Obstetric Crisis Management: Results of an Anesthesia-OB Collaboration

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SFOAI

Happy Tammsvik, Sweden
May 16, 2024

The pictur e can't be displa yed.

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Disclosures

Michaela Farber:

Flat Medical: Research funding (EpiFaith® syringe)

HemoSonics: Medical Advisory Board (Quantra®)

Octapharma: Medical Advisory Board (Fibryga®)

Daniela Carusi and Michaela Farber:

Wolters Kluwer: UpToDate royalties

Crisis Management: Scenarios and Solutions

1. Shortness of Breath in Labor
   Team Huddle/Risk Assessment

2a. Flash Pulmonary Edema
2b. Concealed Hemorrhage
   Urgent Team Activation

#3 Cardiopulmonary Arrest
   Protocol Utilization

#4 Critical Hemorrhage
   Resuscitation/Communication

Part 1:

Shortness of Breath in Labor

Team Huddle Risk Assessment

Part 1: 37-year-old G2P1 with shortness of breath

- African American patient
- BMI 42 kg/m^2
- Asthma
- Preeclampsia, on magnesium
- Epidural in place for past hour

- OB team was in the room 10 minutes ago, but they have left the room
- **Anesthesiologist is now called for help.**

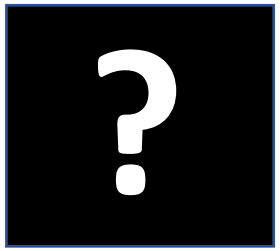
- Nurse: “She’s been saying she’s short of breath throughout the day. I had to give her the oxygen mask 2 hours ago, too.”

Part 1: 37 year-old G2P1 with shortness of breath

What is the anesthesiologist's differential?

-high spinal
-breakthrough pain
-asthma exacerbation
-thrombosis/amniotic fluid embolism

What was the obstetrician's differential?



A Different Kind of Huddle: **Patient-Centered**

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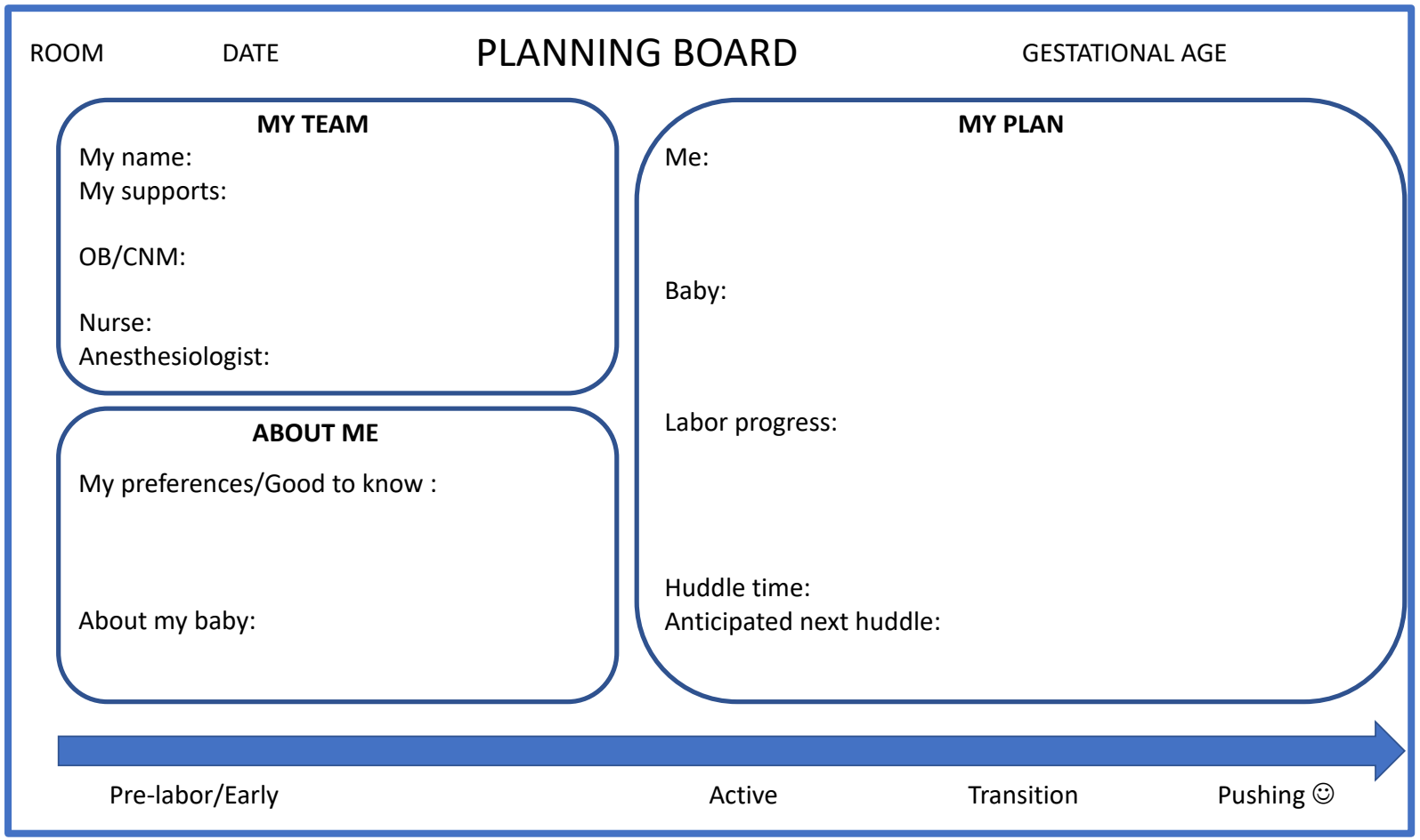

