Chelly’s Story

- 22 years old G2P1 previous c-section.
- 28 weeks she was noted to have a placenta previa with “coagulated blood vessels.”
- Plan was for routine care with elective delivery at 36 weeks.
- 33 weeks presented with vaginal bleeding.
- VS: 75/35, HR=120, RR=18, AF
- She had CBC and type and cross for 2 units of PRBCs.
- Female infant; 2035 gms Apgars 8/9 was delivered.
- With manual delivery of placental pieces.
- Vital signs in OR: 80/40, RR=130s, “relatively unchanged” so given 1 unit of PRBCs for the EBL of 850cc.

Case: Intrapartum

- She continued to bleed post-delivery in the RR with vital signs 70/30 HR=135 feeling weak and looking “pale”
- Taken back the OR for hysterecmy.
- In OR she underwent hysterecmy with continued bleeding from surgical sites and received a total of 8 units of PRBCs.
- Developed ventricular tachycardia followed by PEA.
- She was unsuccessfully coded for 30 minutes later and subsequently pronounced dead.
- Pathology showed placenta accreta

Critical Pathway to Poor Outcome

- Maternal Death
- Near Miss - ICU Admission
- Serious Morbidity
- Symptoms Not Recognized
- Assumption Symptoms Are Not
- Significant
- Delayed Diagnosis
- Delayed Treatment

California PMAR – Healthcare Providers
DENIAL: Recognition of amount of blood loss
DELAY: Administration of blood products
DELAY: Mobilization of equipment.
DELAY: Waiting for cross-matched blood.
DELAY: Getting products from the blood bank
DELAY: Administering additional blood and blood products (i.e. FFP, platelets, and cryoprecipitate)

Not Alone!

Atony ➔ still #1
Lacerations
Abnormal placentation ➔ increasing
Retained products of conception
Abruption with atony and/or DIC
Amniotic fluid embolism

Obstetric hemorrhage V. Trauma

1. Postpartum atony
2. Birth canal trauma
3. Retained POC
4. Placenta previa / accreta
5. Placenta abruption
6. Amniotic fluid embolism

OB Hemorrhage V. Trauma

Trauma
Not Trauma

Etiologies of Hemorrhage

- Atony ➔ still #1
- Lacerations
- Abnormal placentation ➔ increasing
- Retained products of conception
- Abruption with atony and/or DIC
- Amniotic fluid embolism

Our Journey

- Hospital administration requested recommendations
- M&M to discuss hemorrhage Dx and Rx
- Develop a comprehensive maternal hemorrhage protocol
**Our Approach**

- Hospital administration requested recommendations
- M&M to discuss hemorrhage Dx and Rx
- Develop a comprehensive maternal hemorrhage protocol

**Timeline**

- January 2008: maternal death
- July 2008: M&M
- Nov '08 Jan '09: weekly meetings and protocol development
- Feb-Apr '09: "education phase"
- May '09: implemented "protocol"
- Monitored details of cases, blood use, hysterectomy, and compliance
- July 2010 analysis of program

**Key Elements of OB Hemorrhage Protocol**

1. **Help**: reassigns personnel as needed to treat patient changing status of patient.
2. **Eliminate barriers** to rapid transfusion of all components necessary for treatment.
3. **Facilitate access** to all items needed (equipment & supplies).
4. **Resuscitation** based on current and expected future loss.
5. **Prevention of DIC**
6. Protocol should be viewed "code"
7. All 'exposed' **education** regarding goals and role
8. All cases (stage 2-3) reviewed

**Planned Interventions**

- **Risk assessment:**
  - At Admission
  - Staged Response
- **Avoid delay:**
  - Limit Continued Rx
  - Ordered Early
- **Medical therapy:**
  - Use of OB Hemorrhage Pack & Guidelines for use

