# Postpartum Hemorrhage: An Update

## SFOAI 2024

**Happy Tammsvik, Sweden**

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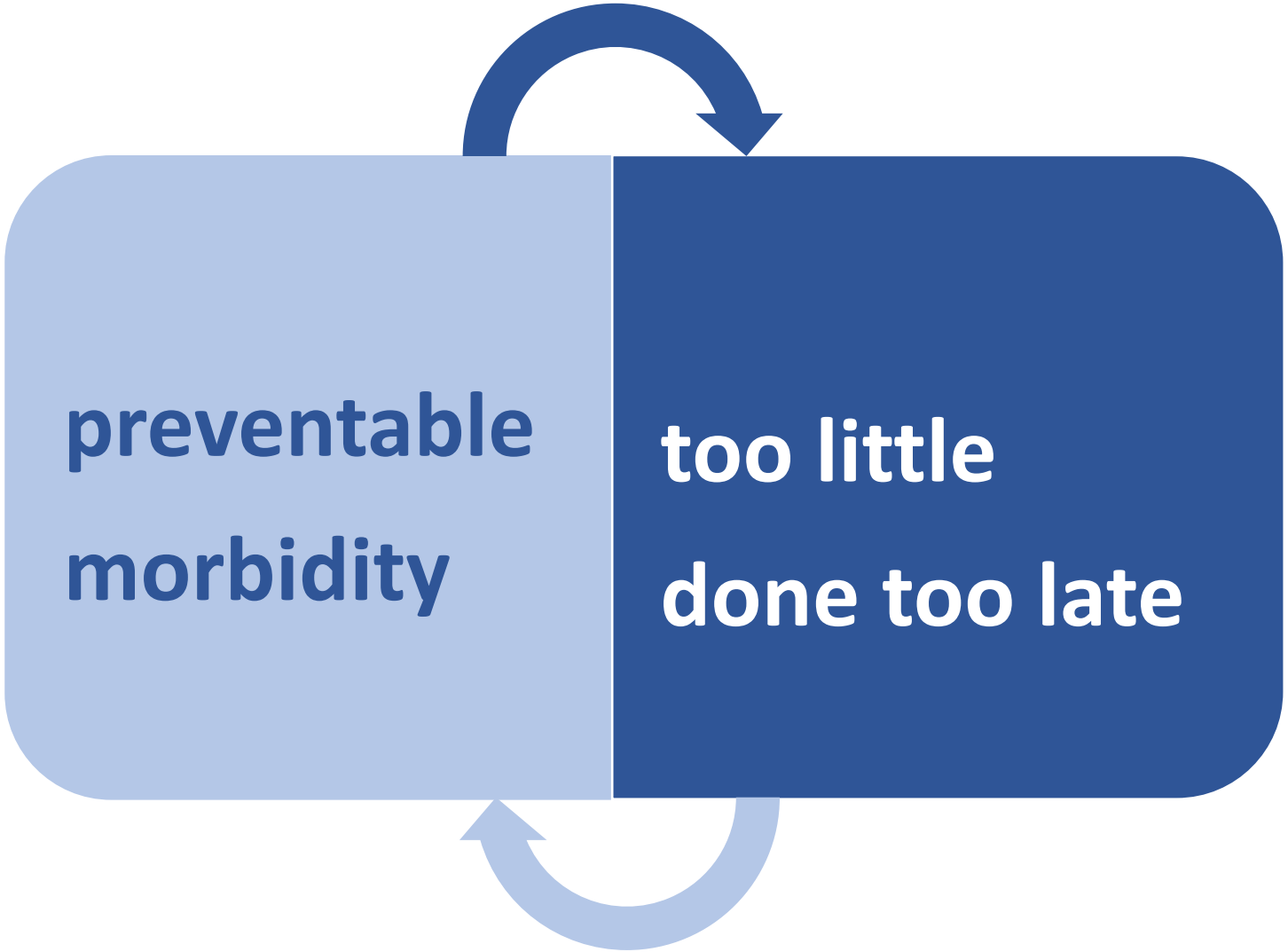
SFOAI

# Postpartum Hemorrhage: the leading cause of preventable morbidity



# Objectives: Postpartum Hemorrhage

- **Optimize** your unit policies overall, with focus on risk assessment and early detection
- **Recognize** the latest evidence for pharmacologic treatment modalities
- **Integrate** an up-to-date, impactful obstetric hemorrhage protocol

# Objectives: Postpartum Hemorrhage

- **Optimize your Unit Polices**

  **→ Assess Hemorrhage Risk**

  **→ Detect Hemorrhage Early**

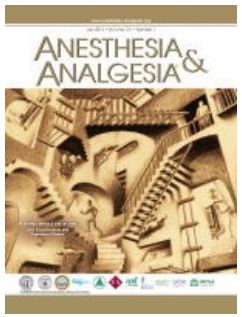
# National Partnership for Maternal Safety: Consensus Bundle on Obstetric Hemorrhage

Elliott K. Main, MD, Dena Goffman, MD, Barbara M. Scavone, MD, Lisa Kane Low, PhD, CNM, Debra Bingham, DrPH, RN, Patricia L. Fontaine, MD, MS, Jed B. Gorlin, MD, David C. Lagrew, MD, and Barbara S. Levy, MD

Hemorrhage is the most frequent cause of severe maternal morbidity and preventable maternal mortality and therefore is an ideal topic for the initial national maternity patient safety bundle. These safety bundles outline critical clinical practices that should be implemented in every maternity unit. They are developed by multidisciplinary work groups of the National Partnership for Maternal Safety under the guidance of the Council on Patient Safety in Women's Health Care. The safety bundle is organized into four domains: Readiness, Recognition and Prevention, Response, and Reporting and System Learning. Although the bundle components may be adapted to meet the resources available in individual facilities, standardization within an institution is strongly encouraged. References contain sample resources and "Potential Best Practices" to assist with implementation. (Anesth Analg 2015;121:142–8)

# The National Partnership for Maternal Safety: A Call to Action for Anesthesiologists

Barbara M. Scavone, MD,* and Elliott K. Main, MD†







Main EK et al. Anesth Analg 2015 Jul;121(1):142-8. Scavone BM and Main EK. Anesth Analg 2015 (121)1:14-6.

- 13 Key Elements
- 4 Action Domains
  - Readiness
  - Recognition
  - Response
  - Reporting

**Box 1. Obstetric Hemorrhage Safety Bundle From the National Partnership for Maternal Safety, Council on Patient Safety in Women's Health Care**

**Readiness (Every Unit)**

1. Hemorrhage cart with supplies, checklist, and instruction cards for intrauterine balloons and compression stitches
2. Immediate access to hemorrhage medications (kit or equivalent)
3. Establish a response team—who to call when help is needed (blood bank, advanced gynecologic surgery, other support and tertiary services)
4. Establish massive and emergency-release transfusion protocols (type-O negative or uncrossmatched)
5. Unit education on protocols, unit-based drills (with postdrill debriefs)

**Recognition and Prevention (Every Patient)**

6. Assessment of hemorrhage risk (prenatal, on admission, and at other appropriate times)
7. Measurement of cumulative blood loss (formal, as quantitative as possible)
8. Active management of the 3rd stage of labor (department-wide protocol)

**Response (Every Hemorrhage)**

9. Unit-standard, stage-based obstetric hemorrhage emergency management plan with checklists
10. Support program for patients, families, and staff for all significant hemorrhages

**Reporting and Systems Learning (Every Unit)**

11. Establish a culture of huddles for high-risk patients and postevent debriefs to identify successes and opportunities
12. Multidisciplinary review of serious hemorrhages for systems issues
13. Monitor outcomes and process metrics in perinatal quality improvement committee

http://www.safehealthcareforeverywoman.org

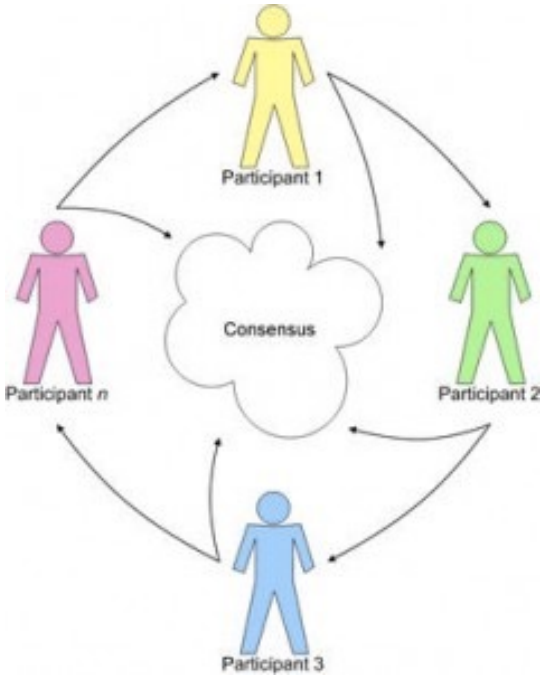
# Identifying Barriers to Implementation of the National Partnership for Maternal Safety Obstetric Hemorrhage Bundle at a Tertiary Center: Utilization of the Delphi Method

Annemaria De Tina, MD, FRCPC,*† Anthony Chau, MD, MMSc, FRCPC,*‡
Daniela A. Carusi, MD, MSc,*§ Julian N. Robinson, MD,*§ Lawrence C. Tsen, MD,*
and Michaela K. Farber, MD, MS*

## Delphi Technique

### Steps to Establish Delphi Technique

1. Assemble a panel of experts.
2. Create a questionnaire of open-ended questions.
3. Summarize the responses and feed back to the panel until the members reach agreement.
4. Create a brief report and send to the panel members for agreement/disagreement.
5. Continue the feedback process until panel reaches agreement.



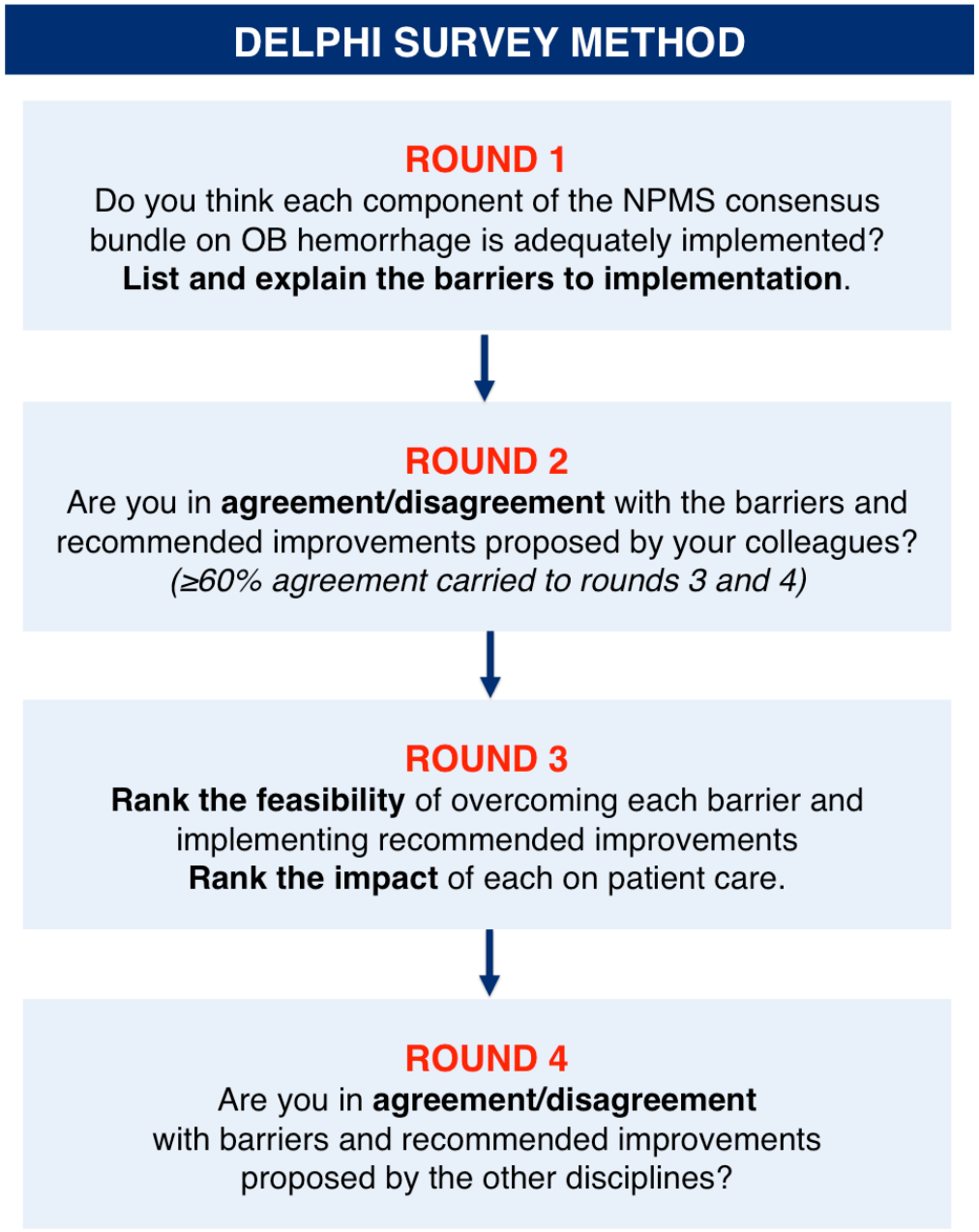

De Tina A et al. Anesth Analg 2019 124(9):1045-50

## Delphi Method

- Four rounds
- All disciplines

## Benefits

- Gathers consensus
- Reveals deficiencies
- Establishes buy-in
- Enhances dialogue

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At a busy tertiary center…

- Every bundle element was ranked as deficient by at least one person surveyed
- Six of 13 (46%) of elements were rated as deficient by consensus

**KEY POINTS**

- **Question:** What barriers exist to the implementation of the national partnership for maternal safety obstetric hemorrhage bundle?
- **Findings:** Six of the 13 bundle elements achieved multidisciplinary consensus as being deficient and were ranked for patient impact and implementation feasibility.
- **Meaning:** The Delphi method identifies institutional deficiencies and promotes tangible, meaningful, and multidisciplinary systemic improvements.