A Different Kind of Huddle: **Patient-Centered**

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*Listen to your patients

Hear Her: A National Communication Campaign Focused on Maternal Morbidity and Mortality

*Listen to each other

CDC

CDC Foundation
Together our impact is greater

MERCK for Mothers

Test your own implicit bias!

https://implicit.harvard.edu/implicit/takeatest.html

www.canstockphoto.com

Seeing the Forest As Well As the Trees:

The Obstetric Comorbidity Index

Development of a Comorbidity Index for Use in Obstetric Patients

Brian T. Bateman, MD, MSc, Jill M. Mhyre, MD, Sonia Hernandez-Diaz, MD, DrPH, Krista F. Huybrechts, MS, PhD, Michael A. Fischer, MD, MS, Andreea A. Creanga, MD, PhD, William M. Callaghan, MD, MPH, and Joshua J. Gagne, PharmD, ScD

ASSESS the RISK for EVERY PATIENT

- Weighted index
- 20 maternal conditions
- Identifiable upon admission
- Score ≥ 6 associated with higher morbidity

Obstetric Comorbidity Index Score[1]

Patient Sticker Here

Maternal Condition	Points	Comments
Preeclampsia with Severe Features* or Eclampsia	5	
Preeclampsia / Gestational / Chronic Hypertension	2	
Congestive Heart Failure	5	
Pulmonary Hypertension	4	
Ischemic Heart Disease	3	
Congenital Heart and/or Valvular Disease	4	
Multiple Gestation	2	
Intrauterine Fetal Demise	2	
Placenta Previa / Suspected Accreta / Abruption	4	
Previous Cesarean Delivery	1	
Autoimmune Disease / Lupus	2	
HIV/AIDS	2	
Sickle Cell Disease / Bleeding Disorder / Coagulopathy	3	
Chronic Renal Disease	1	
Asthma	1	
Pre-Existing Diabetes	1	
Maternal Age > 44	3	
Maternal Age 40-44	2	
Maternal Age 35-39	1	
Drug Abuse	2	
Alcohol Abuse	1	
BMI > 50	3	
BMI > 40	2	
*Severe Features: Systolic BP ≥ 160, diastolic BP ≥ 110, creatinine > 1.1, oliguria (<30 cc/hr), elevated AST or ALT, platelets < 100,000, persistent epigastric pain, headache, or scotomata, placental abruption. *See back of sheet for more details on hypertension.*	**Total:**	**MD Notified:**

Instructions for Use:
1) Circle comorbidities present in your patient and tally score at bottom.
2) Does this patient have any other high-risk features you think should be added to the list? _____
3) Notify Responding Clinician for patients with OB-CMI score > 6 or with any other concerns.
4) Document the OB-CMI score in the nursing handoff template.
5) Place completed sheet in locked bin behind desk.

RN _____ Date _____ Time _____

Bateman BT et al. Obstet Gynecol 2013; 122(5):957-65

What is our patient's score?

Part 1: 37-year-old G2P1 with shortness of breath

- BMI 42 kg/m^2
- Asthma
- Preeclampsia, on magnesium
- Epidural in place for past hour

- Score ≥ 6 associated with higher morbidity

Obstetric Comorbidity Index Score[1]

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Instructions for Use:
1) Circle comorbidities present in your patient and tally score at bottom.
2) Does this patient have any other high-risk features you think should be added to the list? _____
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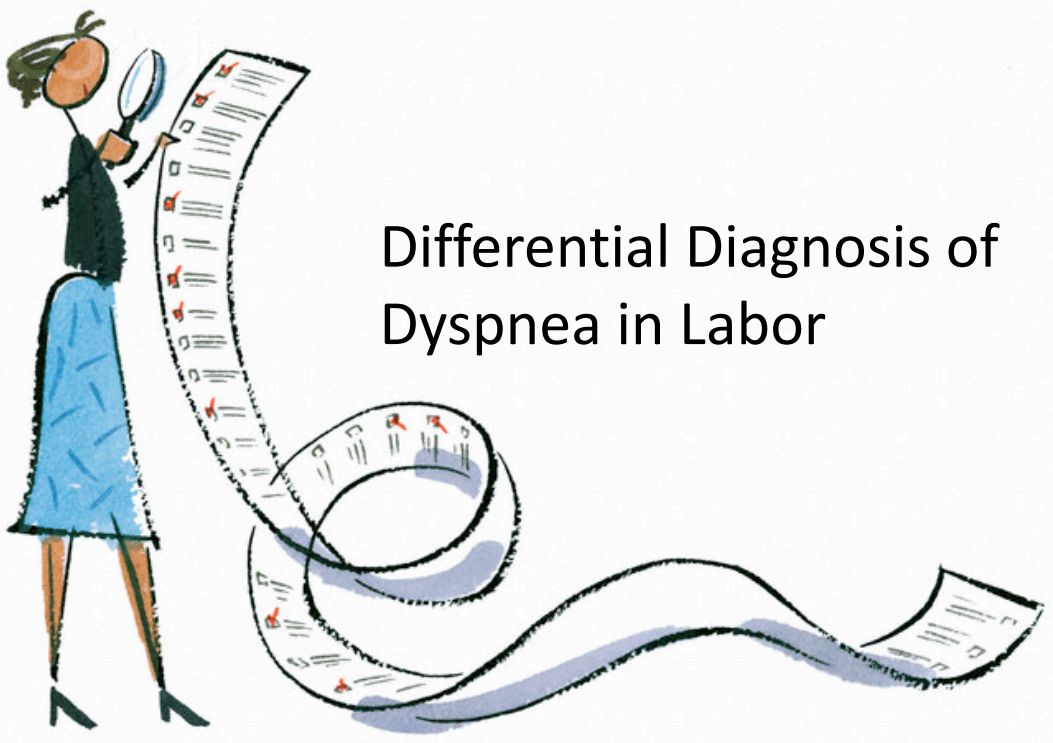
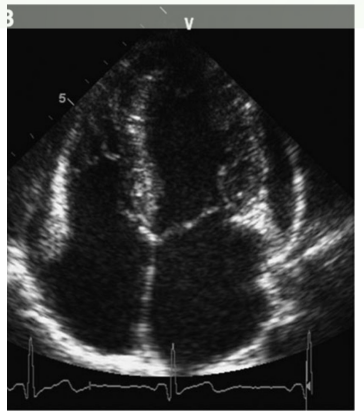
Bateman BT et al. Obstet Gynecol 2013; 122(5):957-65

