
 - Pre & Post sample identification matched
- Pre & Post sample testing

Pre & Post Transfusion Samples

- Pre-
 - Hemolysis: None
 - ABO/Rh: AB pos
 - DAT: Neg
- Post-
 - Hemolysis: Severe
 - ABO/Rh: AB pos
 - DAT: Neg



Additional Testing



Pre-Sample DAT (Poly) Negative

	Pre-	Post-
Screening Cells	AHG (Gel)	AHG (Gel)
Cell 1	0	0
Cell 2	0	0
Cell 3	0	3+

Antibody Panel

Cell	D	C	E	c	e	f	Cw	V	K	k	Fya	Fyb	Jka	Jkb	Lea	Leb	S	s	M	N	P1	Lus	Lub	Cell	Gel	Results
1	+	+	0	0	+	0	+	0	0	+	+	0	+	+	0	+	+	+	0	+	0	+	+	1	0	
2	+	+	0	0	+	0	0	0	+	+	+	+	0	0	0	0	+	+	+	0	+	+	+	2	3+	
3	+	0	+	+	0	0	0	0	0	+	+	0	0	0	0	0	+	+	+	0	+	+	+	3	0	
4	+	0	+	+	+	0	+	0	0	+	0	0	+	0	0	0	+	+	+	+	0	+	+	4	0	
5	0	+	0	+	+	0	0	0	0	+	+	0	0	0	0	0	+	+	+	+	0	+	+	5	0	
6	0	0	+	+	+	0	0	0	+	+	+	+	0	+	+	+	0	+	+	+	0	+	+	6	0	
7	0	0	0	+	+	0	0	+	+	+	+	+	0	+	+	+	+	+	+	+	0	+	+	7	3+	
8	0	0	0	+	+	0	0	+	+	+	+	+	0	+	+	+	+	+	+	+	0	+	+	8	0	
9	0	0	0	+	+	0	0	+	+	+	+	+	0	+	+	+	+	+	+	+	0	+	+	9	0	
10	0	0	0	+	+	0	0	+	+	+	+	+	0	+	+	+	+	+	+	+	0	+	+	10	0	
11	+	+	0	0	+	0	0	0	+	+	+	+	0	+	+	+	0	+	+	+	0	+	+	11	0	
Auto																							Auto	0		

Patient Outcome

- Continued need for products
 - 12 RBCs (K antigen negative)
 - 12 FFP
 - 5 PLPs
- New Type & Screen
 - ABO/Rh: AB pos
 - Antibody Screen: Neg
- Selection of products
 - K antigen negative RBCs (AHG crossmatch)

Case Study #2

- 82 year old male
- Admitted for multiple problems
 - Low hemoglobin
 - Jaundice
 - Dark urine
- Initial laboratory work
 - Urinalysis & Culture
 - Type and crossmatch for 4 units

Urinalysis

Color/Clarity	Amber/Turbid
Specific Gravity	1.010
pH	9.0
Leukocyte	500 (2+)
Nitrate	Neg
Protein/SSA	500 (3+)/ 3+
Glucose	Neg
Ketone	15 (1+)
Urobilinogen	Neg
Bilirubin	Neg
Blood	2 +

Type and Screen

- ABO/Rh – A pos
- Antibody Screen – negative
- 4 units crossmatched (IS)
- Received 3 units
 - No complications noted

Urine Culture

- *Proteus mirabilis*
 - > 100,000 CFU/CC
- Group D Enterococcus
 - > 100,000 CFU/CC
- Patient started on IV antibiotics

7 Days After Admit

- H&H still low
- Type and crossmatch for 2 units
 - ABO/Rh – A pos
 - Antibody screen – negative
- 200cc's of A pos unit given
- Adverse reactions noted

Transfusion Reaction Report

- Symptoms
 - Severe chill
 - Increase in temperature
- Vitals

	Pre-trsf	Post-trsf
Temperature	97.6	99.8
Blood Pressure	113/74	103/59
Pulse	110	132

