

Hematology

Basics and Cases

Blood Components

- Platelets
- Plasma
- Hemoglobin

Case #1

- 23yo woman bilateral femur fractures. Blood loss about 1000mL and continuing. Start transfusing.
- Urine becomes red-tinged

Case #1

- Differential?
- What actions should be taken?
- What would happen in an awake patient?

Type of Reaction	Relative Risk
Allergic	1:500
Febrile	1:1000 to 1:10,000
TRALI	1:5000 to 1:100,000
Hemolytic/Fatal	1:250,000 to 1:600,000

Adverse Reactions

- Allergic reaction
- Febrile reaction
- Hemolytic reaction
- Contamination
- Volume Overload
- TRALI

Consequences

- DIC
- Dilution Thrombocytopenia/Factoremia
- Renal Dysfunction

Type and Screen

- Detect antibodies in patient's serum associated with non-ABO hemolytic reactions
- Mix patient's serum with known red cells
- After T&S <1% reaction

Type and Cross

- Confirm ABO and Rh typing
- Detect antibodies to other blood group systems
- Low titer antibodies

Infectious Risks

- Hepatitis B or C
- HIV
- CMV
- Malaria
- Bacterial

Platelets

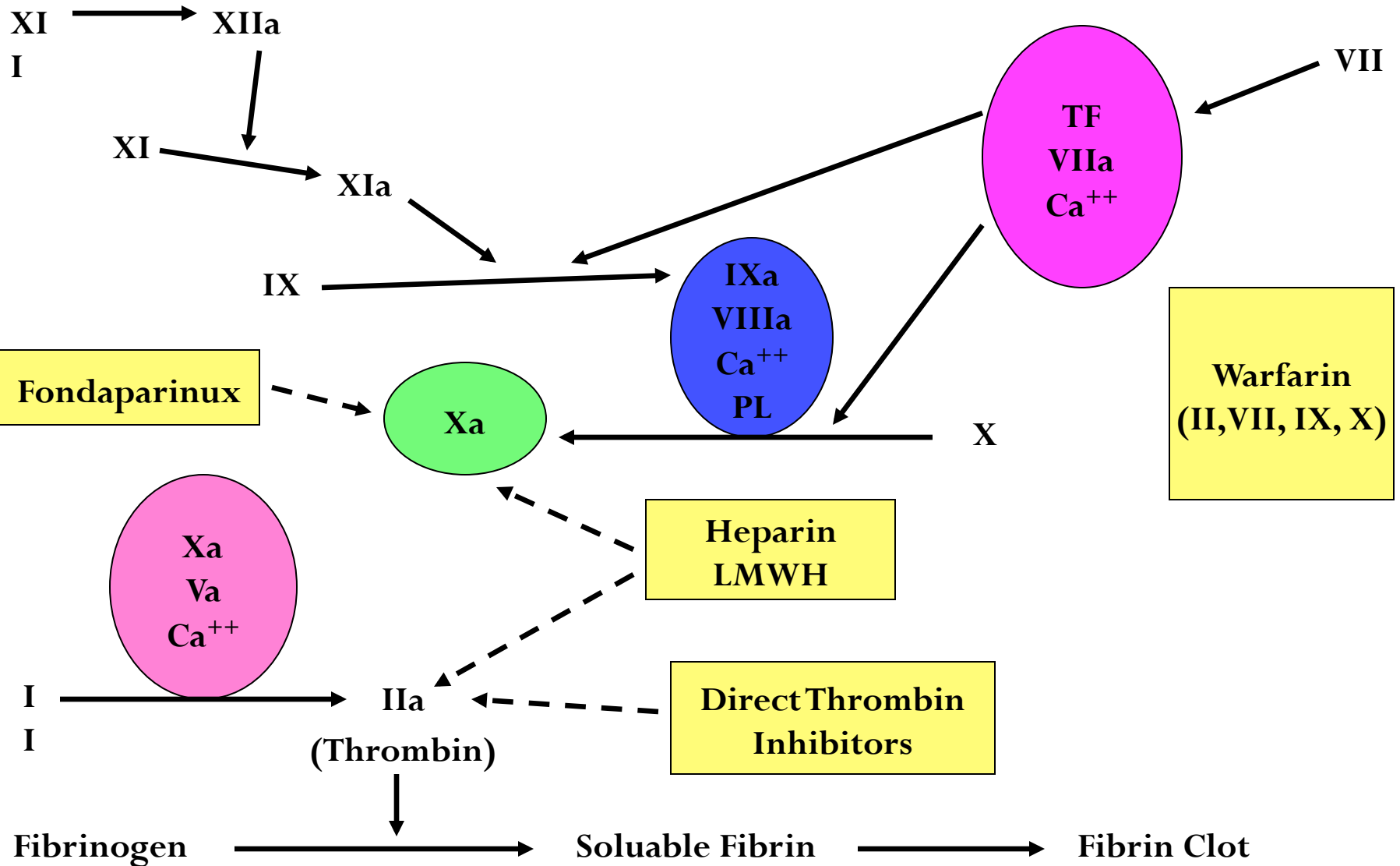
- Amount
- Functional
- Clinical

- How low?
 - 10,000?
 - 50,000?
 - 100,000?