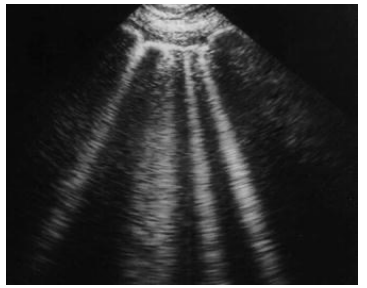
Part 1: 37-year-old G2P1 with shortness of breath

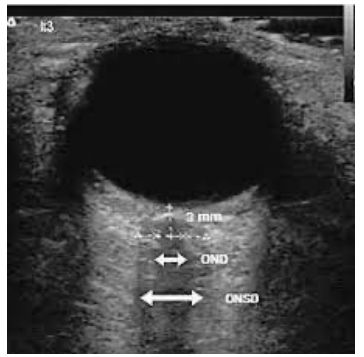


Pregnancy-related
Pain
Asthma
Infection
High spinal
Aspiration
Pulmonary edema
-Hypertension
-Magnesium
-Heart failure
Thrombosis
Amniotic Fluid Embolism

Point-of-Care Ultrasound Abnormalities in Late-Onset Severe Preeclampsia: Prevalence and Association With Serum Albumin and Brain Natriuretic Peptide







Late-onset preeclampsia with severe features

Use of ultrasound to evaluate for:
pulmonary edema, cardiac dysfunction, and elevated intracranial pressure (increased optic nerve sheath diameter, OSND)

- 95 women, prospective observational cohort
- POCUS: cardiac, lung, optic nerve sheath
- Serum albumin, BNP

- **High prevalence of pulmonary edema, diastolic dysfunction, and elevated ICP**
- **Correlation with BNP; not with low albumin**

Ortner CM et al. Anesth Analg 2019; 128: 1208-16

Part 2a:

Flash Pulmonary Edema

Urgent Team Activation

Part 2a. Same patient, delayed care.

- **Hypoxemia** despite nebulizer, nonrebreather
- Anesthesia team: “We should go to the operating room.”

- RN leaves the room to find the obstetrician
- She cannot find her for 5 minutes
- The OB team returns and notes that the fetal tracing still looks ok

---------- **DELAY** ----------

- Decision finally made to go to the operating room for further work-up

Part 2a. Same patient, delayed care.

- In the operating room, maternal O2 Sat and fetal heart rate are both in the 60’s

- Attempted preoxygenation
- Patient too agitated to cooperate with the mask
- Rapid sequence induction
- Difficult airway
- Cardiac arrest

Part 2b:

Patient distress after Cesarean delivery

Urgent Team Activation

Part 2b: A Patient in Distress after Cesarean Delivery

28 yo G2P2 s/p cesarean delivery for arrested labor.

20 minutes after arrival to her room postpartum:
BP 81/52 HR 89

Anesthesia resident paged by nurse: *"Come to room 21 for Hypotension".*
Phenylephrine IV bolus administered and documented. No nurse or OB is in the room.

The OB comes to the room shortly after – the patient expresses feeling distressed.

- No atony or abdominal distension.
- No vaginal bleeding, blood pressure 95/60, HR 100

→ The OB orders a CBC and starts to head home

1 hour from onset: cardiac arrest in the labor room.

Part 2b: A Patient in Distress after Cesarean Delivery

What went wrong here?

- The patient had a concealed retroperitoneal hemorrhage
- She was seen in isolation by the anesthesia MD and the OB

How to Improve?

