Non-Infectious Transfusion Reactions

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Transfusion Reactions

ANY unfavorable consequence is considered a transfusion reaction of blood TX.

The risks of transfusion must be weighed against the benefits.
Transfusion Reactions

1. **Acute (<24 hours) Transfusion Reactions**
   - Immunologic
     - Hemolytic; Febrile-non hemolytic; Allergic; Anaphylactic; Transfusion Reaction of Acute Lung injury (TRALI)

2. **Nonimmunologic**
   - Hemolytic (Physical or Chemical destruction of RBC); Circulatory overload; Air embolus; Hypocalcemia; Hypothermia

3. **Delayed (>24 Hours) Transfusion Reaction**

4. **Immunologic**
   - Hemolytic; Graft vs. Host Disease; Posttransfusion Purpura

5. **Nonimmunologic**
   - Iron Overload

6. **Infectious Complications of Blood Transfusion**
Acute (<24 hours) Transfusion Reactions

1. Immunologic
   - Hemolytic
   - Febrile-non hemolytic
   - Allergic; Anaphylactic
   - Transfusion Reaction of Acute Lung injury (TRALI)

2. Nonimmunologic
   - Volume overload
   - Hemolytic (Physical or Chemical destruction of RBC)
     Air embolus
   - Hypocalcaemia; Hypothermia
Acute Transfusion Reactions

Immunologic

Acute Hemolytic Transfusion Reaction

- Associated with **Intravascular Hemolysis**
- **Etiology:** Antibodies that activate complements in the vasculature: **ABO** antibodies are predominant / not the only ones.
- **Prevention:** Give ABO compatible blood.
Acute Transfusion Reactions

Immunologic

- May also occur due to ABO incompatible plasma in platelet products
- Very rare; less than 20 case reports, all involving group O platelets
- Usually occurs in group A patients or those with anti-A titers greater than 1:1000
- Can prevent by removing plasma from platelets, or limiting number of incompatible group O platelets in a 24 hour period

(Archives 2007;131:909)
Intravascular Hemolysis

Characteristics
- Within minutes
- IgM &/or IgG antibody
- Complement activation
- Release of histamine and serotonin

Signs may include:
- Pain along infusion site
- Shock
- Abnormal bleeding/DIC/
  Hemoglobinemia/uria
- Release of cytokines: fever, hypotension
- Renal failure/ Oliguria, may progress to...anuria
Acute Transfusion Reactions
Immunologic

Febrile non-hemolytic TX Reactions

- An **INCREASE** in temperature of 1°C during infusion of blood component
  - Usually “mild & benign” = not life threatening
  - Can have more severe symptoms, not usually
- **Non-hemolytic**
- Incidence of 0.1% of RBC transfusions
- 0.1-1.0% of platelet transfusions
- **Cause:** Recipient antibodies to donor WBCs & Cytokines in the transfused blood component.
Febrile Transfusion Reactions

Seen in...
- Multiply transfused patients
- Multiple pregnancies
- Previously transplanted

Must rule out...
- Hemolytic transfusion reaction
- Bacterial contamination of unit

Prevention
- Leukocyte reduction (pre-storage reduction may be more effective than post-storage reduction) or plasma removal is also helpful.
Acute Transfusion Reactions

Immunologic
Allergic (Urticarial-Hives)

- **Etiology:** Form of cutaneous hypersensitivity triggered by recipient antibodies directed against:
  - Donor plasma proteins or
  - Other allergens (food, medicines) in donor plasma
- Begins within minutes of infusion
- Characterized by rash and/or hives and itching.
- Common (1 per 2000 transfusions)
- Usually involves release of histamine.
Allergic (Urticarial) Reactions

- MUST be sure that the only reaction is the development of urticaria
- Must rule out more severe symptoms that could lead to anaphylaxis:
  - angioneurotic edema
  - laryngeal edema
  - bronchial asthma
- Prevention:
  - Can pre-treat recipient with anti-histamines before transfusion.
Acute Transfusion Reactions
Immunologic

Anaphylaxis

- Life threatening!!

- Etiology:
  - Recipient is IgA deficient & has anti-IgA in serum
  - Recipient anti-IgA can react to even small amounts of donor IgA in the plasma in any blood component
  - Idiopathic & Haptoglobin deficiency

- Reaction may occur within minutes: Onset of symptoms is SUDDEN

- Prevention: Wash cellular components or blood products from IgA deficient
Anaphylaxis

Symptoms

- Burning sensation at infusion site
- Coughing, difficulty in breathing, and bronchospasms can lead to cyanosis
- Nausea, vomiting, severe abdominal cramps, diarrhea
- Hypotension which can lead to shock, loss of consciousness, & death

- MUST STOP TX IMMEDIATELY
Acute Transfusion Reactions

Immunologic

TX Reaction of Acute Lung Injury

Etiology:
- Acute onset of hypoxemia and pulmonary edema on CX-RAY within 6 hrs of TX without evidence of cardiac failure.