**Admission Hemorrhage Risk Assessment**

<table>
<thead>
<tr>
<th>Low Risk (Clot to Hold)</th>
<th>Medium Risk (Type and Screen)</th>
<th>High Risk (Cross x 2 units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unclear uterus</td>
<td>Hx of PPH</td>
<td>Previa / Acranela</td>
</tr>
<tr>
<td>No Hx of PPH</td>
<td>Prior CS or uterine surg.</td>
<td>Hct &lt; 30 + other risk</td>
</tr>
<tr>
<td>≤ 4 previous vag. Del.</td>
<td>&gt; 4 previous vag. Del.</td>
<td>Bleeding on Admit</td>
</tr>
<tr>
<td>No bleeding disorder</td>
<td>Multiple Gest.</td>
<td>Coagulation defect</td>
</tr>
<tr>
<td>Singleton</td>
<td>Lg. uterine fibroids</td>
<td>Platelets &lt; 100,000</td>
</tr>
<tr>
<td></td>
<td>Chorioamnionitis</td>
<td>Bleeding on admit + Symptoms – Stage 3</td>
</tr>
<tr>
<td></td>
<td>Mag. Sulfate use</td>
<td></td>
</tr>
</tbody>
</table>

**Admission Hemorrhage Risk Assessment**

<table>
<thead>
<tr>
<th>Low Risk (Clot to Hold)</th>
<th>Medium Risk (Type and Screen)</th>
<th>High Risk (Cross x 2 units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unclear uterus</td>
<td>Hx of PPH</td>
<td>Previa / Acranela</td>
</tr>
<tr>
<td>No Hx of PPH</td>
<td>Prior CS or uterine surg.</td>
<td>Hct &lt; 30 + other risk</td>
</tr>
<tr>
<td>≤ 4 previous vag. Del.</td>
<td>&gt; 4 previous vag. Del.</td>
<td>Bleeding on Admit</td>
</tr>
<tr>
<td>No bleeding disorder</td>
<td>Multiple Gest.</td>
<td>Coagulation defect</td>
</tr>
<tr>
<td>Singleton</td>
<td>Lg. uterine fibroids</td>
<td>Platelets &lt; 100,000</td>
</tr>
<tr>
<td></td>
<td>Chorioamnionitis</td>
<td>Bleeding on admit + Symptoms – Stage 3</td>
</tr>
<tr>
<td></td>
<td>Mag. Sulfate use</td>
<td></td>
</tr>
</tbody>
</table>
Quantified Blood Loss (qEBL)

- Weigh Blood Loss (1 Gram=1ml)
- Limitations of Estimated AF contribution
  (nl=700, Oligo=300, Poly=1400)
- CS drain drape after delivery
- Use of Calibrated under-buttocks drapes

Physiologic Goals

- Maintain dBP ≥ 45 mm Hg and sBP ≥ 85mm Hg.
- Receive and use of appropriate blood products
- Hct ≥ 24%
- Fibrinogen > 100 mg/dL
- INR <1.4
- Platelets >50,000/uL
- Maintain pH > 7.2, Base Excess > -5.
- Temperature > 95° F

Hemorrhage → DIC → SMM → Death

- Blood loss → Hypoxia
- Hypoxia → Tissue acidosis
- Tissue Acidosis → Reduced coagulation
- Volume replacement → Dilution → Reduced coagulation
- Hypothermia → Reduced coagulation
- Citrate → hypocalcemia → Reduced coagulation
- ALL INCREASE RISK / VOL of HEMORRHAGE
- Early Intervention and blood product Replacement

OB Hemorrhage Protocol

- All patients at all times are in one of the stages.
- Care is divided into 5 Stages:
  0: Normal intra- and postpartum course
  1: Bleeding greater than expected
  2: Requiring more than two uterotonic agents in addition to oxytocin and not responding usual measures
  3: Blood loss > 1500 cc OR abnormal vital signs
  4: Recovery
Stage 0
Normal Postpartum Course

- Normal Delivery
  - Vaginal EBL ≤ 500ml
  - C/S EBL ≤ 1000ml
  - VS Stable
  
  Standard PP Management
  - Fundal Massage
  - Uterotonic 3rd stage
  - Routine recovery

- Not Normal Delivery
  - Vaginal EBL > 500ml
  - C/S EBL > 1000ml
  - HR > 100

  - BP ≤ 85/45
  - O2 Sat ≤ 94%
  - Clinical Symptoms (SOB, confusion, agitation)