De Tina A et al. Anesth Analg 2019 124(9):1045-50

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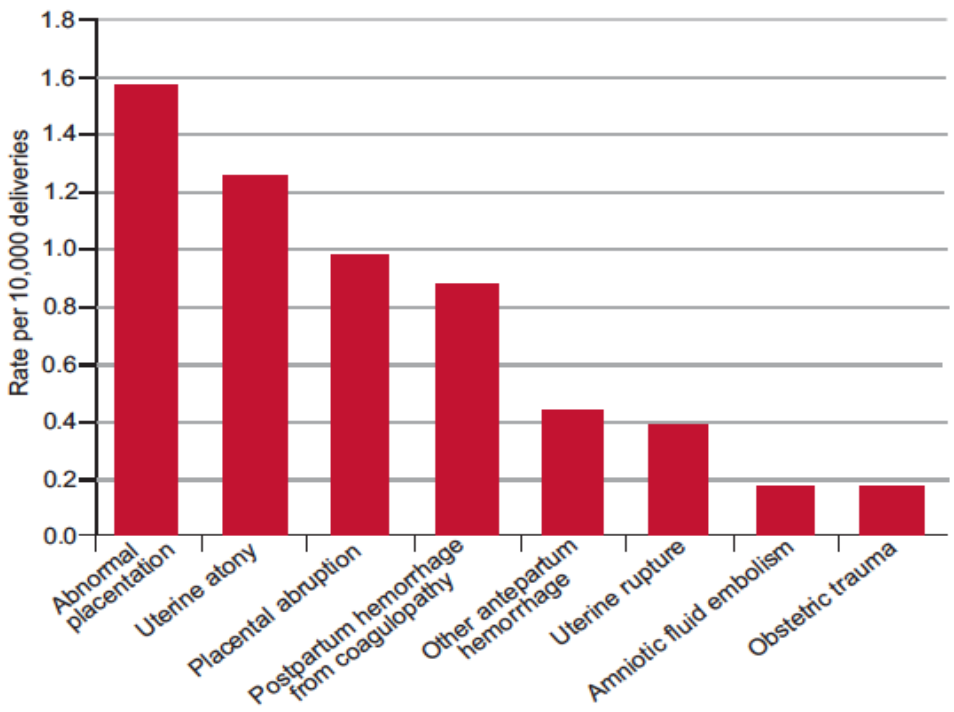
Main EK et al. Anesth Analg 2015 Jul;121(1):142-8.

**Recognition and Prevention (Every Patient)**

6. Assessment of hemorrhage risk (prenatal, on admission, and at other appropriate times)

- System in place?

- High-risk patient clinics
- Risk assessment on admission
- Safety rounds
- Preoperative huddle




- Massive transfusion during hospitalization for delivery, NY state 1998-2007

Main EK et al. Anesth Analg 2015; Mhyre J et al. Obstet Gynecol 2013.

CMQCC
California Maternal Quality Care Collaborative

| **Low**<br>Clot only | **Medium**<br>Type and Screen | **High**<br>Type and Crossmatch |
|---|---|---|
| No prior uterine surgery | Prior cesarean delivery or uterine surgery | Placenta previa |
| Singleton pregnancy | Multiple gestation | Suspected placenta accreta |
| No bleeding disorder | Chorioamnionitis | Known coagulopathy |
| ≤ 4 prior vaginal births | >4 vaginal births | Hematocrit < 30 AND risk factors |
| No history of PPH | History of prior PPH | Platelets < 100,000 |
| | Large fibroids | Active bleeding on admission |

- Prolonged 2nd stage
- Prolonged oxytocin
- Active bleeding
- Chorioamnionitis
- Vacuum or forceps
- Emergency cesarean
- Retained placenta

Admission → Labor and Delivery

AWHONN
PROMOTING THE HEALTH OF WOMEN AND NEWBORNS

# POSTPARTUM HEMORRHAGE (PPH) RISK ASSESSMENT TABLE • 1.1

| RISK CATEGORY: ADMISSION | | | |
|---|---|---|---|
| | **Low Risk** | **Medium Risk**<br>**(2 or More Medium Risk Factors Advance Patient to High Risk Status)** | **High Risk** |
| | ❑ No previous uterine incision | ❑ Induction of labor (with oxytocin) or Cervical ripening | ❑ Has 2 or More Medium Risk Factors |
| | ❑ Singleton pregnancy | ❑ Multiple gestation | ❑ Active bleeding more than "bloody show" |
| | ❑ ≤4 Previous vaginal births | ❑ >4 Previous vaginal births | ❑ Suspected placenta accreta or percreta |
| | | ❑ Prior cesarean birth or prior uterine incision | ❑ Placenta previa, low lying placenta |
| | ❑ No known bleeding disorder | ❑ Large uterine fibroids | ❑ Known coagulopathy |
| | ❑ No history of PPH | ❑ History of one previous PPH | ❑ History of more than one previous PPH |
| | | ❑ Family history in first degree relatives who experienced PPH (known or unknown etiology with possible coagulopathy) | ❑ Hematocrit <30 AND other risk factors |
| | | ❑ Chorioamnionitis | ❑ Platelets <100,000/mm3 |
| | | ❑ Fetal demise | |
| | | ❑ Polyhydramnios | |

= identical to CMQCC tool

# Which tool to implement?

- ACOG, AWHONN, CMQCC
- Patients with PPH: up to 41% are “low risk” by such tools
- We need to refine our tools

Kawakita T et al. Obstet Gynecol 2019; 134: 1308-16.

# Risk Factors for Atonic Postpartum Hemorrhage

*A Systematic Review and Meta-analysis*

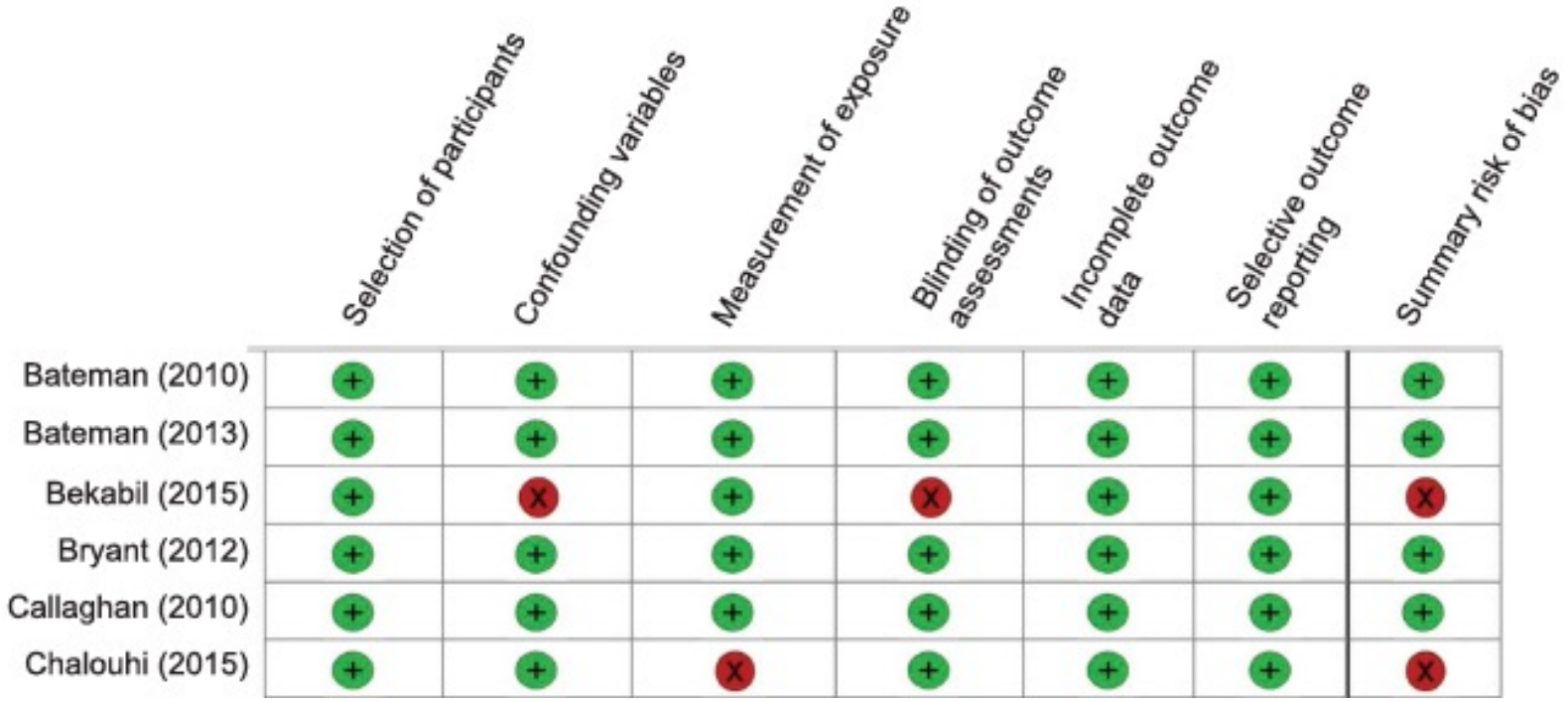
*Holly B. Ende, MD, M. James Lozada, DO, David H. Chestnut, MD, Sarah S. Osmundson, MD, MS, Rachel L. Walden, MLIS, Matthew S. Shotwell, PhD, and Jeanette R. Bauchat, MD, MS*

- 27 studies reporting ≥ 1 risk factor for PPH

- 19 – qualitative data
- 13 – meta-analyzed

- 47 potential risk factors

- **15: definite or likely**




Obstet Gynecol 2021 Feb 1; 137(2): 305-23.

