

Adverse Effects of Transfusion: Diagnosis & Management of Transfusion Reactions

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Objectives

- Transfusion Reactions
- Transfusion transmitted bacterial infection
- Non-immune Complications of Transfusion
 - TA-GVHD
 - Iron Overload
- Hemovigilance
- Cases

Transfusion Reactions (TR)

Presenting with Fever

Acute

- Acute hemolytic TR
- Febrile non-hemolytic TR
- Transfusion-transmitted infection
- Transfusion related acute lung injury (TRALI)

Delayed

- Delayed hemolytic TR
- Transfusion associated-graft versus host disease (TA-GVHD)

Presenting without Fever

Acute

Allergic TR
Hypotensive TR
Transfusion associated circulatory overload (TACO)
Transfusion associated dyspnea

Delayed

Delayed serologic transfusion reaction
Post transfusion purpura

Incidence of TR

Adverse Event	Incidence
Febrile Non-Hemolytic Transfusion Reaction	1 in 330 RBC units 1 in 20 Platelet units
Allergic Reaction	1-3 in 100 (urticaria) 1 in 50,000 (anaphylaxis)
Circulatory Overload	1 in 100
Transfusion-Related Acute Lung Injury (TRALI)	1 in 5000
Acute Hemolytic Transfusion Reaction	1 in 10,000
Delayed Hemolytic Transfusion Reaction	1 in 1900
Transfusion Associated Graft vs Host Disease	1 in 1,000,000

Management of a Suspected TR

- Assume all symptoms are signs of an acute hemolytic TR
- Stop the infusion, notify MD and BB
- Keep line open with IVF (0.9% saline)
- Monitor vital signs
- Initiate a laboratory investigation of a suspected HTR
 - Return the remainder of the unit and tubing to the blood bank
 - Draw repeat labs (T&S, CBC, coags, LFTs, LHD, haptoglobin)
 - Urinalysis



Laboratory Investigation

Required	Additional Considerations
<ul style="list-style-type: none">• Clerical check• Visual inspection of the unit• Posttransfusion serum hemoglobin (qualitative)• Posttransfusion direct antiglobulin test (DAT)• Confirmation of posttransfusion ABO/Rh• Repeat pretransfusion ABO/Rh• Pre- and posttransfusion antibody screen• Repeat special antigen typing• Crossmatch with pre-and postreaction specimens	<ul style="list-style-type: none">• Antibody identification panels on pre- and postreaction samples• Enhanced antibody screening method: PEG, gel, enzymes)• Enhanced crossmatches: PEG, enzymes• Red cell eluate on pre- and postreaction samples• Serum haptoglobin• Serum bilirubin• Urine hemoglobin and hemosiderin• Culture and gram stain of the blood bag• DAT on donor units• Investigation of additional products transfused within 24 hrs

Hemolytic Transfusion Reactions (HTR)

Acute < 24 hrs	Delayed > 24 hrs up to 6 weeks
Intravascular hemolysis <ul style="list-style-type: none"> • Life threatening • Hemoglobinemia • Hemoglobinuria 	Extravascular hemolysis <ul style="list-style-type: none"> • Shortened RBC survival
<u>Symptoms</u>	
<ul style="list-style-type: none"> • Fever ±chills/rigors • Pain (infusion site, back, chest, flank, groin, HA) • Nausea/vomiting • Dyspnea • Hypotension • Tachycardia 	<ul style="list-style-type: none"> • Fever ± chills • Jaundice • Hypotension (very rare)
<u>Complications</u>	
<ul style="list-style-type: none"> • Activation of complement → hypotension and shock • Impaired renal function (multifactorial) • DIC 	<ul style="list-style-type: none"> • Impaired renal function • Anemia
<u>Outcome</u>	
<ul style="list-style-type: none"> • May be fatal 	<ul style="list-style-type: none"> • Rarely fatal