  Move to Stage 1

Move to Stage 1

Stage 1
MATERNAL BLOOD LOSS EXCEEDS THAT EXPECTED FOR ROUTINE VAGINAL OR CESAREAN DELIVERY

"Increased Surveillance"

Stage 1
Vaginal Delivery
EBL > 500ml

- Call for RN assist
- Weigh Blood Loss
- Increase IV rate
- Increase oxytocin rate
- VS Q 5 minutes

- O2 via mask
- Pulse Ox
- Uterine Massage
- Uterotonic
- Empty Bladder

- Notify MD/SBAR

Stage 1
C-Section
EBL >1000ml

- Methergine 0.2 mg IM
- Hemabate 250 mcg IM
- Cytotec 800-1000 mcg

- Bleeding Controlled
- Continued Bleeding
- Move to Stage 2

Secondary Goals:
Increase Manpower
Increase Monitoring
Increase Supplies and Equipment
MD assessment

Stage 2
Bleeding Not Controlled by Routine Methods

Primary Goals:
Increase Manpower
Increase Monitoring
Increase Supplies and Equipment
MD assessment

Anesthesia Sets the Stage

BP: 70/40 HR: 140 EBL 1,500 cc or
BP: 100/60 HR: 100 EBL 1,000 cc

Setting Up Stage 2

- C-section:
  - Early lab and equipment response
  - Early conservative interventions (compression sutures or Balloon)
- Vaginal Delivery:
  - MDs to bedside
  - Limits repeated medical therapy
  - Early conservative interventions (balloon, laceration repair, check for retained products)
**Stage 2**

**Vaginal Delivery**

- Notify shift leader of EBL
- Continue assessment:
  - EBL
  - VS Q 5 minutes
  - O2 and pulse ox
  - Fluid maintenance
  - Pitocin infusion continued

- Start 2nd IV line
- Bedside Fibrinogen - Ob in 30 min for clot

- DIC panel
- Bedside Fibrinogen
- Ck in 10 min for clot

- Insert Foley/urometer
- OB & Anesthesiology to bedside
- Hemorrhage cart to patient room

- DIC panel every 30 min.

- Uterine Massage

**Stage 2 C-Section**

- Notify shift leader
- Hemorrhage cart to OR
- Rapid Infuser & Blood Warmer to OR

- DIC Panel:
  - CBC, Plts, PT, PTT, Fibrinogen

- Uterine Massage
- Uterine packing / Bakri balloon.

**Stage 3**

**Activated When:**

- EBL ≥ 1,500 cc **OR**
- Coagulopathy Present or Suspected **OR**
- Vital Signs: HR>110, BP<85/45, O₂ sat<95%

**Activated by:**

- Nursing, Obstetrics, Anesthesia

**Primary Goals:**

- Increase Manpower
- Activate Blood Bank
- More Aggressive Intervention

**Stage 3 Activation**

- EBL ≥ 1,500 cc, Coagulopathy, In Uterine

**“Her Vitals Look Ok”**

DEGREES OF BLOOD LOSS

<table>
<thead>
<tr>
<th>Volume Estimate</th>
<th>Percent</th>
<th>Type of Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>500 ml or &gt;1000</td>
<td>10-15%</td>
<td>compensated ± HR, ↓PP</td>
</tr>
<tr>
<td>1000-1500 ml</td>
<td>15-25%</td>
<td>Mild: ↑HR, ↓PP →BP</td>
</tr>
<tr>
<td>1500-2000 ml</td>
<td>25-35%</td>
<td>moderate ↑HR ↓BP</td>
</tr>
<tr>
<td>2000-3000 ml</td>
<td>35-50%</td>
<td>Severe ↑HR ↓BP</td>
</tr>
</tbody>
</table>

**Why Not Just RBCs**

Mortality from combat wounds

<table>
<thead>
<tr>
<th>Fibrinogen/RBC</th>
<th>Plasma/RBC</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 vs. 65%</td>
<td>44 vs. 85%</td>
</tr>
</tbody>
</table>

Bonnar Bailler Clin OG 2000

Stringer 2008 Trauma 64:79-85
Borgman Trauma 2007 63:805
Getting Blood Quickly: “Mat Pack”