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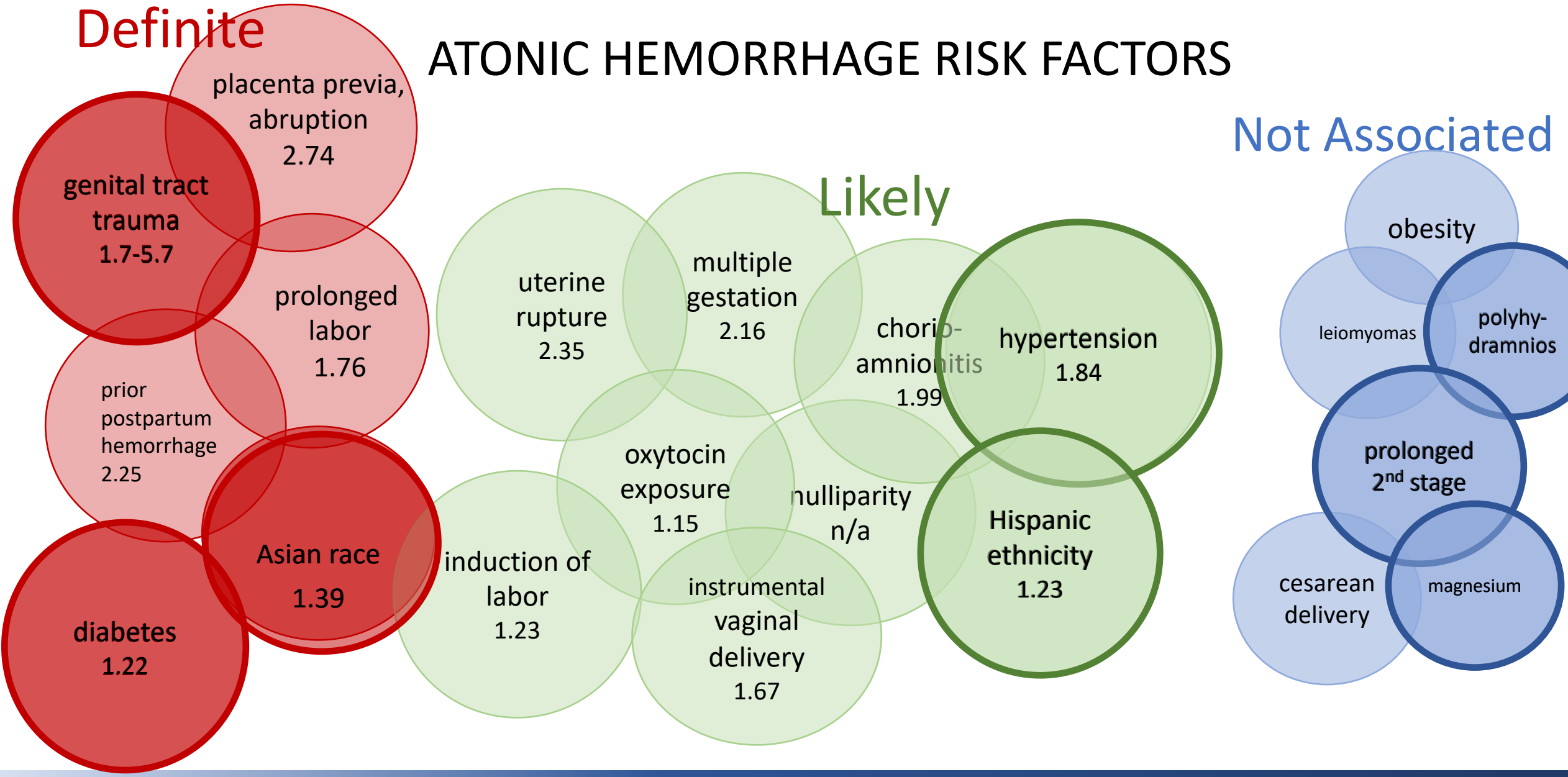
| DEFINITE | Meta-analysis result OR (95% CI) |
|---|---|
| Genital tract trauma | 1.67 (1.28-2.18) perineal<br>2.19 (1.13-4.24) vaginal<br>5.70 (1.40-2.00) cervical |
| Placenta previa, abruption | 2.74 (1.57-4.79) |
| Prior PPH | 2.25 (1.02-4.96) |
| Prolonged labor | 1.76 (1.53-2.03) |
| Asian race | 1.39 (1.33-1.46) |
| Diabetes | 1.22 (1.08-1.39) |

| LIKELY | Meta-analysis result OR (95% CI) |
|---|---|
| Uterine rupture | 2.35 (1.65-3.35) |
| Multiple gestation | 2.16 (1.53-3.06) |
| Chorioamnionitis | 1.93 (1.56-2.39) |
| Hypertension | 1.84 (1.45-2.33) |
| Instrumented vaginal delivery | 1.67 (1.40-2.00) |
| Induction of labor | 1.23 (1.10-1.39) |
| Hispanic ethnicity | 1.23 (1.20-1.25) |
| Predelivery oxytocin exposure | 1.15 (0.95-1.40) |
| Nulliparity | n/a |

| NOT ASSOCIATED |
|---|
| Obesity |
| Leiomyomas |
| Polyhydramnios |
| Magnesium |
| Cesarean delivery |

Obstet Gynecol 2021 Feb 1; 137(2): 305-23.

# ATONIC HEMORRHAGE RISK FACTORS

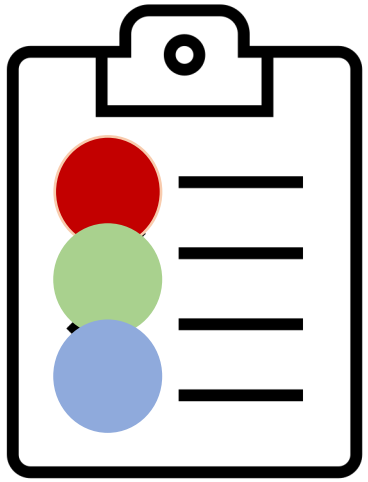



Obstet Gynecol 2021 Feb 1; 137(2): 305-23.

*Current Commentary*

# Current State and Future Direction of Postpartum Hemorrhage Risk Assessment

*Holly B. Ende, MD, and Alexander J. Butwick, FRCA, MS*



**Existing Risk Assessment Tools:** CMQCC, ACOG SMI, AWHONN

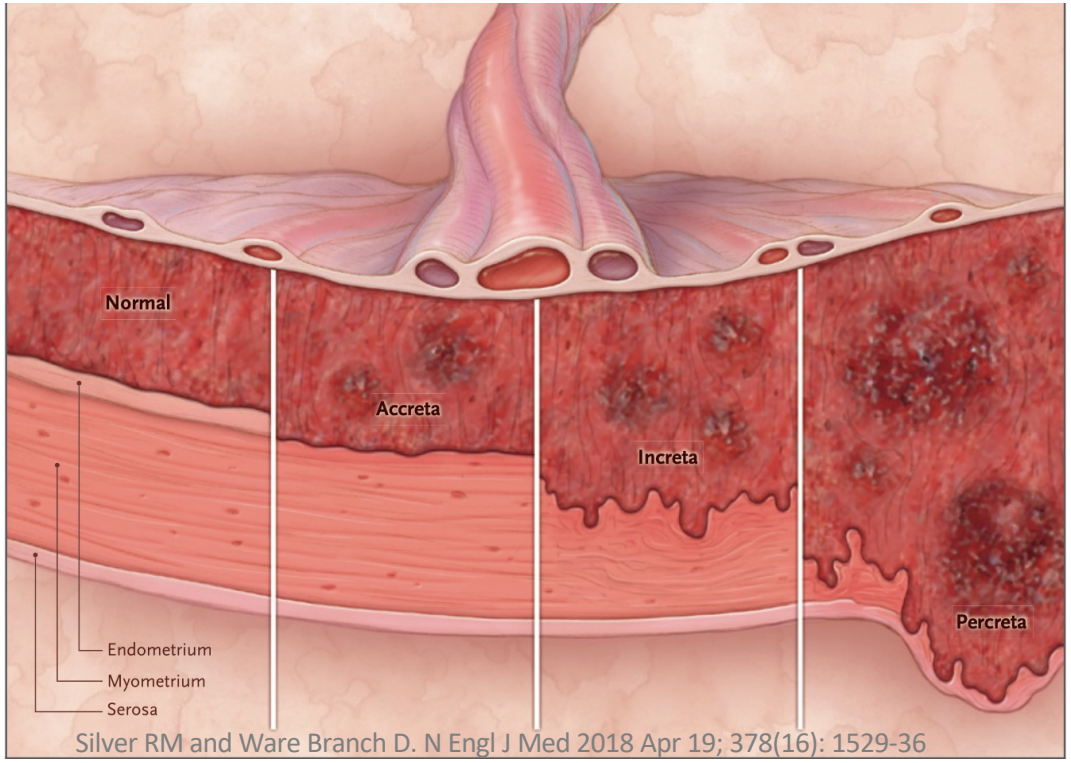
**The Future:** predictive models, machine learning, population-based studies

Obstet Gynecol 2021 Dec 1; 138(6): 924-30.

# Maternal Morbidity Associated With Multiple Repeat Cesarean Deliveries

- 30,132 women, cesarean delivery
- 732 women:  placenta previa

| Prior Cesarean Deliveries | Risk of Placenta Accreta |
|---|---|
| 0 | 3 % |
| 1 | 11 % |
| 2 | 40 % |
| 3 | 61 % |
| 4 or > | 67 % |



Silver RM and Ware Branch D. N Engl J Med 2018 Apr 19; 378(16): 1529-36

Sliver RM et al; Obstet Gynecol 2006; 107(6): 1226-32.

# Incidence and risk factors for severe postpartum haemorrhage in women with anterior low-lying or praevia placenta and prior caesarean: Prospective population-based study

176 maternity units in France

## Inclusion Criteria

- Placenta previa or anterior low-lying placenta
- Prior cesarean delivery
- No suspicion for placenta accreta syndrome

## Primary Outcome

**Severe PPH**

- Blood loss ≥ 1500 mL
- Transfusion ≥ 4 PRBCs
- Embolization or surgical management

# Incidence and risk factors for severe postpartum haemorrhage in women with anterior low-lying or praevia placenta and prior caesarean: Prospective population-based study

## Inclusion Criteria

- Placenta previa or anterior low-lying placenta
- Prior cesarean delivery
- No suspicion for placenta accreta syndrome

## Results: 520, 114 deliveries

- N = 230 met inclusion criteria
- **Severe PPH**: 24.8% (95% CI 19.2-30.4)
  - Placenta previa: 27.5%
  - Low-lying placenta: 15.4%
  - Unsuspected PAS: 9.9%
  - Placenta previa aOR 3.65 (95% CI 1.2-15.8)

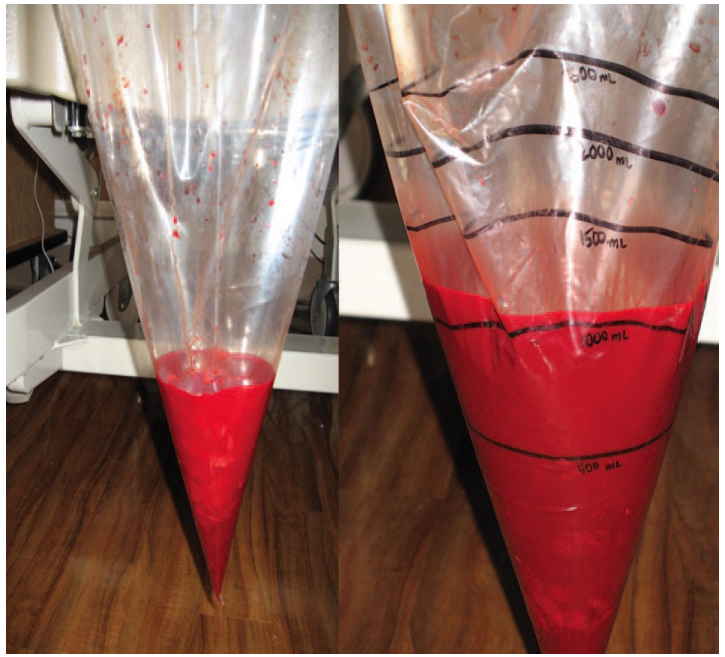
**Take-home: Severe PPH was frequent, even after excluding women with PAS. Severe PPH was 2x as likely with placenta previa than with low-lying placenta.**

Pinton A et al. BJOG 2023;130:1653-61.

7. Measurement of cumulative blood loss (formal, as quantitative as possible)

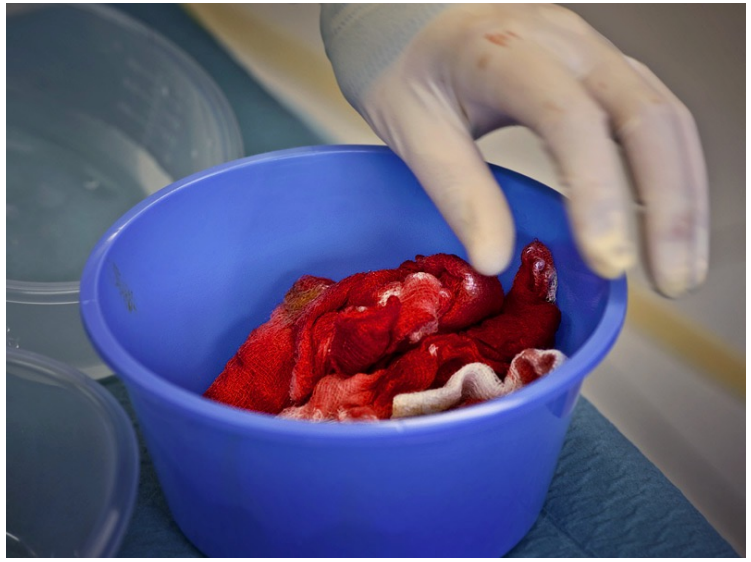
- What's your system?