Diagnosis of HTRs

AHTRs	DHTRs	Delayed Serologic TRs (DSTR)
<ul style="list-style-type: none">• Positive DAT (IgG or C3)• Positive elution test- alloantibody on RBCs• Increased LDH• Increased Bilirubin• Low Haptoglobin• Hemoglobinuria• Low Fibrinogen• Increased Plasma hemoglobin	<ul style="list-style-type: none">• Positive DAT- 24 hours- 28 days after cessation of transfusion• Positive elution test• Inadequate rise of Hb• Unexplained appearance of spherocytes	<ul style="list-style-type: none">• Demonstration of new clinically-significant alloantibodies that were not present on the pre-transfusion specimen (24hrs-28 days)• Positive DAT• Newly positive Ab screen with newly identified RBC alloantibody

Causes of HTRs

- Administration of incompatible blood
 - Majority are due to ABO incompatible units erroneously released
 - FDA reported acute hemolysis related fatalities (1976-1985): 86% were the result of process errors
 - 10% occurred in phlebotomy
 - 33% occurred in the blood bank
 - 57% occurred during transfusion administration
 - Failure to detect a potential incompatibility → DHTRs
 - Deliberate, physician-guided use of an incompatible component
 - Platelet transfusion
 - Unavailability of compatible blood in an emergency

Differential Diagnosis

- AHTR
- DHTR
- Autoimmune hemolytic anemia
- Cold hemagglutinin disease
- Nonimmune hemolysis
 - Incompatible fluids
 - Improper storage
 - Malfunctioning blood warmer
 - Small needles
 - Infusion pumps
 - Bacterial contamination
 - Mechanical thrombectomy
- Congenital hemolytic anemia
- Hemoglobinopathies
- Drug induced hemolysis
- Microangiopathic hemolytic anemia
- Bleeding

Treatment and Prevention

- Minimal symptoms are best managed by careful observation
- Severe reactions require early vigorous intervention

Indication	Intervention	Typical Dose
<ul style="list-style-type: none"> • Prevent renal impairment • Maintain urine output > 100mL/hr and pH >7.5 	<ul style="list-style-type: none"> • Hydration • Alkalinization 	<ul style="list-style-type: none"> • NS • Sodium Bicarb in 5% Dextrose
<ul style="list-style-type: none"> • Prevent renal impairment 	<ul style="list-style-type: none"> • Diuresis 	<ul style="list-style-type: none"> • Mannitol • Furosemide
<ul style="list-style-type: none"> • Increase renal blood flow 	<ul style="list-style-type: none"> • Vasodilatation 	<ul style="list-style-type: none"> • Dopamine drip
<ul style="list-style-type: none"> • Treat DIC 	<ul style="list-style-type: none"> • Anticoagulation 	<ul style="list-style-type: none"> • Heparin
<ul style="list-style-type: none"> • Decrease load of incompatible RBCs 	<ul style="list-style-type: none"> • Red cell exchange 	<ul style="list-style-type: none"> • Exchange of one red cell mass
<ul style="list-style-type: none"> • Hemorrhagic complications of DIC 	<ul style="list-style-type: none"> • Transfuse plasma or platelets prn 	<ul style="list-style-type: none"> • Plasma 1-15mL/kg • One unit apheresis plts
<ul style="list-style-type: none"> • Prevent extravascular hemolysis 	<ul style="list-style-type: none"> • IVIG 	<ul style="list-style-type: none"> • 400 mg/kg

Febrile Non-hemolytic TRs

- Commonly defined as an increase of body temperature by 1°C during or within 4 hours of transfusion
 - Begin with patient feeling “uneasy”
 - Unrelated to underlying causes
 - Hemolysis
 - Sepsis
 - Other known causes of fever in recipient
 - Fever lasts usually no longer 8-12 hours
- Shaking chills without an elevation in body temperature can also be classified as FNHTRs if temporally related to transfusion and no other cause identified
- Cellular components
- Usually mild and self-limited

Complications of FNHTRs

- Rarely patients may develop severe symptoms
 - Rigors
 - Fever elevation $> 2^{\circ}\text{C}$
- Fever increase O_2 demand
 - 13% for every 1°C increase
 - 300% if shivering
 - Elderly, compromised cardiac status, or critically ill can experience cardiorespiratory complications