- 3 units pRBCs: (Crossed or Uncrossed O neg.)
- 2 units FFP
- 1 Platelets (Jumbo Platelet Pack)
- 5-10 Cryo (suspected abruption or AFE)
- Ratio of RBC:FFP = 3:2.
- After 6 pRBC and 4 FFP ratio → of RBC:FFP = 1:1

Recommended Product: Release /Use

<table>
<thead>
<tr>
<th>Reference</th>
<th>RBCs</th>
<th>FFP</th>
<th>Platelets</th>
<th>Cryo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dignity Health</td>
<td>3 units</td>
<td>2 units</td>
<td>1 unit</td>
<td>5-10 units*</td>
</tr>
<tr>
<td>CMQCC</td>
<td>6 units</td>
<td>4 units</td>
<td>1 unit</td>
<td></td>
</tr>
<tr>
<td>WA state</td>
<td>6 units</td>
<td>4 units</td>
<td>1 unit</td>
<td>10 units</td>
</tr>
<tr>
<td>Stanford</td>
<td>6 units</td>
<td>4 units</td>
<td>1 unit</td>
<td>10 units</td>
</tr>
<tr>
<td>USC</td>
<td>6 units</td>
<td>4 units</td>
<td>1 unit</td>
<td>10 units</td>
</tr>
<tr>
<td>PMC</td>
<td>2 units (+)</td>
<td>6 units</td>
<td>1 unit</td>
<td>10 units</td>
</tr>
</tbody>
</table>

Indicated
- Hct = 20-23
- INR >1.5
- < 50,000 Fibrinogen <100

Modified Postpartum Care

Stage 4

- Site of Care: Labor and Delivery
- Vital signs: Q 15 min x 1.5 hrs, Q 30 min x 1.5 hrs, Hourly x 2
- Labs: CBC and DIC panel at 1 and 4 hours
  - Hct > 20%, VS stable, no bleeding, UO > 50cc/hr
  - Observe for 24 hours
  - Hct > 20% but HR>110, BP<90/60, No bleeding, nl Coag.
  - Give 1-2 units pRBC
  - Observe for 24 hours
  - DIC panel abnormal → treat according to Stage 3

Ob Hemorrhage Resources

All facilities
October 2010

Dignity Health Facilities

29 Hospitals with OB services
680 Obstetrical Providers
1600 OB nurses
60,000 deliveries

SMFM PAPERS

Comprehensive maternal hemorrhage protocols improve patient safety and reduce utilization of blood products

Lower stage at resolution of hemorrhage
Reduced utilization of blood products
Reduced DIC
Improved staff and physician perception of patient safety

Key words: comprehensive, maternal hemorrhage, patient safety, protocol

System-wide Assessment

- Recommendations for implementation marginally done
- System-wide goal
- Presented at Annual Perinatal meeting Oct 2012
- Collection of baseline data Nov-Dec 2011 (1 year later)
- Hospital site visits and web based education
- Part of other "evidence based practice bundles"
- Data assessment at April-June and Sept-Oct 2012
- Data collected by OB perinatal safety nurse

How is your hospital monitored?

- Monthly audit (5 charts and all stage 2/3):
  - Hemorrhage risk assessment
  - Correct blood request requested by on risk
  - Qualitative blood loss calculated
  - Correct labs obtained for stage 2 and 3
  - Blood products administered according to protocol
  - Was more than 2 uterotonics given without the MD present

- Additional Information
  - Was the patient sent to the IUC
  - How many blood products are administered and which ones
  - How many stage 1, 2, 3 hemorrhages occurred

Marching Forward

<table>
<thead>
<tr>
<th>Evidence Based Practice</th>
<th>Goal</th>
<th>CY14</th>
<th>CY15</th>
<th>CYF2016</th>
<th>CYF2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyperbilirubinemia</td>
<td>90%</td>
<td>93%</td>
<td>95%</td>
<td>95%</td>
<td>93.9%</td>
</tr>
<tr>
<td>Dystocia Management</td>
<td>90%</td>
<td>92%</td>
<td>93%</td>
<td>91%</td>
<td>89.4%</td>
</tr>
<tr>
<td>Operative Vaginal Deliveries</td>
<td>90%</td>
<td>94%</td>
<td>96%</td>
<td>96%</td>
<td>93.3%</td>
</tr>
<tr>
<td>Shoulder Dystocia</td>
<td>90%</td>
<td>92%</td>
<td>94%</td>
<td>93%</td>
<td>87.2%</td>
</tr>
<tr>
<td>Obstetrical Hemorrhage</td>
<td>90%</td>
<td>93%</td>
<td>93%</td>
<td>93%</td>
<td>93.8%</td>
</tr>
</tbody>
</table>

How is your hospital monitored?

