Preventing Maternal Death from Venous Thromboembolism: An update from the National Partnership for Maternal Safety

Mary E. D’Alton, M.D.
Willard C. Rappleye Professor and Chair, Department of Obstetrics & Gynecology
Columbia University College of Physicians & Surgeons
CONFLICT OF INTEREST
DISCLOSURE STATEMENT

2015 Advisory Board Member, Merck for Mothers

The Safe Motherhood Initiative in New York was funded by Merck for Mothers.
Where Is the “M” in Maternal–Fetal Medicine?

Mary E. D’Alton, MD

In contrast to the generally encouraging trend regarding global maternal mortality, there has been an apparent increase in the maternal mortality ratio in the United States. Although maternal death remains a relatively rare adverse event in this country, programs to reduce maternal mortality also will result in a reduction in maternal morbidity, which is a far more prevalent problem. Progress in the field of maternal–fetal medicine over the past several decades has been largely attributable to improvements in fetal and neonatal medicine. We need to develop an organized, national approach focused on reducing maternal mortality and morbidity. The goal will be to outline a specific plan for clinical, educational, and research initiatives to put the “M” back in maternal–fetal medicine.

(Obstet Gynecol 2010;116:1401–4)

decreasing maternal mortality. More recently, reduction in maternal mortality became one of the eight Millennium Development Goals of the United Nations.²

There has been good news this year in the progress toward the Millennium Development Goals of the United Nations, which targets a reduction in the maternal mortality ratio by 75% from 1990 to 2015. In a comprehensive analysis funded by the Bill and Melinda Gates Foundation, estimates of global maternal deaths have declined from 526,300 in 1980 to 342,900 in 2008.³ Maternal mortality is difficult to measure, particularly in developing countries; thus, there are wide uncertainty intervals around these numbers. Nevertheless, these new estimates provide hope that interventions to reduce fertility rates, increase income and education, and expand access to skilled birthing attendants,
Building Consensus

- ACOG-CDC Maternal Mortality/Severe Morbidity Action Meeting occurred in Atlanta, November 2012
- Participants identified key priorities:
  - 6 multidisciplinary working groups were formed
  - Work product presented in New Orleans 2013

<table>
<thead>
<tr>
<th>Core Patient Safety Bundles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obstetric Hemorrhage</td>
</tr>
<tr>
<td>Severe Hypertension in Pregnancy</td>
</tr>
<tr>
<td>Venous Thromboembolism Prevention in Pregnancy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Supplemental Patient Safety Bundles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal Early Warning Criteria</td>
</tr>
<tr>
<td>Facility Review</td>
</tr>
<tr>
<td>Family and Staff Support</td>
</tr>
</tbody>
</table>

Putting the “M” back in maternal–fetal medicine

Although maternal death remains rare in the United States, the rate has not decreased for decades. There continue to be dramatic mortality has not decreased for decades. 

Current Commentary

The National Partnership for Maternal Safety

Mary E. D’Alton, MD, Elliott K. Main, MD, M. Kathryn Menard, MD, and Barbara S. Levy, MD

Recognition of the need to reduce maternal mortality and morbidity in the United States has led to the creation issued a Sentinel Alert entitled “Preventing Maternal Death” and proposed various initiatives to decrease maternal mortality, including case reporting, and
Implementation of The National Partnership for Maternal Safety

The Council on Patient Safety in Women’s Health Care will:

• provide oversight for the implementation of the 3 safety bundles within 3 years
• track implementation throughout the US using lessons learned from IHI 5 Million Lives Campaign
• provide a platform for facilities to share best practices
• systematically review the impact of these initiatives

www.safehealthcareforeverywoman.org

IHI. 5 Million Lives Campaign. Available at: http://www.ihi.org
Annual Birth Volume in U.S. Hospitals, 2008

NUMBERS OF HOSPITALS

- <500: 1,193
- 500-1,000: 696
- 1,000-1,999: 690
- 2,000-2,999: 342
- 3,000-3,999: 177
- 4,000-4,999: 80
- 5,000-5,999: 36
- 6,000-6,999: 23
- 7,000-7,999: 10
- 8,000-8,999: 8
- 9,000-9,999: 3
- >10,000: 5

n = 3,265

Pregnancy Related Mortality United States (1987-2010)