Transfusion Reaction Workup

- Clerical – OK
- Hemolysis
 - Pre-sample – slightly icteric
 - Post-sample – slightly icteric
- DAT
 - Post-sample – 2+ (IgG)
- ABO/Rh
 - Post-sample – A pos

Further Testing

- Pre-sample testing
 - ABO/Rh – A pos
 - DAT – neg (IgG)
- Donor segment and unit
 - DAT – neg (IgG)
 - Gram stain – “no organisms seen”
- Post-sample
 - Antibody Screen – neg
 - Crossmatch – compatible (AHG)

Further, Further Testing

- Post-sample
 - Elution - negative
- So, what do you think?

Pathology Report

- “Probable Drug-induced Antibody”
- Let’s do a little further testing....

DAT	Pre-sample	Post-sample
Poly	0	3+
IgG	0	2+
C3	0	3+

Additional Lab Test Results

- Bilirubin (Total – mg/dl)
 - Pre-rxn – 2.2
 - Day of reaction – 18.2
- Urine Bilirubin (mg/dl)
 - Admit – Neg
 - Day of reaction – 1+
- Haptoglobin (mg/dl)
 - Pre-rxn – 90.7
 - Day of reaction - < 6

Review of Patient Medications

- Started on IV piperacillin day of admit
- Discontinued day of reaction
 - Bilirubin continued to increase 5 days post reaction
 - Haptoglobin – < 6 (3 days post)

Conclusion of Case #2

- Drug Induced Hemolytic Anemia
- Transfusion reaction work-up assisted in determining cause of patient's continuously decreasing H&H, even though patient had no apparent signs of bleeding
 - Ruled out delayed hemolytic reaction

Case Study #3

- 12 year old black female
- Admitting diagnosis – sickle cell crisis
 - Hgb – 5.1 g/dL
- 2 units ordered STAT
- Blood bank history
 - Anti-E, -K @ another facility

Pre-transfusion testing

- ABO/Rh – A positive
- Antibody screen – positive
 - Anti-E and Anti-K
 - No additional antibodies
- Crossmatch (Tube)
 - 2 units, E & K antigen negative compatible

Five Days Post Transfusion

- New request for 2 units
 - Hgb – 5.0 g/dL
- New sample results
 - ABO/Rh – A pos
 - Antibody Screen – positive
 - Crossmatch with 2 new E & K antigen negative units
 - 1 unit incompatible (1+)

Panel Results

Cell	D	C	E	c	e	Cw	K	k	Fya	Fyb	Jka	Jkb	Lea	Leb	P1	M	N	S	s	IS	37	IgG	
1	+	+	0	0	+	+	0	+	0	+	+	+	+	0	+	+	+	+	+	0	0	0	0
2	+	+	0	0	+	+	0	+	+	+	0	0	+	+	+	+	+	+	+	0	0	0	2+
3	+	0	+	+	0	0	0	+	0	+	+	+	0	+	+	+	+	+	+	0	0	0	3+
4	+	0	0	+	+	0	0	+	0	0	+	+	0	0	+	+	+	+	+	0	0	0	0
5	0	+	0	+	+	0	0	+	0	+	0	+	0	+	+	+	+	+	+	+	0	0	0
6	0	0	+	+	0	0	+	+	+	+	+	+	0	+	+	+	+	+	+	0	0	0	2+
7	0	0	0	+	+	0	+	+	0	+	0	+	0	+	0	+	+	+	+	0	0	0	2+
8	0	0	0	+	+	0	0	+	+	0	0	+	+	0	+	0	+	+	+	0	0	0	1+
9	0	0	0	+	+	0	0	+	0	+	+	+	0	+	0	+	+	+	+	0	0	0	0
10	0	0	0	+	+	0	0	+	+	0	+	0	0	+	0	+	+	+	+	0	0	0	1+
11	+	+	0	0	+	0	0	+	0	+	0	+	0	0	+	0	+	+	+	+	0	0	0
Auto																							1+ MF