Coagulation Cascade

Intrinsic System

Extrinsic System



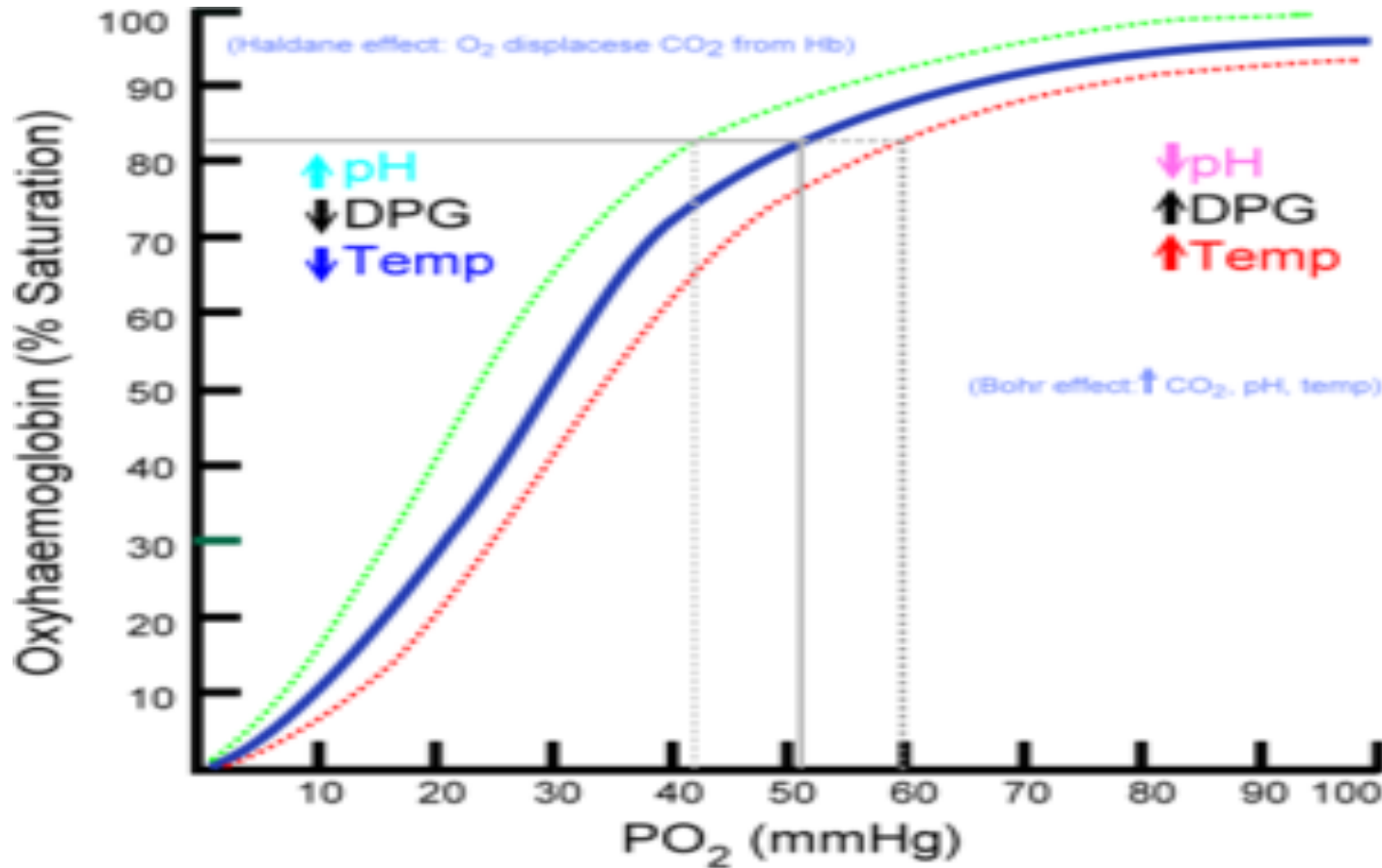
Case #2

- 25yo man presents with penetrating trauma to right arm. Actively bleeding. HR 130 beats per minute. BP 95/49 mmHG.

Hemoglobin

- Oxygen transport
- CO₂ transport
- Buffer system

Hemoglobin-Oxygen Dissociation



Case #2

- Temperature
- pH
- Adequate Factors/Platlets
- Calcium
- Arterial Oxygen Content

Arterial Oxygen Content

Bound Oxygen

- $1.39(\text{Hgb})\text{SaO}_2$
- Majority of oxygen in blood

Dissolved Oxygen

- 0.003PaO_2
- Fraction of oxygen in blood

Reasonable Hemoglobin

$$\text{CaO}_2 = 1.39 \text{ Hgb SaO}_2 + 0.003 \text{ PaO}_2$$
$$1.39 (10) 100\% + 0.003 (150) =$$

- Bound O₂ = 13.9
- Total Oxygen
 $13.9 + 0.45 = 14.35$
- Dissolved O₂ = 0.45
- $0.45 / 13.9 = 0.032$

Reduced Hemoglobin

$$CaO_2 = 1.39 \text{ Hgb SaO}_2 + 0.003 \text{ PaO}_2$$

$$1.39 (5) 100\% + 0.003 (150) =$$

- Bound O₂ = 6.95

- Total O₂ = 6.95 + 0.45 = 7.4

- Fraction of Dissolved Oxygen

$$0.45 / 6.9 = 0.06$$

- Dissolved O₂ = 0.45

Reduced Oxygen Saturation