- Calibrated drapes
- Suction canisters
- Gravimetric
- New technology?



Main EK et al. Anesth Analg 2015; Toledo P et al. Anesth Analg 2007

# Visual Estimation of Blood Loss After Delivery

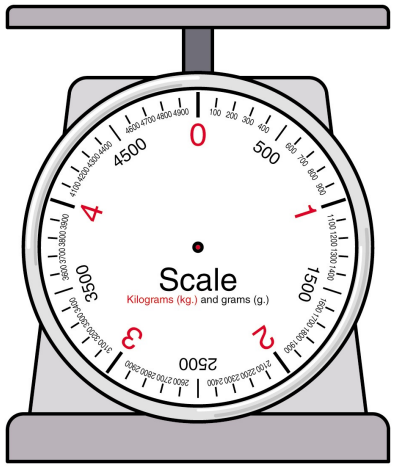


We are REALLY BAD at this!

Calibrated V-Drapes

Calibrated Canisters

1g = 1 mL




Gravimetry


Refined Gravimetry

Colorimetry- Sponges

Colorimetry - Canisters

# Introduction of a Novel System for Quantitating Blood Loss After Vaginal Delivery: A Retrospective Interrupted Time Series Analysis With Concurrent Control Group

Mario I. Lumbreras-Marquez, MBBS, MMSc,*† Sharon C. Reale, MD,†
Daniela A. Carusi, MD, MS,* Julian N. Robinson, MD,* Nora Scharf, RN, MS,‡
Kara G. Fields, MS,† and Michaela K. Farber, MD, MS†


- 3 months before (vEBL)
- 3 months after (QBL)

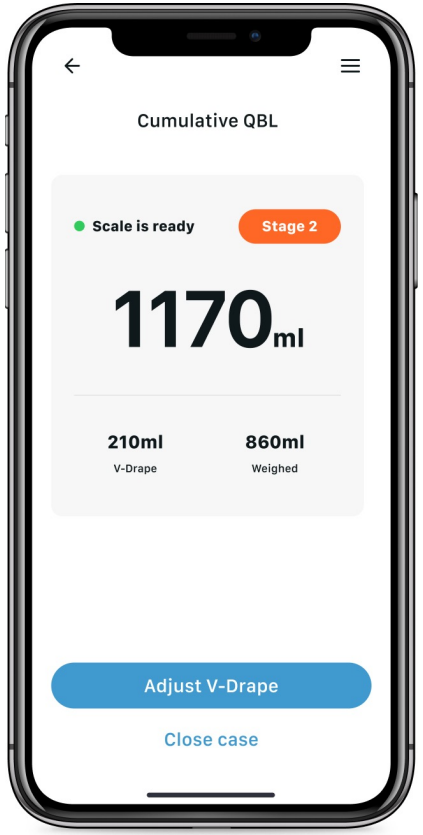
- Primary outcome:
- Incidence of PPH detection (blood loss ≥ 500 mL)

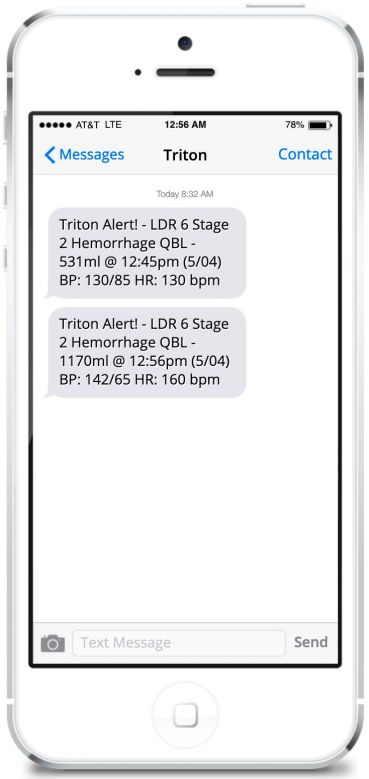
- PPH detection before vs. after device implementation:

11.5 → 26.8%

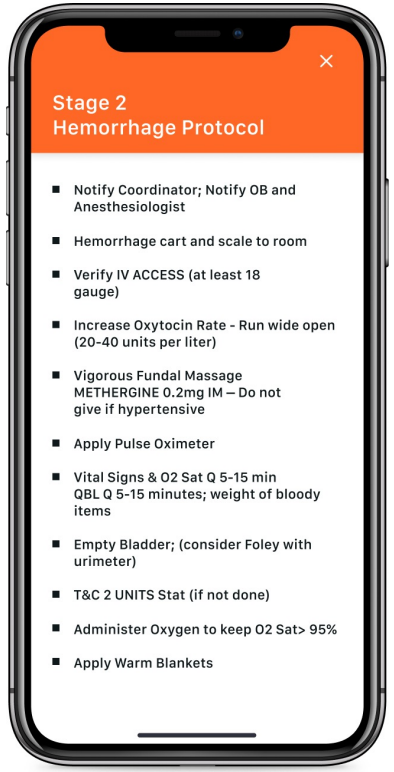
# Clinician Alerts and Protocol Prompts for Active Bleeding

- Triggered by QBL ≥ 500 mL
- Vital sign thresholds input by nurse
- Staged protocol prompts provided




Triton Alert! – LDR 6 Stage 2 Hemorrhage QBL – 1263 ml @ 4:56am (10/23) BP: 99/58 HR: 138 bpm

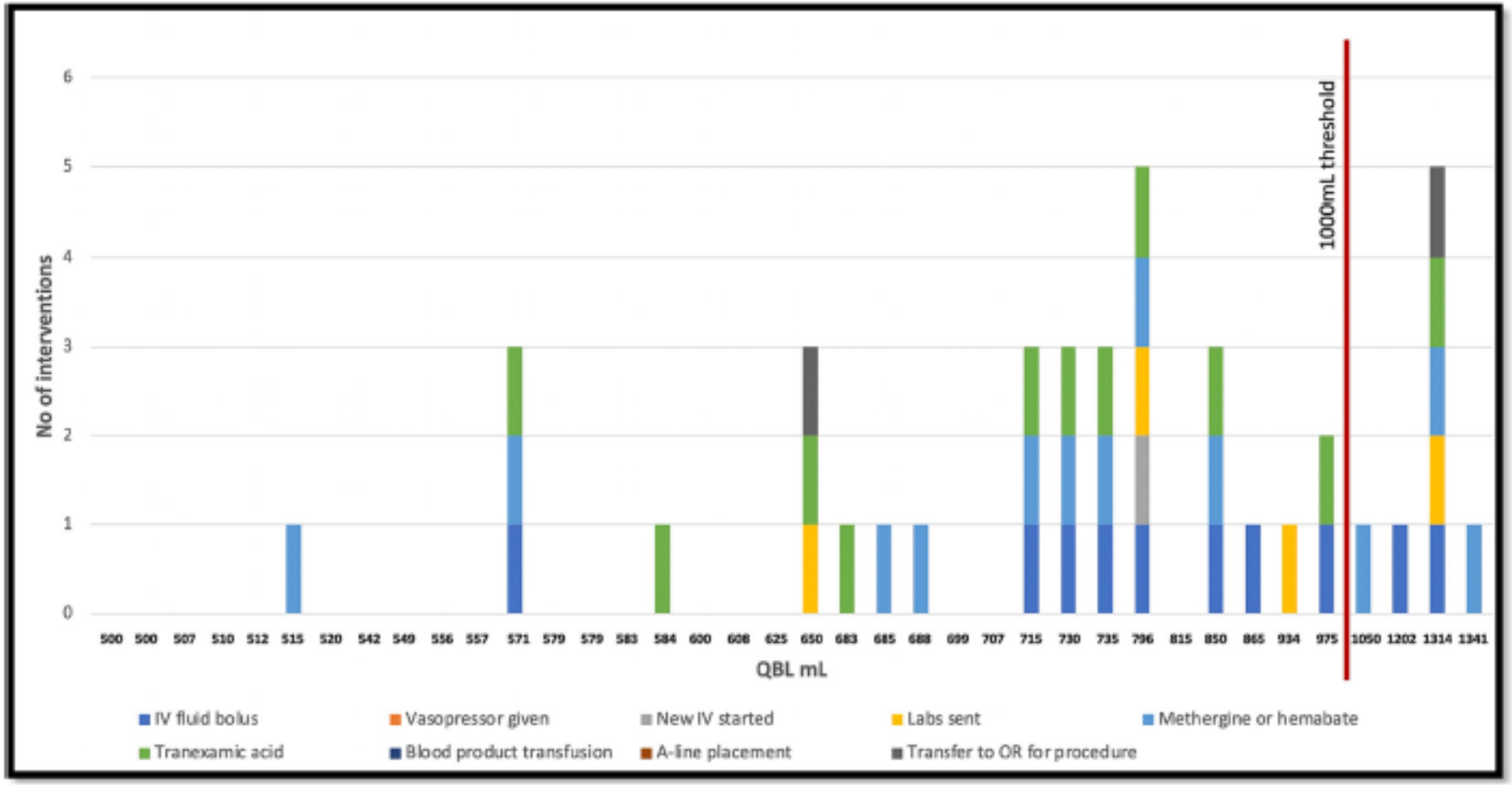



# An automated clinician alert for postpartum hemorrhage after vaginal delivery


Image. Stryker QBL system and iWatch notification for alert.

## METHODS

- IRB-approved single-center prospective pilot study conducted over six months (2021)
- Stryker® QBL devices were installed in every labor room in our unit with automatic Apple iWatch notifications for QBL ≥500 mL
- Devices automatically triggered an alert sent to members of Anesthesia team who responded to hemorrhage.




## RESULTS

- 38 alerts, convenience sample
- Median alert QBL: 637 mL
- 50% of alerts: intervention
- 90%: occurred < 1000 mL

## Most common interventions:

- Second uterotonic (31%)
- Tranexamic acid (28%)
- IV fluid bolus (23%)

**Correlation coefficient** between QBL and # interventions:
0.63 ($P < 0.001$)

***Key point: a QBL threshold of 500 mL is a clinically important trigger for intervention for hemorrhage after vaginal delivery***

# Objectives: Postpartum Hemorrhage

- **Optimize** your unit policies overall, with focus on risk assessment and early detection
- **Recognize** the latest evidence for pharmacologic treatment modalities
- **Integrate** an up-to-date, impactful obstetric hemorrhage protocol

# Objectives: Postpartum Hemorrhage

- Latest Evidence for Pharmacologic Treatment Modalities:
  - Tranexamic Acid
  - Calcium
  - Methylergonovine

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http://www.safehealthcareforeverywoman.org

2. Immediate access to hemorrhage medications (kit or equivalent)

**Tranexamic Acid**
**Calcium**
**Methylergonovine**

Main EK. Anesth Analg 2015; 121:142-8.

# Guidelines: TXA for postpartum hemorrhage

## October 2017


- use TXA in ***all cases of PPH***, regardless of the bleeding source or cause
- use TXA ***within 3h of birth*** and as soon as possible after onset of PPH.