Panel Results

Cell	Rh										Kell		Duffy		Kidd		Lewis		MNSs				Lutheran		Results		
	D	C	E	c	e	f	Cw	V	K	k	Fya	Fyb	Jka	Jkb	Lea	Leb	S	s	M	N	P1	Lua	Lub	Cell	IS	37	AHG
1	+	+	0	0	+	0	+	+	0	+	+	+	+	0	+	+	+	+	0	+	+	+	+	1	0	0	1+
2	+	+	0	0	+	0	0	+	+	+	+	+	+	0	0	0	0	+	+	+	+	+	+	2	0	0	2+
3	+	0	+	+	0	0	0	0	+	+	+	+	+	0	0	+	+	+	+	+	+	+	+	3	0	0	2+
4	+	0	0	+	+	0	0	+	+	+	+	+	+	0	0	+	+	+	+	+	+	+	+	4	0	0	0
5	0	+	0	+	+	0	0	0	+	+	+	+	+	0	0	+	+	+	+	+	+	+	+	5	0	0	0
6	0	0	+	+	+	0	0	0	+	+	+	+	+	0	0	+	+	+	+	+	+	+	+	6	0	0	2+
7	0	0	0	+	+	0	0	+	+	+	+	+	+	0	0	+	+	+	+	+	+	+	+	7	0	0	2+
8	0	0	0	+	+	0	0	0	+	+	+	+	+	0	0	+	+	+	+	+	+	+	+	8	0	0	0
9	0	0	0	+	+	0	0	0	+	+	+	+	+	0	0	+	+	+	+	+	+	+	+	9	0	0	0
10	0	0	0	+	+	0	0	0	+	+	+	+	+	0	0	+	+	+	+	+	+	+	+	10	0	0	1+
11	+	+	0	0	+	0	0	0	+	+	+	+	+	0	0	+	+	+	+	+	+	+	+	11	0	0	0
Auto																							Auto	0	0	1+MF	

Panel Rule-Outs

Cell	Rh										Kell		Duffy		Kidd		Lewis		MNSs				Lutheran		Results		
	D	C	E	c	e	f	Cw	V	K	k	Fya	Fyb	Jka	Jkb	Lea	Leb	S	s	M	N	P1	Lua	Lub	Cell	IS	37	AHG
1	+	+	0	0	+	0	+	+	0	+	+	+	+	0	+	+	+	+	+	+	+	+	+	1	0	0	1+
2	+	+	0	0	+	0	0	+	+	+	+	+	+	0	0	+	+	+	+	+	+	+	+	2	0	0	2+
3	+	0	+	+	0	0	0	0	+	+	+	+	+	0	0	+	+	+	+	+	+	+	+	3	0	0	2+
4	+	0	0	+	+	0	0	+	+	+	+	+	+	0	0	+	+	+	+	+	+	+	+	4	0	0	0
5	0	+	0	+	+	0	0	0	+	+	+	+	+	0	0	+	+	+	+	+	+	+	+	5	0	0	0
6	0	0	+	+	+	0	0	0	+	+	+	+	+	0	0	+	+	+	+	+	+	+	+	6	0	0	2+
7	0	0	0	+	+	0	0	+	+	+	+	+	+	0	0	+	+	+	+	+	+	+	+	7	0	0	2+
8	0	0	0	+	+	0	0	0	+	+	+	+	+	0	0	+	+	+	+	+	+	+	+	8	0	0	0
9	0	0	0	+	+	0	0	0	+	+	+	+	+	0	0	+	+	+	+	+	+	+	+	9	0	0	0
10	0	0	0	+	+	0	0	0	+	+	+	+	+	0	0	+	+	+	+	+	+	+	+	10	0	0	1+
11	+	+	0	0	+	0	0	0	+	+	+	+	+	0	0	+	+	+	+	+	+	+	+	11	0	0	0
Auto																							Auto	0	0	1+MF	