Mechanism’s
- **Primary Suspect:** Donor antibodies to recipient WBCs
- Another cause: Biologically active lipids in the lungs causing edema
Transfusion Reaction of Acute Lung Injury (TRALI)

**Symptoms**
- Chills, fever, cough, cyanosis, hypotension, increased difficulty breathing

**Prevention:**
- For recipients: give male products
- For donors: watch/defer.
Acute Transfusion Reactions

NONimmunologic

Circulatory Overload

- **Etiology:** Rapid increases in blood volume to patient.
- **Risk factors:** compromised cardiovascular function, current volume overload, small intravascular volume (elderly, young children), severe chronic anemia.

**Signs and Symptoms**

- Dyspnea, cyanosis, severe headaches, **hypertension** or CHF (congestive heart failure). **Chest Xray:** pulmonary edema, distended pulmonary artery, cardiomegaly
- **Laboratory:** elevated B-natriuretic peptide (BNP) is 81% sensitive and 89% specific

**Prevention:** Slow Tx.

**Treatment:** Stop infusion and place patient in sitting position.
Acute Transfusion Reactions
NONimmunologic

Physically or Chemically Induced Red Cell Destruction

Etiology:

- Destruction of red blood cells in the collection bag and infusion of free hemoglobin, etc.

Improper temperatures: High or Low

- Microwave blood bag, malfunctioning blood warmer or water bath, inadvertent freezing of blood.
Physically or Chemically Induced Red Cell Destruction

Osmotic Hemolysis
- Addition of drugs or hypotonic solutions (5% dextrose, deionized water, etc.) to transfusion.

Mechanical Hemolysis
- Caused by rollers in blood pump
- Pressure infusion pumps
- Small bore needles
- **Prevention**: Adherence to procedures for all aspects of procuring, processing, issuing and administering red blood cell transfusions.
Acute Transfusion Reactions
NONimmunologic

Hypocalcemia

- **Excess citrate**: When infused at rate >100 mL/minute or individuals with impaired liver function:
  - Citrate is broken down by liver.
- Seen more in pediatric and elderly patients
- **Signs and Symptoms**: Facial tingling, nausea, vomiting.
- **Prevention**: Slowing or discontinuing infusion.
Acute Transfusion Reactions

NONimmunologic

Hypothermia

- **Etiology:** Drop in core body temperature due to rapid infusion of large volumes of cold blood.
- **Symptoms:** Decreased body temperature and ventricular arrhythmias.
- **Seen:** in small infants or massive transfusion
- **Prevention:** Reduce rate of infusion or use blood warmers.
Acute Transfusion Reactions

NONimmunologic

Air Embolism

- **Etiology:** If blood in an open system is infused under pressure or if air enters the system while container or blood administration sets are being changed.
- **Treatment:** Place patient on left side with head down to displace air bubble from pulmonic valve.
Delayed (>24 Hours) Transfusion Reaction -

1. Immunologic
   - Hemolytic
   - Graft vs Host Disease
   - Posttransfusion Purpura

2. Nonimmunologic
   - Iron Overload
Delayed Transfusion Reactions

**Immunologic**

**Delayed Hemolytic Transfusion Reaction**

*(Red blood cell alloimmunization)*

- Onset within days (>24 hours)
- Associated with Extravascular Hemolysis
- **Etiology:** Antibodies that usually do **NOT** activate Complements: *Rh, Kell, etc.*
- **Prevention:** Give antigen negative blood.
Extravascular Hemolysis

Characteristics
- Reaction within days
- Antibody attaches to RBC: RBC destroyed in spleen or liver, etc.
- Commonly IgG
- May or may not activate Complement

Signs may include:
- No release of free Hgb, or enzymes into circulation
- May be immediate (hours) or delayed (days)
- Bilirubinemia or bilirubinuria
Extravascular Hemolysis

Signs & Symptoms continued...

1. Fever or fever & chills
2. Jaundice
3. Unexpected anemia
   • Some may present as an ABSENCE of an anticipated increase in Hemoglobin and hematocrit.
Delayed Transfusion Reaction

Immunologic

Graft vs Host Disease (GVHD)

- **Etiology:**
  - Donor \( \text{CD}^8+ \) T-Lymphocytes attack recipient (host) tissues. Very rare in blood stored 4+ days due to WBC *inactivation*

- **Groups at risk:**
  - Immunocompromised patients (Cancer, fetus, neonatal, bone marrow transplant).

