### ACUTE TR

#### IMMUNE
- **AIHTR**
- **FNHTR**
- **Allergic Rx**
- **Anaphylaxis, Anaphylactoid**
- **TRALI**
- **Plasma has protein/allergen**

#### NON IMMUNE
- **Bacterial contamination (PAS)**
- **TACO**
- **Physical/Chemical RBC damage**
- **Depletion & dilution of Coagulation factory and RBC**

#### Dx & Tx of TR

<table>
<thead>
<tr>
<th>Acute TR</th>
<th>Delayed TR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present within 24 hours of transfusion</td>
<td>Present after 24 hours of transfusion</td>
</tr>
</tbody>
</table>

**Initial**
- At the bedside:
  - Patient, transfusionist, Physician
  - Rule out hemolysis

**Intermediate**
- Transfusion service technical staff
- Transfusion service physician

**Recognition — Evaluation — Resolution**

#### 4 LEADING CAUSES OF PREVENTABLE LAB ERROR

1. Improper specimen identification
2. Improper patient identification
3. Antibody identification error
4. Crossmatch procedure error

#### ACUTE TR

- **HAIR**
  - Incompatible RBC / WB
  - 1-2 Hours

- **PATHOPHYSIOLOGY**
  - Intravascular Hemolysis
  - Extravascular Hemolysis

- **SYMPTOMS**
  - Conscious
  - Fever
  - Oliguria/Anuria
  - Hypotension – death
  - Coagulopathy
  - Anesthetized
  - Hemoglobinuria
  - Bleeding at surgical wound site
  - Hypotension
  - Extravascular
  - Fever, chills, jaundice
  - Unexpected anemia

- **DIAGNOSIS**
  - DAT (±)
  - UCH
  - Bilirubin
  - Hb
  - Hct

- **TAS**
  - Antileukocyte abs

- **FNHTR**
  - 1°C rise in temp from px’s baseline w/o medical explanation
  - 8 – 24 hours posttransfusion

- **PATHOPHYSIOLOGY**
  - HLA Ab in plasma
  - Production of C3a, C5a
  - Most common: urticaria

- **SYMPTOMS**
  - Fever w/o chills
  - Rash: hypotension
  - Immediate: flush, rash, hives, fever
  - Delayed: angioedema, bronchial asthma

- **DIAGNOSIS**
  - DAT (±)

- **TX & PREVENTION**
  - Stop the transfusion, keep the line open & send the unit to the lab for visual inspection, G/S & culture
  - Maintain renal blood flow
  - Blood culture drawn from px
  - Keep IV line open w/ normal saline
  - Discontinue transfusion

#### MILD: ALTR

- May involve any organ: lungs, blood vessels, nerves, skin & GI tract

- **PATHOPHYSIOLOGY**
  - Plasma has protein/allergen

- **SYMPTOMS**
  - Vascular dilation & permeability
  - Swelling, red welts & edema
  - Majority: mild & not life-threatening

- **DIAGNOSIS**
  - DAT (±)

- **TX & PREVENTION**
  - Anti-histamine — mild forms
  - Patient with history of allergic reaction
  - Premedicate w/ anti-histamine

#### SEVERE: Anaphylaxis & Anaphylactoid

- **PATHOPHYSIOLOGY**
  - IgA deficient pts with anti-IgA antibodies due to previous sensitization

- **SYMPTOMS**
  - 2 Features:
    - a. Fever is absent
    - b. Clinical signs & symptoms occur after transfusion of just a few mL of plasma or plasma containing blood

- **DIAGNOSIS**
  - DAT (±)

- **TX & PREVENTION**
  - Stop the transfusion, keep the line open & send the unit to the lab for visual inspection, G/S & culture
  - Maintain renal blood flow
  - Blood culture drawn from px
  - Keep IV line open w/ normal saline
  - Discontinue transfusion

#### NCPE / TRALI

- **PATHOPHYSIOLOGY**
  - Pulmonary capillary leak syndrome reaction
  - Allergic pulmonary edema
  - Similar to adult respiratory distress syndrome (ARDS)
  - Transfusion related Acute lung injury

- **SYMPTOMS**
  - Pulmonary edema
  - Fever
  - Chills, cough, fever, cyanosis, hypotension
  - Increasing respiratory distress shortly after transfusion of blood component

- **DIAGNOSIS**
  - S/S & history

- **TX & PREVENTION**
  - Discontinue transfusion
  - Respiratory & hemodynamic supportive treatment
  - Pulmonary infiltrates usually clear after several days

#### PULMONARY

- **PATHOPHYSIOLOGY**
  - Transfusion associated circulatory overlay

- **SYMPTOMS**
  - Within 6 hours of transfusion
  - Chills, cough, fever, cyanosis, hypotension

- **DIAGNOSIS**
  - S/S & history

- **TX & PREVENTION**
  - Discontinue transfusion
  - Respiratory & hemodynamic supportive treatment