Pathophysiology

- FNHTR seems to be part of a systemic immune inflammatory response in patient's provoked by transfusion
- Currently, 2 accepted theories:
 - “Classical” theory: infused antigens (e.g., leukocytes) stimulate the in-vivo generation of cytokines in the recipient
 - Infusion of pyrogenic cytokines (or activated complement proteins, LPS, neutrophil-priming lipids) that accumulate in the extracellular fluid during storage
 - Bacterial contamination

- Common pathway
 - Increase in circulating pyrogens
 - IL-1 β
 - IL-6
 - TNF- α
 - Newer models suggest the role of prostaglandins in the CNS
 - LPS induce C5a which induces rapid peripheral production of PGE2
 - PGE2 binds receptors in the hypothalamus

Treatment

- Antipyretics
- Unless signs of an allergic reaction are present, antihistamines are NOT indicated
- Rigors
 - Meperidine (Demerol)
 - Morphine
- Continue hemotherapy if necessary after the patient is stabilized

Prevention

- Premedication with acetaminophen if a history of *recurrent* FNHTRs
- Steroids
 - Reaction prone patients in which antipyretics alone are not sufficient
 - Glucocorticoids (hydrocortisone)
 - Often administered incorrectly
- Reduce the rate of infusion
- Leukoreduction
 - $0.25-2.5 \times 10^9$ is the threshold number of leukocytes required for a TR
 - $< 5 \times 10^6$ WBC after leukoreduction

Allergic TRs

- An immediate hypersensitivity reaction due to the interaction of an allergen with preformed antibodies
- Classified as mild or severe based on the symptoms
 - Mild: maculopapular rash, urticaria, pruritis (generalized), flushing (generalized)
 - Severe: angioedema (localized), oropharyngeal edema, periorbital or conjunctival edema, respiratory distress, bronchospasm, hypotension

Anaphylactic and Anaphylactoid Reactions

- Serious and potentially life threatening
- Rapid onset
- Anaphylactic reactions are differentiated based on their systemic nature and severity
- Affect multiple systems: cutaneous, cardiovascular, respiratory, and gastrointestinal
- Symptoms:
 - Laryngeal edema, wheezing, coughing, stridor
 - Generalized urticaria, erythema
 - Tachycardia, hypotension
 - Nausea, vomiting, diarrhea, cramping, abdominal pelvic pain
 - Shock, syncope, respiratory failure, and death

Etiology

- Recipient preformed IgE interacts with an allergen present in the donor plasma.
 - IgE is bound via Fc receptors to the surface of mast cells and basophils.
 - Crosslinking on the surface of the cell and ultimately release of mediators
 - Leukotrienes
 - Prostaglandins
 - Cytokines
 - Platelet-activating factor (PAF)
- PAF induces production of NO which is thought to be the underlying cause of the hypotension and cardiovascular collapse seen during anaphylaxis.
- Rare reports of preformed IgE antibodies in the donor reacting with the antigen in the recipient.

- Anaphylactoid reactions
 - Immune complexes result in complement activation and production of anaphylatoxins C3a, C4a, and C5a
 - Best demonstrated in IgA deficient patients that have formed IgG anti-IgA
- Anaphylactic and anaphylactoid reactions have also been attributed to patients with deficiencies of other plasma proteins such as haptoglobin, VWF, or complement components

Diagnosis

- Clinical manifestations
- Serologic BB investigations are usually unrevealing
- Severe reactions
 - Serum β -tryptase or histamine levels
 - Measure IgA levels
- All allergic reactions should be reported to the blood bank

Treatment

- Mild symptoms
 - First-generation H1-blocking antihistamines (Benadryl)
 - Newer second generation antihistamines (loratadine, cetirizine, fexofenadine)
 - H2 blockers (ranitidine, cimetidine) can be added and speed the resolution of symptoms
 - Can resume transfusion after 30 minutes if complete resolution of symptoms has occurred

Treatment

- Anaphylaxis
 - Once clinically evident → epinephrine
 - IV crystalloid or colloid for pressure support
 - O2 for respiratory distress
 - Intubation for laryngeal edema/stridor
 - Nebulizers for wheezing
 - Antihistamines for urticaria, angioedema and GI symptoms
 - Glucocorticoids for the late-phase inflammatory response

