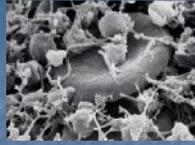
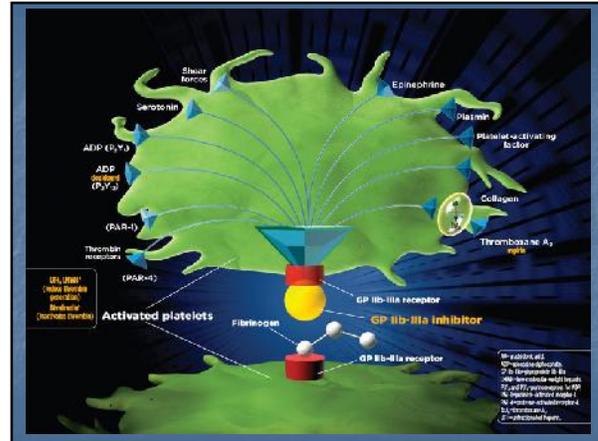


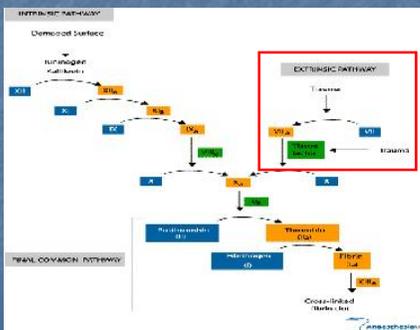
Platelets



- Vessel wall damage exposes collagen under the endothelium
 - Tissue Factor (III) is exposed with this damage, changes shape, and sensitizes platelets⁴
- A sensitized platelet morphs from a smooth, rounded shape into an irregular, tentacled coagulation factory.



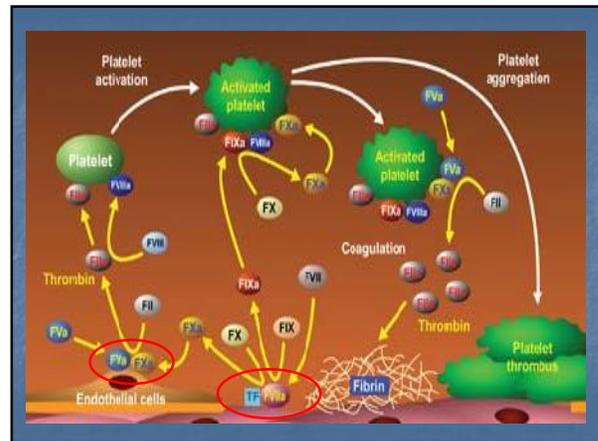
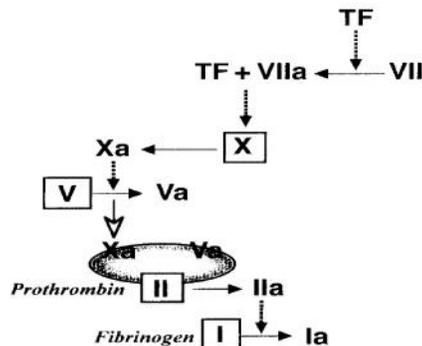
The Classical View



Extrinsic Pathway

- Also called the Tissue Factor Pathway
- Circulating FVII contacts the exposed Tissue Factor (III) from the damaged endothelium
- FVIIa activates FX, known as "tenase"
 - FX then combines with FV
 - FXa + FVa = Mom & Pop thrombin production, aka "prothrombinase"²
 - Soon to be bought out by a Big Box platelet producer

The Classical Extrinsic Pathway



Late Coagulopathy

- More familiar version associated with dilution
- Massive bleeding
 - One blood volume in less than 24 hrs.
 - Loss of half of blood volume in three hours
- Blood product administration is hazardous
 - Increased mortality
 - Major adverse cardiac and noncardiac outcomes⁶

Task Force for Advanced Bleeding Care in Trauma⁷

- Convened in 2005 to 2006
- A group of European professional societies
- Critical survey of published literature with consensus agreement among the societies
- Formulated recommendations based on their findings...

