Massive Obstetric Hemorrhage
Trauma Blood Replacement Strategies
and Algorithms to Prevent the
“Lethal Triad” of Non-Survivors

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CDC’s Pregnancy Mortality Surveillance System

ACOG Practice Bulletin #76, Oct 2006

- “Although many risk factors have been associated with postpartum hemorrhage, it often occurs without warning.
- “All obstetric units and practitioners must have the facilities, personnel, and equipment in place to manage this emergency properly.”

Reported Errors in Management of Postpartum Hemorrhage

- Failure to accurately measure blood loss
- Delay in identifying hemorrhage
- Delay in ordering blood
- Delay in starting blood transfusions
- Delay in moving patient to an operating room
- Delay in getting assistance
- Delay in acquiring hemostasis
- Failure to identify and/or manage shock

Harvey, Dildy. (2012) Massive Postpartum Hemorrhage. (chpt.) in Troiano, Harvey, Chez, ...
Reported Errors in Management of Postpartum Hemorrhage

Collaboratively create clinical guidelines that “standardize” the circumstances under which an order or action are initiated.

Transfer of Patient to an OR: Algorithm

<table>
<thead>
<tr>
<th>Sign</th>
<th>Management</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient is bleeding after delivery; uterine atony</td>
<td>Bimanual compression (PCP), uterine massage, oxytocin (IV-diluted, or IM)</td>
<td>Monitor patient: VS every 15 minutes, delivery provider remains at BS, etc.</td>
</tr>
<tr>
<td>Bleeding continues</td>
<td>2nd line Uterotonic (any) ordered</td>
<td>Monitor patient, notify charge person, provider at BS.</td>
</tr>
<tr>
<td>Bleeding continues</td>
<td>3rd line Uterotonic (any) ordered, or – a second dose of the 2nd line uterotonic</td>
<td>Charge nurse notified, anesthesia notified, delivering MD or MD backup to BS, transfer patient to an OR.</td>
</tr>
</tbody>
</table>

Transfer of Patient to OR (cont’)

- More than one uterotonic (in addition to oxytocin) is employed, or more than one dose of a uterotonic is administered;
- Retractors or assistance is required to visualize the vagina;
- Blood products become necessary (excluding blood transfusions for the sole purpose of increase H&H in a stable patient); or
- Hemodynamic instability (tachycardia or hypotension unrelated to epidural analgesia/ anesthe sia).

Evidence-based MTP and Guidelines/Protocols

Management of OB Hemorrhage

http://www.cmqcc.org/ob_hemorrhage
Measuring Blood Loss

- Visual estimation
- Indirect measurement
- Direct measurement

Visual comparisons: Lap sponges

- 18 x 18 inch dry lap sponge
- Mini Lap 4 in. x 18 in.
  - 25 ml
  - 50 ml
  - 75 ml
  - 100 ml
What is the most accurate method to determine estimated blood loss at delivery, c-section or surgery?

The Answer:
- Weigh all linen, waste
- Measure amounts in containers
- Subtract out estimates for amniotic fluid, irrigation, urine
- Record total

New Guidelines for Blood Transfusions
Hemorrhage Research in Afghanistan and Iraq

- Coagulopathy present on admission in severe injuries (10 – 25%)
- Most mortality from this group
- Early coagulopathy WITHOUT hemodilution; prior to hypothermia and/or acidosis
- Evidence of cell based vs. strict coagulation cascade for hemostasis

Dawes, 2009

Hemorrhage resuscitation: What’s New -

- Crystaloids (avoid colloids ?)
- Early transfusion of FFP
- Early transfusion of PRBC
- Early transfusion of platelets
- Ratio: FFP:PRBC:PLT = 1:1:1 (or near 1:1:1)
- Early prevent/ID/tx “Deadly Triad”

U.S. Civilian Trauma Centers Review

- 16 centers, 467 patients
- Excluded deaths within 30 min
- 4 groups based on 1:2 ratio cut-off of plasma or plt to RBCs:
  - 24-hr Survival
  - High plasma, high platelets 87%
  - High plasma, low platelets 86%
  - Low plasma, high platelets 83%
  - Low plasma, low platelets 58%


