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Postpartum Emergencies

Hemorrhage
Amniotic Fluid Embolism
Pulmonary Embolism
Cardiovascular Collapse
Preeclampsia with Severe Features
Sepsis

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September, 2018

Disclosures

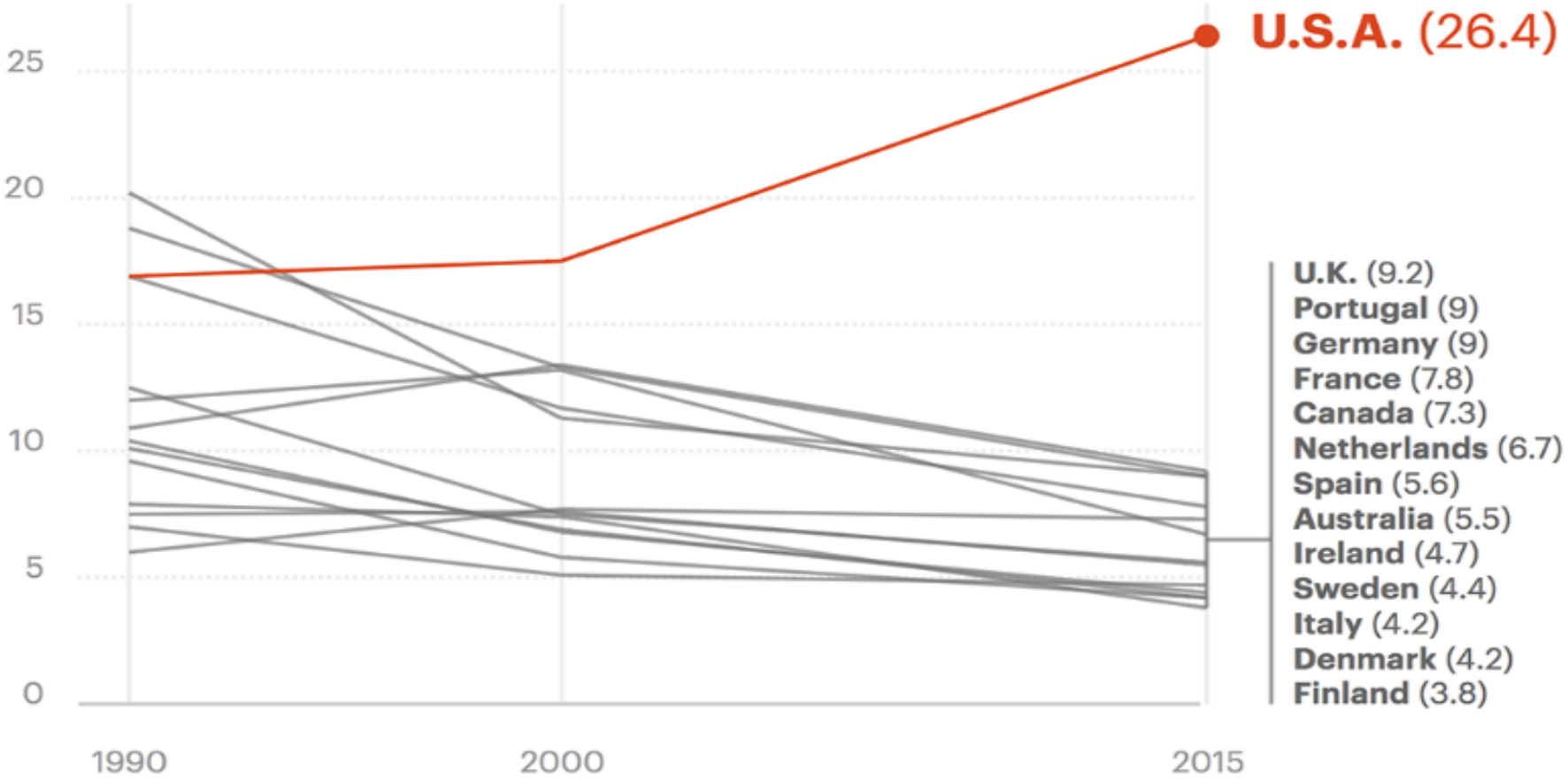
- I have no financial relationships with any commercial interests
- No relevant financial relationships exist

Objectives

- Discuss abnormal conditions that increase a pregnant woman's risk for rapid decline
- Review the physiological changes of pregnancy that mask the severity of maternal decompensation
- Describe the importance of multidisciplinary care teams aimed to provide comprehensive care
- Cite at least 3 patient safety bundles aimed to prevent maternal morbidity and death

Maternal Mortality Is Rising in the U.S. As It Declines Elsewhere

Deaths per 100,000 live births



Notes

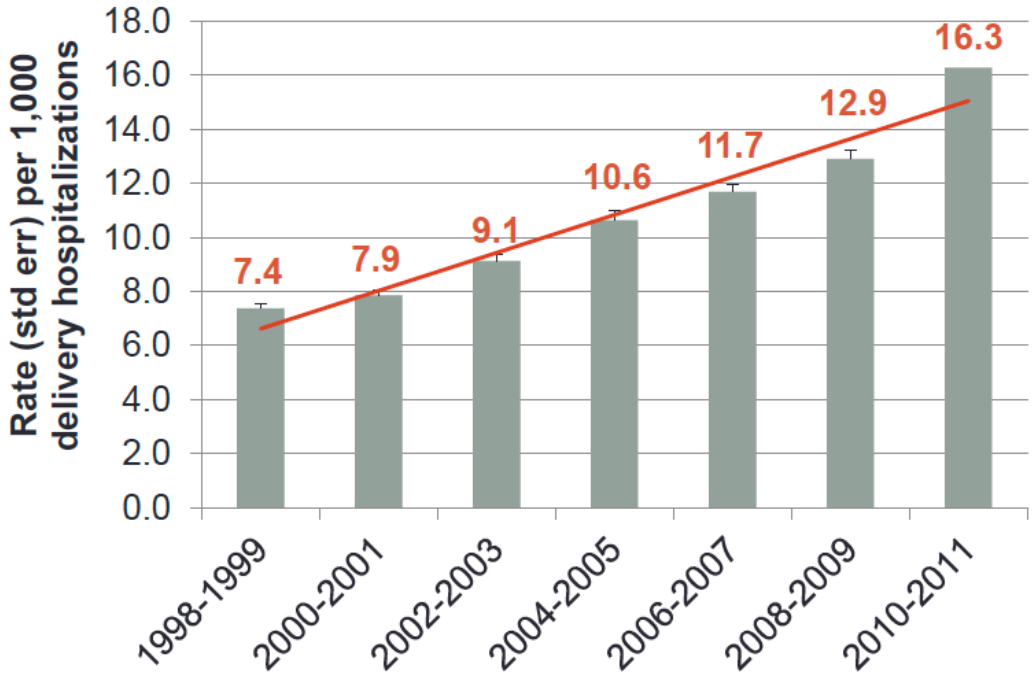
"Global, regional, and national levels of maternal mortality, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015," *The Lancet*. Only data for 1990, 2000 and 2015 was made available in the journal.

Source: The Lancet

Credit: Rob Weychert/ProPublica

From Creanga, A. Why isn't pregnancy getting safer for women in the US? CDC Webinar 1/30/14

Trends in severe maternal morbidity during delivery hospitalizations: United States,1998-2011



- severe morbidity during delivery hospitalizations more than doubled
- blood transfusion, hysterectomy & eclampsia accounted for ~75% of severe morbidity

Callaghan, Creanga & Kuklina, Obstet Gynecol, 2012.

The American College of Obstetricians and Gynecologists

- WOMEN'S HEALTH CARE PHYSICIANS

Current Commentary

Obstetrics & Gynecology
VOL. 123, NO. 5, MAY 2014

The National Partnership for Maternal Safety

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

Current Commentary

Obstetrics & Gynecology
VOL. 124, NO. 4, Oct 2014

The Maternal Early Warning Criteria

A Proposal From the National Partnership for Maternal Safety

Mhyre, J., D' Oria, R., Hameed, A., et al

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Maternal Warning Systems

- The Joint Commission (2010) requires hospitals to have written criteria to observe change or deterioration in a patient's condition and how to recruit staff to manage patient care

- Signs and symptoms of impending severe maternal illness or collapse went unrecognized in many cases (CEMACH, 2011) due to the relative rarity of such events and normal changes in physiology associated with pregnancy and childbirth compounds the problem
  - **Recommendation:** Develop and adopting systems to alert the team of maternal deterioration to assist in early recognition, intervention and timely referral of treatment of women (CEMACH, 2011)

- The *National Partnership for Maternal Safety* is a multi-stakeholder consensus effort and is comprised of representatives from organizations in women's health care and other provider, state, federal, and regulatory bodies which supports early warning criteria to promote patient safety http://www.safehealthcareforeverywoman.org/maternal-safety.html

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Vital Sign Assessment

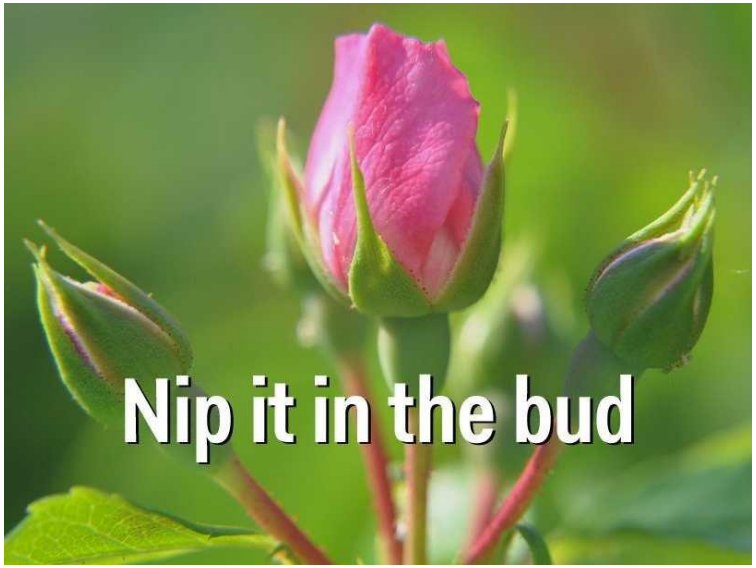
- Vital sign assessment is critical during active bleeding. Blood pressure, pulse and respirations have been the standard in assessing vital signs.

- Often variations in vital signs are ignored or dismissed as “normal” due to the physiological changes in pregnancy (CEMACH, 2011)

- Lack of standardized documentation can result in delays in recording of abnormal results which can effect timeliness of clinical decision making (Yeung, Lapinsky, Granton, Doran, & Cafazzo, 2012)

Maternal Early Warning Systems

- Abnormal physiologic signs and symptoms precede critical illness
- Early intervention will avoid severe M&M occurrence
- Effective policy of escalation of care



Maternal Early Warning Criteria

The Maternal Early Warning Criteria	
Measure	Value
Systolic Blood Pressure (mm Hg)	<90 or >160
Diastolic Blood Pressure (mm Hg)	>100
Heart rate (beats per minute)	<50 or >120
Respiratory rate (breaths per min)	<10 or >30
Oxygen saturation on room air, at sea level %	<95
Oliguria, mL/hr for ≥2 hrs	<35
Maternal agitation, confusion, or unresponsiveness	
Woman with preeclampsia reporting a non-remitting headache or shortness of breath	

The Maternal Early Warning Criteria: A Proposal From the National Partnership for Maternal Safety.
Mhyre, Jill; DOria, Robyn; MA, RNC; Hameed, Afshan; Lappen, Justin; Holley, Sharon; CNM, DPN; Hunter, Stephen; MD, PhD; Jones, Robin; King, Jeffrey; DAlton, Mary

National Partnership Strategy to Enhance Maternal Safety

BUNDLE SCIENCE

A "bundle" is a group of interventions related to a disease process that, when executed together, result in better outcomes than when implemented individually.