- Monthly audit (5 charts and all stage 2/3):
  - Hemorrhage risk assessment
  - Correct blood request requested by on risk
  - Qualitative blood loss calculated
  - Correct labs obtained for stage 2 and 3
  - Blood products administered according to protocol
  - Was more than 2 uterotonics given without the MD present

- Additional Information
  - Was the patient sent to the IUC
  - How many blood products are administered and which ones
  - How many stage 1, 2, 3 hemorrhages occurred

System Level Evaluation

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Time 1</th>
<th>Time 2</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deliveries (1,000)</td>
<td>10,433</td>
<td>10,497</td>
<td>11,169</td>
<td>(+) 7%</td>
</tr>
<tr>
<td>Stage 2 /1,000</td>
<td>7.01</td>
<td>9.47</td>
<td>9.58</td>
<td>(+) 17%</td>
</tr>
<tr>
<td>Stage 3 /1,000</td>
<td>28</td>
<td>32</td>
<td>48</td>
<td>(+) 60%</td>
</tr>
<tr>
<td>pRBC (n)</td>
<td>232</td>
<td>180</td>
<td>197</td>
<td>(-) 15%, p=0.02</td>
</tr>
<tr>
<td>Platelets</td>
<td>65</td>
<td>35</td>
<td>26</td>
<td>(-) 60%, p=0.01</td>
</tr>
<tr>
<td>FFP</td>
<td>35</td>
<td>24</td>
<td>56</td>
<td>(+) 60%, p=0.1</td>
</tr>
<tr>
<td>Cryo</td>
<td>43</td>
<td>18</td>
<td>18</td>
<td>(-) 58%, p=0.01</td>
</tr>
<tr>
<td>Total Units of Blood</td>
<td>35.9</td>
<td>33.9</td>
<td>26.6</td>
<td>(-) 25.9%, p=0.01</td>
</tr>
<tr>
<td>Products /1,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Required &gt; 4u pRBC</td>
<td></td>
<td></td>
<td></td>
<td>(-) 88%</td>
</tr>
<tr>
<td>Hyst/1,000</td>
<td>1.22</td>
<td>1.04</td>
<td>1.04</td>
<td>(-) 14.8%, p=0.2</td>
</tr>
</tbody>
</table>

Tranexamic Acid and Recombinant Factor VIIa?

- The World Health Organization states that TXA may be used if other measures have failed, but point out that the evidence is poor and that further clinical trials of TXA in PPH are needed.
- Mean blood loss with TA -77 mL, and with both vaginal and caesarean section births.
- TA: Not tested in high risk conditions, i.e. previa or accreta
- rf VIIa: Not considered first line therapy, add after multiple rounds of transfusion packs (6 pRBC, 3 FFP, 3 Platelets).
OB Hemorrhage – Bundle

July 2015

Toolkit and Materials

http://safehealthcareforeverywoman.org

www.CMQCC.org

Drills, Simulation, Review, Re-educate

Dr. D – 2011
“I do not need a protocol to help me manage PPH"

Dr. D – 2016
"we need to talk the protocol was not as smooth as I am use to"

Low tech drills
walk through the event, make purposeful wrong request...

Review cases
people like to hear they did well and fine tune system

2016 Review
80% of staff had not been part of the original educational process

Working Together

Summary

• Death from obstetric hemorrhage should be a very rare event
• System level preparation for obstetrical should be required
• Standardized your approach – people like to know what to do
• Practice, train, and include everyone possibly involved
• Monitor adherence to process
• Monitor outcomes – diagnosing more is not bad
Thank You