- Activate a team response
- Discuss the total picture

→ **Event Manager**

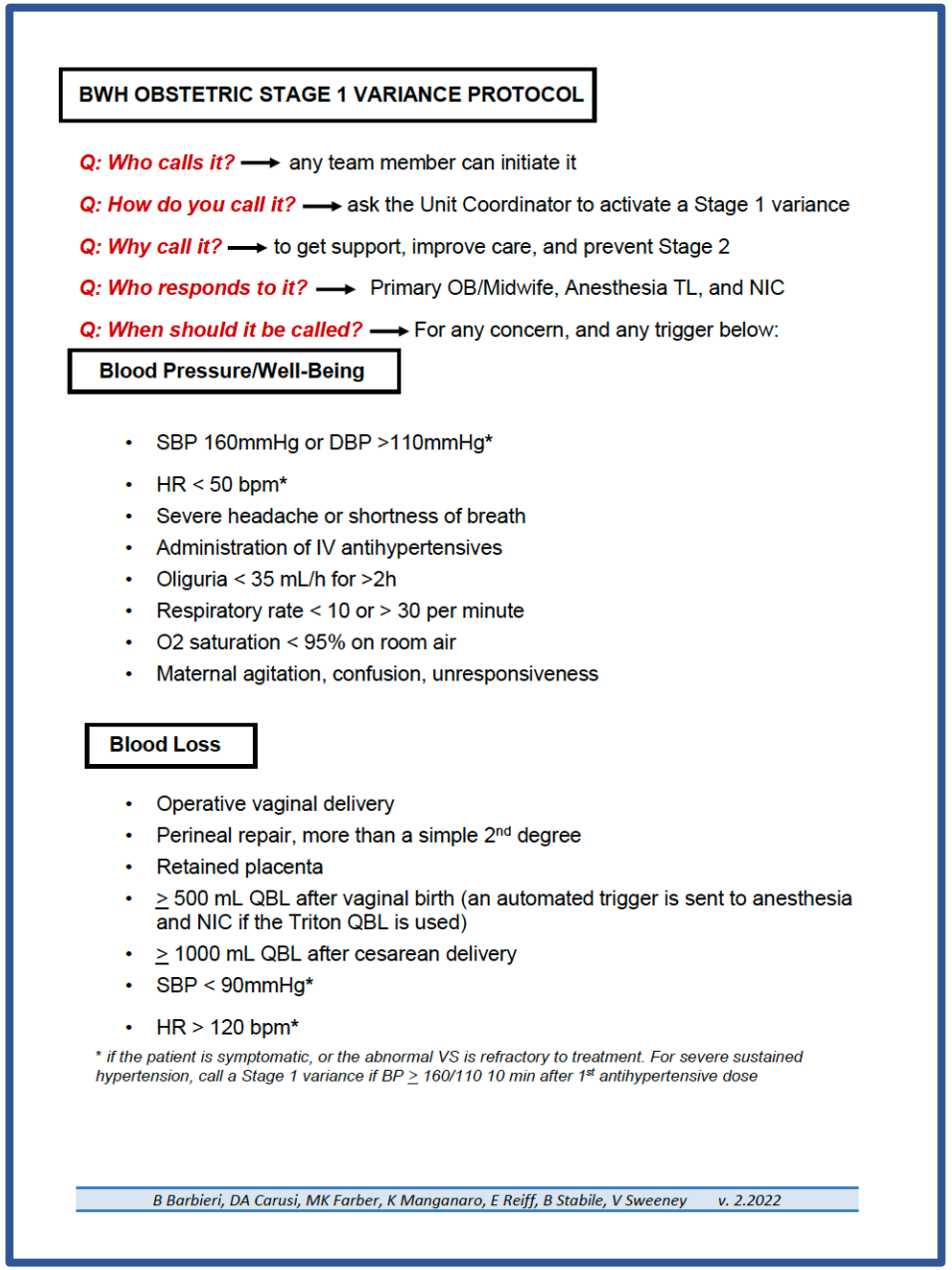
Communicating Variance

Who needs to know?

- Nursing Assistants/Nurses
- Obstetricians
- Midwives
- Obstetric anesthesiologists

Goals for Team Education

1. Rationale and purpose
2. Buy-in
3. Identification of roles
4. Ongoing education/refreshers
5. Tailoring the system to your unit



BWH OBSTETRIC STAGE 1 VARIANCE PROTOCOL

Q: Who calls it? → any team member can initiate it

Q: How do you call it? → ask the Unit Coordinator to activate a Stage 1 variance

Q: Why call it? → to get support, improve care, and prevent Stage 2

Q: Who responds to it? → Primary OB/Midwife, Anesthesia TL, and NIC

Q: When should it be called? → For any concern, and any trigger below:

Blood Pressure/Well-Being

- SBP 160mmHg or DBP >110mmHg*
- HR < 50 bpm*
- Severe headache or shortness of breath
- Administration of IV antihypertensives
- Oliguria < 35 mL/h for >2h
- Respiratory rate < 10 or > 30 per minute
- O2 saturation < 95% on room air
- Maternal agitation, confusion, unresponsiveness