- **FREQUENT ERROR CAUSES ASSOCIATED WITH TR**

- **DEFINITION**
  - Paroxysmal nocturnal hemoglobinuria
  - Autoimmune hemolytic anemia
  - Glucose-6-phosphate dehydrogenase deficiency
  - Malignant hyperthermia
  - Hemoglobinopathies
  - RBC membrane defects

- **SYMPTOMS**
  - 1. Patient misidentification
  - 2. Sample error
  - 3. Wrong blood issued
  - 4. Transcription error
  - 5. Administration error
  - 6. Technical error
  - 7. Storage error
### DEFINITION

**Delayed TR**
- Anamnestic response for previous sensitization & ab is not detectable through standard pretransfusion mdts
- 3–7 days post-transfusion

### PATHOPHYSIOLOGY
- **Causes:**
  1. Secondary response to transfused RBCs
  2. Primary alloimmunization
- Extravascular Hemolysis
- Abs Causing DHTR
  - Associated w/ BM transplant due to HLA Ags

### SYMPTOMS
- Mild
- May be undetected clinically
- Complement not activated
- If w/ S/S
  - Fever w/ chills
  - Moderate jaundice
  - Oliguria & DIC – rare

### DIAGNOSIS
- ↓ Hb
- ↓ Total bilirubin
- Coag test, renal fx test, RBC survival

### TX & PREVENTION
- Goal: prevent & if necessary treat severe complications of DHTR
- Renal fen: IV fluid therapy to maintain normovolemic status
- Symptomatic anemia: RBC transfusion
- Monitor hemolysis & DIC
- Check history thoroughly

### ALLOIMMUNIZATION
- **DEFINITION**
  - Donor Antigenic RBC
- **PATHOPHYSIOLOGY**
  - Antibody attachment due to secondary exposure
- **SYMPTOMS**
  - Fever
  - History of patient
- **DIAGNOSIS**
  - Ab screening (+)
  - ↓ Hb
  - Hct
  - Lymphocyte panel & lymphotoxic ab
- **TX & PREVENTION**
  - Corticosteroid
  - Exchange transfusion, plasmapheresis

### TA-GVHD
- **DEFINITION**
  - At risk
  - Lymphopenia
  - BM suppression
  - Fetus receiving intrauterine transfusion
  - Exchange transfusion -NB
  - Congenital immunoedef
  - F. Blood relatives
- **SYMPTOMS**
  - - 3–30 days post-transfusion
  - - Liver, GI tract, skin & BM may be affected
  - - HLA typing to detect donor cells in px's circulation
- **DIAGNOSIS**
  - Pancytopenia
  - ID donor engraftment
  - ↓ T & PREVENTION
  - Corticosteroid
  - Cyclosporine, methotrexate, azathioprine, anti-thymocyte
  - Prevention:
  - - Give irradiated blood 25 – 35 Gray

### PTP
- **DEFINITION**
  - 1 unit of pRBC = 225 mg iron
- **PATHOPHYSIOLOGY**
  - Not clear
- **SYMPTOMS**
  - Not specific
- **DIAGNOSIS**
  - Platelet count <10,000
  - Tests for antibodies
  - Thrombocytopenia
  - HPA Ab
- **TX & PREVENTION**
  - Desferrioxamine
  - Remove accumulated tissue iron stores w/o lowering the Hb
  - Hypertransfusion of units rich in neocytes

### IRON OVERLOAD
- **DEFINITION**
  - 1 unit of pRBC = 225 mg iron
- **PATHOPHYSIOLOGY**
  - Affects the heart, liver, endocrine glands
- **SYMPTOMS**
  - Muscle weakness, fatigue, weight loss, mild jaundice
  - For patients with long history of RBC transfusion
- **DIAGNOSIS**
  - High ferritin level
  - ↓ T & PREVENTION
  - Transfuse when necessary
  - What is necessary

### IMMUNOSUPPRESSION
- **PATHOPHYSIOLOGY**
  - Not clear
- **SYMPTOMS**
  - Not specific
  - Increased risk to suppress patient’s immune system
- **DIAGNOSIS**
  - Pancytopenia
  - ID donor engraftment

### PCITRS
- **DEFINITION**
  - Physical RBC damage
  - Dilution & depletion of coag factors & platelets
  - Hypothermia
  - Citrate toxicity
  - Hypokalemia/hyperkalemia
  - Air embolism
- **PATHOPHYSIOLOGY**
  - Intravascular hemolysis by hyper/hypotonic solutions, heat, freezing or mechanical problems
  - Dilutional coagulopathy
  - Transfusion of cold blood (<35°C)
  - Excess citrate-hypocalcemia
  - DIC
- **SYMPTOMS**
  - Facial numbness, chills
- **DIAGNOSIS**
  - Lab tests:
    - Electrolytes, serum ionized calcium
    - Blood platelet, PT, APTT
    - Hb & Hct
    - Blood glucose
    - UA
  - ↓ T & PREVENTION
  - Correct S/S
  - Hypothermia: warm blanket
  - Cardiac arrhythmias: supportive
  - DIC = heparin
  - Citrate toxicity: calcium rich product