- **Signs:**
  - Fever, dermatitis, or erythroderma, hepatitis, diarrhea, pancytopenia, etc.

- **Prevention:**
  - Irradiation of blood products.
Delayed Transfusion Reaction

Immunologic

Post-transfusion Purpura

- **Etiology:**
  - Antibodies to platelet antigens (HP1a) causes abrupt onset of severe thrombocytopenia (platelet count <10,000/µl) 5-10 days following transfusion. Usually affects multiparous women.

- **Signs:**
  - Purpura, bleeding, fall in platelet count

- **Treatment:**
  - IVIG, plasmapheresis or corticosteroids; platelet transfusions usually NOT recommended
Delayed Transfusion Reaction

NONimmunologic Iron Overload

- **Etiology:**
  - Excess iron resulting from chronically transfused patients such as hemoglobinopathies, chronic renal failure, etc.

- **Signs:**
  - Muscle weakness, fatigue, weight loss, mild jaundice, anemia, etc.

- **Treatment:**
  - Infusion of deferoxamine - an iron chelating agent has been useful.
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5. Infectious Complications of Blood Transfusion
Infectious Complications of Blood Transfusion (Viral is rare)
Infectious Complication of Blood Transfusion

Bacterial Contamination

- **Etiology:**
- At time of collection: either from the donor or the venipuncture site.
  - During component preparation, etc.
- Usually involves *endotoxins*
  - *Staph, Pseudomonas, E.coli, Yersinia*
Bacterial Contamination

- **Components:**
  - Most often from platelet components (room temp). Red cell units will look dark.

- **Symptoms:**
  - Rapid onset
    - Fever, hypotension, shaking chills, muscle pain
    - Vomiting, abdominal cramps, bloody diarrhea, hemoglobinuria, shock, renal failure, & DIC.
Transfusion must be stopped immediately

- Gram stain & blood cultures should be done on the unit, patient and all infusion sets.
- Broad-spectrum antibiotics should be given immediately intravenously
- Prevention: Maintain standards of donor selection, blood collection and proper maintenance of collected blood components.

Bacterial Contamination
Transfusion Reactions

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5. Infectious Complications of Blood Transfusion
Clinical Information Needed:

- Recipient diagnosis
- Medical history of pregnancy &/or transfusion
- Current medications
- Signs & symptoms during transfusion reaction
- How many mL’s of RBC’s or plasma were transfused?
Clinical Information Needed

- Were rbc’s cold or warm when transfused?
- Were red cells infused under pressure?
- What was the size of the needle used?
- Were other solutions given through the IV line at the same time? If so what?
- Were any other drugs given at the time of transfusion? If so, what?
- What were pre- & post- transfusion vital signs?
Transfusion Reaction Follow-up

Post Transfusion Reaction blood samples to be collected from the recipient:

- Clotted specimen
- EDTA specimen
- Clotted specimen
- 1st voided urine specimen post-tx’n
- Repeat ABO, Rh, IAT and Crossmatch. Visual check for hemolysis and compare with pre transfusion sample.
- DAT (Direct Antiglobulin Test)
- Collect 5-7 hours post transfusion to check for bilirubin
- Free hemoglobin determination
Transfusion Reaction Workup

**CLERICAL CHECKS**

1. Correct identification of patient, specimen, and transfused unit.
2. Agreement of records and history with current results.
3. Correct labeling of transfused unit.

**SPECIMEN CHECKS**

- Visual inspection of post-transfusion specimen.
- Visual inspection of blood bag and lines.
Post Transfusion Lab Testing

Direct Antiglobulin Test (DAT)
- Recipient post-tx’n spec.
- **Positive:** Perform eluate and identify antibody if the pre-TX spec negative.

ABO Grouping and Rh Typing
- Recipient *pre*transfusion and *post*transfusion specimen
- Donor bag.
Post Transfusion Lab Testing

Indirect Antiglobulin Test (IAT)

- Recipient Pre- & post-transfusion reaction specimens
- Pre neg and post pos:
- Identify antibody and compare results of serum panel with eluate panel.
In Summery:

1-Allergic: Minor VS Serious

2-Febrile: Minor VS Serious

3-Onset<15 Mints, Temp>1C with other symptoms or Temp>39C, BP↑↓, Shock, SOA, Rigors, Back/Chest Pain, Bleeding from IV site, Tachy/Arrhythmia, Nausea/Vomiting and Generalized Flushing
In Summary:

1- Stop TX immediately and keep an IV open with 0.9 Saline
2- Contact the clinician
3- Check vital signs every 15 minutes
4- Check labels, forms, and IDs
5- Send bags & patient’s blood to BB
6- Minor (allergic-febrile non-hemolytic) VS Serious (hemolytic & febrile)
Thank You