Evaluation of Panel Results

- Anti-E, -K, and -Fya
 - Selected cell panel
- Auto control – 1+ MF
- What is significance of mixed field reaction?
 - Elution

Elution Results

Cell	Rh										Kell		Duffy		Kidd		Lewis		MNSs				Lutheran		Results		
	D	C	E	c	e	f	Cw	V	K	k	Fya	Fyb	Jka	Jkb	Lea	Leb	S	s	M	N	P1	Lua	Lub	Cell	IS	37	AHG
1	+	+	0	0	+	0	+	+	0	+	+	+	+	0	+	+	+	+	+	+	+	+	+	1	0	0	2+
2	+	+	0	0	+	0	0	0	+	+	+	+	+	0	0	+	+	+	+	+	+	+	+	2	0	0	2+
3	+	0	+	+	0	0	0	0	+	+	+	+	+	0	0	+	+	+	+	+	+	+	+	3	0	0	0
4	+	0	0	+	+	0	0	0	+	+	+	+	+	0	0	+	+	+	+	+	+	+	+	4	0	0	0
5	0	+	0	+	+	0	0	0	+	+	+	+	+	0	0	+	+	+	+	+	+	+	+	5	0	0	0
6	0	0	+	+	+	0	0	0	+	+	+	+	+	0	0	+	+	+	+	+	+	+	+	6	0	0	2+
7	0	0	0	+	+	0	0	+	+	+	+	+	+	0	0	+	+	+	+	+	+	+	+	7	0	0	0
8	0	0	0	+	+	0	0	0	+	+	+	+	+	0	0	+	+	+	+	+	+	+	+	8	0	0	0
9	0	0	0	+	+	0	0	0	+	+	+	+	+	0	0	+	+	+	+	+	+	+	+	9	0	0	0
10	0	0	0	+	+	0	0	0	+	+	+	+	+	0	0	+	+	+	+	+	+	+	+	10	0	0	2+
11	+	+	0	0	+	0	0	0	+	+	+	+	+	0	0	+	+	+	+	+	+	+	+	11	0	0	0
Auto																							Auto	0	0	1+MF	

Elution Results

Cell	D	C	E	c	e	Cw	K	Fya	Fyb	Jka	Jkb	Lea	Leb	P1	M	N	S	s	IgG
1	+	+	0	0	+	+	+	0	+	+	+	+	+	+	+	+	+	+	0
2	+	+	0	0	+	+	+	+	+	+	+	+	+	+	+	+	+	+	2+
3	+	0	+	+	0	0	0	0	+	+	+	+	+	+	+	+	+	+	0
4	+	0	0	+	+	0	0	+	+	+	+	+	+	+	+	+	+	+	0
5	0	+	0	+	+	0	0	+	+	+	+	+	+	+	+	+	+	+	0
6	0	0	+	+	+	0	0	+	+	+	+	+	+	+	+	+	+	+	2+
7	0	0	0	+	+	0	0	+	+	+	+	+	+	+	+	+	+	+	0
8	0	0	0	+	+	0	0	+	+	+	+	+	+	+	+	+	+	+	2+
9	0	0	0	+	+	0	0	+	+	+	+	+	+	+	+	+	+	+	0
10	0	0	0	+	+	0	0	+	+	+	+	+	+	+	+	+	+	+	2+
11	+	+	0	0	+	0	0	+	+	+	+	+	+	+	+	+	+	+	0

Questions To Consider

- What is the significance of anti-Fya in eluate?
 - Alloimmunization (secondary) response resulting in delayed hemolytic transfusion reaction
 - Undetectable during pre-transfusion testing
 - Exposure to Fya antigen increased titer, causing donor cells to be coated

