TRANSFUSIONS

Why do we even care?

FIRST, DO NO HARM
BECAUSE
BLOOD CAN KILL
7 TRALI DEATHS SINCE 2002 WMC
5 women
BECAUSE

In OB you are transfusing 2 instead of 1
BECAUSE BLOOD IS A LIQUID TRANSPLANT
RISKS versus BENEFITS

versus

ALTERNATIVES
RISKS
Adverse effects of RBC transfusion contrasted with other risks. Risk is depicted on a logarithmic scale.
TRANSFUSION RELATED IMMUNE MODULATION (TRIM)

**Immune Activation**
- TA-GVHD
- TRALI
- Alloimmunization
  - Red cell antibodies
  - Platelet antibodies
  - Leukocyte antibodies

**Immune Suppression**
- Nosocomial Infections
- Postoperative Infections
- Cancer Recurrence
- Enhanced Allograft Survival
- Microchimerism
- Lymphoma (SLL)
- Leukemia (CLL)

Any blood product can cause it

**Noncardiogenic** pulmonary edema **within 6** hours of transfusion with hypoxia

Dyspnea, **hypoxia**, hypotension, fever, crackles

Anti-neutrophil or anti-HLA antibodies/ cytokines

Mortality 5% to 25%

Supportive care

Do **NOT** use diuretics
Onset: Symptoms/Signs

- TRALI
- TACO
- Anaphylactic
- Bacterial Cont
- AHTR

Hours: 0, 0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5, 5.5, 6
TRANSFUSION INFECTIONS

68 Emerging Pathogens

- Babesiosis
- Malaria
- Lyme disease
- Chikungunya virus
- Parvoviruses
- vCJD
- Simian foamy virus
- Borrelia
- Parvoviruses

- Brucella
- Leishmania
- Rickettsia
- EBV
- TTV
- LCV
- Herpes viruses 6,7,8
- Dengue
- 68 other emerging diseases from CDC
CLINICAL CONSEQUENCES OF RED CELL STORAGE

Transfusion 2006;46:2014-2027
RBCs ARE DAMAGED GOODS

- Decreased 2,3 DPG
- Decreased ATP
- Decreased nitric oxide
- Decreased deformability
- Increased adhesiveness and aggregation
- Increased free hemoglobin
- Formation of microparticles
BENEFITS and ALTERNATIVES
RBC TRANSFUSIONS

- **Acute Hemorrhage**

- **Chronic Anemia only** with significant symptoms (chest pain, CHF, marked orthostatic changes not responsive to saline)

- **DO NOT TRANSFUSE A NUMBER!!!!**
RBC TRANSFUSIONS
HBG LESS THAN 7

- Resuscitated critically ill patients
- Critically ill with hemodynamically stable anemia
- Critically ill with mechanical ventilation
- Critically ill with stable cardiac disease
RBC TRANSFUSIONS

- Should be given as **SINGLE** units

- **NEW RULE** ---- 1 instead of 2

- **REMEMBER** ---- *less is more*
Massive Hemorrhage

- NOTIFY BLOOD BANK x22850
- Order “acute bleed profile”, NOT the DIC profile (tube #36)
- **Massive Blood Transfusion Protocol (MBT)**
  
  Order MBT ONLY when excessive bleeding is occurring
Massive Blood Transfusion Protocol (MBT)

- Must have baseline labs (Hbg, INR, Plt, Fib) which is the "acute bleed profile"

- ===5-4-1-5===5-4-1-5===repeat

- 5 RBCs – 4 FFP – 1 Plateletpheresis – 5 Cryo

- **TUBE STATION** #36 stat lab/blood bank
MASSIVE TRANSFUSION

- Prevent hypothermia and acidosis
- TXA (tranexamic acid) (3 hour limit)
- Replace calcium, follow ionized levels
- Prothrombin Complex Concentrate (4-PCC)
  - Wait till used all blood components
  - Variable outcomes (i.e. NOT a sure thing)
CHRONIC ANEMIA

- **FIRST** --- Identify cause of the anemia
- Transfuse **only** with significant symptoms (chest pain, CHF, marked orthostatic changes not responsive to saline)
- Do **NOT** transfuse a number !!!!
- **ONLY ONE UNIT AT A TIME** (NOT TWO)
- **CONSIDER ALTERNATIVES**
IRON THERAPY