Targeted Blood Pressure (2C)

- SBP of 80 to 100 mm Hg
 - Until major bleeding stopped in patients without brain injury
 - MAP of 80 mmHg recommended in TBI
- Increased blood pressure associated with increased hydrostatic pressure⁷

Fluid Management (2C)

- Suggest crystalloids initially
- Colloids within prescribed limits
 - Studies are equivocal but suggest limits of 30 cc/kg
- 3% Saline better than NS in increased ICP

Management of Bleeding, and Coagulation (1C)

- Target Hgb 7 to 9 g/dl
 - Rheological effect of RBC's may marginalize the platelets in the vessel
- FFP for coags > 1.5 times control
 - Dosed 10 to 15 cc/kg
 - Problems include overload, ABO, TRALI
- Platelets to maintain platelet count > 50K
 - A 4 to 8 pool or one apheresis pack

Packed Red Blood Cells

- Preserved in CPDA or "Additive Solution"
 - CPDA: Hct 70-75%, TV 275 ml, 35 day shelf life
 - Additive: Hct 60%, TV 350 ml, less citrate, 42 day shelf life, 75% fewer microaggregates
- One unit raises hgb 1g/dl and hct 3%
- With known ABO and Rh alone in naïve pt.
 - 99.8% likelihood of a compatible transfusion¹¹

Fresh Frozen Plasma

- One unit is the plasma from one donated unit of whole blood
 - contains preservative: CPDA or AS
 - Frozen quickly to preserve FV and FVIII
 - Must be ABO compatible, Rh not a factor
- Dosing is 10 to 15 cc/kg, usually 4 units to replenish clotting factors adequately¹¹
 - 1 unit of FFP increases most factors ~2.5%

Platelets

- Dose is 1 unit/10 kg of body weight
 - Generally a 6 pool of platelets
- Raises the platelet count 5 to 10 K/mcl
- Four hour expiration
- ABO compatibility not as critical
 - Very few RBC's and about 60 cc's of plasma in platelet pools¹¹

Cryoprecipitate

- A precipitate that remains when FFP is thawed slowly at 4° C.
 - One unit cryo is the yield from one unit of FFP
 - No ABO compatibility issues
- Concentrated source of FVIII, vWF, FXIII, fibronectin and fibrinogen¹¹
- Hypofibrinogenemia is less than 100 mg/dl
 - 6 pack of cryo raises fibrinogen by 45 mg/dl

Transfusion Ratios

- Low ratio is FFP to PRBC less than 1:4
- Medium ratio is FFP to PRBC 1:4 to 1:2
- High ratio is greater than 1 unit of FFP for every 2 units of PRBC
 - Has shown decreased rates of complication in massive transfusions after combat injuries
- FFP to PRBC to Platelet of 1:1:1 with minimal crystalloid resuscitation

Transfusion Practices

- Transfusion with all components of whole blood in preserved form does not produce a whole blood equivalent
 - 1FFP+1PRBC+1PLT = Hct of 29%
 - Total volume of 660cc, platelets of 88K, and coagulation activity 65% of whole blood
- Whole blood Hct is 38 to 50%, Plts 150 to 400K, and 100% of coag factors³

Tranexamic Acid:

the solution to fibrinolysis

- Studies on surgical patients have used wide ranges of dosing
 - Loading doses: 2.5 to 100 mg/kg
 - Infusion doses: 0.25 to 4 mg/kg/hr
- No benefit between high and low dosing
 - Bolus of 10 mg/kg and infusion of 1 mg/kg/hr provides sufficient plasma levels for antifibrinolysis⁸

CRASH-2

- Randomized over 20,000 trauma patients
 - 274 hospitals in 40 countries
 - First patient enrolled in May, 2005
- Bolused with TA 1 gm over 10 mins and infused with TA 1 gm over 8 hours.
- TA reduces the risk of death from hemorrhage
 - No apparent increase in fatal or nonfatal vascular occlusive events
 - All-cause mortality was significantly reduced with tranexamic acid⁹

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