OB Hemorrhage Pack

MTP Example 1
Per Cooler:
- 8 PRBC
- 8 FFP
- 3 platelet apheresis (~35K - 50K in each)
- 2 adult dose cryo bags (~40-20 units)

MTP Example 2
Per Cooler:
- 6 PRBC
- 6 FFP
- 6 platelet units; or
- 1-2 apheresis (~35K - 50K in each)
- 1 adult dose cryoprecipitate (~7 – 10 units)

Trauma Exsanguination Protocol (MTP) and Mortality

Cotton, 2008
Predefined Massive Transfusion Protocols are Associated With a Reduction in Organ Failure and Postinjury Complications

- Institution’s TEP associated with:
  - Reduction in multiorgan failure
  - Reduction in infectious complications
  - Increase in ventilator-free days
  - Reduction of abdominal compartment syndrome

“Fresh” PRBCs compared to longer stored PRBCs decrease mortality in massive transfusion of trauma patients


Age of PRBC: Time from donation to transfusion

- Large retrospective analysis of blood usage in trauma centre
- Patients that required more than 5 units of blood
- Pts transfused > 3 units of PRBC
- If older than 14 days - doubled mortality

Transfuse ‘newest’ blood products


“Lethal Triad” of Massive Hemorrhage and Transfusion

1. Hypothermia
2. Acidosis
3. Coagulopathy

When Triad Present: >65% MORTALITY

Dawes, 2009

“Lethal Triad” of Massive Hemorrhage

- Perpetuating combination of acute coagulopathy, hypothermia, and acidosis seen in exsanguinating trauma patients.

- Hypo-perfusion leads to:
  - decreased oxygen delivery, a
  - switch to anaerobic metabolism,
  - lactate production, and
  - metabolic acidosis

Dawes, 2009
Perioperative Hypothermia (PH)

- The U.S. Center for Disease Control and Prevention (CDC) identified hypothermia as the cause of approx. 600 deaths in the U.S. (Holtzclaw, 2008, p. 1)

- A drop in temperature of 2 degrees Celsius increases blood loss by approx. 500 milliliters. (AORN, 2007, p. 972, 979)

- One study identified the incidence of culture-positive surgical site infections in patients with mild PH was 3 times higher than normothermic perioperative patients (Kurz & Sessler, 1996, p. 1214)

Active Patient Warming Devices

Internal Active Patient Warming/Cooling

PPH: Success rates of interventions prior to hysterectomy

- Less Invasive Procedures for Treatment of Massive Hemorrhage Secondary to Uterine Atony

- NICE clinical guideline #65
  Implementing NICE guidance
  2nd edition August 2011
Intrauterine Tamponade Balloon Catheters

Bakri BT Cath
ebb

# FDA Approved Catheters: 3

Intrauterine Tamponade Balloon Catheters – Maximum Fill Volumes

Bakri 500 mL
B-T Cath 500 mL
ebb Uterine balloon: 750 mL

Relative Size with 1,000 mL IV bag

Bakri BT-Cath ebb

Interventional Radiology


Adjuncts to Transfusion

- Concentrated fibrinogen
- Activated Recombinant Factor VII (rFVIIa)
- Antifibinolytics (tranexamic acid)

Recombinant Activated Factor VII:

FDA OFF-LABEL

NovoNordisk - NovoSeven® 2013 Update
Classic Steps- Clotting Cascade

[Diagram showing the clotting cascade with blood vessel trauma and extraneous trauma]

Recombinant Activated FVII?

- FDA approved for hemophiliacs to treat active bleeding
- FDA Off-label use as a universal hemostatic agent in various settings of massive blood transfusion

Warnings

Antifibrinolytics

World Maternal Antifibrinolytic Trial (WOMAN)

- Investigators: London School of Hygiene and Tropical Medicine have begun enrolling patients.
- Goal: measure outcomes of women who are given an antifibrinolytic (tranexamic acid) during PPH.
- Recruitment goal: 15,000 women who hemorrhage after delivery.
- Randomized to either tranexamic acid or placebo.
- Follow-up: to 42 days after delivery.
- Completion of the study is scheduled for 2015.

Use in PPH is FDA OFF-LABEL!

Antifibrinolytics

AWHONN in Leadership Role

- Improve Recognition
- Improve Readiness
- Improve Response

Summary and Conclusions
Thank you, for your time and attention.

Carol J Harvey