Prevention

- IgA deficient patients
 - IgA deficient plasma
 - Washed cellular components
- Platelet Additive Solution (PAS)
 - 65% less plasma
 - A comparison of adverse reaction rates for PAS C versus plasma platelet units.
[Cohn CS¹](#), [Stubbs J](#), [Schwartz J](#), et al. [Transfusion](#). 2014 Aug;54(8):1927-34
- Washed cellular products
 - Repeat severe allergic reactions
 - Anaphylaxis

Transfusion-Associated Circulatory Overload (TACO)

- Cardiac insufficiency, renal impairment, or expanded blood volumes
- Rapid infusion of blood increases the risk of TACO
- Symptoms: dyspnea, tachycardia, acute hypertension, and pulmonary edema, right or left sided heart failure
- Diagnosis can be difficult
 - BNP
 - Response to diuretics
- Treatment
 - Diuretics
- Prevention
 - 2-4 mL/kg/hr
 - Diuretics
 - Split units

Hypotensive TR

- Drop in blood pressure occurring during or with in an hour of cessation of transfusion
- Symptoms not accounted for by a more specific TR
- Secondary to the infusion of bradykinin to patients with decreased ACE activity
- Reported in patients receiving bed-side leukocyte reduced platelets and taking ACE inhibitors
- Mechanism of action
 - Factor XII, a contact factor, becomes aXII as the transfused product passes through the negatively charged surface of the leukoreduction filter
 - aXII converts prekallikrein to kallikrein, cleave high molecular weight kininogen to bradykinin

Symptoms

- Hypotension
 - Adults: > 30 mmHg drop in systolic BP AND systolic < 80 mmHg
 - Infants and children: >25 mmHg drop in systolic BP AND systolic <90 mmHg
 - Neonates: >25 mmHg drop in systolic BP from baseline
- Responds rapidly to cessation of transfusion and supportive treatment
- May have flushing, dyspnea, or abdominal cramps

Prevention

- Pre-storage leukoreduction
 - Bradykinin is broken down rapidly in the stored unit
- Temporary discontinuation of ACE inhibitor

Post Transfusion Purpura

- Thrombocytopenia arising 5-12 days after transfusion of cellular blood components
- 85-95% of cases are women
- Incidence 1:24,000
- Pt previously sensitized via pregnancy or transfusion
 - Alloantibodies directed against HPA-1a or other platelet antigens
- Platelet count $< 10,000/\mu\text{L}$
 - Decrease to less than 20% of the pre-transfusion count
- 5-10% mortality



Pathogenesis

- Despite the presence of platelet specific alloantibodies, pathogenesis remains elusive
- Currently accepted hypothesis:
 - Alloantibodies express autospecificity
 - Alloreactive antibodies are detected for years
 - Autoreactive antibodies are only detected during the acute episode

Treatment

- IVIG
- 90% response rate
- >100,000 platelets/uL in average 4 days

Bacterial Contamination of Blood Products

- Bacterial contamination of blood components is often overlooked problem
- Recent public attention has focused on transfusion-transmitted viral infections
- Bacterial contamination has emerged as the leading cause of transfusion-transmitted disease
- The FDA, AABB and CAP have instituted requirements to detect bacterial contamination of platelet products

Bacterial Contamination of Blood Products

- Clinical Presentation:
 - Range from asymptomatic to mild fever to acute sepsis and death
- Contamination of components
 - RBC: rare event, risk of death estimated 0.13/ million
 - Most common organisms
 - *Staph epi*
 - *Serratia*
 - *Klebsiella*
 - *E. coli*
 - *Yersinia*
 - Plasma and Cryo
 - Rarely associated with significant contamination
 - *Pseudomonas cepacia* and *P. aeruginosa*

Bacterial Contamination of Platelet Products

- Platelets are stored at room temperature (20-24°C)
- Approximately 1 in 1,000 to 3,000 units are contaminated
- Septic transfusion rate is 1 in 25,000
- Most common organisms:
 - *Staph epi*
 - *Serratia*
 - *Klebsiella*
 - *E. coli*