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CA-PAMR: Chance to Alter Outcome

Grouped Cause of Death; 2002-2004 (N=145)

Grouped Cause of Death	Chance to Alter Outcome			
	Strong / Good (%)	Some (%)	None (%)	**Total** N (%)
Obstetric hemorrhage	69	25	6	16 (11)
Deep vein thrombosis/ pulmonary embolism	53	40	7	15 (10)
Sepsis/infection	50	40	10	10 (7)
Preeclampsia/eclampsia	**50**	**50**	**0**	**25 (17)**
Cardiomyopathy and other cardiovascular causes	25	61	14	28 (19)
Cerebral vascular accident	22	0	78	9 (6)
Amniotic fluid embolism	0	87	13	15 (10)
All other causes of death	46	46	8	26 (18)
Total (%)	**40**	**48**	**12**	**145**

Normal physiologic changes

Cardiovascular

Hematologic

Pulmonary

Cardiovascular

Normal Cardiac Adaptation during Pregnancy

Cardiac Changes

Stroke Volume

↑ **30-50%**

Heart Rate

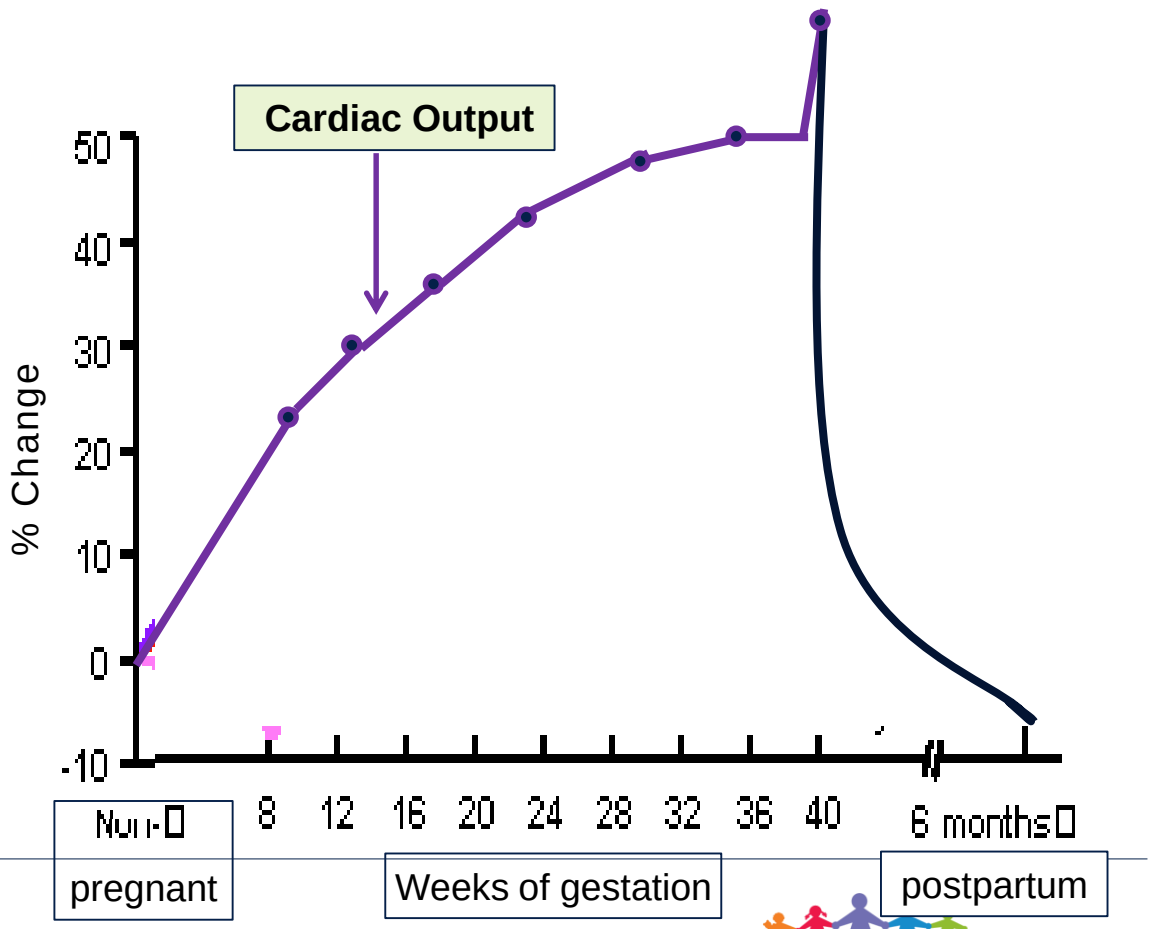
↑ 20% (~10-20 beats)

Anatomic Changes

↑ **Uterus**

Vascular Resistance

↓ **SVR** ↓ **PVR**



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Hematologic

Normal Hematologic Events Associated with Pregnancy

Blood Volume Changes

Total Volume

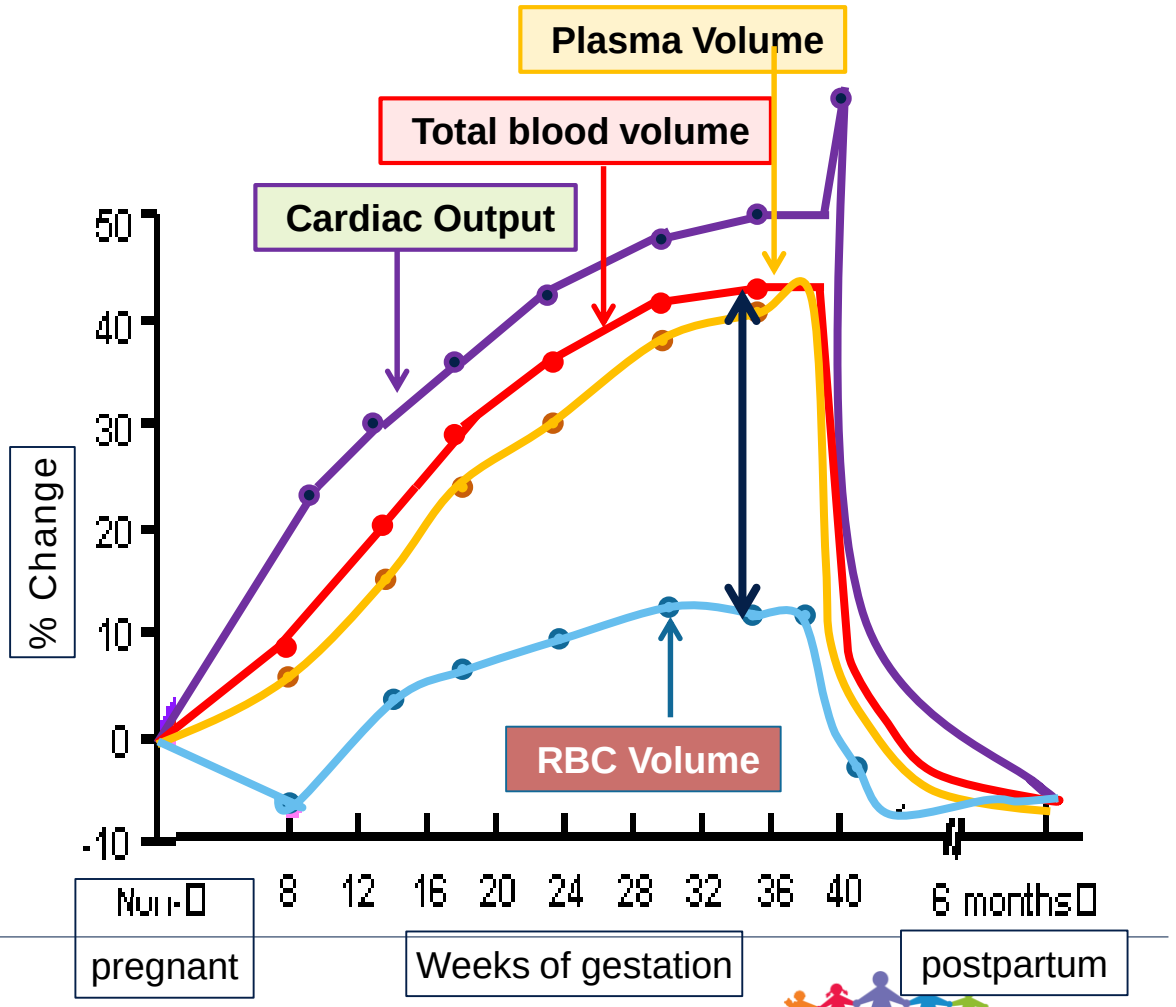
↑ 35% (~ 2,000ml)

Plasma Volume

↑ 50% (~ 1,600ml)

RBC Mass

↑ 17% (~ 350mL)



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Hematologic continued:

Clotting Factors During Pregnancy

Parameter	Change
Fibrin	Increases 40% at term
Plasma fibrinogen	Increases 50% (300 – 600) mg/dl
Coagulation factors I, VII, VIII, X, XII	Increases markedly
Von Willebrand factor antigen	Increases markedly
Coagulation factor XI	**Decreases 60% - 70%**
Coagulation factor XIII	**Decreases slightly**
Coagulation factors II, V	Increases slightly or unchanged
Protein S (anticoagulant) activity	**Decreased**
Clotting and bleeding time	Unchanged
Prothrombin time	Increases slightly or unchanged
Partial plasma thromboplastin time	Increases slightly or unchanged
Fibrin degradation products	Increased (D–Dimer increased)
Platelets	Unchanged (150 K – 500K)

Hematologic

- ⇧ Factors V, VII, VIII, IX, X, XII
- ⇩ **Fibrinolysis**
- ⇧ Fibrinogen
- ⇧ Prothrombin

Pulmonary

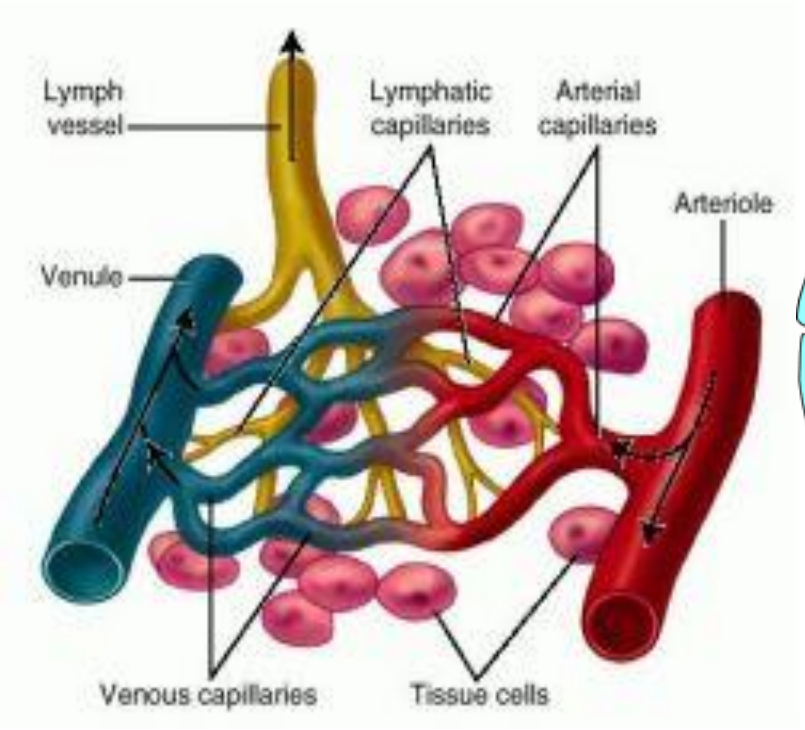
- ↑ Diaphragm 4-7 cm –ribs flare
- ↓ Functional Residual Capacity 25%
- ↑ Respiratory Rate 16-20
- ↑ Tidal volume from 500 – 700 ml
- ↑ Compensatory Alkalemia

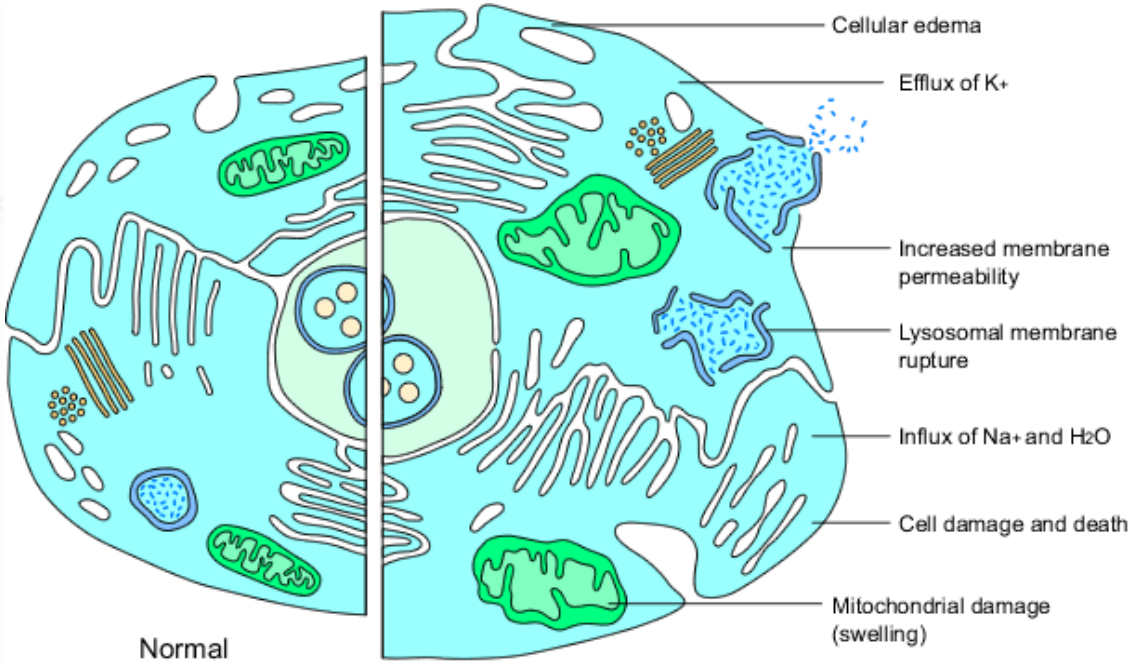
Not Pregnant
pH 7.35 – 7.45
pO2 90 -100
pCO2 35 – 45
HCO3 22 - 26