New York City 2006-2010
Pregnancy-Associated Mortality

<table>
<thead>
<tr>
<th>Cause of Death</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemorrhage</td>
<td>36</td>
<td>27.3</td>
</tr>
<tr>
<td>Embolism</td>
<td>26</td>
<td>18.7</td>
</tr>
<tr>
<td>Pregnancy-Induced hypertension</td>
<td>19</td>
<td>13.7</td>
</tr>
<tr>
<td>Cardiovascular condition</td>
<td>18</td>
<td>12.9</td>
</tr>
<tr>
<td>Infection</td>
<td>10</td>
<td>7.2</td>
</tr>
<tr>
<td>Cancer</td>
<td>5</td>
<td>3.6</td>
</tr>
<tr>
<td>Injury</td>
<td>3</td>
<td>2.2</td>
</tr>
<tr>
<td>Anesthesia complication</td>
<td>3</td>
<td>2.2</td>
</tr>
<tr>
<td>Other</td>
<td>16</td>
<td>11.5</td>
</tr>
<tr>
<td>Unknown</td>
<td>1</td>
<td>0.7</td>
</tr>
<tr>
<td>Total</td>
<td>139</td>
<td>100</td>
</tr>
</tbody>
</table>

VTE Prophylaxis

- Venous thromboembolism (VTE) is a leading cause of maternal mortality and severe morbidity
- Maternal death from VTE is amenable to prevention

“single cause of death most amenable to reduction by systematic change in practice”

Clark, SL. Semin Perinatol 2012;36(1):42-7

- Protocols in the UK have led to significant reduction in maternal death from VTE
- Strategies for preventing VTE require minimal resources and are easily implementable
“Facts and figures are essential, but insufficient, to translate data and promote the acceptance of evidence-based practices and policies...”

Stories, when compared with statistical evidence, can have more impact and help to make sense of population-based evidence.

Guideline developers must recognize the value of stories to explain the science of guidelines to patients and families, health care professionals, and policy makers to promote optimal understanding, uptake, and use.

34 yo G3P0020 at 33 weeks with Preterm PROM (2012)

- No significant medical or surgical history
- BP 126/78, HR 87, SpO2 99%, BMI 22
- Benign physical exam
  - SSE visually 1cm dilated
- Betamethasone, latency antibiotics
- Hospital day 3, spontaneous preterm labor
- Arrest of dilation at 5cm
  - Face presentation
- Primary LTCD without complication
  - Intrapartum compression devices
  - Male infant, Apgars 8/9
  - EBL 800cc
Personal Case Presentation

• Postoperative
  – BP 110s-120s/60s-80s
  – HR 70s-90s
  – RR 15-18
  – SpO2 97-99%

• Postoperative DVT prophylaxis
  – Sequential compression devices (SCDs)
  – Early ambulation
• 0800, Ambulating around the room
  – HR 118/88, HR 93, RR 19, SpO2 97%
• 0900, Acute chest pain, shortness of breath
• Patient unresponsive, without palpable pulse
• Medical response team called
  – MFM, Cardiology, anesthesia at bedside
• CPR was performed, sinus rhythm was restored
• Transferred intubated to CCU
• Right heart failure on echo
• Patient never regained consciousness
• Cerebral edema, pupils fixed
• On POD#9, support was removed
CT Angiogram
Personal Case Presentation

Was standard of care met?

Current ACOG Guidelines:

• Placement of pneumatic compression devices before CD is recommended for all women not already receiving thromboprophylaxis

• Studies of routine thromboprophylaxis for CD have been
  • small
  • not adequately powered

Unable to assess decreased risk of DVT or PE with anticoagulation therapy

ACOG Practice Bulletin No. 123 (2011, Reaffirmed 2014)
Recommend heparin if at least 1 of the factors below is present:
- Already receiving heparin as outpatient
- Pre-pregnancy class 3 obesity (BMI ≥ 40)
- Any history of VTE
- Thrombophilia and family history of VTE

OR 2 or more risk factors below are present:
- Cesarean delivery
- Hemorrhage
- Hysterectomy
- General anesthesia
- Postpartum infection
- Age > 40 or < 15 years
- Pre-pregnancy obesity (BMI > 30)
- Bed rest
- Any Thrombophilia
- Medical or pregnancy complications