Strategies to Reduce the Risk of Posttransfusion Sepsis

- Bacterial Avoidance
 - Donor screening
 - Skin preparation
 - Diversion
- Bacterial Detection
 - Visual inspection
 - Microscopic examination
 - Endotoxin assay- Limulus amoebocyte lysate assay
 - Rapid immunoassay- platelet PDG test
 - Bacterial culture
 - BacT/ALERT
 - eBDS

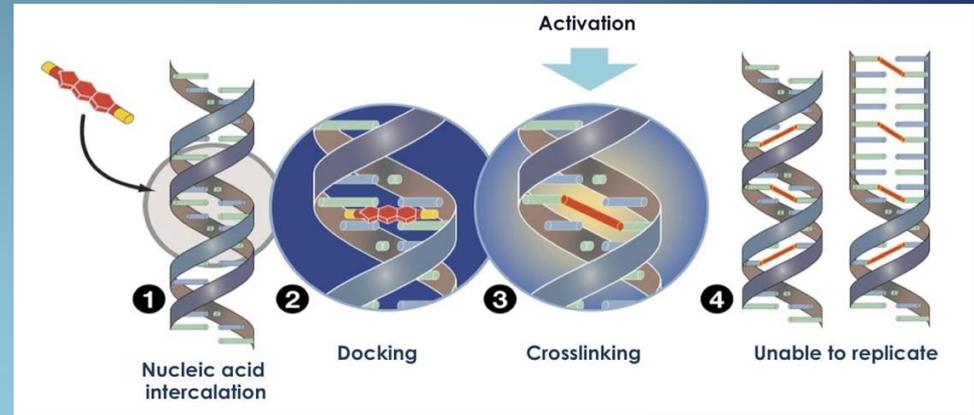


Pathogen Inactivation (PI)

- Development for new tests take on average 1 year after the pathogen has been discovered and described
- PI represent a pro- active approach
- Additional safety measure
 - Inactivating a broad range of pathogens
 - Viruses, bacteria, protozoa, WBCs

PI

- Principle: based on photochemical treatment
- Amotosalen intercalates and reversibly binds DNA and RNA
- UVA exposure causes covalent bonding between amotosalen and pyrimidine bases
- Genomes can no longer be transcribed or replicated



Non-immune Complications of Transfusion

- Complications of massive transfusion
 - Citrate toxicity
 - Transient decrease in ionized calcium, magnesium, potassium
 - Perioral parathesia, muscle spasms, N/V, bradycardia, arrhythmia, and hypotension
 - Electrolyte imbalance
 - Hyperkalemia: accumulation of extracellular potassium over time
 - Hypokalemia: potassium-depleted infused RBCs re-accumulate this ion intracellularly
 - Hypothermia
 - Rapid infusion of refrigerated blood (4°C) can cause a drop in core temp to < 35°C
 - Circulatory overload
 - FNHTR and allergic TRs

- Non-immune hemolysis
 - Rare
 - Physical or chemical destruction of the cells
 - Heating
 - Freezing
 - Hemolytic drug or solution added to the product
 - Mechanical hemolysis

Transfusion-Associated Graft-vs-Host Disease (TA-GVHD)

- Donor T cells, responding to proteins on host cells, proliferate and target host organs
- Mortality is >90%; Incidence-unknown
- Onset of symptoms is approximately 10 days (2-30)
- Immunocompromised patients are at highest risk

Pathophysiology

- Three requirements:
 - Graft must contain immunologically competent cells
 - There must be antigenic differences between the donor and host
 - Recipient unable to mount an effective immunologic response

Patients at Risk for GVHD

- **Neonates**
 - Intrauterine transfusion (IUT)
 - Postnatal transfusion in recipients of IUT
 - Very low-birthweight premature neonates
 - Neonatal alloimmune thrombocytopenia
- **Congenital Immunodeficiency**
 - Severe combined immunodeficiency
 - Wiskott-Aldrich syndrome
 - DiGeorge syndrome
 - Other T-cell defects
- **Malignancies and Immunosuppression Caused by Treatment**
 - Leukemia and lymphoma
 - Neuroblastoma
 - Rhabdomyosarcoma
 - Other solid tumors
- **Purine Analog Therapy**
 - Fludarabine
- **Hematopoietic Cell Transplantation**
 - **Allogeneic**
 - Autologous
 - Syngeneic
- **Solid-Organ Transplant**
 - Lung
 - Liver
 - Heart
 - Kidney
 - Pancreas
- **Surgery**
 - Cardiac surgery
 - Extracorporeal membrane oxygenation