Pregnant
pH 7.40 – 7.45
pO2 104 -108
pCO2 27 – 32
HCO3 18 - 22

Pathophysiology of Hypovolemic Shock

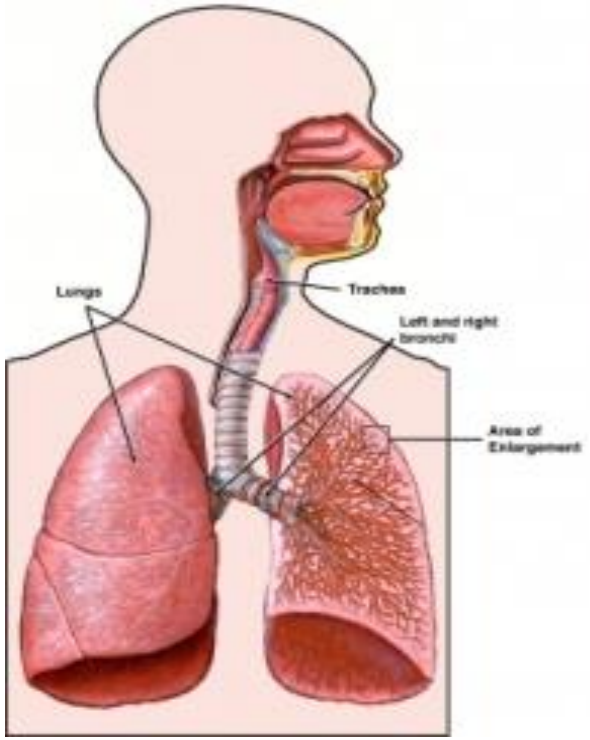
- Tissue hypoperfusion → metabolic acidosis → inflammatory mediators → tissue and vascular injury → multiple organ failure

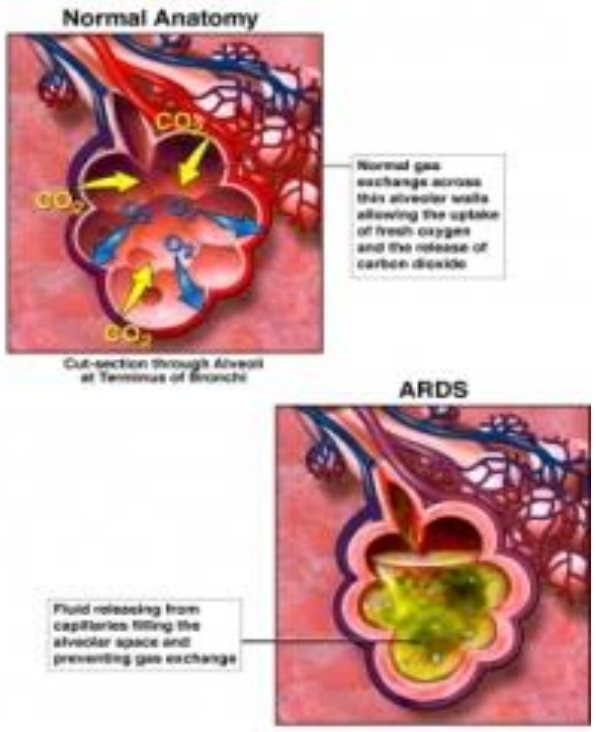




Adult Respiratory Distress Syndrome

Hemorrhagic Shock →





Damage to endothelial cells in pulmonary vasculature →
Fluid leaks from vascular space into alveoli →
Respiratory failure

Case Presentation: Hemorrhage

- 38 y.o. @40+2 admitted for elective IOL:
  - Hgb 12.5, Hct 39.2, Plt 195K, Blood Type A+, Antibody screen: neg
- Dinoprostone placed, misoprostol X2, AROM, oxytocin started
- Epidural is placed
- Rapidly progress to 10 cm , MD Notified
- 15 minute 2nd stage → male infant
- 1 minute later: Placenta delivered spontaneously
- Manual exploration of uterus "cleared of clots "
- Fundal checks (6) RN charted "moderate"

Unplanned Hysterectomy: Postoperative Course

- Transfer from ICU
- Weak but stable
- Loss of choice
- Hbg Hct
  - Iron—IV (sucrose)
  - Rh-Erythropoeitin
  - Heparin

- Discharge home with support

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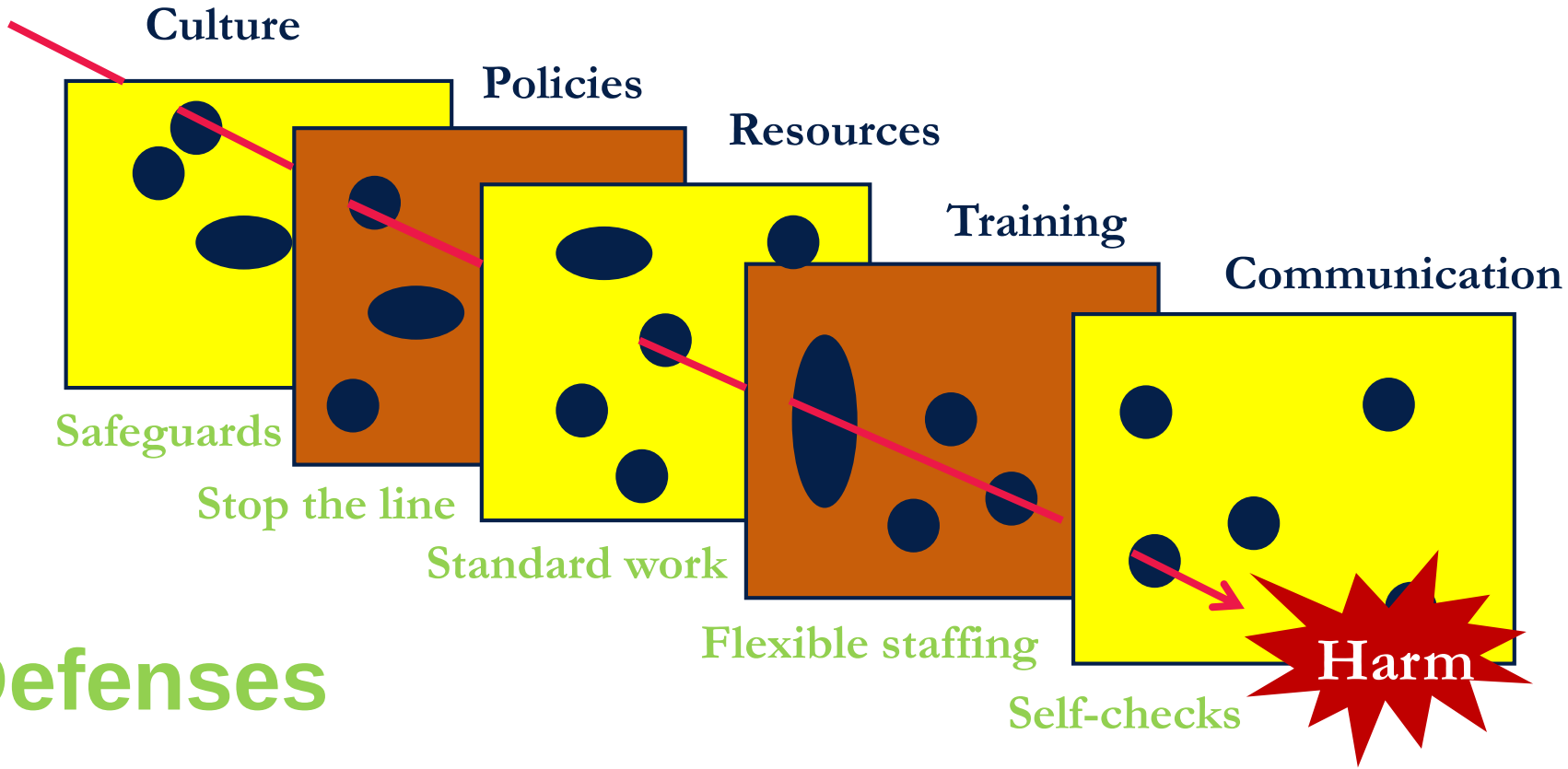
How Errors Occur

Failures



Defenses

The Maternal Safety Bundle for Obstetric Hemorrhage

- Proactive approach
- Includes 13 elements
- Establishes resources
- Manage OB Hemorrhage

Hemorrhage

ACOG defines OB hemorrhage as:
cumulative blood loss ≥1000 mL
accompanied by s/sx of hypovolemia within 24 hrs after birth (including intrapartum blood loss) regardless of mode of birth.

- Even with proper management can occur in
  - **~ 4% of vaginal births and ~ 6% of cesarean birth**
  - As a result: 1/20 women will experience PPH
- Early or Primary (≤ 24 hr after birth)
  - **Highest risk in the first hour after delivery because large venous areas are exposed after placental separation**
- Late or Secondary (>24 hr to 6 weeks after)
  - **Caused by infection, placental site subinvolution, retained placental fragments, or coagulopathies (DIC)**

ACOG.(2017). Postpartum hemorrhage. Practice Bulletin No.183. *Obstetrics & Gynecology,* 130(4), e168-e186.

Etiologies of Obstetric Hemorrhage

Antepartum

- Uterine rupture
- Placental abruption
- Placenta Previa
- Vasa Previa

Intrapartum

- Uterine rupture
- Placental abruption

Postpartum

- **Uterine atony**
- **Retained Placenta**
- **Lower genital tract lacerations** (cervix, vagina, perineum)
- **Upper genital tract lacerations** (uterine rupture)
- **Placenta accreta, increta, percreta**
- **Uterine inversion**
- **Inherited coagulopathy** (Von Willebrand Disease)
- **Acquired coagulopathy** (abruption, AFE, retained dead fetus syndrome)

Improve *Recognition…*

Perform on-going objective quantification of actual blood loss during and after all births *(record output on a flow sheet)*

- **Training and quantification of how blood loss is estimated – put up posters**
- **Measurement of actual blood**
  - **Fluid in canisters, under buttocks drapes**
  - **Weigh saturated items**
  - **and subtract dry weight**

AWHONN
Postpartum Hemorrhage Project Video

https://www.youtube.com/watch?v=F_ac-aCbEn0

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OB Hemorrhage Cart

- Quick access to emergency supplies
- Refrigerator for meds
- Establish necessary items and par levels
- Label drawers/compartments
- Include checklists
- Develop process for checking and restocking
- Educate nursing and physician staff

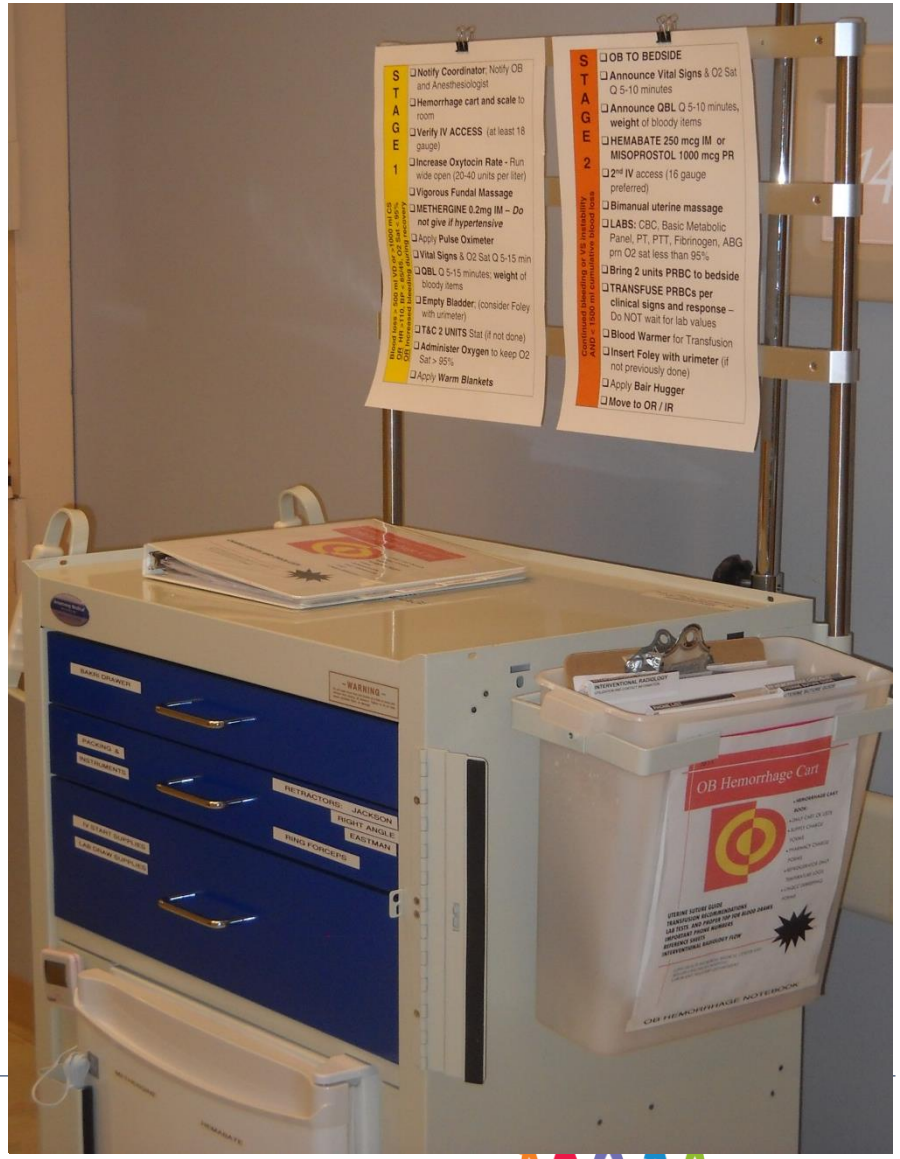

Photo courtesy of J. McNulty MD, 2014.

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Tranexamic acid (TXA)

- For women with established PPH
  - Not responsive to medications or treatments
  - Considered an adjunct treatment
  - Most effective if used within first 3 hours
  - Dose: 1 gram
  - may repeat in 30 minutes if bleeding persists

WOMAN Trial Collaborators. (2017) Effect of early TXA administration on mortality, hysterectomy, and other morbidities in women with post-partum haemorrhage (WOMAN): an international, randomised, double-blind, placebo-controlled trial. *Lancet*, 389(10084), 2105–2116.