- ALWAYS consider oral or IV iron therapy as an ALTERNATIVE to RBC transfusions
- Usually have maximal reticulocytosis in 7 to 10 days
- Usually see 2 gram rise in hemoglobin 1 week
- Usually see normal hemoglobin values in one month
- Order set #233 Iron Gluconate 250mg x4
36 year old heavy menses
hemoglobin 5.6

After 4 doses IV iron her
hemoglobin was 10.4 in
3 and a half weeks
Do **NOT** transfuse red blood cells for
- Anemia that can be treated medically
- Volume replacement
- Oncotic pressure
- Improve wound healing (only need 4 g/dl)
- Sense of well being
PRE-OP ANEMIA

- Diagnose it
- Treat it medically
- Do NOT transfuse it!!!
YELLOW BLOOD

- PLATELETS
- FRESH FROZEN PLASMA (FFP)
- CRYOPRECIPITATE (CRYO)
HEMOSTATIC RANGE

MUST DIFFERENTIATE HEMOSTATIC RANGE FROM REFERENCE RANGE

- Platelets: 50,000 (hemostatic)
- INR: less than 2 (hemostatic)
- Fibrinogen: 100 (hemostatic)
  200 (pregnant)

- Reference platelets: 150,000-400,000
- Reference INR: 0.9-1.1
- Reference fibrinogen: 200-400
THE INR, PLATELET COUNT AND FIBRINOGEN DO **NOT** PREDICT WHO WILL BLEED

**BUT** THEY CAN GUIDE REPLACEMENT THERAPY **IF** BLEEDING
PLATELETS

- Prophylaxis < 10,000
- Bleeding < 50,000
- Bleeding confined spaces (like brain) < 100,000
- Platelet dysfunction (drugs) --- ANY count
- Massive blood transfusion
EPIDURAL / SPINAL

- 170 obstetrical patients with platelet counts between 50,000 to 100,000
- No complications
- Recommendation of platelet count at least 75,000 for epidural anesthesia ????
- BEWARE of RAPIDLY FALLING platelet counts!!!!!!!!!!!
PLATELETS

- Therapeutic dose
  - One plateletpheresis pack
    - From only one donor
    - Equivalent to 6 to 10 random platelets
    - ABO/Rh compatibility preferred
    - NEVER use microaggregate filter
PLATELETS

- Timing of transfusion
  - If actively bleeding, then transfuse ASAP
  - If pre-procedure, then give within 4 hours of procedure or surgery
  - Should raise platelets 30 to 60K
PLATELET NO-NOs

- **Do NOT** transfuse platelets for
  - Thrombotic thrombocytopenic purpura (TTP)
  - Immune thrombocytopenia (ITP)
  - Post-transfusion purpura (PTP)
  - Heparin induced thrombocytopenia (HIT)
  - Drug-induced thrombocytopenia (DIT)

- **UNLESS** life threatening bleeding
<table>
<thead>
<tr>
<th>Coagulation Factor</th>
<th>Hemostatic Level</th>
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<tbody>
<tr>
<td>Fibrinogen</td>
<td>50mg/dl</td>
</tr>
<tr>
<td>Prothrombin</td>
<td>20-30%</td>
</tr>
<tr>
<td>Factor V</td>
<td>15-20%</td>
</tr>
<tr>
<td>Factor VII</td>
<td>15-20%</td>
</tr>
<tr>
<td>Factor VIII</td>
<td>15-20%</td>
</tr>
<tr>
<td>Factor X</td>
<td>15-20%</td>
</tr>
<tr>
<td>Factor XIII</td>
<td>2-5%</td>
</tr>
</tbody>
</table>

Mannuci, Blood, 2004;104:1243
FRESH FROZEN PLASMA

- Bleeding with INR of 2 or greater
- Massive blood transfusion
- URGENT warfarin reversal (if no 4-PCC)
  - Vitamin K (10mg IV)
  - 4 Prothrombin Complex Concentrate (4-PCC)
- Factor deficiencies without concentrates
- Heparin resistance
FFP

**MUST BE ADEQUATE DOSE**

- **USUAL DOSE** -- 10 to 20 ml/kg
- Average volume of one FFP is 300 ml
- So minimum dose is usually at least 3 FFP in 70 kg patient (up to 5 FFP)
FFP

**MUST BE GIVEN AT RIGHT TIME**

- Only give within 4 hours of a procedure or when actually bleeding
- Coagulation effect only lasts about 6 hours
- NEVER give the night before a procedure
- NEVER give to “normalize” INR
INR OF FFP

- INR of FFP was actually measured
  - Only 20% had INR of 1.0
  - 60% had INR of 1.1
  - 10% had INR of 1.2
  - 5% had INR of 1.3