GVHD in Immunocompetent Patients

- Transfusion from a donor that is HLA homologous to the recipient
 - Directed donation from a family member
 - Japanese population
- Surgery
- Fresh Blood



Clinical Presentation

Manifestation	HSCT GVHD	TA-GVHD
Median Onset		days (2-30 days)
Fever		usually
Skin Rash		
Liver involvement		
Gastrointestinal involvement		
Pancytopenia		most always
Occurrence		re
Response to therapy		re
Mortality	10-25%	90-100%

Treatment

- Poor prognosis
- Steroids
- Antithymocyte globulin (ATG)
- Extracorporeal photopheresis

Prevention

- 25 Gy gamma irradiation reliably inactivates donor lymphocytes
- Does not damage platelets or granulocytes
- Irradiation
 - Limited storage (28 days)
 - Membrane damage of RBCs
- Pathogen Inactivation

Iron Overload

- Tissue iron overload results in patients who receive regular red cell transfusions
- Initial deposition in liver and reticuloendothelial system
 - Liver
 - Heart
 - Pancreas
- Starting chronic transfusion later in life mitigates the effects to some extent
 - Sickle cell patients
 - Oncology patients

Transfusion Associated Iron Burden

- Each unit of red cells contains 200-250 mg of iron
- Body can excrete 1-2mg/day
- Careful records of the amount transfused
- Some say as few as 20 units of RBCs can lead to overload
- Monitoring
 - Liver iron concentration (LIC) is a monitor of total iron burden
 - >7mg/g dry weight associated with increased risk of liver fibrosis
 - Newer noninvasive methods have been described
 - Serum ferritin

Management of Iron Overload

- Chelating agents
 - Desferoxamine mesylate: sub-Q infusion daily over 8-12 hours
 - Pain at site of infusion, rare (vision/hearing disturbances)
 - Deferiprone: oral 3-4 times a day
 - Severe complications (neutropenia, erosive arthropathy, neurologic syndromes)
 - Deferasirox: Oral once a day
 - GI upset, rash, rarely neutropenia
- Compliance is the main determinant in the survival of patients

“Hemovigilance”

- Term has become widely used over the past 10 years
- Systematic surveillance of adverse transfusion reactions and events, encompassing the whole transfusion chain and aimed at improving safety of the transfusion process, from donor to recipient, “vein to vein”
- This data along with the clinical assessment of transfused patients provides critical information
- “Biovigilance”

Hemovigilance

- Ability to collect data AND use it to make recommendations that improve patient safety
- Four core concepts:
 - Enhance safety by learning from failures
 - Reporting is only of value when it leads to constructive response
 - Reporting must be safe
 - Meaningful analysis, learning and distribution of lessons learned requires expertise and other human and financial resources

Hemovigilance in the US

- 2010 Biovigilance Component of the National Healthcare and Safety Network (NHSN)
- Participating facilities voluntarily report all transfusion-associated adverse events using a web based tool
- Reactions are classified using standard criteria set forth in the NHSN manual

Case 1

- JK is a 55yo male with HTN, DM and CAD. He post-op day 3 s/p triple vessel bypass. The patient's Hb=8.3 and he is oxygen saturation is 96% on 2L NC. The surgeon decides the patient requires an RBC transfusion.
- The unit was hung and infused over one hour
- Five minutes after the completion
 - Chills, chest pain, SOB, wheezing
- Change in BP: Pretransfusion 117/53 → Postransfusion 167/83
- Tachycardic
- 45 minutes after completion the patient was intubated due to hypoxia= 65% O₂
- What is your differential diagnosis?
- What would you like to do?