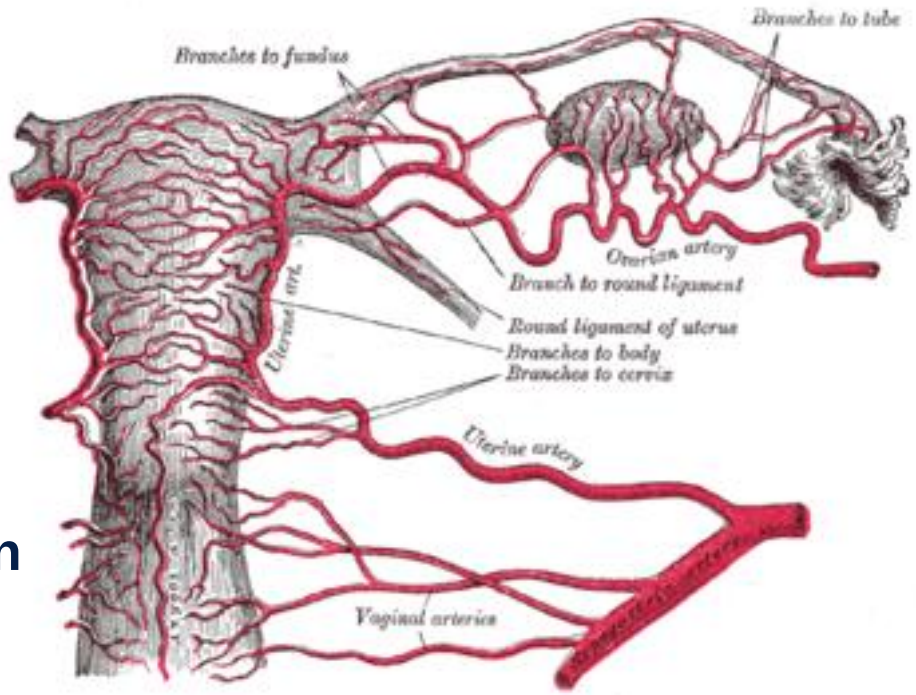
Intrauterine Balloons

- Used for intrauterine tamponade during hemorrhage
- Need ultrasound guidance to determine placement
- Use sterile solution (normal saline)
- Average filling volume = 250 ml – 300 ml (500 ml max)
- Document amount of NS used
- Insert vaginal packing and secure tubing
- Connect to a closed system/urinary catheter bag

Additional Hemorrhage Management

Intervention Radiology

- **Uterine artery embolization**
- **Collateral circulation**
- **Ongoing assessment**



☆ **Patient must be in stable condition**

Henry Vandyke Carter [Public domain], via Wikimedia Commons

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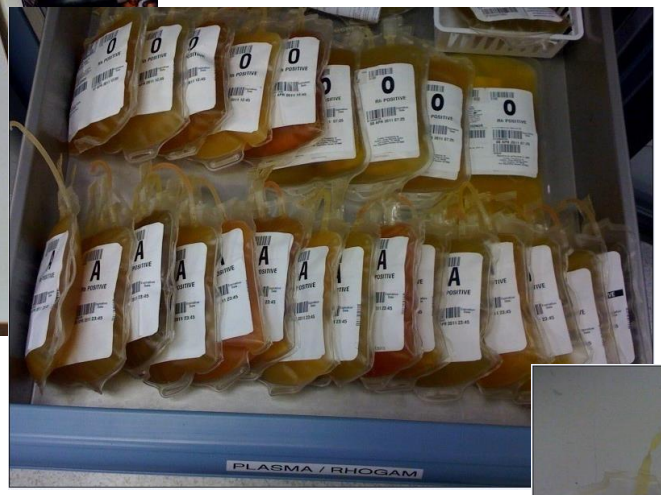
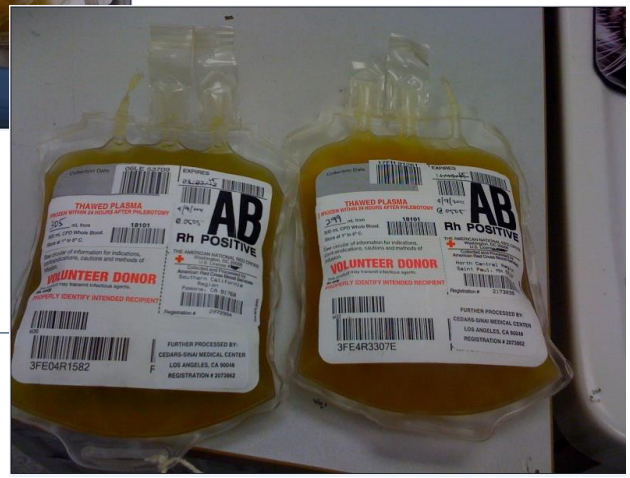
Blood Products and Equipment

Massive Transfusion Guideline





- Rapid Infuser
- Platelet infusion set
- Mechanical warming device

Photos courtesy of Holli M. Mason MD, 2017
CPMS Blood Bank Webinar Slide Set

Blood Component Therapy

PRODUCT	VOLUME (ML)	CONTENTS	EFFECT (PER UNIT)
Packed Red Blood Cells	240	RBC, WBC, plasma	↑ hematocrit 3% & Hgb 1 g/dl
Platelets	50	Platelets, RBC,WBC, plasma	↑ platelet count 5,000-10,000 mm^3 per unit
Fresh Frozen Plasma	250	Fibrinogen, antithrombin III, factors V* & VIII*	↑ fibrinogen by 10mg/dl
Cryoprecipitate	40	Fibrinogen, factors VIII & XIII and Von Willebrand	↑ fibrinogen by 10mg/dl

Laboratory Diagnosis of DIC

All routine screening tests of coagulation yield grossly abnormal results

Laboratory Test	Value
Platelets	Decreased
Fibrinogen	Less than 200
Fibrin Split Products	Increased
PT & aPTT	Initially increased
D Dimer	Increased

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The Lethal Triad of Coagulopathy: Why?

- Dilutional
  - Transfusion of crystalloid and packed cells devoid of clotting factors
  - A problem once 1 ½ total blood volume replaced
- Hypothermia
  - Significantly decreases platelet function: even if counts are adequate
- Acidemia
  - Occurs with massive hemorrhage due to hypovolemia, peripheral tissue hypoxia: as hydrogen ion concentration increases, enzyme functions involved in coagulation pathway stop functioning
  - VERY DIFFICULT TO REVERSE!

What is DIC?

- Underlying disorder
- Activates coagulation cascade
  - Blood clot formation
  - Coagulation factors become depleted
  - Results in uncontrolled bleeding
    - Death

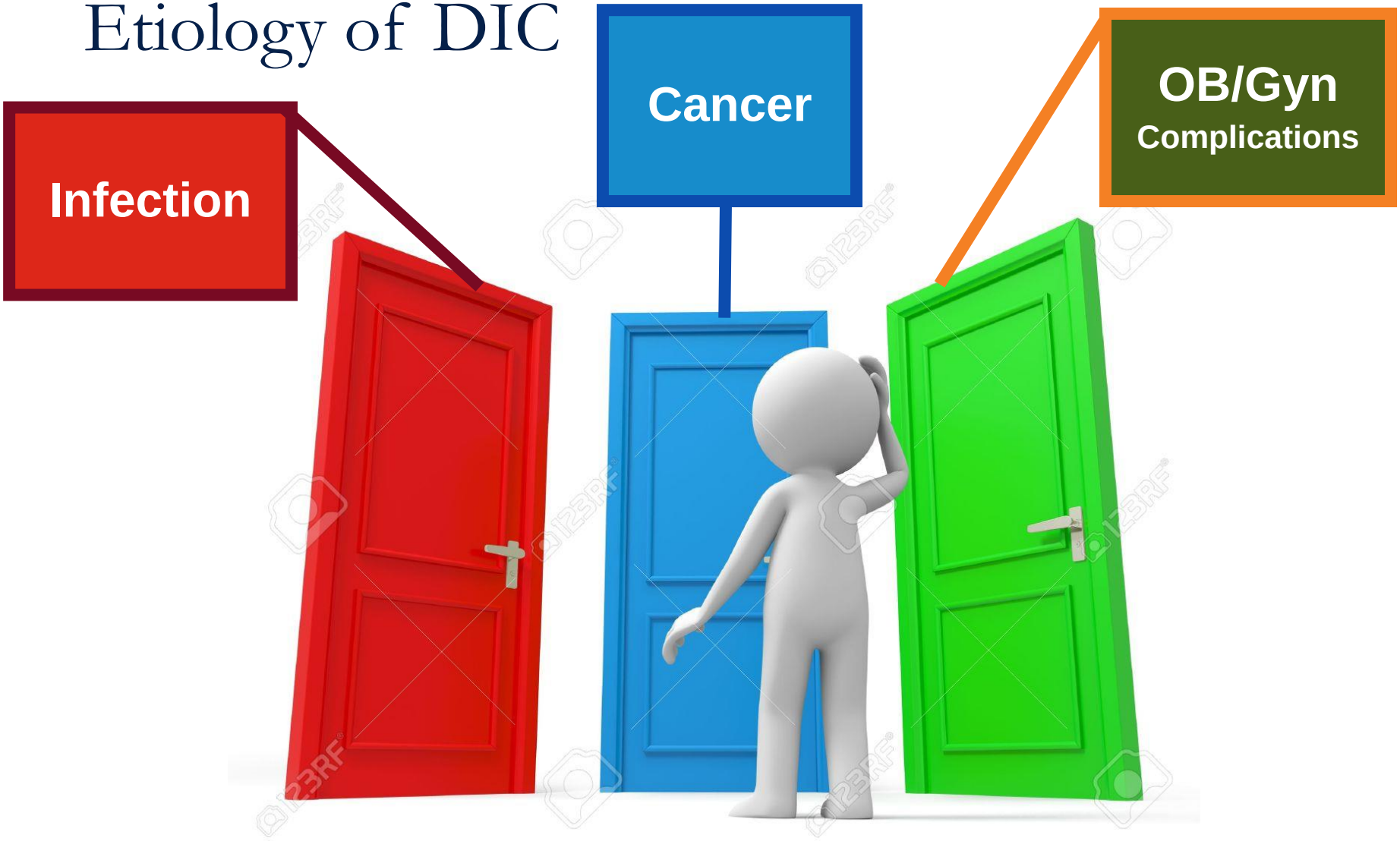
Disseminated Intravascular Coagulation

Society on Thrombosis and Hemostasis defines “DIC as:

*An **acquired** syndrome characterized by the **intravascular activation of coagulation** with loss of localization arising from different causes. It can originate from and cause damage to the **microvasculature** which if sufficiently severe **can produce organ dysfunction.***

- Accompany certain obstetrical conditions
- Varied clinical presentation and prognostic course
- **An “effect “ of** other disease processes
- Treatment will be focused on **removal of the causative agent**

Etiology of DIC



OB Complications

Placental Tissue

After Birth

- Coagulation is initiated to prevent hemorrhage at placentation
- Platelet plugs and fibrin clots for to provide hemostasis
  - Fibrinogen and platelet counts decrease

Physiology Review: Hemostasis

Failure or deficiencies in any of the components can lead to varying degrees of uncontrolled hemorrhaging or clotting

Primary components:

- Vascular endothelium
- Circulating platelets
- Circulating proteins

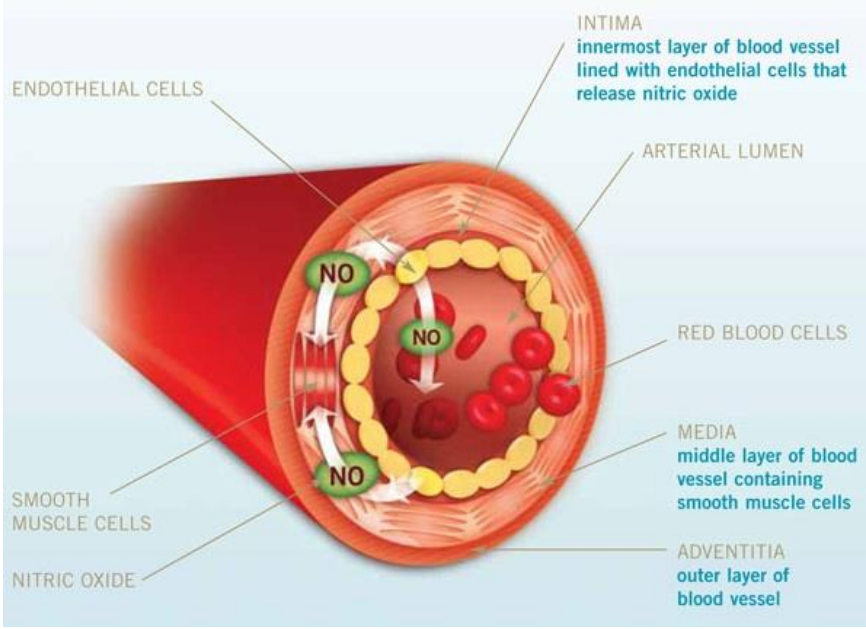
Vascular System: Blood Vessels

Daily Function

- Endothelium
  - Controls vessel permeability
  - Controls blood flow rate
    - vasoconstriction
  - Produces and releases substances that inhibit or stimulate platelets, coagulation, and fibrinolysis