Questions to Consider

- What additional testing must be performed to complete the transfusion reaction workup?
 - Donor unit testing for Fya antigen
 - Both units Fya antigen positive

Questions to Consider

- What can be done to minimize future transfusion reactions?
 - Patient education
 - Antibody card
 - Phenotype patient

Case Study #4

- 19 year old female
- Trauma victim
- Immediately taken to intensive care unit
- Order received for type and crossmatch for 6 units of RBCs

Day 1

- Specimen received with results:
 - A pos; negative
 - No discrepancies noted
- 4 units of plasma requested
 - Thawed and transfused 4 units of A
- First RBC unit given at 10:14am
- Second RBC unit given at 13:36pm

Day 2

- 2 A pos RBC units given at 8:23am
- 11:23am – RN calls BB reporting transfusion reaction
 - Patient is hypotensive
 - Dr. requests work-up for units given on day 1
 - Blood bags etc discarded
- Technologist requests sample

Day 2

- Specimen work-up revealed + DAT
 - Pre sample negative
- ABO/Rh same on pre and post samples
- Tech called RN for patient history and post-transfusion urine
- Antibody screen & elution negative

Day 2

- Pre and post specimens crossmatched with units
 - Pre – compatible
 - Post – 2+ incompatible
- Patient receiving IV antibiotics
 - Gentamycin & Penicillin
- Pathology findings: Drug induced positive DAT

Day 3

- 5th & 6th units of A pos RBCs transfused
 - No reactions reported

Day 4

- New specimen received for T & Xmatch
- New reactions encountered:

Anti-A	Anti-B	Anti-A,B	Anti-D	ACells	BCells
3+	0	3+	3+	1+	2+

- Extra rxns in reverse
 - A subgroup
- A cells incompatible; O cells compatible

Day 5

- 1st unit of O pos RBCs transfused
- Physician ordered DAT
 - Requested use of sample from day 4
- DAT +; Anti-A1 eluted off cells
- 3 more units of O pos RBCs transfused

Day 9

- New orders for T & Xmatch
 - Specimen revealed different results:
- | Anti-A | Anti-B | Anti-A,B | Anti-D | ACells | BCells |
|--------|--------|----------|--------|--------|--------|
| 0 | 0 | 0 | 3+ | 2+ | 3+ |
- No mixed field reactions seen
 - Specimen drawn earlier that day for CBC exhibits same reactions

Day 9

- Antibody screen negative
 - New sample drawn – same results
- Physician notified about incompatibility
- Specimens from previous days were retested....
 - MF reactions noted with Anti-A

What Happened????

- Patient Identification Error
 - Samples mislabeled
- Clerical/Technical errors
 - Mixed field reactions missed
- Communication to get follow-up test requests

Review of Transfusion Rxn Results

- DAT +
- Antibody screen – neg
- Elution – neg
- WHY???
- ABO incompatibility not detected by antibody screening cells or elution

Review of Day 5 Results

- DAT on specimen from Day 4
- Patient had received: 6 units of A pos
- DAT +; Anti-A1 eluted off cells
- Patient actually group O and has “naturally occurring” anti-A & anti-B
 - Patient’s anti-A coating transfused RBCs

Patient Outcome

- Received 6 units of ABO incompatible blood
 - **MIRACULOUSLY SURVIVED!!!**
- Between days 6 & 9, patient was put on dialysis
- Therefore, on day 9, no longer detected mixed field reactions

More Things to Consider

- Process re-evaluation
 - Specimen collection (ID, collectors, site of collection)
- Competency training
- Workload & pass-offs

Summary

- Never dismiss an adverse event
- It may not be the transfusion of products, but the workup can assist in other diagnoses
- Just like anything else.....

It’s a Process!

Questions



Understanding Transfusion Reactions and How to Resolve

Lisa Anderson, MHSA, MT(ASCP)SBB
andersli@mail.armstrong.edu