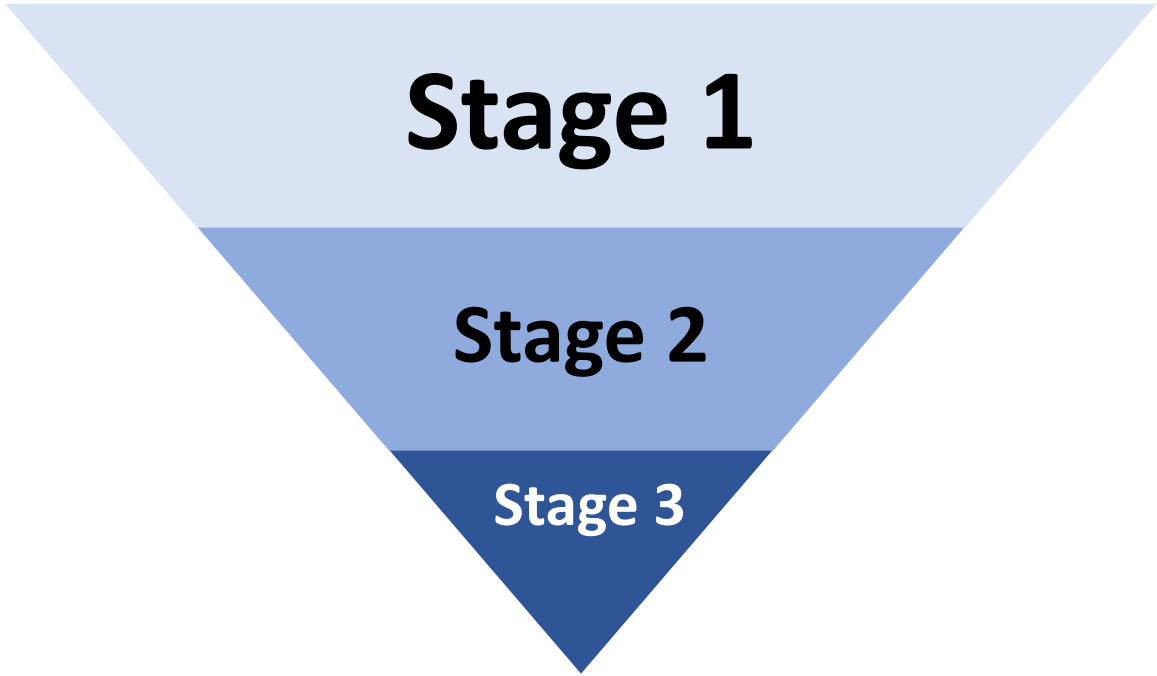
Blood Loss

- Operative vaginal delivery
- Perineal repair, more than a simple 2nd degree
- Retained placenta
- ≥ 500 mL QBL after vaginal birth (an automated trigger is sent to anesthesia and NIC if the Triton QBL is used)
- ≥ 1000 mL QBL after cesarean delivery
- SBP < 90mmHg*
- HR > 120 bpm*

** if the patient is symptomatic, or the abnormal VS is refractory to treatment. For severe sustained hypertension, call a Stage 1 variance if BP ≥ 160/110 10 min after 1st antihypertensive dose*

B Barbieri, DA Carusi, MK Farber, K Manganaro, E Reiff, B Stabile, V Sweeney v. 2.2022

Crisis Response: Obstetric Variance System



Stage 1

- Routine Notification of Variance

Stage 2

- All Hands On Deck

Stage 3

- Crisis Management

Delayed Response Activation Associated with Morbidity

- Prospective study
- Inpatients meeting rapid response criteria
- Call delayed for 21%

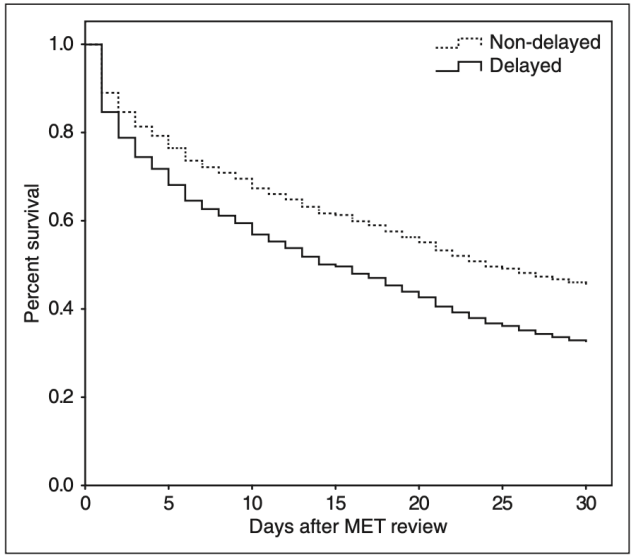


Figure 1. Cox regression curve for 30-d mortality in delayed (*continuous line*) vs nondelayed (*dotted lines*) medical emergency team (MET) calls ($p < 0.001$).

Re-setting Response Criteria does not reduce calls

- Prospective Study, all inpatients
- 6.7% had call criteria modifications

Usual Criteria → 4% RR call

Modified Criteria → 5% RR call

- Modifying call criteria
  - Did not reduce the call number
  - Delayed the calls

RR = Rapid Response

Boniatti MM, et al. Crit Care Med. 2014 Jan;42(1):26-30. Chinthamuneedi RM, et al. Internal Medicine Journal 53 (2023) 1212–1217

Part 3:

Maternal Cardiac Arrest

Protocol Utilization

Do you have a protocol in place for **maternal cardiac arrest?**

Do you perform **drills to evaluate the protocol?**

Operating Room Crisis Checklists

Management of Adult Emergencies

October 2023 version

>> Do not remove book from this room <<

ARIADNE LABS

Brigham and Women's Hospital
Founding Member, Mass General Brigham

HARVARD T.H. CHAN
SCHOOL OF PUBLIC HEALTH

Revised Oct. 2023 (231013.1)

