Consumptive coagulopathy: More than blood replacement

Dorit Blickstein, MD
Obstetrics is a bloody business

Williams Obstetrics, 16th to 23rd editions
Causes of maternal death

- Thromboembolism
- Pre-eclampsia
- Sepsis
- Obstetric hemorrhage - mortality
  - morbidity
Maternal mortality:

~500,000 /year across the world

~25% - post partum hemorrhage (PPH)
Maternal mortality from obstetrical hemorrhage:

Developing countries: 1:1,000 deliveries
Developed countries: 1:100,000 deliveries
Maternal mortality:

Rapid and appropriate intervention can make a great difference...
Complications of major blood loss

- Hypovolemic shock
- Consumptive thrombohemorrhagic disorder
- Renal failure
- Hepatic failure
- Adult respiratory distress syndrome (ARDS)
<table>
<thead>
<tr>
<th>Blood loss</th>
<th>Class</th>
<th>Clinical picture</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;15%</td>
<td>I</td>
<td>Minimal change in pulse &amp; blood pressure</td>
</tr>
<tr>
<td>15-30%</td>
<td>II</td>
<td>Tachycardia, tachypnea</td>
</tr>
<tr>
<td>30-40%</td>
<td>III</td>
<td>Cardiovascular instability &amp; clouded sensorium</td>
</tr>
<tr>
<td>&gt;40%</td>
<td>IV</td>
<td>Life threatening</td>
</tr>
</tbody>
</table>
Definitions:

PPH

Bleeding of $\geq 500$ ml in the first 24 h postpartum

Severe PPH

Bleeding of $\geq 1,000$ ml following delivery

1-5% of deliveries
## Causes of PPH

<table>
<thead>
<tr>
<th>Causes</th>
<th>Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morbid adhesion of placenta (placenta accreta)</td>
<td>Previous PPH</td>
</tr>
<tr>
<td>Uterine atony</td>
<td>Multiparity</td>
</tr>
<tr>
<td>Retained placenta</td>
<td>Preeclampsia</td>
</tr>
<tr>
<td>Lower genital tract laceration</td>
<td>Anemia at 24-29w and before delivery</td>
</tr>
<tr>
<td>Uterine rupture</td>
<td>Low income</td>
</tr>
<tr>
<td>Coagulopathy</td>
<td>Ethnicity</td>
</tr>
<tr>
<td>Previous cesarean section</td>
<td>Uterine inversion</td>
</tr>
</tbody>
</table>
Risk factors for postpartum hemorrhage

- Nulliparity
- Obesity
- A large baby
- Multiple pregnancies
- Prolonged labor
- Prolonged third stage
- Antepartum hemorrhage
- Previous postpartum hemorrhage
- Operative deliveries, emergency cesarean section
Prophylactic measures

Active management of the third stage of labor
Recognition and treatment of coagulation disorders
Estimation of blood loss
Early involvement of hematologist and anesthesiologist
Identification of patients who refuse blood transfusion - prepare a substitute
Blood loss

Usually underestimated
Patients at risk for PPH: prophylactic measures

IV access

Cross matched blood

Active management of third stage of labor

Uterotonics
Management of PPH

Multidisciplinary approach

Rapid and good communication between specialists

Cornerstones of management

Resuscitation

Arrest of bleeding
Volume resuscitation

2 IV accesses, initial laboratory tests

Restoration of blood volume by rapid replacement with crystalloids

• Ringer’s lactate,
• Hartman’s solution,
• 0.9% saline

1,000 ml in each of 2 venous accesses

Volumes: X 3 estimated blood loss.
Volume resuscitation

No Dextrose

• Only 10% remains in circulation
• Negative effect on platelet function

No albumin

Central line - efficacy of volume replacement
Red cell transfusion

Acute/excessive blood loss
Hb < 8 g% leads to

• Disturbed hemostasis
• Low platelet adhesion
• Higher velocity

Early call to alert blood bank
Red cell transfusion

O Rh(-) if bleeding is torrential or no fully cross matched blood available after 3.5 L of fluid infusion

Fully cross matched blood

Target: Hb 7-10 g%

Filter 170-200 μ

High viscosity- dilute with 100 ml normal saline (no Ringer!)