Endothelium

Anatomy

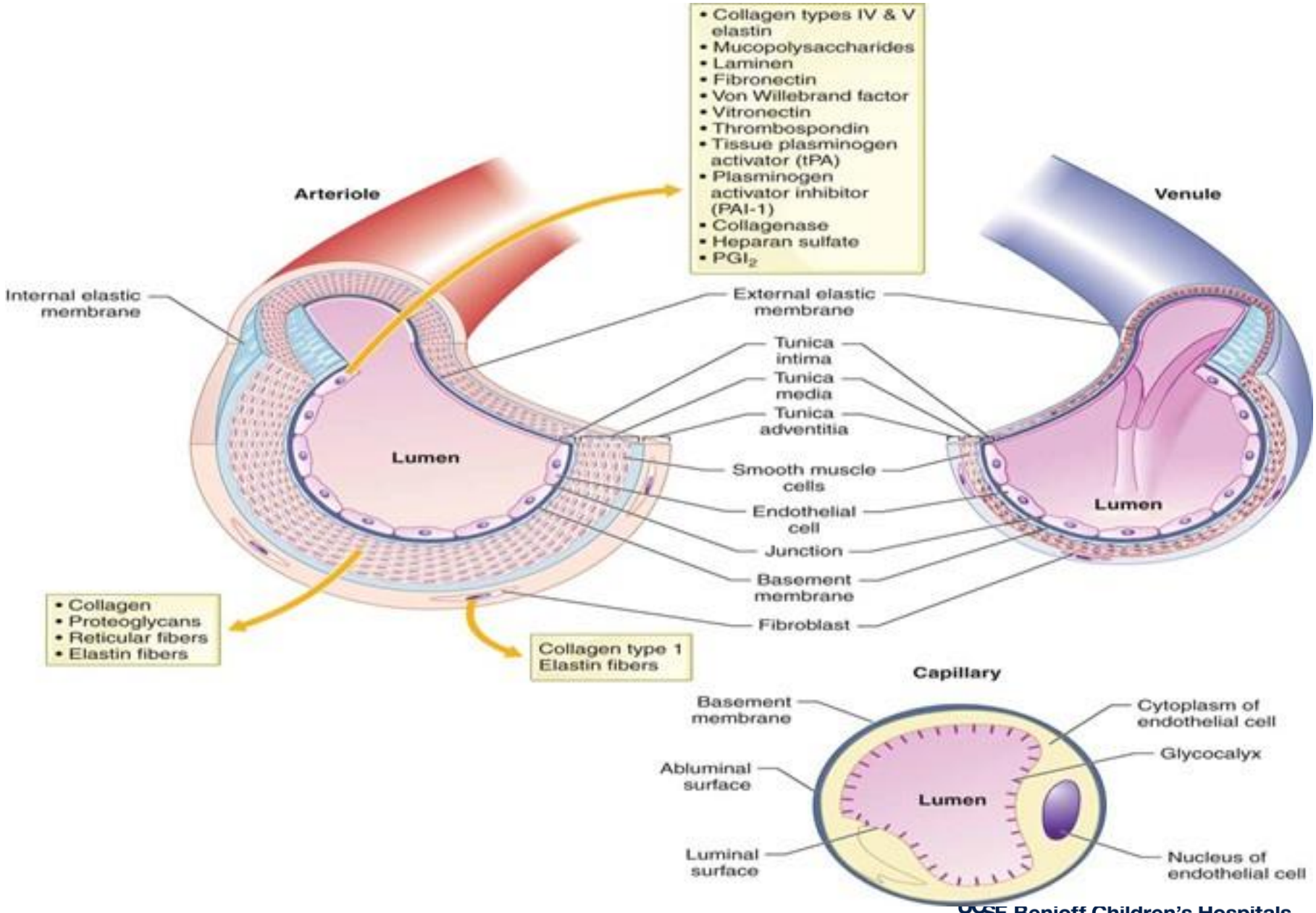


- Endothelium
- Single layer of endothelial cells, lining vessels
- Coated by glycocalyx (protein and mucopolysaccarides)
- Protects basement membrane
- Negatively charged, repels circulating proteins and platelets
- Secretes substances to keep the blood vessel in a nonreactive environment

Vascular System

Anatomy of the blood vessels

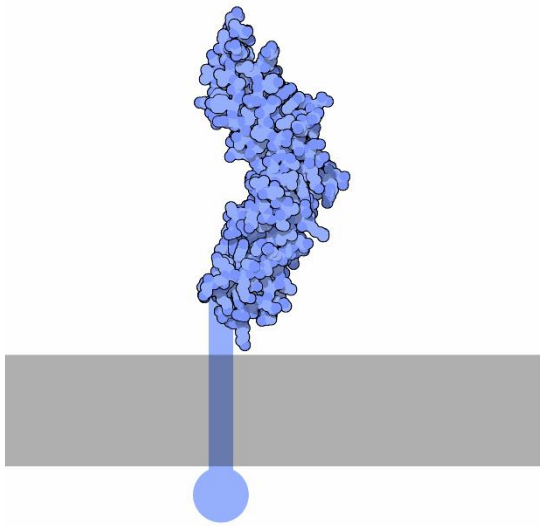
- Subendothelium
  - Smooth muscle and connective tissue with collagen fibers
  - Basement membrane
    - Collagen – stimulates platelets
    - Tissue Factor (TF) – activates coagulation & fibrin formation
  - Connective tissue
    - Elastic fibers – provide support around vessels

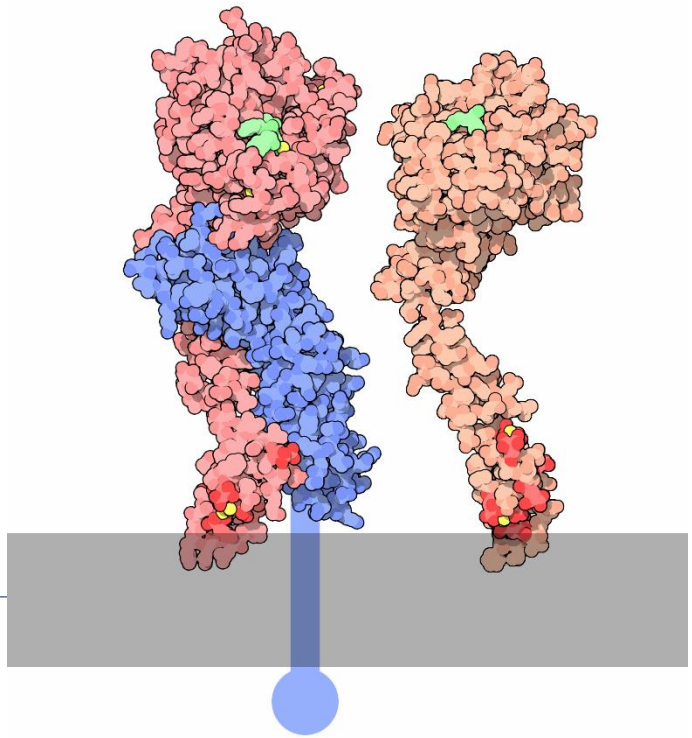

• Collagen types IV & V elastin
• Mucopolysaccharides
• Laminen
• Fibronectin
• Von Willebrand factor
• Vitronectin
• Thrombospondin
• Tissue plasminogen activator (tPA)
• Plasminogen activator inhibitor (PAI-1)
• Collagenase
• Heparan sulfate
• PGI_2
Arteriole
Venule
Internal elastic membrane
External elastic membrane
Tunica intima
Tunica media
Tunica adventitia
Lumen
Smooth muscle cells
Endothelial cell
Junction
Basement membrane
Fibroblast
Lumen
• Collagen
• Proteoglycans
• Reticular fibers
• Elastin fibers
Collagen type 1
Elastin fibers
Capillary
Basement membrane
Cytoplasm of endothelial cell
Glycocalyx
Abluminal surface
Lumen
Luminal surface
Nucleus of endothelial cell

Coagulation Cascade Pathway

The Role of Tissue Factor

- Tissue damage
- Tissue factor is released
  - Tissue factor is a protein found tissue



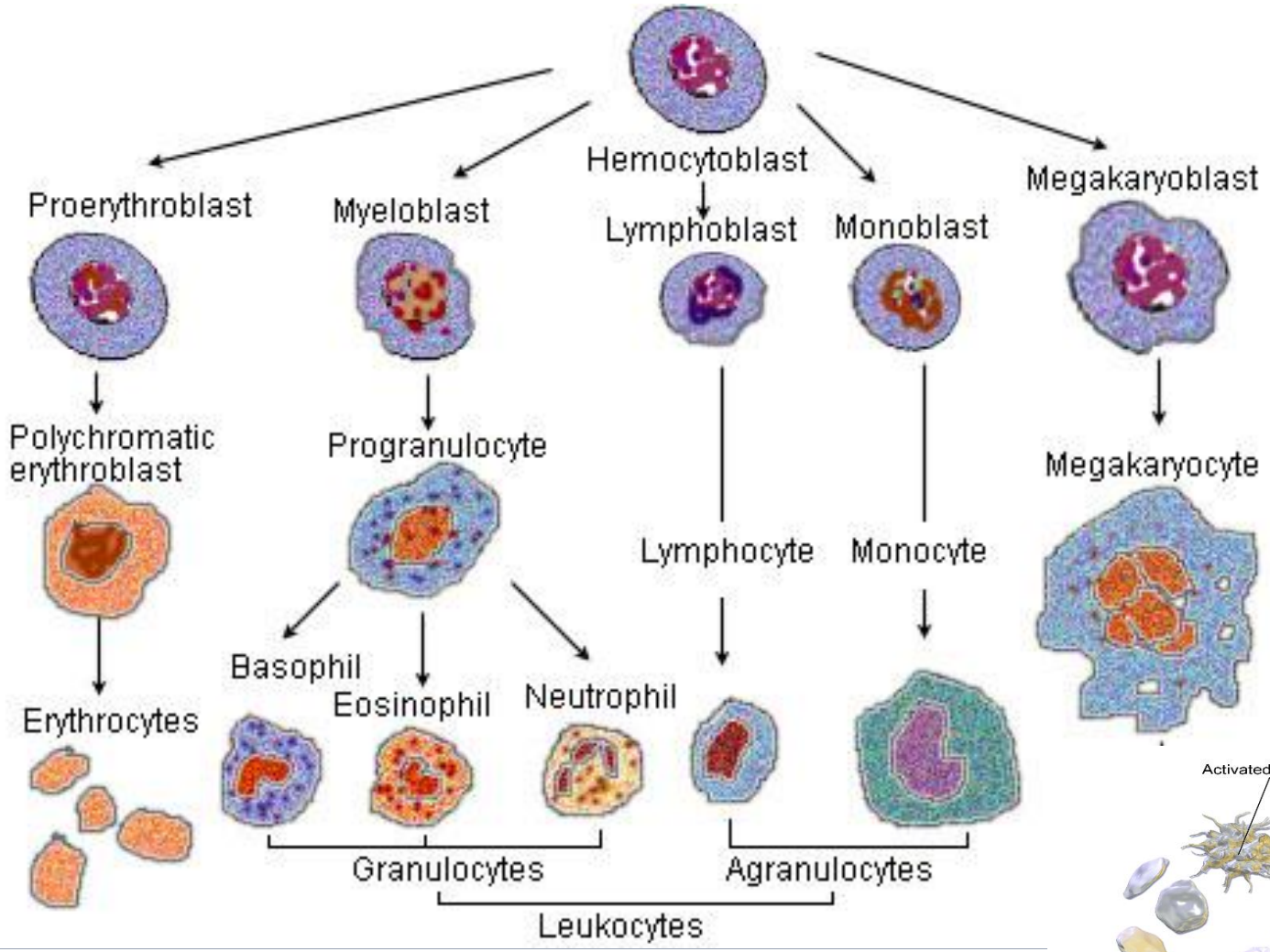


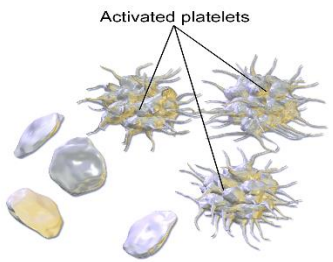
Hemostatic Trigger

Once vessel damage occurs, action begins!