ACOG
The American College of Obstetricians and Gynecologists

***should be considered*** when initial medical therapy fails

***Earlier use*** is likely to be superior to delayed treatment

***Data are insufficient*** to recommend it for ***prophylaxis*** outside of the context of research

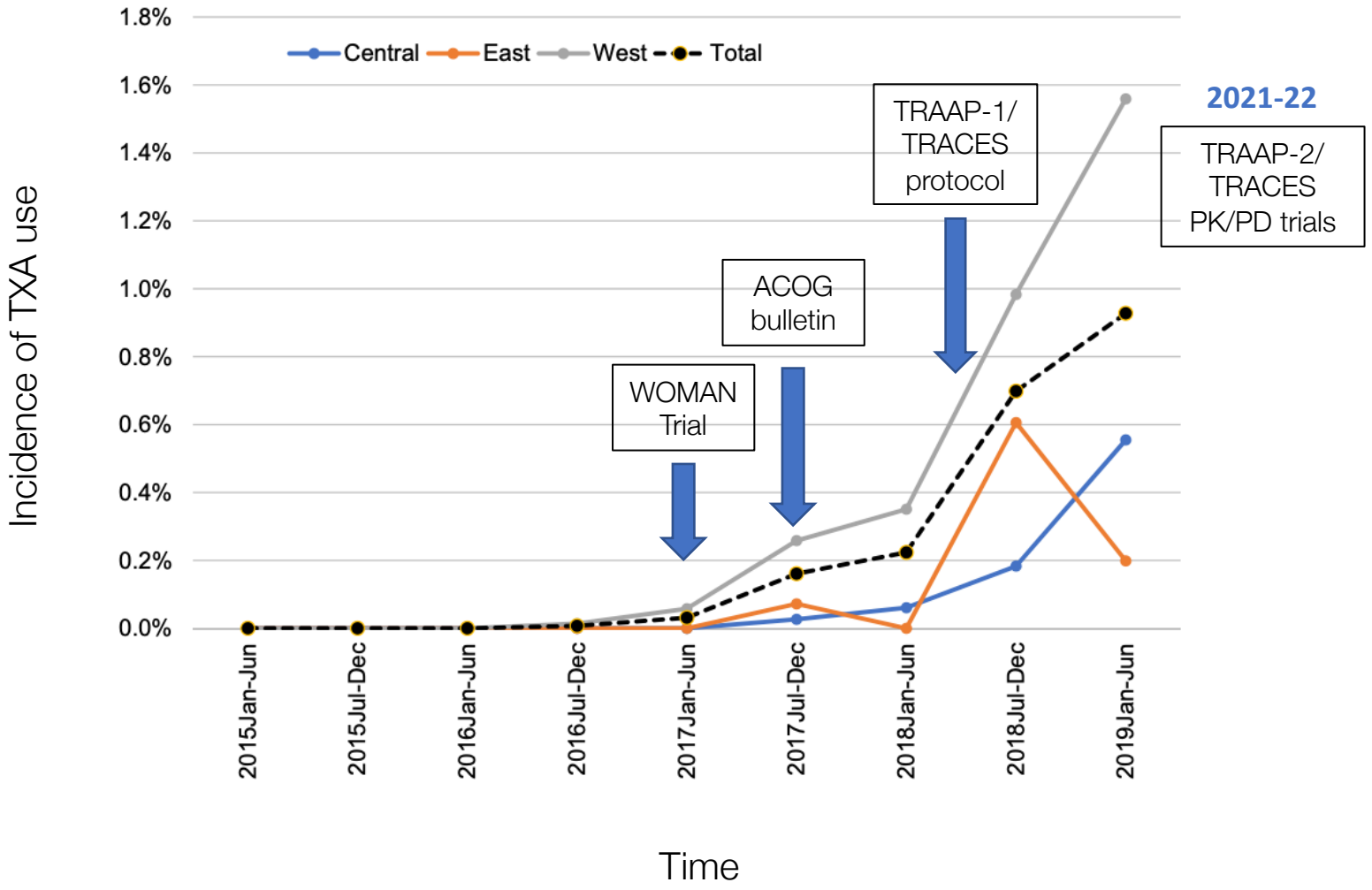
## June 2021

International Confederation of Midwives

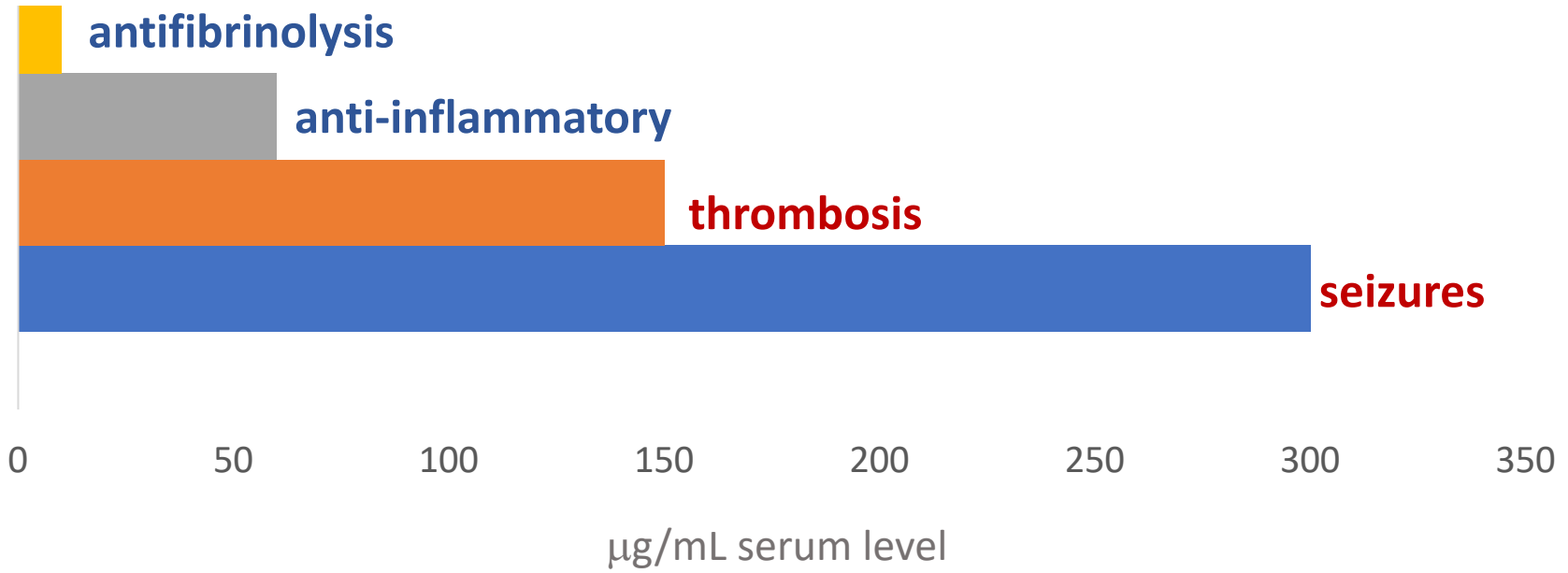
FIGO
International Federation of Gynecology and Obstetrics

- Early use ***within 3h*** of clinical diagnosis
- Always ***in addition to*** standard care

# National trends of peripartum tranexamic acid use by region in the United States, 2015-2019



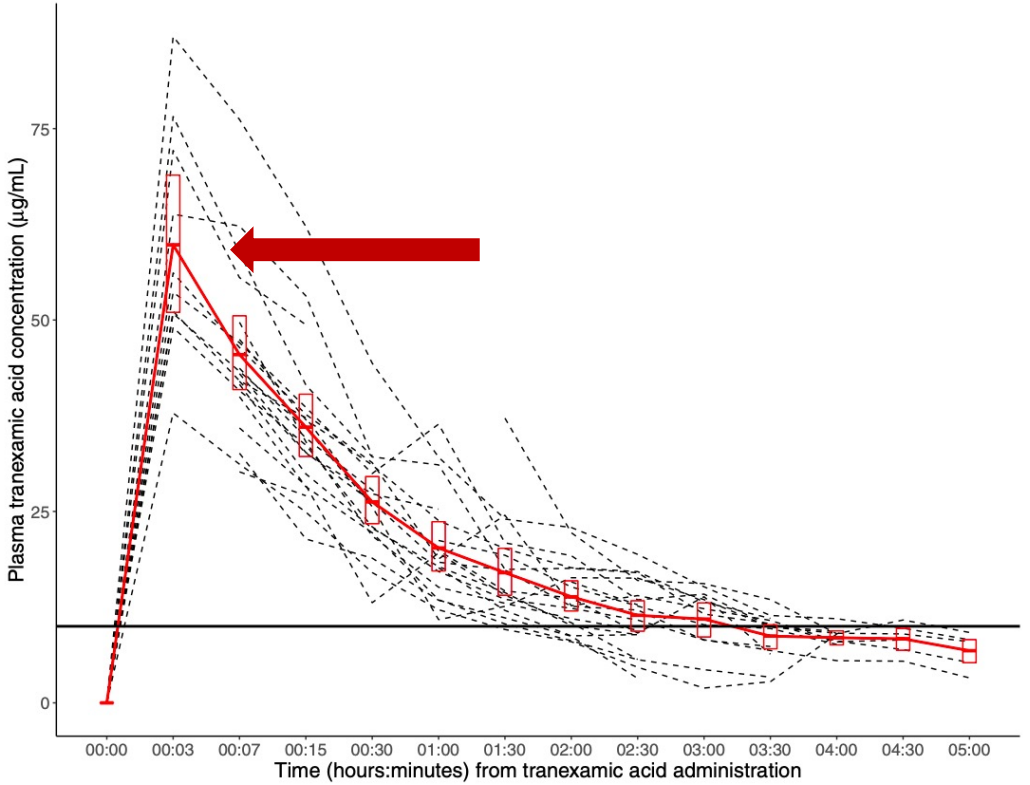

# *Tranexamic Acid Plasma Level: Efficacy vs. Toxicity*

*What **serum level of TXA** do we actually achieve with*
***1g IV given during postpartum hemorrhage?***

- A mean **peak of 60 µg/mL**
  3 minutes after dosing
- Serum levels **above 10 µg/mL**
  for an hour after dosing

**FIGURE 1**
**Tranexamic acid plasma concentrations**




Values are presented as mean (standard error). The *black line* highlights the 10 µg/mL threshold.

*Seifert. Tranexamic acid: maternal pharmacokinetics and pharmacodynamics. Am J Obstet Gynecol 2022.*

Seifert SM et al. Am J Obstet Gynecol 2023 Jan;228(1):111-112

Systematic Reviews ajog.org

# Tranexamic acid for the prevention of postpartum hemorrhage in women undergoing cesarean delivery: an updated meta-analysis

Ioannis Bellos, MD; Vasilios Pergialiotis, MD, PhD

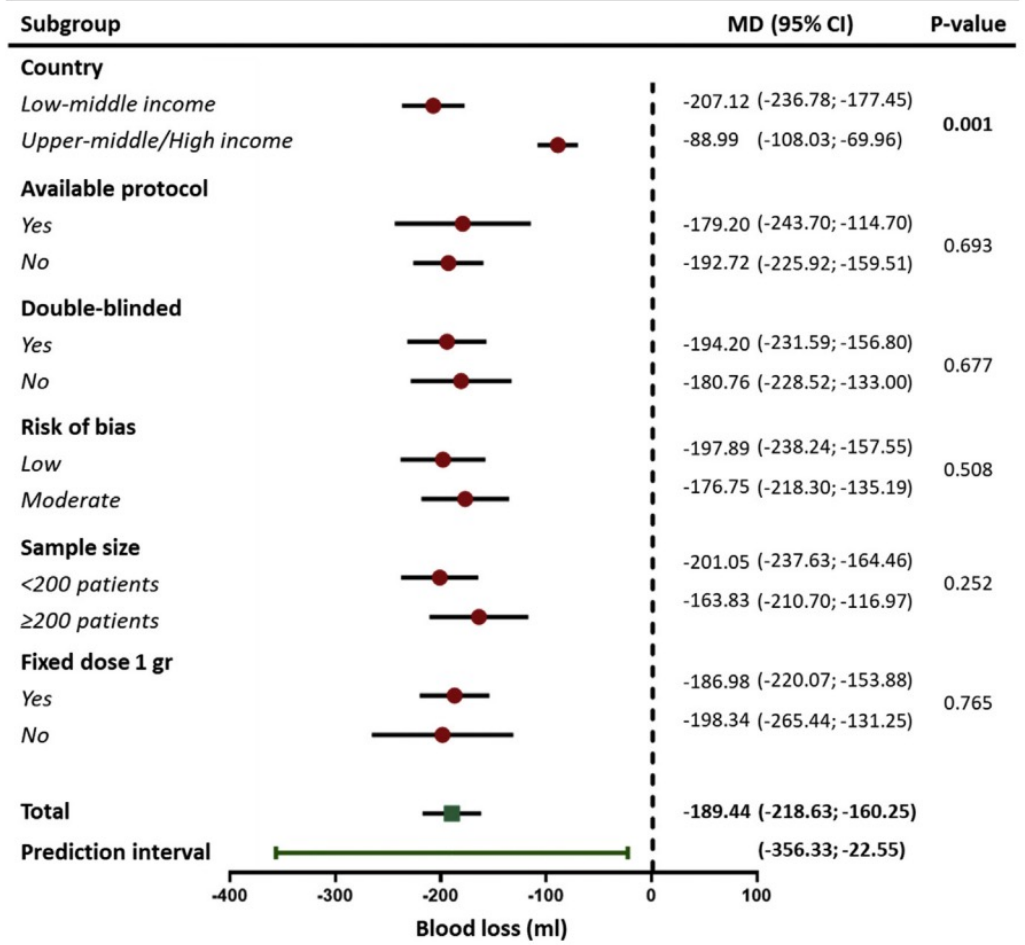
- 36 randomized controlled trials
- n = 10,659
- 1g in most trials
- 7 trials used a 10mg/kg dose

## Conclusion:

***Prophylactic TXA is effective in limiting PPH***

- Especially in low-middle income countries

**FIGURE 2**
**Subgroup analysis of the total blood loss outcome**




*CI*, confidence intervals; *MD*, mean difference.