Create and Drill OB-Specific Crisis Checklists

11 Respiratory Distress

5/16/24

START

Hypoxemia, shortness of breath, wheezing, desaturation

① Call for help
Respiratory Therapy
Anesthesia
Who will be the crisis manager ?
② Request code cart, intubation kit
③ 100% oxygen via non-rebreather facemask
④ Monitor VS: O_2 Saturation, BP
⑤ Assure airway patency; auscultate lungs
⑥ Establish IV access
⑦ If pregnant: fetal monitoring, left lateral positioning, consider induction when stable
⑧ Arterial blood gas if SpO_2<92%
⑨ Consider Chest X-ray
⑩ Consider albuterol nebulizer

CRITICAL CHANGES

Consider :
- Pulmonary thromboembolism
- Amniotic fluid embolism
- High spinal
- Aspiration
- Pneumothorax
- Pulmonary edema
- Magnesium toxicity
- Sepsis
- Pneumonia
- Asthma exacerbation

DRUG DOSES & TREATMENTS

Albuterol 2.5 mg with 2.5 ml Saline via nebulizer

17 OB-Specific Crisis Checklists

4 Cardiac Arrest–Asystole/Pulseless Electrical Activity (PEA)

5/16/24

START

Non-shockable pulseless cardiac arrest

① **Call for help: "Stage 2 OB Variance**." Obtain code cart, c-section kit.
② "Who will be the **EVENT MANAGER**?"
Crisis manager designates checklist reader
Ask "Who will be the code recorder-timekeeper?"
Say "The top priority is high quality CPR"
③ Put backboard under patient, supine position; manual left uterine displacement if pregnant
④ **Start CPR and assessment cycle: Announce time every minute**
- **Perform CPR**
  - Hard and fast, 100-120 compressions/min
  - Ensure full chest recoil with minimal interruptions
  - 8 breaths/min, do not over-ventilate
- **Give epinephrine as soon as feasable**
  - Repeat epinephrine every 3-5 min
- **Assess every 2 minutes**
  - Change CPR compression provider
  - Check $ETCO_2$
    If: <10 mm Hg, evaluate CPR technique
    If: Sudden increase to > 40 mm Hg, may indicate return of spontaneous circulation
  - Check rhythm: if rhythm organized, check pulse
    If: Asystole/PEA continues
    - Resume CPR & Assessment Cycle
    - Read aloud Hs & Ts
    If: VT/VF
    - Resume CPR
    - Go to Checklist 3

DELIVER WITHIN 5 MINUTES IF NO RETURN OF SPONTANEOUS CIRCULATION

DRUG DOSES & TREATMENTS

Epinephrine: 1 mg IV, repeat every 3-5 mins

TOXIN TREATMENT
Local anesthetic:
- Intralipid 1.5 ml/kg IV bolus
- Repeat 1-2 times for persistent asystole
- Start infusion 0.25-0.5 ml/kg/min for 30-60 min for refractory hypotension

Beta-Blocker: Glucagon 2-4 mg IV push
Calcium channel blocker: $CaCl_2$ 1 g IV

HYPERKALEMIA TREATMENT
1. Calcium gluconate 30 mg/kg IV
   -or-
   Calcium chloride 10 mg/kg IV
2. **Insulin/Dextrose** 10 units regular insulin IV with 1-2 amps D50W as needed
3. **Sodium Bicarbonate** if pH < 7.2 1-2 mEq/kg slow IV push

Hs & Ts

- Hydrogen ion (Acidosis)
- Hyperkalemia
- Hypothermia
- Hypovolemia
- Hypoxia
- Tamponade (Cardiac)
- Tension pneumothorax
- Thrombosis (coronary/pulmonary)
- Toxin (local anesthetic, beta blocker, calcium blocker

Simulation Training in OB

High Fidelity

Neil and Elise Wallace
STRATUS
CENTER FOR MEDICAL SIMULATION
BRIGHAM AND WOMEN'S HOSPITAL

Low Fidelity

Connors Center for Women and Newborns
Labor and Delivery Unit

Cardiac arrest in obstetric patients receiving anaesthetic care: results from the 7th National Audit Project of the Royal College of Anaesthetists

Why did obstetric patients have cardiac arrest?

2021-2022

Cause of cardiac arrest	Patients affected; n
Major haemorrhage	7
High neuraxial block	6
Bradyarrhythmia	6
Amniotic fluid embolism	4
Drug error	2
Anaphylaxis	1
Pulmonary embolism	1
Severe hypoxaemia	1
Vagal outflow (e.g. pneumoperitoneum, oculocardiac reflex)	1
Other	12

Underestimated severity; delayed resuscitation

Anesthesia-specific

No arrests from:
-failed airway management
-remifentanil PCA

Lucas DN et al. Anaesthesia 2024; 79:514-23.