- Arteries and arterioles vasoconstrict
- Smooth muscle cells contract to reduce blood flow
- The endothelium becomes thrombogenic
  - Platelets and coagulation proteins are activated
  - VWF is secreted
  - Fibrinolysis initiated

Bone Marrow Stem Cells





Platelets

Platelets: The 3A's

- Role of Platelets in Hemostasis

- **Platelet Adhesion**
  - Injury
  - Platelets contact subendothelium
  - vWF
  - Fibrinogen
  - Platelets bind with subendothelium

- **Platelet Activation**
- Adhere and activate
- Change shape
- Release proteins and coag factors
- Localized vasoconstriction

- Platelet Aggregation
- Platelet agonists attract more platelets
- Activated platelets combine with adhered platelets
- Thrombin
- Fibrinogen
- Platelet plug formed

https://www.youtube.com/watch?v+R8JMfbYW2p4

The population we serve

Pathophsiology of DIC

1. **Disseminated Fibrin Thrombi**
   - Obstructed blood flow
   - End organ ischemia / necrosis

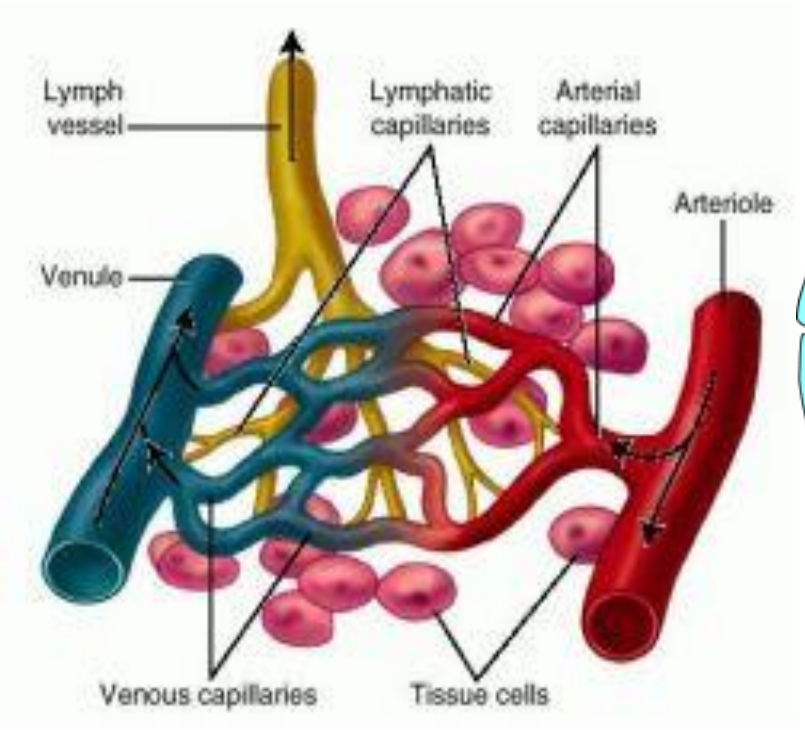
2. **Activation of kinin system**
   - Vascular permeability
   - Hypotension
   - Shock

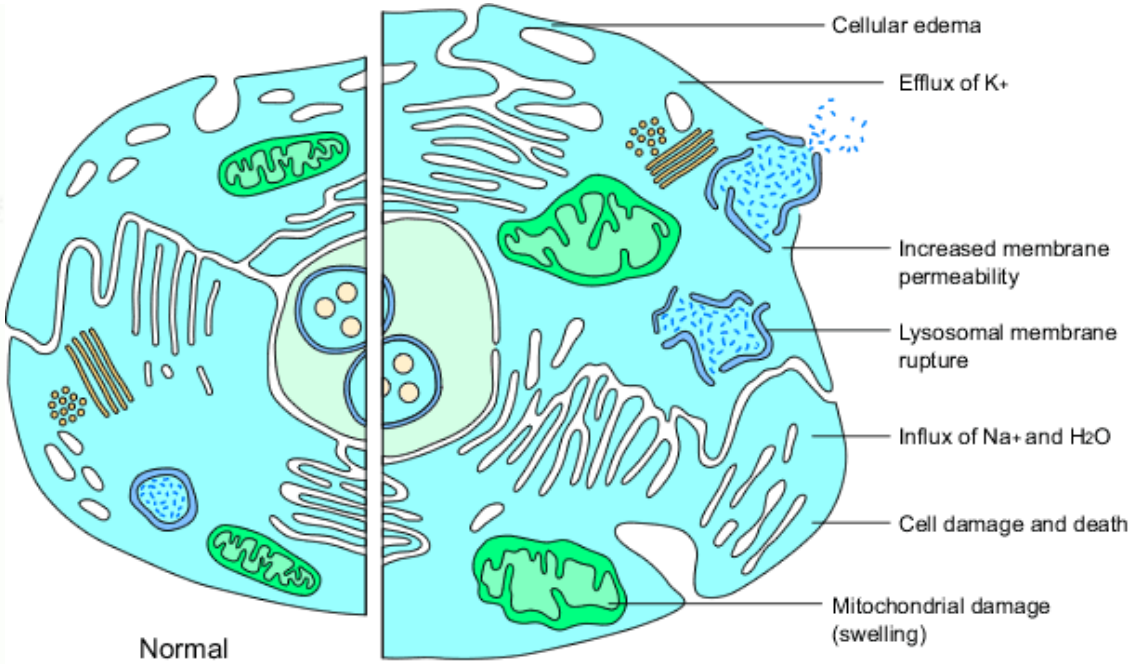
Pathophsiology of DIC

3. **Activation of the complement system**
   - Red cell and platelet lysis
   - ↑ vascular permeability
   - Shock
4. **Release of cytokines (IL 1 & 6) and TNF**
5. **Plasma-induced lysis of fibrin**
   - FDP's
   - Depletion of Coag factors
   - Hemorrhage and shock

Pathophysiology of Hypovolemic Shock

- Tissue hypoperfusion → metabolic acidosis → inflammatory mediators → tissue and vascular injury → multiple organ failure





The Nurse Detective

Etiology of DIC

Underlying OB conditions associated with DIC

Intrauterine Fetal Demise	25%
Placental abruption	37%
PPH / Hypovolemia / MBT	29%
Severe Pre E / HELLP	14%
Acute Fatty Liver	8%
Amniotic Fluid Embolism	6%
Sepsis	6%

100 %

Intrauterine Fetal Demise 25%

Mechanism

- Release of
  - Necrotic tissue and Thromboplastin
- ⇩ Plasma fibrinogen
- FDP's circulate

Diagnosis

- U/S ⇨ Confirm fetal demise
- Baseline coagulation tests
  - Platelet count
  - PT
  - aPTT
  - Fibrinogen

Management

- Deliver fetus and placenta
- If DIC is Present
  - Volume
  - Blood products
  - Supportive care

Placental Abruption 37%

Mechanism

- Release of procoagulant substances
- Activation of fibrinolytic enzyme pathway

Diagnosis

- Vaginal bleeding
- Abdominal pain
- Uterine tenderness
- Uterine contractions
- Coagulation tests

Management

- Delivery v/s Expectant
- If DIC is Present
  - Volume
  - Blood products
  - Supportive care

Clinical Presentation

- Peripheral cyanosis
- Renal impairment
- Drowsiness
- Confusion
- Coma
- Cardiorespiratory failure
- Large and small vessel thrombosis
- Ischemia
- End organ damage

Bleeding from unrelated sites

- Venipuncture sites
- Epistaxis
- Ecchymosis
- Purpura
- Petechiae
- Hematomas

Diagnosis of DIC

- Obvious with massive hemorrhage
- Lab tests
  - CBC, Plts
  - Fibrinogen, FDP's
  - PT, aPTT
  - D Dimer
- Rotem

Risk Factors for PPH

Maternal Hx

- **High parity**
- **History of PPH**
- **Previous uterine surgery**

Labor Factors

- **Chorioamnionitis**
- **Rapid or prolonged labor**
- **Augmented labor**
- **Preeclampsia**
- **Prolonged third stage**

Pregnancy Factors

- **Uterine overdistension**
  - Macrosomia
  - Polyhydramnios
  - Multiple gestation
- ***Placental abnormality***
  - Previa
  - Accreta
  - Abruption

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RISK ASSESSMENT

LOW	MEDIUM	HIGH
No previous uterine incision	History of previous PPH	Placenta previa/Low lying placenta
No known bleeding disorder	Prior cesarean birth(s) or uterine surgery	Suspected placenta accreta
No history of PPH	Multiple gestation	Active bleeding (greater than show) on admission
≤ 4 previous vaginal births	Large uterine fibroids	Hematocrit < 30
Singleton pregnancy	Chorioamnionitis	Known coagulopathy
	Magnesium sulfate	Active anticoagulation therapy
	Preeclampsia	Platelets <100,00
	Rapid or prolonged labor	EBL on admission >1500
	Antibody positive on prenatal type & screen	Other factors designated by physician
□ Verify Type & Screen on prenatal record □ Send HOLD CLOT on admission □ Order T&S if not on available on record	□ Order Type & Screen on admission □ Review hemorrhage protocol	□ Order Type & Crossmatch X 2 unit on admission □ Review hemorrhage protocol □ Notify anesthesia and blood bank of patient risk

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CMQCC Toolkit Version 2.0

OB Hemorrhage Emergency Management

Stage 2 – Continued bleeding ≤1,500ml

Meds/ Procedures

- 2nd IV access 18 gauge

Blood Bank

- Send additional Labs
- DIC Panel

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CMQCC Toolkit Version 2.0

OB Hemorrhage Emergency Management

Stage 3 – Blood loss >1,500ml or **2 units PRBC's** or **unstable VS** or **suspicion of DIC**

Meds/ Procedures

- Activate MTP

Blood Bank

- Transfuse aggressively
- Near 1:1 PRBC to FFP
- 1 PLT apheresis pack (per 4-6 units PRBC's)

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Clinical Signs of Hypovolemia

CMQCC OB Hemorrhage Emergency Management

Cumulative blood loss of 500 -999 mL

- **Should trigger increased supervision and intervention**

Amount of Blood Loss	Clinical Signs
• 1000 mL	• Slight BP △, HR, RR UO normal
• 1500 mL	• Narrow PP, HR >100, diaphoretic
• 2000 mL	• ↓ BP, Narrow PP, HR > 120, pale cool, restlessness
• ≥ 2500 mL	• Profound Hypotension, HR >140, RR > 40, ↓ UO, anuria

Postpartum Care and Patient Satisfaction after Hemorrhage

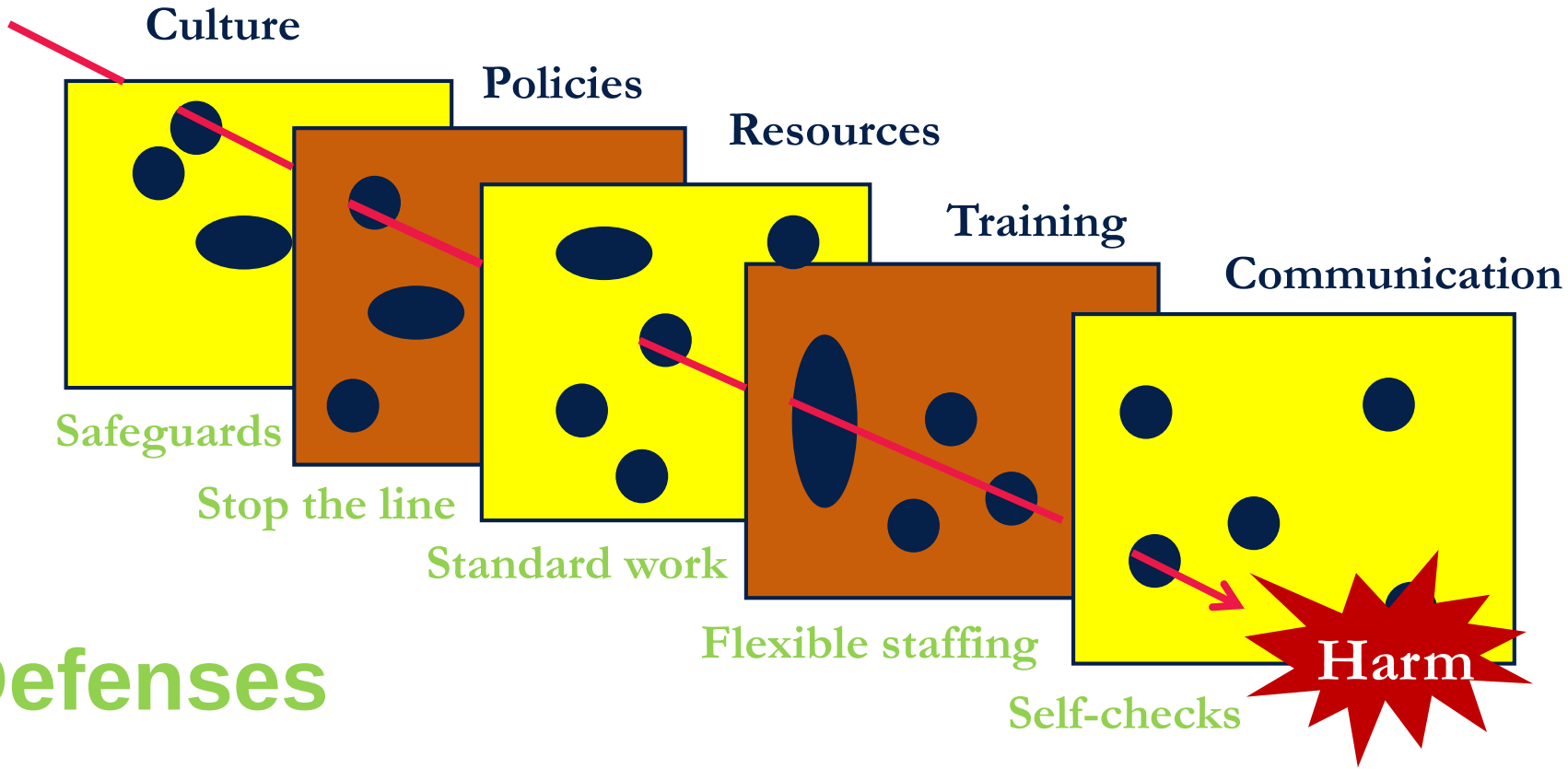
- Australian study: 206 women primary PPH >1500 ml
  - Written questionnaire 1st week and 2 and 4 months
  - Four Themes:
    1. Adequacy of care
    2. Emotional response
    3. Future Implications
    4. Concern for the baby
- Findings suggest pay particular attention to informational and emotional needs of women who experience significant PPH