Prophylactic LMWH or UFH until discharge

RCOG, 2009 Green Top 37a
Leading causes of direct maternal deaths
UK 1985-2013 (per million maternities)

- Pregnancy induced hypertension
- Thromboembolism
- Hemorrhage
- AFE
- Sepsis
New York Presbyterian/CUMC VTE Guidelines

• October 2012, NYP issued new guidelines
• Apply pneumatic compression devices prior to surgery
  ▪ Maintain until ambulatory
• Anticoagulation
  ▪ Unfractionated Heparin
    - 5000 Units, subcutaneously, every 12 hours
    - May be administered at any time interval after epidural catheter removal or spinal needle placement
    - First dose given in PACU
  - Low Weight Molecular Heparin
    - First dose 6 hours post op
    - Weight-based dosing
• Promote early ambulation
## Underuse of Post-cesarean Thromboembolic Prophylaxis

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>None</th>
<th>Mechanical</th>
<th>Pharmacologic</th>
<th>Combination</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>955,787 (75.7)</td>
<td>278,669 (22.1)</td>
<td>16,639 (1.3)</td>
<td>12,110 (1.0)</td>
</tr>
<tr>
<td>Year of Surgery</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>115,663 (91.6)</td>
<td>8,717 (6.9)</td>
<td>1,274 (1.0)</td>
<td>664 (0.5)</td>
</tr>
<tr>
<td>2004</td>
<td>124,230 (87.4)</td>
<td>15,674 (11.0)</td>
<td>1,319 (0.9)</td>
<td>923 (0.7)</td>
</tr>
<tr>
<td>2005</td>
<td>131,220 (84.6)</td>
<td>21,013 (13.5)</td>
<td>1,889 (1.2)</td>
<td>1,051 (0.7)</td>
</tr>
<tr>
<td>2006</td>
<td>154,876 (81.0)</td>
<td>32,302 (16.9)</td>
<td>2,413 (1.3)</td>
<td>1,608 (0.8)</td>
</tr>
<tr>
<td>2007</td>
<td>145,589 (74.7)</td>
<td>44,842 (23.0)</td>
<td>2,451 (1.3)</td>
<td>2,053 (1.1)</td>
</tr>
<tr>
<td>2008</td>
<td>131,250 (66.0)</td>
<td>62,545 (31.4)</td>
<td>2,852 (1.4)</td>
<td>2,294 (1.2)</td>
</tr>
<tr>
<td>2009</td>
<td>125,096 (60.5)</td>
<td>75,315 (36.4)</td>
<td>3,609 (1.8)</td>
<td>2,753 (1.3)</td>
</tr>
<tr>
<td>2010</td>
<td>27,863 (58.4)</td>
<td>18,261 (38.3)</td>
<td>832 (1.7)</td>
<td>764 (1.6)</td>
</tr>
</tbody>
</table>

# Prophylaxis in Vaginal Delivery Hospitalizations

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No Prophylaxis</th>
<th>Any Prophylaxis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>All Patients</td>
<td>2,605,151</td>
<td>97.4</td>
</tr>
<tr>
<td><strong>Year of Delivery</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>366,317</td>
<td>98.4</td>
</tr>
<tr>
<td>2007</td>
<td>374,851</td>
<td>98.3</td>
</tr>
<tr>
<td>2008</td>
<td>352,438</td>
<td>97.8</td>
</tr>
<tr>
<td>2009</td>
<td>354,460</td>
<td>97.3</td>
</tr>
<tr>
<td>2010</td>
<td>367,470</td>
<td>96.9</td>
</tr>
<tr>
<td>2011</td>
<td>402,359</td>
<td>97.1</td>
</tr>
<tr>
<td>2012</td>
<td>390,881</td>
<td>97.2</td>
</tr>
</tbody>
</table>

VTE Prophylaxis

- The Agency for Healthcare Research and Quality defined VTE as the “number one patient safety practice” for hospitalized patients.
- Safe practices published by the National Quality Forum (NQF) recommend:
  - Routine evaluation of hospitalized patients for risk of VTE
  - Use of appropriate prophylaxis
- ENDORSE Survey
  - Evaluated prophylaxis rates in 17,084 major surgery patients
  - More than one third of patients at risk for VTE (38%) did not receive prophylaxis
  - Rates varied by surgery type