Testing post transfusion Hb, serial Hb levels
Circulation

Volume dilution by blood & crystalloids

Loss of coagulation factors & plt

Consumptive thrombohemorrhagic disorder

“Consumption coagulopathy”

DIC
Consumptive thrombohemorrhagic disorder

Baseline hemostatic parameters:

• Platelets
• PT/PTT
• Fibrinogen
• D-Dimmer

Distinguish from hemodilution (very difficult)
Consumptive thrombohemorrhagic disorder

Empirically or “blind” transfusion:

**FFP** (near normal levels of pro- and anticoagulants)

- 2-4 FFP
- Additional 4 FFP after every 6 RBC units
- If PT and/or PTT x1.5 upper limit
Consumptive thrombohemorrhagic disorder

Empirically or “blind” transfusion:

Platelets to maintain level > 50,000/mm$^3$
Consumptive thrombohemorrhagic disorder

Empirically or “blind” transfusion:

Cryoprecipitate (10 bags of cryo=65-70 mg/dL fibrinogen)

If fibrinogen less than 100mg/dl
Consumptive thrombohemorrhagic disorder

Empirically or “blind” transfusion:

Prophylactic anticoagulation in massive transfusion
Hypothermia

Disturbs coagulation function → coagulopathy

Causes:

Wet clothing / no cloths

Hemorrhagic shock impairs perfusion and metabolic activity

Fluids and blood given in room temperature

Rx:

Blood warmer

Dry cloths
Metabolic alkalosis
Disturbs coagulation function → coagulopathy
Secondary to citric acid in RBC (pH 7.1)
Hypocalcemia

Some coagulation factors depend on Ca\(^{+2}\) → coagulopathy

Infusion of citrate

Treatment with calcium if low serum calcium
Hyperkalemia

Passive diffusion of potassium from RBC up to 1 mEq/L per day
Obstetrical/surgical treatment

Uterotonics
Tamponade of birth canal
Uterine suturing
Ligation of arteries
Selective arterial embolization
Hysterectomy
Medical treatment

IV Tranexamic acid 1gr X 3/12 h (controversial)
Recombinant activated F VII (Novo Nordisk)
Recombinant activated factor VII

Treatment of hemophilic patients with inhibitors

Off label

Non-hemophilic bleeding, unresponsive to conventional therapy, reducing exposure to allogenic blood.

In thrombocytopenia, bleeding due to hepatic failure, major surgery, trauma, life-threatening obstetric and gynecological hemorrhage.
Mechanism of action of rFVII

TF

VIIa/rFVIIa

Fibrin

Fibrinogen

Thrombin

Activated Platelet

rFVIIa

Xa

Va

Prothrombin
Function of rFVIIa

Linear increase in factor Xa independently of TF
Dose-response thrombin generation even in the absence of F VIII & F IX
Direct activation of F IX on activated platelets in the absence of TF
Localization to site of bleeding on activated platelets
Inhibition of fibrinolysis (TAFI)

Enhancement of thrombin generation on platelet surface
Formation of stable (fibrinolysis-resistant) fibrin clot
Use of rFVIIa in PPH

65 women treated up to 2007
All with known risk factors for PPH
10.8% had congenital bleeding disorders
9.2% DIC complication
46.1% underwent hysterectomy
Median dose of rFVIIa 72.9 µg/kg
73% a single dose of rFVIIa

Conclusion: rFVIIa controls bleeding in the majority of patients

Franchini & Franchi BJOG, Nov 2006
Caveats for the use of rFVIIa

- Off label use
- S/E: Thromboembolism
- Data: Uncontrolled studies
  Single case or small series (up to 12 patients)
- Effectiveness m/p over-estimated
- Appropriate dosage: unknown
- Cost: 1 Euro per microgram
  (>5000 Euros / 70 kg patient)
Bleeding patient

Call for help!

Resuscitation & Monitoring

Replacement of crystalloids, blood, and blood products

Correct hypothermia, $O_2$, pH, Ca, K

Obstetrical / surgical management
Thank you!

THE 9th WORLD CONGRESS ON
CONTROVERSIES IN OBSTETRICS
GYNECOLOGY & INFERTILITY

Thank you!