Case Presentation

- 33 yo G5 P0 admitted at 36 +2 weeks admitted for IOL
  - Hx Hypothyroidism, Severe Hyperemesis
  - IUGR – severe (1% ile)
    - Reactive NST / Baseline 145 - FHR: Cat I Tracing
    - Normal AFI
    - normal Doppler flow
  - Admission VS: 98.5F, 117, 20, 117/78
  - SVE: 1cm/60%/-3/soft /posterior
  - UC's 4-9 minutes – patient describes as "tightening's" pain + 0/10
  - IV started
  - Cervidil placed

How Errors Occur

Failures



Defenses

HISTORICAL PERSPECTIVE

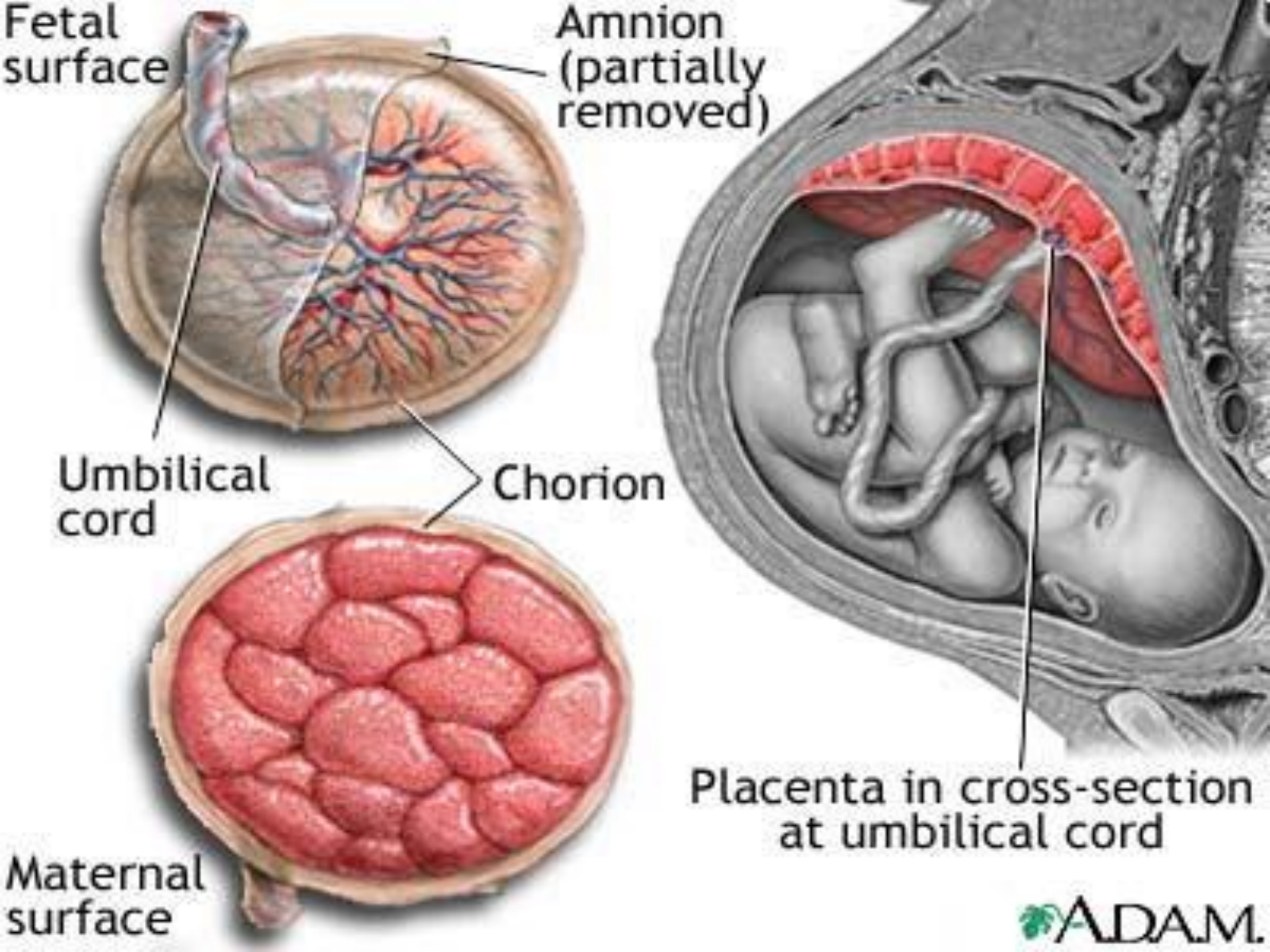
- 1926 AFE is identified by Meyer in a Spanish medical journal
- 1941 Described in detail by Steiner and Lushbaugh, as AFS
- 1979 272 cases reported by Morgan weakened uterine stimulation theory
- 1988 Clark at University of Utah SOM created a national registry
- 1995 Clark describes anaphylactoid syndrome of pregnancy

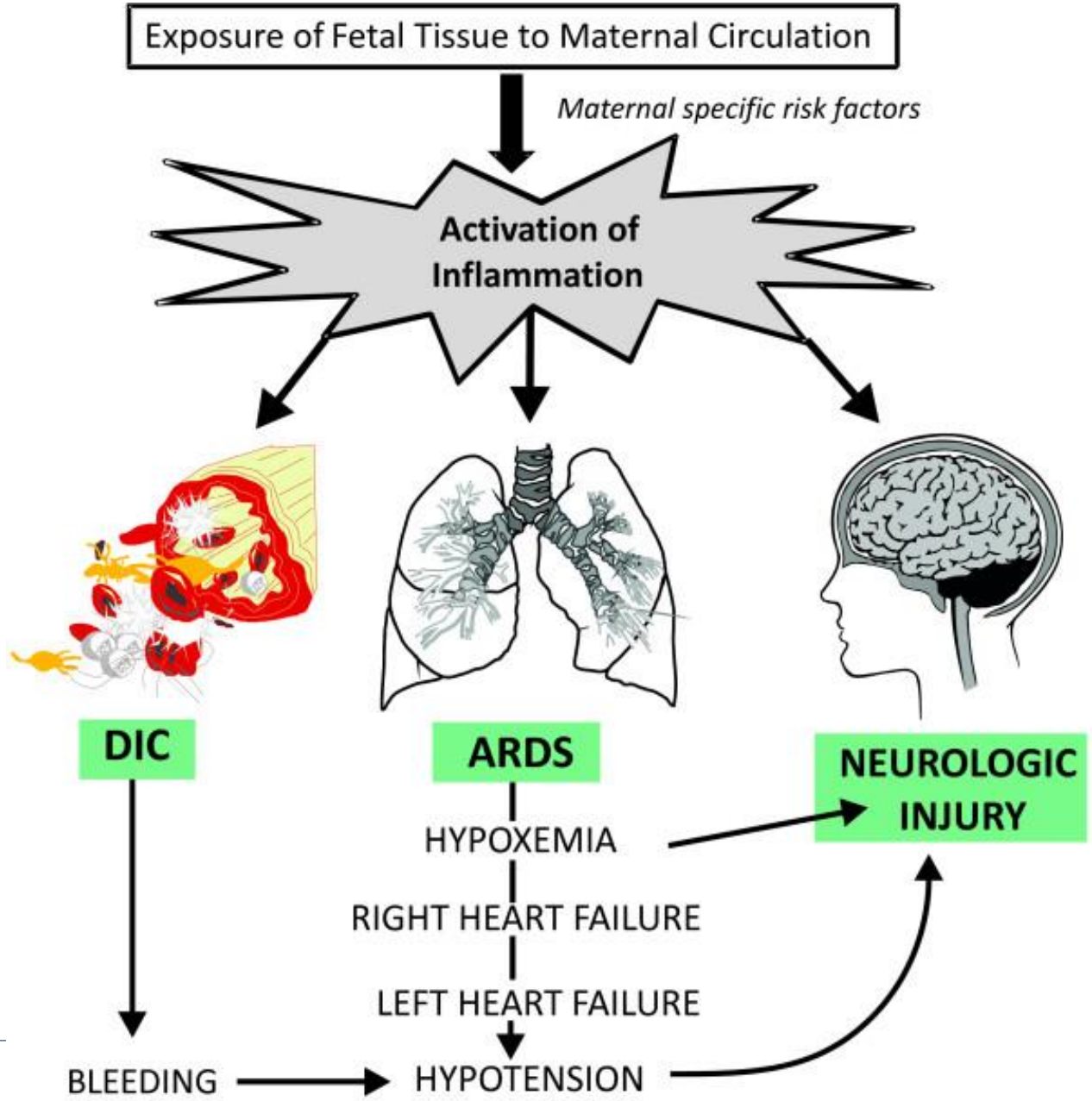
INCIDENCE and FINDINGS

- AFE accounts for 10% of US maternal deaths
- Occurs 1/20,000 deliveries
- US reported a mortality rate of 60%
  - 15% of patient's survive neurologically intact
- Neonatal survival rate 79%
  - Only 50% of these infants survive w/o neurological impairment
- Can occur up to 48 hours postpartum

PATHOGENESIS

- Breech in the maternal fetal barrier
- Amniotic fluid enters maternal circulation
- Fetal squames and trophoblasts initiate a pathophysiological cascade similar to anaphylaxis and sepsis

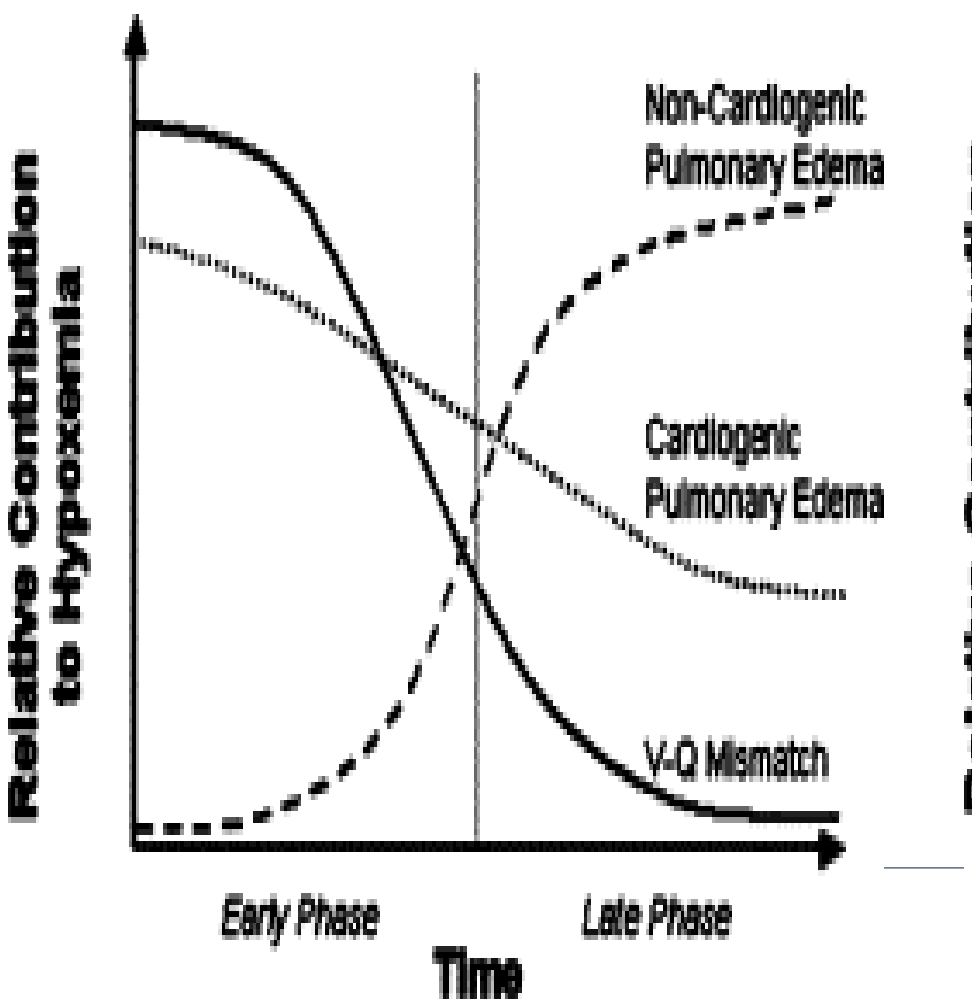

Fetal surface
Amnion (partially removed)
Umbilical cord
Chorion
Maternal surface
Placenta in cross-section at umbilical cord
A.D.A.M.