NQF. National Voluntary Consensus Standards for Prevention and Care of Venous Thromboembolism, 2006.
VTE Bundle Committee Members

- Steven Clark, MD
- Robyn D'Oria, MA, RNC, APN
- Alexander Friedman MD
- Jennifer Frost, MD
- Afshan Hameed, MD
- Deborah Karsnitz, PhD, CNM
- Douglas Montgomery, MD
- Michael Paidas, MD
- Richard M. Smiley, MD

- Mary D’Alton, MD (Chair)
- Jeanne Mahoney (ACOG)
## Venous Thromboembolism Prevention Safety Bundle

### READINESS (Every Unit)
- Use a standardized thromboembolism risk assessment tool for VTE during:
  - Outpatient prenatal care
  - Antepartum hospitalization
  - Hospitalization after cesarean or vaginal deliveries
  - Postpartum period (up to 6 weeks after delivery)

### RECOGNITION (Every Patient)
- Apply standardized tool to all patients to assess VTE risk at time points designated under “Readiness”
- Apply standardized tool to identify appropriate patients for thromboprophylaxis
- Provide patient education
- Provide all healthcare providers education regarding risk assessment tools and recommended thromboprophylaxis

### RESPONSE (Every Unit)
- Use standardized recommendations for mechanical thromboprophylaxis
- Use standardized recommendations for dosing of prophylactic and therapeutic pharmacologic anticoagulation
- Use standardized recommendations for appropriate timing of pharmacologic prophylaxis with neuraxial anesthesia

### REPORTING/SYSTEMS LEARNING (Every Unit)
- Review all thromboembolism events for systems issues and compliance with protocols
- Monitor process metrics and outcomes in a standardized fashion
- Assess for complications of pharmacologic thromboprophylaxis
Thromboembolism prophylaxis is a Joint Commission quality measure.

The Joint Commission states that all patients should receive VTE prophylaxis or have documentation why no VTE prophylaxis was given:

- "the day of or the day after hospital admission"
- "the day of or the day after surgery end date for surgeries that start the day of or the day after hospital admission”
VTE Prevention: Readiness

• Excluded populations Joint Commission measure:
  ▪ Patients with ICD-9-CM Principal or Other Diagnosis Codes of Obstetrics

• Sample Codes:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>642.50</td>
<td>SEVERE PREECLAMP-UNSPEC</td>
</tr>
<tr>
<td>642.51</td>
<td>SEVERE PREECLAMP-DELIVER</td>
</tr>
<tr>
<td>642.52</td>
<td>SEV PREECLAMP-DEL W P/P</td>
</tr>
<tr>
<td>642.53</td>
<td>SEV PREECLAMP-ANTEPARTUM</td>
</tr>
<tr>
<td>642.54</td>
<td>SEV PREECLAMP-POSTPARTUM</td>
</tr>
<tr>
<td>642.60</td>
<td>ECLAMPSIA-UNSPECIFIED</td>
</tr>
<tr>
<td>642.61</td>
<td>ECLAMPSIA-DELIVERED</td>
</tr>
<tr>
<td>642.62</td>
<td>ECLAMPSIA-DELIV W P/P</td>
</tr>
<tr>
<td>642.63</td>
<td>ECLAMPSIA-ANTEPARTUM</td>
</tr>
<tr>
<td>642.64</td>
<td>ECLAMPSIA-POSTPARTUM</td>
</tr>
<tr>
<td>642.70</td>
<td>TOX W OLD HYPERTEN-UNSP</td>
</tr>
<tr>
<td>642.71</td>
<td>TOX W OLD HYPERTEN-DELIV</td>
</tr>
<tr>
<td>642.72</td>
<td>TOX W OLD HYP-DEL W P/P</td>
</tr>
<tr>
<td>642.73</td>
<td>TOX W OLD HYPER-ANTEPART</td>
</tr>
<tr>
<td>642.74</td>
<td>TOX W OLD HYPER-POSTPART</td>
</tr>
<tr>
<td>642.90</td>
<td>HYPERTEN PREG NOS-UNSPEC</td>
</tr>
<tr>
<td>642.91</td>
<td>HYPERTENS NOS-DELIVERED</td>
</tr>
<tr>
<td>642.92</td>
<td>HYPERTENS NOS-DEL W P/P</td>
</tr>
<tr>
<td>642.93</td>
<td>HYPERTENS NOS-ANTEPARTUM</td>
</tr>
<tr>
<td>642.94</td>
<td>HYPERTENS NOS-POSTPARTUM</td>
</tr>
</tbody>
</table>