- CXR prior to infusion: no evidence of pneumothorax status post left chest tube removal
- CXR after infusion: new bilateral perihilar parenchymal consolidations → pulmonary edema versus aspiration pneumonia
- Patient was given IV lasix and extubated in less than 24 hours
- Histamine and Tryptase levels were within normal limits
- BNP not obtained due to lab error

Final Diagnosis

- TACO

Case 2

- EL is a 54 yo male with HCV and alcoholic cirrhosis admitted with a GI bleed
- Vitals: T=37.6, BP=132/86, HR=117, Pox=97% RA
- PE: large amount of melena
- ER decides to transfuse PRBC and plasma
- Pt states, “ I almost died at that last hospital when they tried to transfuse me.”
- Team decides the patient needs to be transfused and proceeds with the transfusion

- 20 minutes into the transfusion the patient complains of difficulty breathing
- What do you want to do?
- What is your differential diagnosis?
 - TACO
 - ANAPHYLAXIS
 - TRALI

- The patient develops stridor and hypoxia (Pox=60% RA)
- He is rapidly intubated and treated with epinephrine
- Nurse notes urticaria on his trunk
- What is your diagnosis?
- What would you like to order?
 - CXR: unremarkable ET in correct position
 - BNP: WNL
 - IgA and haptoglobin levels WNL

Final Diagnosis

- Anaphylaxis

Case 3

- TR is a 20 yo male who presented to the ER with complaints of sudden onset of dark urine, shortness of breath, nausea and vomiting, flank pain, and fever. He reported receiving red cell and platelet transfusions earlier in the day at another hospital. He was vague about the indications for the transfusions. He denied recent infection, illness. Labs were obtained.
- Vital signs: T=99.8, BP= 110/74, HR=104, RR=24, 98% on RA
- What labs would you order?

- Hemoglobin= 10.5 g/dL
- Hematocrit= 30.0%
- Platelet count=11,000/uL
- UA=4+ hemoglobin, 0-2 RBC and 0-2 WBC/HPF
- DAT= Positive
- IAT=Positive
- Hemoglobinemia
- What is in your differential diagnosis?

Differential Diagnosis

- AHTR *
- DHTR *
- Sickle Cell in Crisis
- AIHA *
- TTP

- The ER physician contacts the other hospital and requests transfer
- While patient is en route, what information would you like as the accepting physician?
 - Patient's blood group
 - Results of the pretransfusion work-up
 - Previous transfusion history

Review of BB results

- B+
- AB screen: positive
- Anti-K identified
- Autocontrol was negative
- Patient was given 3 units of B- and Kell negative RBC
- What else would you like done before the patient arrives?
 - Repeat the pretransfusion type and screen
 - Repeat antigen testing and confirm they were ABO compatible and negative for Kell

- Meanwhile the patient arrives in the ER and his vitals signs are essentially unchanged and he is not in acute distress
- What additional labs would you like now?
 - CBC
 - Chemistries
 - Coagulation profile with D-dimer
 - Haptoglobin
 - Transfusion reaction work-up
 - Repeat type and screen
 - Repeat DAT

BB Results

- Transfusion reaction work-up:
 - No clerical error
 - Visible hemolysis: evident on the postransfusion sample but not of the pretransfusion sample
 - Pretransfusion DAT: negative
 - Posttransfusion DAT: positive with polyspecific and IgG AHG reagents
 - ABO on pre and posttransfusion samples: B+
 - All units issued confirmed B-
 - All units confirmed Kell antigen negative
- Still working on the repeat antibody screen/panel and repeat crossmatches
- What does this tell us?

- Patient was admitted to the floor with a diagnosis of suspected acute hemolytic transfusion reaction
- Additional BB results come back:
 - Antibody screen:
 - Pretransfusion sample: Positive; anti-K identified
 - Posttransfusion sample: Positive, anti-K and anti-D
 - Crossmatch: all units transfused were crossmatch-compatible with both pre- and posttransfusion samples
- What other test would you like?
- Can an Rh positive patient make anti-D?

- Fortunately the Heme-Onc attending finally returns his page
- Pt has not only pure red cell aplasia, he has ITP as well
- He was given a dose of IV RhIG earlier in the day

Final Diagnosis

- Anti-D in the patient's serum and eluate were due to IV RhIG
- Cause of the acute hemolysis is due to passive anti-D due to the RhIG coating his autologous Rh-positive red cells

Questions?