- THEREFORE 75% of FFP has an INR >1.0
**FFP NO NOs**

- Do **NOT** transfuse FFP to
  - Normalize abnormal INR results
  - Patients on heparin (unless heparin resistant)
  - Increase blood volume
  - Increase albumin level
  - Elevated INR that can be corrected with Vitamin K or PCC
VITAMIN K

IF you use ONLY 1.0 to 2.5 mg vitamin K

THEN you will NOT make patient resistant to restarting coumadin
CRYOPRECIPITATE

- Bleeding with fibrinogen less than 100 UNLESS pregnant than less than 200
- Massive blood transfusion
- Congenital fibrinogen deficiencies
- Factor XIII deficiency
Low fibrinogen predictive of severe postpartum hemorrhage

Fibrinogen <200 mg/dL predictive of severe PPH

TRANEXAMIC ACID

- MBT --- given ASAP (best within one hour)

- Prophylactically C-sections (#197)

- Use in post-partum bleeding
  - WOMAN TRIAL – in progress (15,000)
  -- Small study using 4 g TXA if > 800 ml bleed
TRANSEXAMIC ACID

- Efficacy of IV TXA in Reducing Blood Loss With Elective C-section: Prospective, Randomized, Double-blind, Placebo Controlled Study

- 660 women – 330 in each arm

- 1 g TXA IV over 5 minutes at least 10 minutes prior to skin incision

- Oxytocin given after delivery

- Order Set # 193
Since 2013, 46 women given TXA prophylactically and 0 were transfused!

Since 2013, 31 women given TXA for bleeding and only 9 (29%) were transfused and 22 (71%) were not transfused
TXA for treatment of PPH

- French multicenter RCT at eight obstetric centers
- Subjects: vaginal deliveries with EBL > 800 mL
  - N = 72 per group
- Intervention: 4 g TXA loading dose over 1 hr, followed by 1 g/hour for 6 hours.
- Primary outcome: reduction of blood loss in women with PPH

Ducloy-Bouthors, et al., Crit Care 2011; 15:R117

www.aabb.org
TXA for treatment of PPH

Less procoagulant blood products used in TXA group:
- 7% in TXA
- 20% control (p = 0.013)

Persistent bleeding at 30 minutes significantly lower in TXA group:
- 28 vs. 40 (p = 0.03)

P = 0.042

Ducloy-Bouthors, et al., Crit Care 2011; 15:R117
www.aabb.org
CELL SAVER

- New and improved
- Better washing of red cells and use of microaggregate filter
- Very helpful with patient with multiple antibodies
- 800 procedures done safely in OB
- Amnionic fluid embolism risk negligible
- Can order as STAND-BY
DIC AND TRANSFUSION
TREATMENT DIC

MOST IMPORTANT

Control/correct the underlying triggering pathologic disease
TREATMENT DIC

SUPPORTIVE CARE

– VOLUME EXPANSION WITH CRYSTALLOIDS TO CORRECT HYPOTENSION

– BLOOD PRODUCTS ONLY IF BLEEDING
DIC LABS

- **DIC Profile (Wesley Lab)**
  - CBC (WBC, HBG, PLATELET COUNT)
  - PTT
  - PT/INR
  - FIBRINOGEN
  - D-DIMER (NO MORE FSP)

- **ACUTE BLEED PROFILE (Wesley Stat Lab)**
  - HBG, Platelet count, PT/INR, Fibrinogen
  - Tube station #36
TREATMENT DIC

- BLOOD PRODUCT USAGE **IF BLEEDING**
  - YELLOW blood can be life saving with severe hemorrhage
    - If fibrinogen less than 200...transfuse cryo
    - If platelets less than 50,000...transfuse platelets
    - If INR greater than or equal to 2 ...transfuse FFP
  - RED blood used to keep hemoglobin greater than 7 at least
ALTERNATIVES

- Pharmacy is the NEW blood bank!!!
- IV Iron (iron gluconate, order #233)
- IV Vitamin K
- Antifibrinolytics (TXA, order set #193)
- Coagulation Factor Concentrates
  - Kcentra (4 factor PCC)
  - Humate P
  - Factor 8 and 9 concentrates
  - Fibrinogen concentrate—new, not at WMC yet
WEAK D

- D antigen genotyping on the way for next year via reference lab

- Resolve the discrepancy between Rh positive versus Rh negative

- Avoid unnecessary Rh immune globulin