Full list available in the 2015 Joint Commission Specifications Manual for National Hospital Inpatient Safety (Appendix A, Table 7.02)
Recommendation: Joint Commission measure be extended to the obstetric population

All patients should be assessed for VTE risk multiple times in pregnancy including during:

- Presentation for prenatal care
- Hospitalization for an antepartum indication
- Delivery hospitalization (in-house postpartum)
- Discharge from a delivery hospitalization
VTE Prevention: Recognition

• VTE risk assessment tools should be applied to every patient to determine risk for VTE

• Risk assessment tools based on recommendations from major society guidelines
  ▪ American College of Obstetricians and Gynecology (ACOG)
  ▪ American College of Chest Physicians (ACCP)
  ▪ Royal College of Obstetricians and Gynecologists (RCOG)

• Pharmacologic prophylaxis may be with unfractionated heparin (UFH) or low-molecular weight heparin (LMWH)
VTE Prevention: Recognition

• Antepartum Management
  – ACOG recommends either prophylactic or therapeutic anticoagulation for women
    “at significant risk of VTE during pregnancy or the postpartum period such as those with high risk acquired or inherited thrombophilias”
  – ACCP recommendations more specific
    ▪ Prophylaxis recommended for very high risk women
      - reduced mobility, history of VTE or known thrombophilia

ACOG Practice Bulletin No 123, 2011

Chest, Feb 2012; 141
### Clinical history

<table>
<thead>
<tr>
<th>Multiple VTE episodes</th>
<th>VTE with high-risk (HR) thrombophilia</th>
<th>VTE with acquired thrombophilia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idiopathic VTE</td>
<td>VTE with pregnancy or oral contraceptive</td>
<td>VTE with low risk (LR) thrombophilia</td>
</tr>
<tr>
<td></td>
<td>Family history of VTE with HR thrombophilia</td>
<td>HR thrombophilia</td>
</tr>
<tr>
<td>1st VTE provoked</td>
<td>Family history of VTE with LR thrombophilia</td>
<td>LR thrombophilia (no prior event)</td>
</tr>
</tbody>
</table>

### Anticoagulation

- **Treatment dose**
  - LMWH or UFH

- **Prophylactic**
  - LMWH or UFH

- **No treatment**
In-Patient Antepartum Hospitalization

Recognition & Response

In-Patient Antepartum Hospitalization for at least 72 hours:

- All patients should be considered for pharmacologic prophylaxis

- For women at high risk of delivery or bleeding, mechanical thromboprophylaxis should be utilized

- Consider prophylaxis with unfractionated heparin near time of expected delivery rather than low molecular weight heparin (LMWH) to facilitate intrapartum conduction anesthesia
Recognition and Response
Vaginal Delivery

- All patients
  - Early mobilization
  - Avoid dehydration

- Postpartum pharmacologic prophylaxis with LMWH or UFH based on risk factors
  - History of VTE or thrombophilia
  - Already receiving LMWH or UFH as outpatient

- For women with multiple risk factors for VTE by RCOG criteria
  - Pharmacologic prophylaxis with LMWH or UFH may be considered
Women undergoing cesarean delivery should:

- Receive sequential compression devices perioperatively and postpartum
- Receive pharmacologic prophylaxis (LMWH or UFH) based on risk factors

An “opt-out” strategy where all women undergoing cesarean delivery receive prophylaxis with LMWH or UFH unless there is a specific contraindication is also an acceptable approach
Chest Recommendations

- Pharmacologic prophylaxis (LMWH) recommended for one major, or two or more minor risk factors
- Mechanical prophylaxis recommended for those with contraindications to pharmacologic prophylaxis