$$\begin{aligned} \text{CaO}_2 &= 1.39 \text{ Hgb SaO}_2 + 0.003 \text{ PaO}_2 \\ 1.39 (5) \mathbf{85\%} + 0.003 (50) &= 5.9 + 0.15 \end{aligned}$$

- Bound Oxygen = 5.9
- Total Oxygen = 6.05
- Dissolved Oxygen = 0.15
- Fraction of Dissolved O₂
 $0.15 / 5.9 = .02$

Oxygen Content

Hgb 10

- Bound O₂ = 13.9
- Dissolved O₂ = 0.45
- Fraction of dissolved O₂
- 0.32

Hgb 5

- Bound O₂ = 6.9
- Dissolved O₂ = 0.45
- Fraction of dissolved O₂
- 0.6

Blood Loss

- Estimate blood volume
- Estimate RBCV at the appropriate Hemoglobin
- Calculate difference

Blood Volume

- Neonates
 - premature 95mL/kg
 - full-term 85mL/kg
- Infants 80mL/kg
- Adults
 - Men 75mL/kg
 - Women 65mL/kg

Blood Loss

- 85kg woman has a pre-operative hematocrit of 35%. How much blood loss will decrease her hematocrit to 30%?
- Estimate blood volume:
 - $-65\text{mL/kg} \times 85\text{kg} = 5525\text{mL}$
- Red Blood Cell Volume at appropriate hematocrits
 - RBCV35% = 1934 mL
 - RBCV30% = 1658 mL
 - Difference is 276mL
 - Multiple by 3 to get Allowable blood loss (828 mL)

Questions?