Part 4:

Critical Hemorrhage

Resuscitation/ Communication

Part 4: 33 year-old G6P3 with acute abdominal pain

- 3 prior cesareans, concern for PAS during this pregnancy
- Uterine “window” noted during last cesarean
- 23 ½ weeks GA, presents to L&D with acute pain, BP 87/50, HR 119
  - “My heart doesn’t feel good”

- Transferred urgently to OR for laparotomy under General Anesthesia
- Uterine rupture with hemorrhage discovered

Part 4: 33 year-old G6P3 with acute abdominal pain

Anesthesia Team

- GA induced, airwary secured
- Call for massive transfusion protocol
- Arterial line placed

OB Team

- Vertical skin incision
- Fetus delivered
- Rapid transition to hysterectomy
- Call for backup surgeons

Blood pressure drifts down to 60s / 40s despite resuscitation

- “We need urgent blood pressure control”
- “Hysterectomy is the plan to stop the bleeding”

Part 4: Massive Hemorrhage

- What went wrong?
  - Teams' ideas of how to solve the crisis were discordant
  - Reconciliation not achieved during crisis
  - Patient stabilized with massive transfusions

ACTIONS TO TAKE: MASSIVE HEMORRHAGE

- Trendelenberg positioning
- Vasopressors
- Raise legs
- Ask surgical team to:

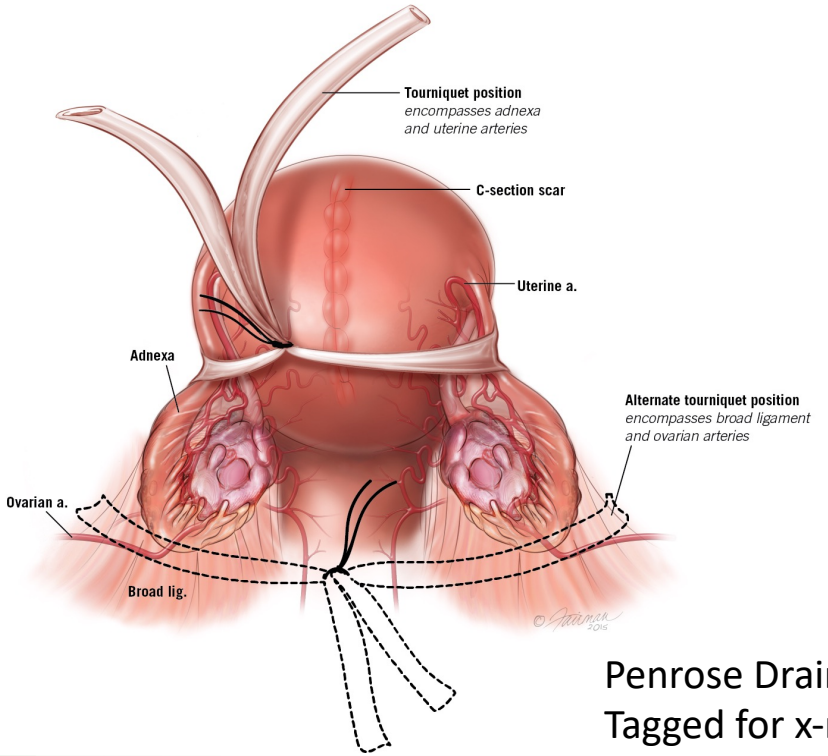
  -apply pressure to bleeding areas

  -compress aorta

- 2 large bore IVs (16g or greater)
- Arterial line
- Rapid infuser
- Blood bank → MTP
- Monitor vitals every 1-2 minutes
- Consider conversion to GA