<table>
<thead>
<tr>
<th>Major risk factors</th>
<th>Minor risk factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immobility (strict bed rest ≥1 week in the antepartum period)</td>
<td>BMI &gt;30 kg/m2</td>
</tr>
<tr>
<td>Postpartum hemorrhage ≥1000 mL with surgery</td>
<td>Multiple pregnancy</td>
</tr>
<tr>
<td>Previous VTE</td>
<td>Emergency caesarean</td>
</tr>
<tr>
<td>Pre-eclampsia with fetal growth restriction</td>
<td>Smoking &gt;10 cigarettes/day</td>
</tr>
<tr>
<td>Thrombophilia</td>
<td>Fetal growth restriction</td>
</tr>
<tr>
<td>Antithrombin deficiency</td>
<td>Thrombophilia</td>
</tr>
<tr>
<td>Factor V Leiden (homozygous or heterozygous)</td>
<td>Protein C deficiency</td>
</tr>
<tr>
<td>Prothrombin G20210A (homozygous or heterozygous)</td>
<td>Protein S deficiency</td>
</tr>
<tr>
<td>Medical conditions</td>
<td>Pre-eclampsia</td>
</tr>
<tr>
<td>Systemic Lupus erythematosus</td>
<td></td>
</tr>
<tr>
<td>Heart disease</td>
<td></td>
</tr>
<tr>
<td>Sickle cell disease</td>
<td></td>
</tr>
<tr>
<td>Blood transfusion</td>
<td></td>
</tr>
<tr>
<td>Postpartum infection</td>
<td></td>
</tr>
</tbody>
</table>

Chest, Feb 2012; 141
## RCOG Scoring System

<table>
<thead>
<tr>
<th>4 Points</th>
<th>2 Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Previous VTE (except for a single event related to major surgery)</td>
<td>• Cesarean in labor</td>
</tr>
<tr>
<td>• Ovarian hyperstimulation syndrome (1st trimester only)</td>
<td>• Obesity (BMI &gt;40kg/m2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3 Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Previous VTE provoked by major surgery</td>
</tr>
<tr>
<td>• Known high-risk thrombophilia</td>
</tr>
<tr>
<td>• Any surgical procedure in pregnancy or puerperium except immediate repair of the perineum, e.g. appendectomy, postpartum sterilization</td>
</tr>
<tr>
<td>• Hyperemesis</td>
</tr>
<tr>
<td>• Medical comorbidities e.g. cancer, heart failure, active systemic lupus erythematosus, inflammatory polyarthropathy or inflammatory bowel disease, nephrotic syndrome, type I diabetes mellitus with nephropathy, sickle cell disease, current intravenous drug user</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1 Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Family history of unprovoked or estrogen-related VTE in first-degree relative</td>
</tr>
<tr>
<td>• Known low-risk thrombophilia (no VTE)</td>
</tr>
<tr>
<td>• Age (&gt;35 years)</td>
</tr>
<tr>
<td>• Obesity (BMI &gt;30kg/m2)</td>
</tr>
<tr>
<td>• Parity &gt; 3</td>
</tr>
<tr>
<td>• Smoker</td>
</tr>
<tr>
<td>• Gross varicose veins</td>
</tr>
<tr>
<td>• Preeclampsia in current pregnancy</td>
</tr>
<tr>
<td>• Assisted reproductive technology/in vitro fertilization (antenatal only)</td>
</tr>
<tr>
<td>• Multiple pregnancy</td>
</tr>
<tr>
<td>• Elective cesarean</td>
</tr>
<tr>
<td>• Mid-cavity rotational operative delivery</td>
</tr>
<tr>
<td>• Prolonged labor (&gt;24 hours)</td>
</tr>
<tr>
<td>• Postpartum hemorrhage (&gt;1 liter or blood transfusion)</td>
</tr>
<tr>
<td>• Preterm birth &lt;37 weeks in current pregnancy</td>
</tr>
<tr>
<td>• Stillbirth in current pregnancy</td>
</tr>
</tbody>
</table>

RCOG, 2015 Green Top 37a
RCOG Clinical Recommendations

- If total score > 4 antenatally, consider thromboprophylaxis from the first trimester
- If total score 3 antenatally, consider thromboprophylaxis from 28 weeks
- If total score > 2 postnatally, consider thromboprophylaxis for at least 10 days
- If admitted to hospital antenatally consider thromboprophylaxis
- If prolonged admission (> 3 days) or readmission to hospital during the puerperium consider thromboprophylaxis