*Bellos. Prophylactic tranexamic acid in cesarean delivery. Am J Obstet Gynecol 2022.*

# Tranexamic acid for the prevention of postpartum hemorrhage in women undergoing cesarean delivery

estimated blood loss was used in the meta-analysis. Because TRAAP2 observed a statistically significant reduction in estimated blood loss but not gravimetrical blood loss, this raises the possibility of selective reporting bias in favor of TXA affecting the results of the meta-analysis.

The results of the TRAAP2 trial also stand out. Unlike the other, poorer quality trials, TRAAP2 did not observe any evidence for a beneficial effect of TXA on gravimetrically measured blood loss or other related outcomes such as blood transfusion. Yet, in this meta-analysis, the reliable evidence generated by the TRAAP2 trial has been distorted by the numerous substandard clinical trials that pervade this important research topic. TRAAP2 is the only trial completed to date that reliably assesses the effects of TXA for preventing PPH. The evidence from all other trials is unreliable, as are the results of meta-analyses they contribute data to.[2,4]

Loïc Sentilhes, MD, PhD
Department of Obstetrics and Gynecology
Bordeaux University Hospital
Place Amélie Raba Léon

# Tranexamic Acid to Prevent Obstetrical Hemorrhage after Cesarean Delivery

## Prophylaxis with Tranexamic Acid: Is it warranted?

- 31 US hospitals; randomized controlled trial
- 11,000 women having elective or non-elective cesarean delivery

- Cord clamping → placebo vs. TXA: 1g diluted in 40 mL normal saline

- Primary outcome: composite of maternal death or blood transfusion within 7d or by hospital discharge

- Secondary outcomes: EBL >1L, interventions, hemoglobin change


Pacheco LD et al. NEJM 2023; 388:1365-75.

# Tranexamic Acid to Prevent Obstetrical Hemorrhage after Cesarean Delivery

**Table 2. Primary and Secondary Outcomes.***

| Outcome | Tranexamic Acid (N=5525) | Placebo (N=5470) | Relative Risk or Mean Difference (95% CI)† |
|---|---|---|---|
| Primary outcome: maternal death or blood transfusion by hospital discharge or 7 days post partum, whichever was earlier — no. (%) | 201 (3.6) | 233 (4.3) | 0.89 (0.74 to 1.07)‡ |
| Maternal death | 0 | 1 (<0.1) | — |
| Blood transfusion | 201 (3.6) | 232 (4.2) | 0.86 (0.71 to 1.03) |
| Estimated blood loss >1 liter — no./total no. (%) | 339/4641 (7.3) | 368/4573 (8.0) | 0.91 (0.79 to 1.05) |
| Intervention in response to bleeding and related complications by 7 days post partum — no. (%) | 892 (16.1) | 986 (18.0) | 0.90 (0.82 to 0.97) |
| Surgical or radiologic intervention by 7 days post partum — no. (%) | 233 (4.2) | 231 (4.2) | 1.00 (0.84 to 1.19) |
| Uterotonic agent other than oxytocin by 48 hr post partum — no. (%) | 649 (11.7) | 732 (13.4) | 0.88 (0.80 to 0.97) |
| Open-label use of tranexamic acid by 7 days post partum — no. (%) | 108 (2.0) | 109 (2.0) | 0.98 (0.75 to 1.28) |
| Transfusion of any blood product by 7 days post partum — no. (%) | 205 (3.7) | 238 (4.4) | 0.85 (0.71 to 1.02) |
| Change in hemoglobin level — g/dl§ | −1.8±1.1 | −1.9±1.1 | −0.1 (−0.2 to −0.1) |

**Take-home: Prophylactic TXA during cesarean delivery did not lead to a lower rate of death or blood transfusion**

Pacheco LD et al. NEJM 2023; 388:1365-75.

# The Largest Peril of Tranexamic Acid: Intrathecal Injection

**Catastrophic drug errors involving tranexamic acid administered during spinal anaesthesia**

**S. Patel,**[1] **B. Robertson**[2] and **I. McConachie**[3]




- Accidental intrathecal injection
  - **21 cases**
  - 10 deaths (48%)

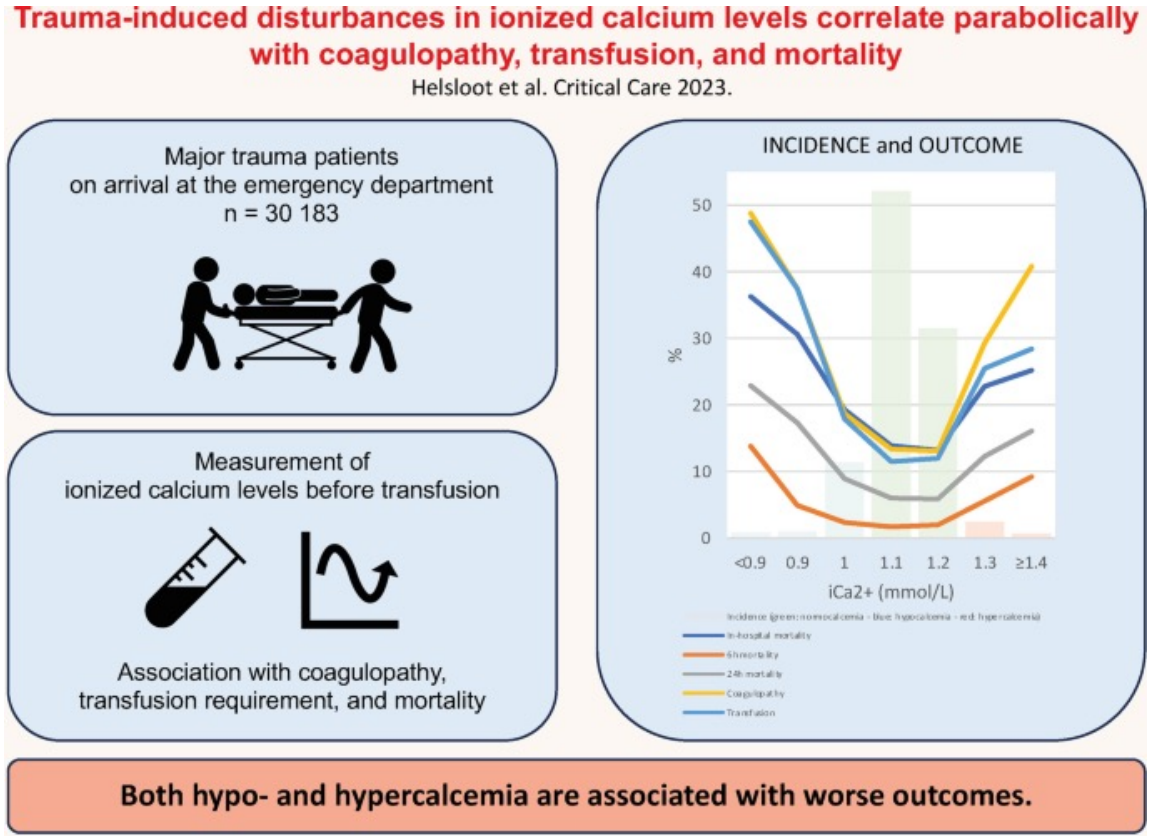
  - **7 obstetric patients**
  - 6 deaths (86%)

**TXA for PPH:**

- **is not warranted** for prophylaxis
- **should not be prioritized** over other treatments
- **must be stored carefully** on L&D

Patel S et al. Anaesthesia 2019 Jul; 74(7):904-14.

# Calcium: Longstanding Use in Critical Care, Hemorrhage, and Transfusion




- Inexpensive
- Shelf-stable
- Familiar use in obstetrics:
  - correcting transfusion-related hypocalcemia
  - treating magnesium toxicity

## Uterine Effects

- May improve contractility
- In vitro: low calcium, lower contractility
- Laboring patients – higher calcium
- Hemorrhage risk – lower calcium

Helsloot D et al. Crit Care 2023 Jul 6; 27(1):267. Ansari JR et al. Obstet Gynecol 2024;143:104–12.

# Intravenous Calcium to Decrease Blood Loss During Intrapartum Cesarean Delivery

*A Randomized Controlled Trial*

**Hypothesis:** calcium infusion will decrease blood loss at delivery in patients at risk for atonic postpartum hemorrhage

- Randomized, placebo-controlled, double-blind superiority trial
- ≥ 34 weeks, cesarean delivery after oxytocin exposure
- 1g IV CaCl2 vs. saline, 1 min after cord clamping [both: oxytocin standard infusion]
- Primary outcome: quantitative blood loss
- Subgroup: exclusion of non-atony cases

# Intravenous Calcium to Decrease Blood Loss During Intrapartum Cesarean Delivery

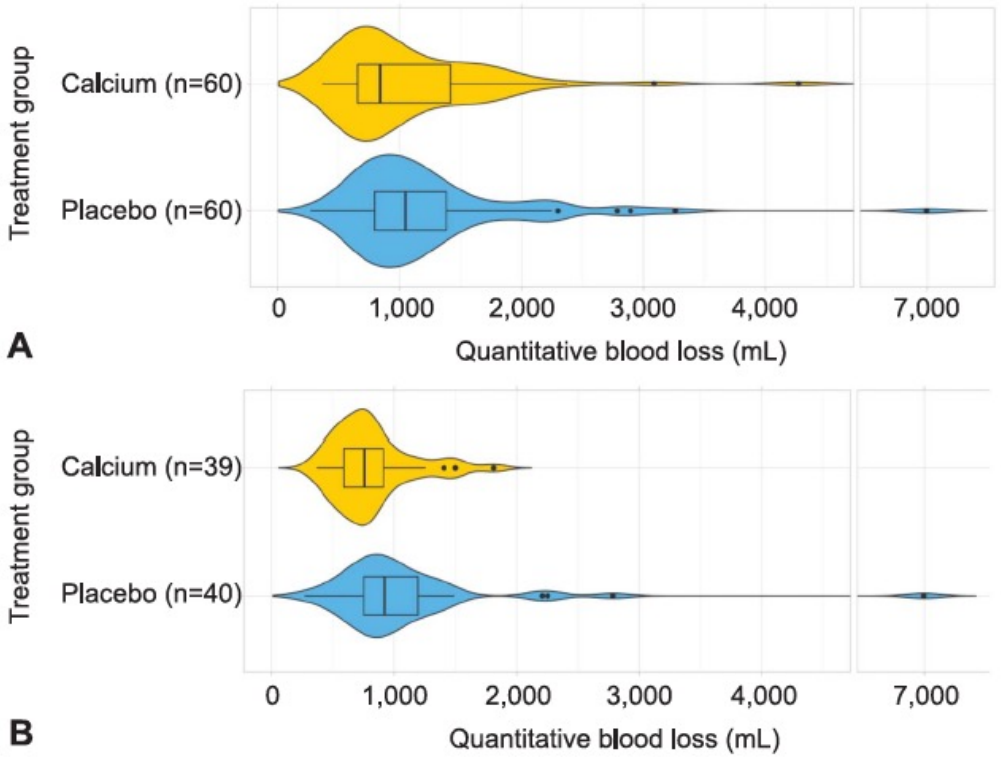
*A Randomized Controlled Trial*

## Results

828 laboring patients consented; 120 enrolled

Median QBL 840 mL ($CaCl_2$) vs. 1,051 mL (placebo)
QBL reduction 211 mL; NS (95% CI -33 to 410)

Subgroup n = 79 (uterine atony only)
**QBL reduction 356 mL (95% CI 159-515)**

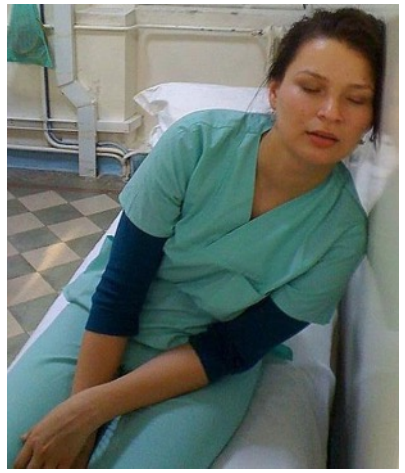



**Take-home: Calcium is well-tolerated, low-risk, and reasonable to consider for PPH related to uterine atony**

# Prophylactic Administration of Uterotonics to Prevent Postpartum Hemorrhage in Women Undergoing Cesarean Delivery for Arrest of Labor