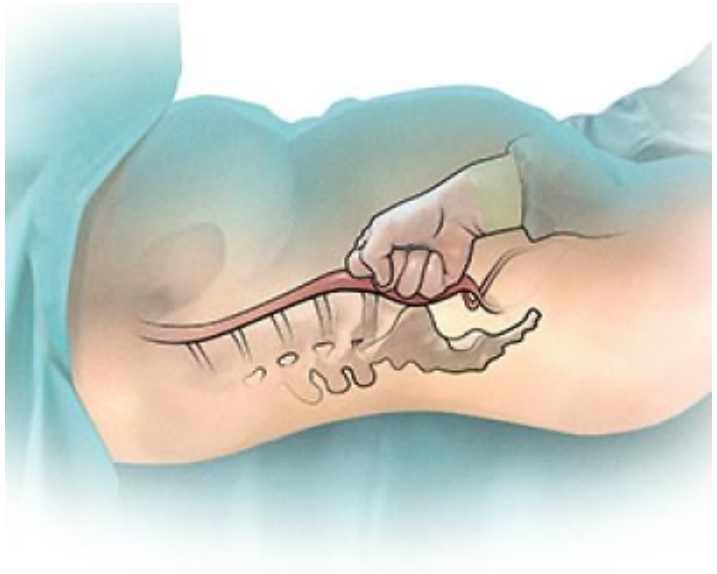
Rescue maneuvers: massive haemorrhage

- B-lynch, Bakri balloon
- Uterine tourniquets



Penrose Drain
Tagged for x-ray detection

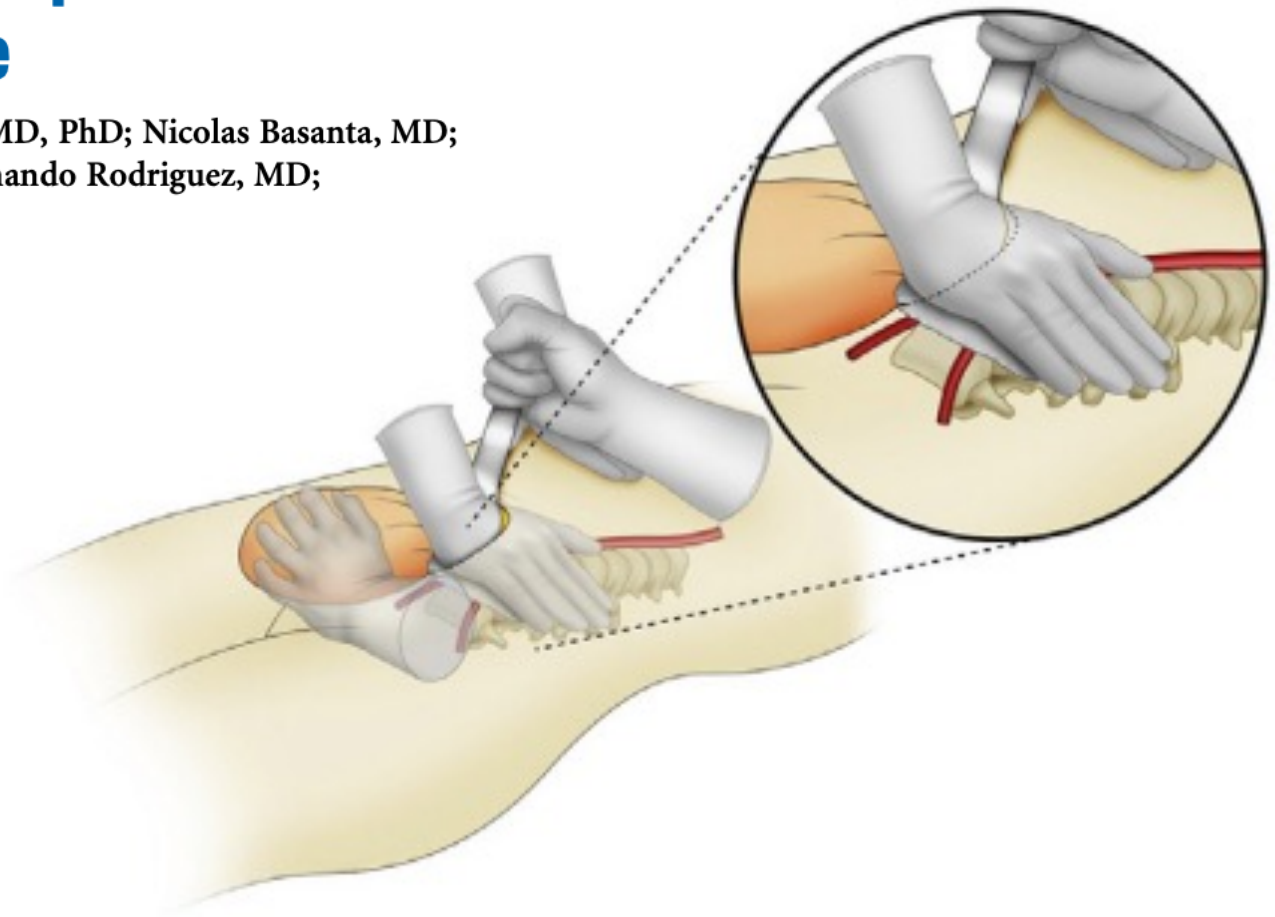
- Abdominal/pelvic packing
- REBOA
- Manual aortic compression
  -no need for a retroperitoneal dissection
  -may not be possible with a transverse incision



Internal manual compression of the aorta—an effective way to temporarily control pelvic bleeding in obstetrical hemorrhage

Albaro José Nieto-Calvache, MD; José Miguel Palacios Jaraquemada, MD, PhD; Nicolas Basanta, MD; Rozi Aditya Aryananda, MD; Stiven Ernesto Sinisterra-Díaz, MD; Fernando Rodriguez, MD; Alejandra Hidalgo Cardona, MD; Adriana Messa Bryon, MD

The uterus is externalized and moved over the symphysis pubis, while the surgeon places their dominant hand in the abdomen & compresses aorta against the vertebral bodies immediately above its bifurcation with the help of a surgical pad.



Nieto-Calvache AJ et al. Am J Obstet Gynecol 2022.

Speaking Across the Drapes

Communication Strategies of Anesthesiologists and Obstetricians During a Simulated Maternal Crisis

Simulation to Enhance Communication: **Words Matter!**

- 44 recorded scenarios of an obstetric crisis:

Laboring patient with epidural

- Falls down → breaks femur!
- To the OR for cesarean
- Epidural dosed → total spinal!
- Intubation attempt → difficult airway!
- Bradycardia → hypoxic cardiopulmonary arrest

Minehart R et al. Sim Healthcare 2012; 7: 166-70

How Well Do You Communicate?

Table 1. Communication Strategies: Examples of Advocacy, Inquiry, and Joint Plan

	Anesthesiologist	Obstetrician
Information advocacy	"The patient has hypotension."	"We have fetal bradycardia."
Information inquiry	"How's the baby?"	"Is the patient stable?"
Plan advocacy	"I'm going to intubate."	"I need to start the section."
Plan inquiry	"Are you starting the section?"	"Are you intubating?"
Joint plan	"I'll intubate, then you start the section."	"Tell me when you're done intubating, and I'll start."

	Advocacy	Inquiry	Joint Plan
Anesthesiologist	100%, 93%	30%, 11%	45%
Obstetrician	73%, 73%	75%, 59%	45%

Minehart R et al. Sim Healthcare 2012; 7: 166-70

Conclusions

Crisis Management: Scenarios and Solutions

Thank You!

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- Assess risk for every patient. Recognize unconscious bias.
- Huddle with the patient, nurse, OB, and anesthesiologist.
- Call a variance to get all providers to the bedside.
- Use in situ simulation to drill protocols and crisis management.
- Practice how to communicate better every time.