RCOG, 2015 Green Top 37a
Caesarean Thromboprophylaxis Comparison of 3 Leading Guidelines

- 293 patients included in analysis

ACOG
1%
All based on having a prior event

Chest
35%
Emergency caesarean, Pre-eclampsia
Obesity, Multiple gestation
Postpartum hemorrhage

RCOG
85%
Caesarean during labor, Maternal Age ≥35
Obesity, Pre-eclampsia, Infection, High Parity

Compliance with mechanical VTE prophylaxis after cesarean delivery

- Observational study of 293 patients
- Observations performed before 7am on day 1 post op
- 60 patients were non-compliant (21%)
- Reasons: Patient discomfort, incorrect device use, machine malfunction
- Device use was suboptimal in our patients

Compliance with mechanical VTE prophylaxis after cesarean delivery

For institutions that rely primarily on mechanical prophylaxis for obstetric patients, quality assurance and auditing of use is necessary to ensure patients are receiving adequate prophylaxis.

Recognition and Response
Postpartum after delivery hospitalization

**Clinical history**

- Multiple VTE episodes
  - VTE with high-risk (HR) thrombophilia
  - VTE with acquired thrombophilia

- Idiopathic VTE
  - VTE with pregnancy or oral contraceptive
  - VTE with low risk (LR) thrombophilia
  - Family history of VTE with HR thrombophilia
  - HR thrombophilia (including acquired)

- VTE provoked*
  - LR thrombophilia and family history of VTE*

- LR thrombophilia

**Anticoagulation**

- 6 Weeks Treatment
  - LMWH/UFH

- 6 Weeks
  - Prophylactic
  - LMWH/UFH

- No treatment

* (two changes from initial assessment)
## Protocols for Prophylaxis

<table>
<thead>
<tr>
<th>Weight based</th>
<th>Agent</th>
<th>LMWH Enoxaparin</th>
<th>Dalteparin</th>
<th>Tinzaparin</th>
<th>UFH Unfractionated heparin</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;50kg</td>
<td></td>
<td>20mg daily</td>
<td>2500 units daily</td>
<td>3500 units daily</td>
<td>First trimester 5000-7500 units Twice daily</td>
</tr>
<tr>
<td>50-90kg</td>
<td></td>
<td>40mg daily</td>
<td>5000 units daily</td>
<td>4500 units daily</td>
<td>Second trimester 7500-10000 units Twice daily</td>
</tr>
<tr>
<td>91-130kg</td>
<td></td>
<td>60mg daily*</td>
<td>7500 units daily*</td>
<td>7000 units daily*</td>
<td>Third trimester 10000 units Twice daily</td>
</tr>
<tr>
<td>131-170kg</td>
<td></td>
<td>80mg daily*</td>
<td>10000 units daily*</td>
<td>9000 units daily</td>
<td></td>
</tr>
<tr>
<td>&gt;170kg</td>
<td></td>
<td>0.6mg/kg/day*</td>
<td>75 units/kg/day</td>
<td>75 units/kg/day</td>
<td></td>
</tr>
</tbody>
</table>

Hospitalized antepartum patients may receive 5000 units UFH twice daily for prophylaxis to facilitate regional anesthesia

*=may be given in two divided doses

Adapted from ACOG Practice Bulletin 123, ACCP Recommendations, RCOG Green Top Guideline 37a
## Timing of Neuraxial Anesthesia

<table>
<thead>
<tr>
<th>Antepartum/Intrapartum</th>
<th>Postpartum</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UFH ≤10,000IU/day</strong></td>
<td>Heparin may be administered at any time interval after epidural catheter removal or spinal needle placement</td>
</tr>
<tr>
<td><strong>UFH &gt;10,000IU/day</strong></td>
<td>Wait ≥1 hour after epidural catheter removal or spinal needle placement</td>
</tr>
<tr>
<td><strong>IV Heparin</strong></td>
<td>Wait ≥4 hours after epidural catheter removal or spinal needle placement</td>
</tr>
<tr>
<td><strong>LMWH prophylaxis</strong></td>
<td>Avoid therapeutic dosing with epidural catheter in situ. Wait at least 24 hours after catheter removal or spinal needle placement</td>
</tr>
<tr>
<td><strong>LMWH therapeutic</strong></td>
<td>Sources: FDA Drug Safety Communication Nov, 2013; NYP protocol; ASRA guidelines</td>
</tr>
</tbody>
</table>