## *A Randomized Controlled Trial*

*Mrinalini Balki, MD, Kristi Downey, MSc, Andrew Walker, PhD, Gareth Seaward, MMed, and Jose C. A. Carvalho, MD, PhD*



***Question: Does prophylactic secondary uterotonic prevent postpartum hemorrhage during cesarean delivery for failure to progress?***

- Arrest of labor
- ≥ 4h on oxytocin
- Double-blind, 3-arm RCT
- Tone checks: 3,5,10 min

→ Oxytocin alone 5 IU IV

→ Oxytocin + ergonovine 0.25mg IV

→ Oxytocin + carboprost 0.25 mg IM

- **Primary outcome: intraoperative need for additional uterotonics**

**Box 1. Protocol for Administration of Additional Uterotonics (Open Label)**

**1st uterotonic**

- Oxytocin 5 international units bolus over 1 min

**2nd uterotonic**

- Carboprost 0.25 mg intramyometrial OR Ergonovine 0.25 mg intramuscular

**3rd uterotonic**

- Carboprost 0.25 mg intramyometrial 15 min after the previous dose OR Ergonovine 0.25 mg intramuscular (IF not yet given)

Balki M et al. Obstet Gynecol 2021 Mar 1; 137(3):505-13

# Prophylactic Administration of Uterotonics to Prevent Postpartum Hemorrhage in Women Undergoing Cesarean Delivery for Arrest of Labor

*A Randomized Controlled Trial*

*Mrinalini Balki, MD, Kristi Downey, MSc, Andrew Walker, PhD, Gareth Seaward, MMed, and Jose C. A. Carvalho, MD, PhD*

| | Oxytocin alone (n = 35) | Oxytocin plus ergonovine (n = 33) | Oxytocin plus carboprost (n = 32) | P value |
|---|---|---|---|---|
| Additional uterotonics | 13 (37%) | 11 (33%) | 11 (34%) | 0.932 |
| Tone at 3 min | 22 (63%) | 19 (58%) | 21 (66%) | 0.814 |
| EBL (mL) | 676 ± 183 | 663 ± 143 | 714 ± 309 | 0.644 |
| Nausea, vomiting | 18 (51%) | 28 (85%)<br>OR 5.3 (1.7-16.9) | 23 (72%)<br>OR 2.4 (0.9-6.7) | 0.010 |
| Hypotension | 14 (40%) | 5 (15%) | 8 (25%) | 0.068 |

***Take-home: for patients having CD after labor with oxytocin augmentation, there is no benefit to prophylactic ergonovine or carboprost.***

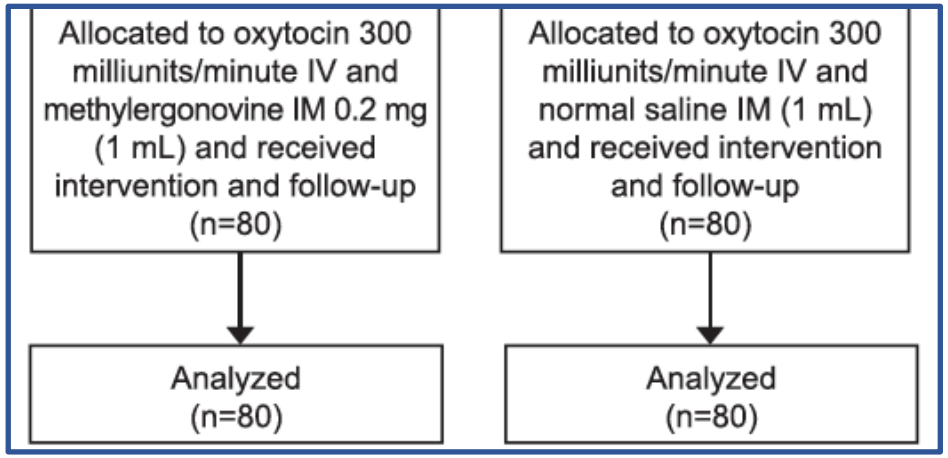
Balki M et al. Obstet Gynecol 2021 Mar 1; 137(3):505-13

# Prophylactic Methylergonovine and Oxytocin Compared With Oxytocin Alone in Patients Undergoing Intrapartum Cesarean Birth

*A Randomized Controlled Trial*

*Nicole Masse, MD, Franklin Dexter, MD, PhD, and Cynthia A. Wong, MD*

## N = 160 randomized




**Single-center, randomized placebo-controlled trial**
1088 approached on arrival to L&D
160 enrolled at time of failure to progress cesarean

***Oxytocin plus prophylactic methylergonovine:***

| | |
|---|---|
| → *lower additional uterotonic* | *20 vs 55%, RR 0.4, 95% CI 0.2-0.6* |
| → *more satisfactory tone* | *80 vs. 41% RR 1.9, 95% CI 1.5-2.6* |
| → *lower PPH 35 vx. 59% RR* | *0.6, 95% CI 0.4-0.9* |
| → *lower QBL 967 vs 1315 mL* | *mean diff 348, 95% CI 124-572* |
| → *lower transfusion* | *5 vs 23% RR 0.2, 95% CI 0.1-0.6* |

***Take-home: for patients having CD after labor with oxytocin augmentation, there ~~is no~~ may be benefit to prophylactic Ergonovine!***

***-IM vs IV?***
***-different oxytocin dosing?***

# Objectives: Postpartum Hemorrhage

- **Optimize** your unit policies for hemorrhage risk assessment and delivery planning
- **Recognize** the latest evidence for pharmacologic treatment modalities
- **Integrate** an up-to-date, impactful obstetric hemorrhage protocol

## Objectives: Postpartum Hemorrhage

- Update your obstetric hemorrhage protocol: Coagulation Testing?

**Box 1. Obstetric Hemorrhage Safety Bundle From the National Partnership for Maternal Safety, Council on Patient Safety in Women's Health Care**

**Readiness (Every Unit)**

1. Hemorrhage cart with supplies, checklist, and instruction cards for intrauterine balloons and compression stitches
2. Immediate access to hemorrhage medications (kit or equivalent)
3. Establish a response team—who to call when help is needed (blood bank, advanced gynecologic surgery, other support and tertiary services)
4. Establish massive and emergency-release transfusion protocols (type-O negative or uncrossmatched)
5. Unit education on protocols, unit-based drills (with postdrill debriefs)

**Recognition and Prevention (Every Patient)**

6. Assessment of hemorrhage risk (prenatal, on admission, and at other appropriate times)
7. Measurement of cumulative blood loss (formal, as quantitative as possible)
8. Active management of the 3rd stage of labor (department-wide protocol)

**Response (Every Hemorrhage)**

9. Unit-standard, stage-based obstetric hemorrhage emergency management plan with checklists
10. Support program for patients, families, and staff for all significant hemorrhages

**Reporting and Systems Learning (Every Unit)**

11. Establish a culture of huddles for high-risk patients and postevent debriefs to identify successes and opportunities
12. Multidisciplinary review of serious hemorrhages for systems issues
13. Monitor outcomes and process metrics in perinatal quality improvement committee

http://www.safehealthcareforeverywoman.org

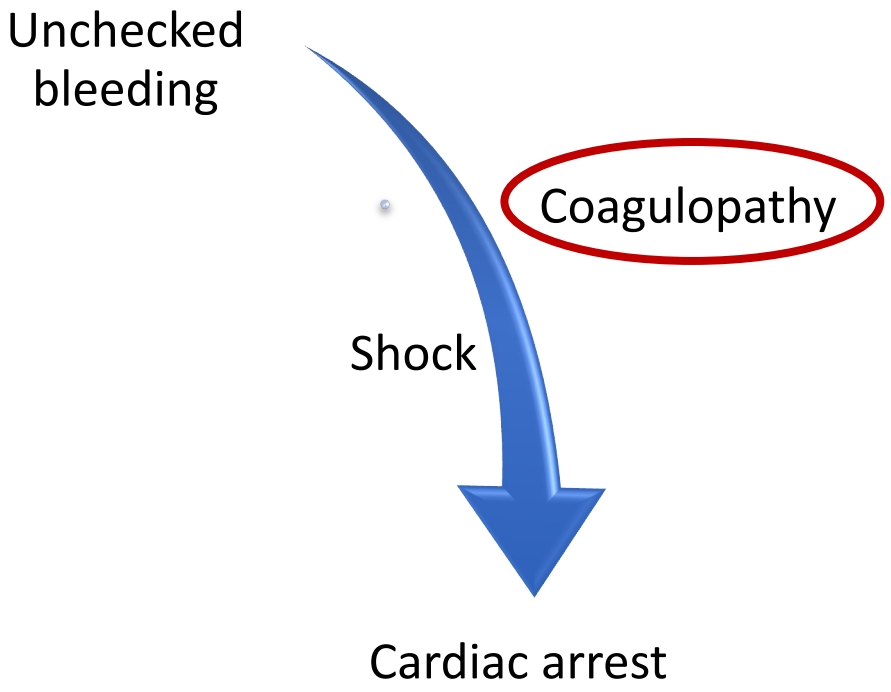
4. Establish massive and emergency-release transfusion protocols (type-O negative or uncrossmatched)

***detection and treatment of coagulopathy**

# Morbidity from Postpartum Hemorrhage: 75% Preventable

| Preventable Issues |
| --- |
| **Underestimation of blood loss** |
| Missing signs of **hypovolemic shock** |
| **Late activation of MTP** |
| **Inadequate resuscitation** |
| Failure to **call for expert help** |

## "Too Little Done Too Late"



Revised December 2016

Safe Motherhood Initiative

ACOG The American Congress of Obstetricians and Gynecologists District II

Example

# Obstetric Hemorrhage Checklist

**Complete all steps in prior stages plus current stage regardless of stage in which the patient presents.**

## Recognition:

☐ Call for assistance (Obstetric Hemorrhage Team)

Designate: ☐ Team leader _____ ☐ Checklist reader/recorder ☐ Primary RN

Announce: ☐ Cumulative blood loss ☐ Vital signs _____ ☐ Determine stage

**Stage 1: Blood loss > 500 mL vaginal OR blood loss > 1000 mL cesarean with normal vital signs and lab values**

## Initial Steps:

☐ Ensure 16G or 18G IV Access
☐ Increase IV fluid (crystalloid without oxytocin)
☐ Insert indwelling urinary catheter
☐ Fundal massage

## Medications:

☐ Ensure appropriate medications given patient history
☐ Increase oxytocin, additional uterotonics

## Blood Bank:

☐ Type and Crossmatch 2 units RBCs

## Action:

☐ Determine etiology and treat
☐ Prepare OR, if clinically indicated (optimize visualization/examination)

**Oxytocin (Pitocin)**:
10-40 units per 500-1000mL solution

**Methylergonovine (Methergine)**:
0.2 milligrams IM; **Avoid with hypertension**

**15-methyl $PGF_2\alpha$ (Hemabate, Carboprost)**:
250 micrograms IM (may repeat in q15 minutes, maximum 8 doses); **Avoid with asthma; use with caution with hypertension**

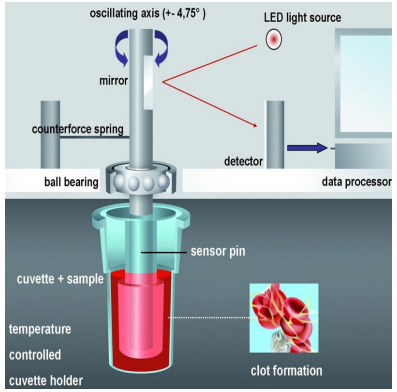
**Misoprostol (Cytotec)**:
800-1000 micrograms PR
600 micrograms PO or 800 micrograms SL