No contraindications to timing of heparin dose and performance of neuraxial blockade

Wait 12 hours after last dose prior to neuraxial blockade or check aPPT *

Wait 4-6 hours after discontinuation of IV heparin; consider checking aPPT

Wait 12 hours post last dose prior to neuraxial blockade

Wait 24 hours post last dose prior to neuraxial blockade

No specific society guidelines for management of patients also receiving aspirin

No specific society guidelines for management
**Post-Cesarean VTE Prophylaxis**

- Unfractionated heparin (UFH)
  
  ▪ The patient may receive standard order of 5000 units SC every 12 hours starting at any time before or after spinal anesthesia placement or epidural catheter placement or removal

  ▪ A reasonable clinical strategy is to administer the first dose of 5000 units SC when the patient meets PACU discharge criteria

NYP Prophylaxis Protocol
Low-molecular-weight heparin (LMWH)

- The patient should receive the first dose of LMWH no sooner than 6 hours postoperatively regardless of anesthesia technique.
- If an epidural catheter remains in situ for pain control, it should not be removed until 12 hours after last dose of LMWH.
- If the epidural catheter is to be removed prior to a dose of LMWH, the LMWH may not be given until 4 hours after removal.

Sources: FDA Drug Safety Communication Nov, 2013; NYP protocol
Heparin Induced Thrombocytopenia (HIT)

• Extremely rare complication in the obstetric population receiving UFH/LMWH for VTE prevention

• For patients expected to be on either UFH or LMWH for greater than >7 days a reasonable clinical strategy is to check a complete blood count 7-10 days after initiation of therapy

• Some guidelines, such as those from ASRA, recommend that patients receiving prophylaxis have a CBC checked 4 days after prophylaxis is initiated
Reporting/Systems Learning

• Recommendation:
  ▪ Review all thromboembolism events for systems issues and compliance with protocols
  ▪ Monitor process metrics and outcomes in a standardized fashion
  ▪ Assess for complications of pharmacologic thromboprophylaxis
“Because human error is normal and, by definition, unintended, well-intentioned people who make errors or who are in systems that have failed around them need to be supported, not punished, so...

they will report their mistakes and the system defects they observe so that all can learn from them.”

A promise to learn – a commitment to act. Improving the Safety of Patients in England. London: Department of Health; August 2013
“Aggregated data may camouflage variations (between or) within organizations that would be revealed by intelligent fine grained analysis at local level.”


A promise to learn – a commitment to act.
Birth Volume NYS Hospitals, 2012

N = 127

Source: http://hospitals.nyhealth.gov/
Maternal Mortality in New York State

• NYS ranks 46th among 50 states
  ▪ Only 4 states have higher rates - Mississippi, Oklahoma, Georgia, Michigan

• Peaked at 29.2 per 100,000 live births in 2008

• Decreased to 22.4 per 100,000 live births in 2010

• Decreased to 17.9 per 100,000 live births in 2013

Reducing Maternal Mortality in New York State – SMI

- First working group met January 2013
- Meetings held quarterly at rotating institutions throughout the state (13 meetings to date)
- Consensus driven and multidisciplinary
- We asked ALL maternity care hospital CEOs and obstetric leaders to standardize care during obstetric emergencies by agreeing to:
  - Implement 3 maternal safety bundles/protocols
  - Partner with ACOG District II for education and on-site assistance
  - 118 out of 124 NYS hospitals have confirmed agreements
Conclusion

• All patients require VTE risk assessment at multiple time points in pregnancy and postpartum

• All patients undergoing cesarean delivery require mechanical prophylaxis, early ambulation, and adequate hydration

• Women with additional risk factors for VTE after delivery will benefit from pharmacologic prophylaxis

• Empiric pharmacologic prophylaxis is a reasonable option for
  ▪ all women undergoing cesarean delivery
  ▪ all antepartum hospital admissions >72 hours
Preventing Maternal Death from Venous Thromboembolism: An update from the National Partnership for Maternal Safety

Mary E. D’Alton, M.D.

Willard C. Rappleye Professor and Chair, Department of Obstetrics & Gynecology
Columbia University College of Physicians & Surgeons