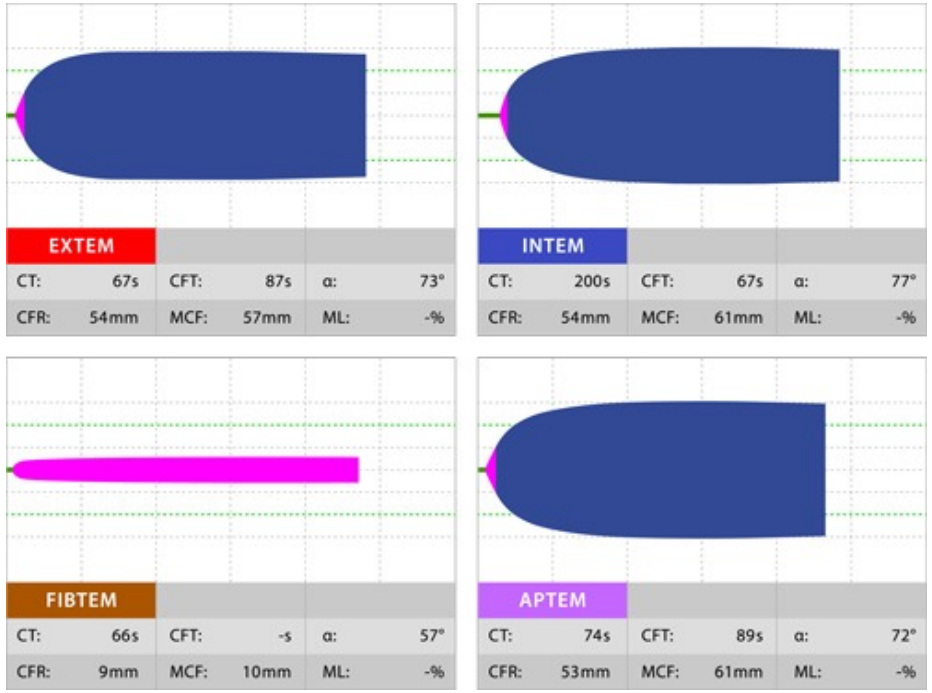
**Tone** (i.e., atony)
**Trauma** (i.e., laceration)
**Tissue** (i.e., retained products)
**Thrombin** (i.e., coagulation dysfunction)

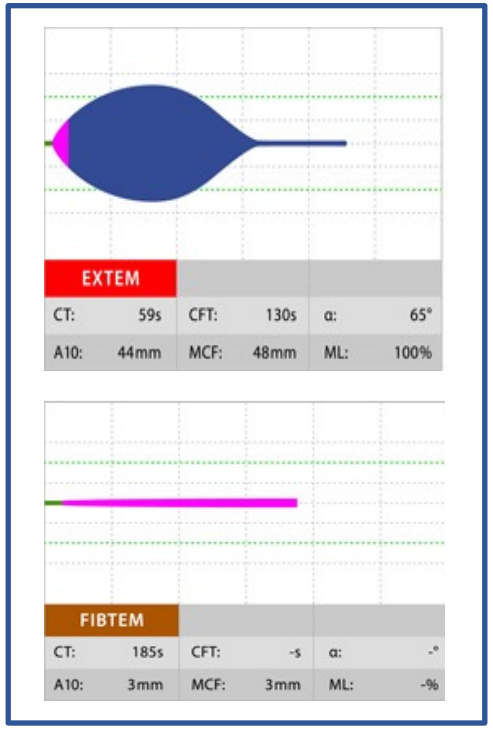
# Coagulopathy Detection During Postpartum Hemorrhage: You have Choices!

Low fibrinogen state?
**FIBTEM**

Hyperfibrinolysis?
**APTEM**




Bell SF. Int J Obstet Anesth 2021 Aug; 47:102983.

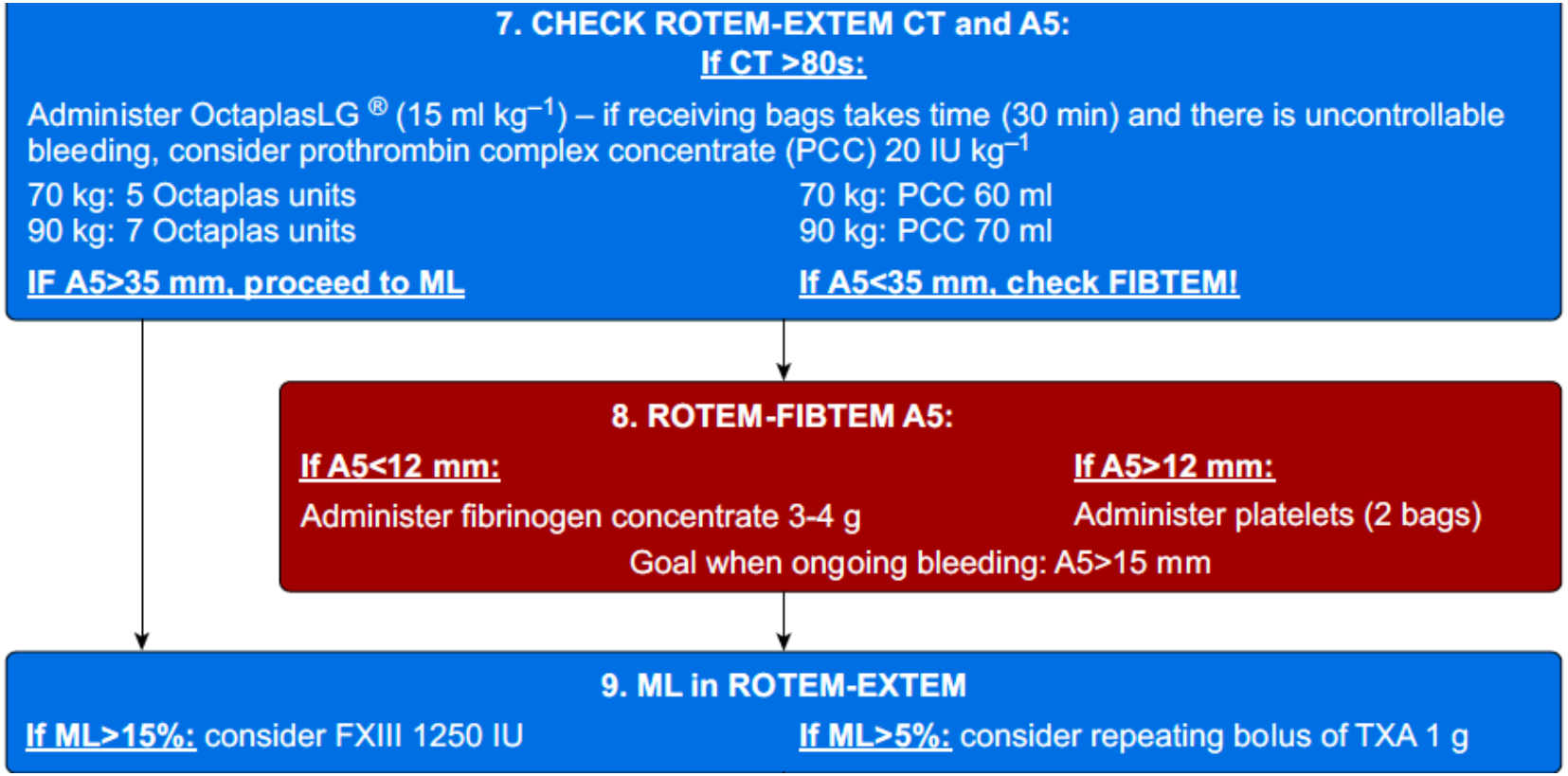
# Thromboelastometry-guided treatment algorithm in postpartum haemorrhage: a randomised, controlled pilot trial

Hypothesis: a ROTEM-guided protocol will decrease the need for **red blood cell transfusion.**

- Single center, single-blinded randomized controlled trial
- January 2016- September 2019
- Severe PPH: QBL $\geq$ 1500 mL
- Primary outcome: blood product transfusion

Jokinen S et al. Br J Anaesth. 2023 Feb;130(2):165-174.

# Thromboelastometry-guided treatment algorithm in postpartum haemorrhage: a randomised, controlled pilot trial




## Results

54 patients

**Products transfused,**

**ROTEM vs. Control:**

- PRBCs 2 vs 3 (P = 0.399)
- Plasma 5 vs 12 (p = 0.040)
- No other differences!

**Take-home: ROTEM use during severe PPH did not lower blood transfusion but was associated with less plasma administration.**

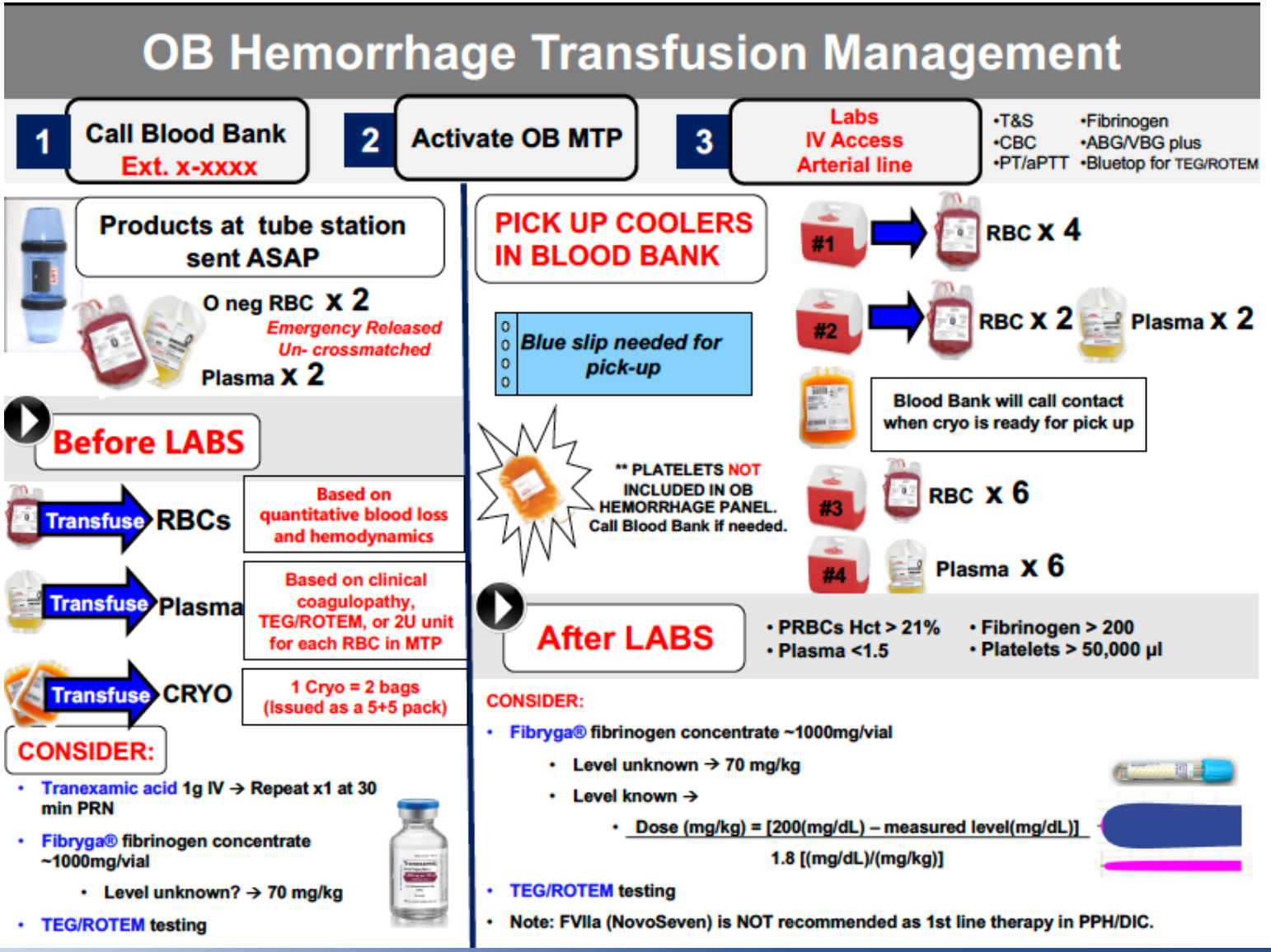
Jokinen S et al. Br J Anaesth. 2023 Feb;130(2):165-174.

# Point-of-care coagulation testing for postpartum hemorrhage: Key points

- There's **limited evidence** from randomized controlled trials to support POCCT integration into hemorrhage protocols.
- Many algorithms include them anyway.

- **Robust studies are difficult to conduct!**
  - Obstetric emergency situations preclude enrollment
  - Coagulopathy cases are very rare
  - Studies are underpowered for the outcome of transfusion
  - Patient and bleeding heterogeneity
  - Bias from lack of blinding
  - Protocol adherence can be low

# An OB-Specific Massive Transfusion Protocol




*IMMEDIATE, ORGANIZED RELEASE OF BLOOD PRODUCTS

*FIBRINOGEN SOURCES
*TRANEXAMIC ACID
*COAGULATION TESTING

# Conclusion: Postpartum Hemorrhage

- **Unit Protocols:** can always be improved!
- **Risk assessment:** standardize it to your unit, with continued refinement
- **Detection:** do quantitate blood loss
- **Tranexamic acid:** use for treatment, not for prophylaxis
- **Calcium:** consider for patients with atonic hemorrhage
- **Methergine:** prophylaxis good for hi-risk
- **Coagulopathy detection:** incorporate it in your hemorrhage protocol

**Thank you!**
**mfarber@bwh.harvard.edu**