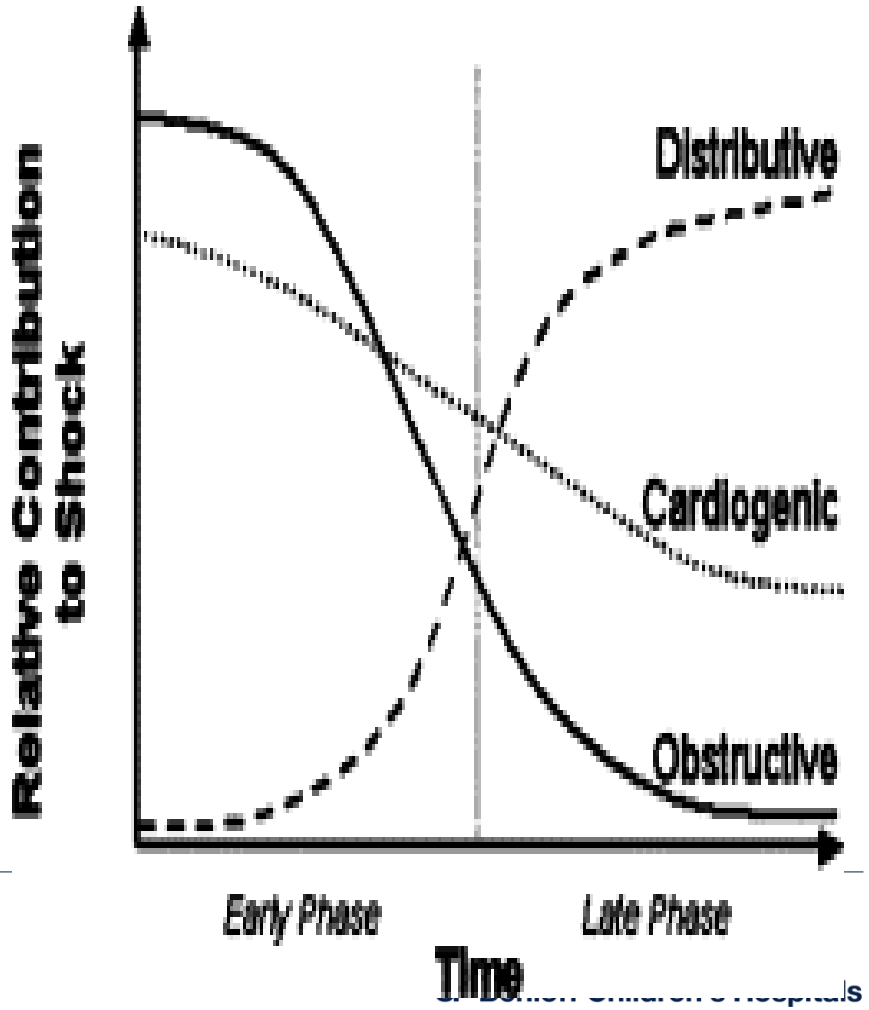
Neligan PJ 2011

Primary and Secondary Phases of AFE

Hypoxemia



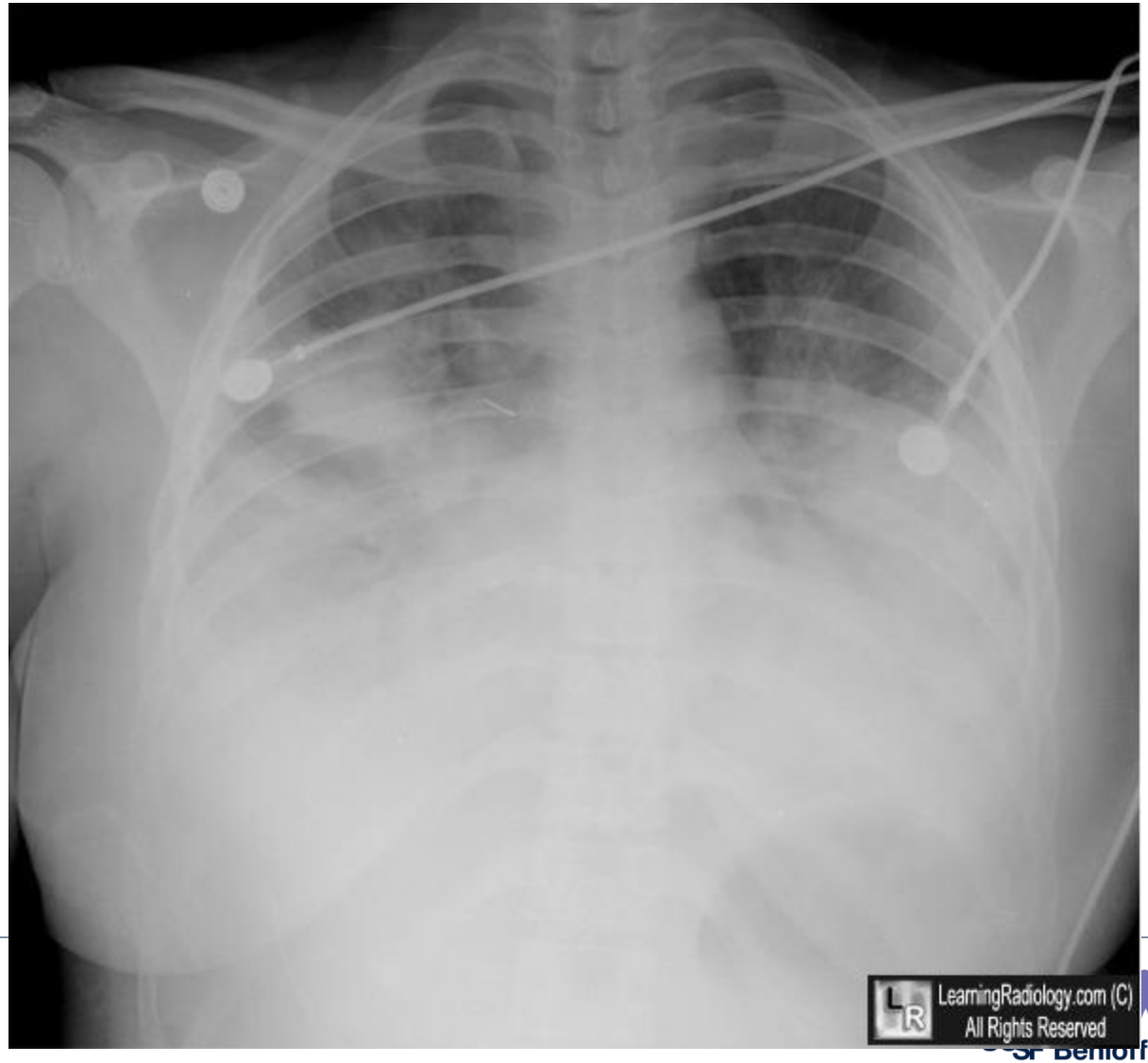
Shock



DIFFERENTIAL DIAGNOSIS

- Pulmonary thromboembolism
- Air embolism
- **Hemorrhage**
- Aspiration of gastric contents
- Anesthetic complications
- **Anaphalaxisis**
- Sepsis/systemic inflammatory syndrome
- Myocardial Infarction
- Cardiomyopathy
- **Eclampsia**
- Transfusion Reaction

Chest radiographs usually show pulmonary edema



Initial Management of AFE

- Optimize hemodynamic function
- Improve cardiac output
- Optimize preload - IV fluids wide open
- Administer high concentration oxygen (100%)
- If respirations are absent: BMV or intubate
- Improve oxygenation
- Transfuse PRBC's – more hemoglobin
- Reverse coagulopathy
- Transfuse blood components:
- Fresh or liquid plasma, Platelets, clotting factors

Initial Management of AFE

- Prompt Diagnosis – requires collaboration
- Prompt Resuscitation restore equilibrium

Maintain:

- ✓ Systolic BP>90
- ✓ Arterial pO2 >60 mm Hg
- ✓ SaO2 > 95%
- ✓ Urine output > 25 ml/hr

- Postmortem cesarean delivery - 5 min
- Re-establishing uterine tone
- Implement Massive Transfusion Protocol
- Crisis intervention for the family

Links to Stephanie Arnold videos

Watch in order below:

- Book Trailer:
  - https://www.youtube.com/watch?v=WgUux2u30ms
- Regression Footage: WARNING: Graphic Video)
  - http://stephaniearnold.net/intuition-general/
- Press Video for book:
  - https://vimeo.com/156957431
  - Password: AfterI!fe37SA

Case Presentation: Venous Thromboembolism

42 y.o. G3 P1, two days after emergency cesarean for fetal intolerance to labor

- On your initial assessment in the morning:
  - Afebrile, vital signs stable, lungs are clear
  - Dressing dry and intact, bowel sounds in four quadrants
  - Fundus firm midline and below umbilicus
  - Lochia normal

Case Presentation: Venous Thromboembolism

You take out her IV and help her get up to take a shower
As she returns from the bathroom she says her leg hurts
On exam you note redness in one leg.

- What do you think?
- What do you do next?

Deep Vein Thrombosis Formation

Venous stasis

+

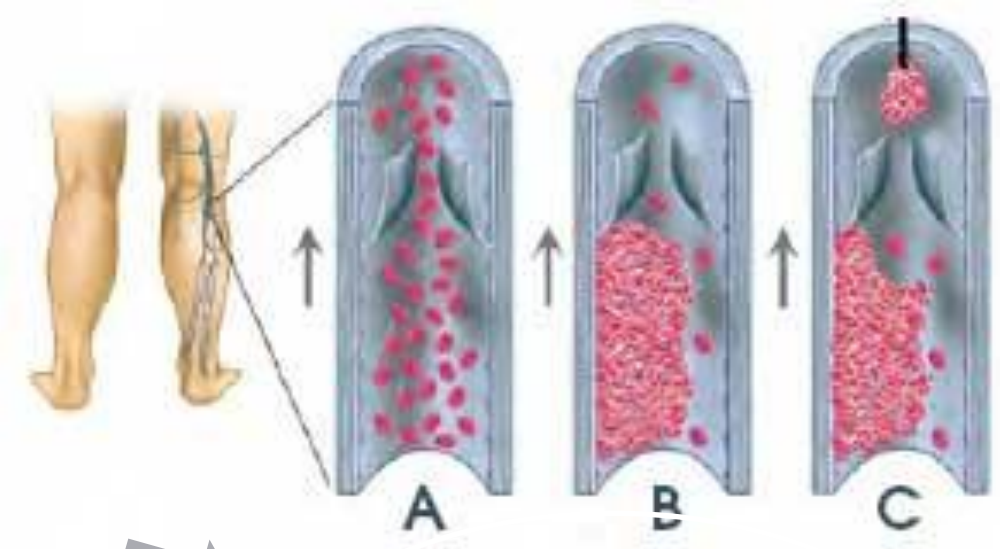
↓ Clotting clearance

+

Platelets deposits in valve cusp pockets

+

↑ Hypercoagulation
↓ Anticoagulation



A. Normal Blood Flow

B. Deep Vein Thrombosis

C. Embolus

The Nurse Detective

COUNCIL ON PATIENT SAFETY IN WOMEN'S HEALTH CARE

safe health care for every woman

PATIENT SAFETY BUNDLE

Maternal Venous Thromboembolism Prevention

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 & PREVENTION

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

Standardization of health care processes and reduced variation has been shown to improve outcomes and quality of care. The Council on Patient Safety in Women's Health Care disseminates patient safety bundles to help facilitate the standardization process. This bundle reflects emerging clinical, scientific, and patient safety advances as of the date issued and is subject to change. The information should not be construed as dictating an exclusive course of treatment or procedure to be followed. Although the components of a particular bundle may be adapted to local resources, standardization within an institution is strongly encouraged.

The Council on Patient Safety in Women's Health Care is a broad consortium of organizations across the spectrum of women's health for the promotion of safe health care for every woman.

October 2015

For more information visit the Council's website at www.safehealthcareforeverywoman.org

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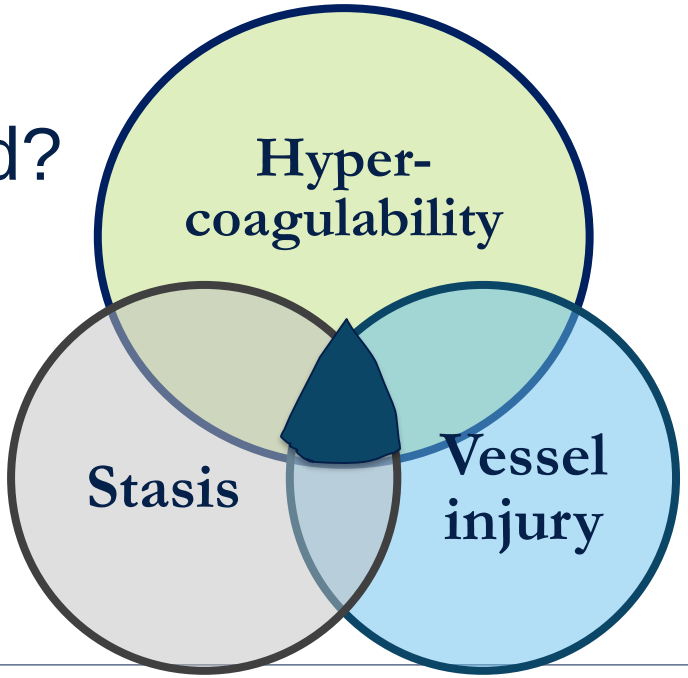
Deep Vein Thrombosis (DVT)

- Pregnancy predisposes to DVT due to:
  - Venous stasis from enlarge uterus compression, and decreased vascular tone
  - Hypercoagulability
  - Remember Virchow's triad?
    - Hypercoagulability
    - Stasis of blood flow
    - Endothelial injury



Risk Factors for DVT

Maternal	Pregnancy	Labor
Obesity	Multiparity	Cesarean Birth
Smoking	Preeclampsia	PPH Blood
Hx of VTE	**Physiologic changes of Pregnancy**	Infection
Diabetes		Immobilization
Age > 35 years		

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AWHONN Post Birth Warning Signs VTE Parent Education

- What is VTE?
  - VTE is when you develop a blood clot usually in your leg (calf area)
- Signs of VTE
  - Leg pain, tender to touch, burning or redness, particularly in calf area
- Getting Help
  - Call healthcare provider immediately for signs of VTE if no response call 911 or go to nearest hospital emergency department

http://www.awhonn.org/?page=POSTBIRTH

VTE: Key Summary Points

- 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 may benefit from pharmacologic prophylaxis
- Empiric pharmacologic prophylaxis is a reasonable option for:
  - All women undergoing cesarean delivery
  - All antepartum patients hospitalized >72 hours

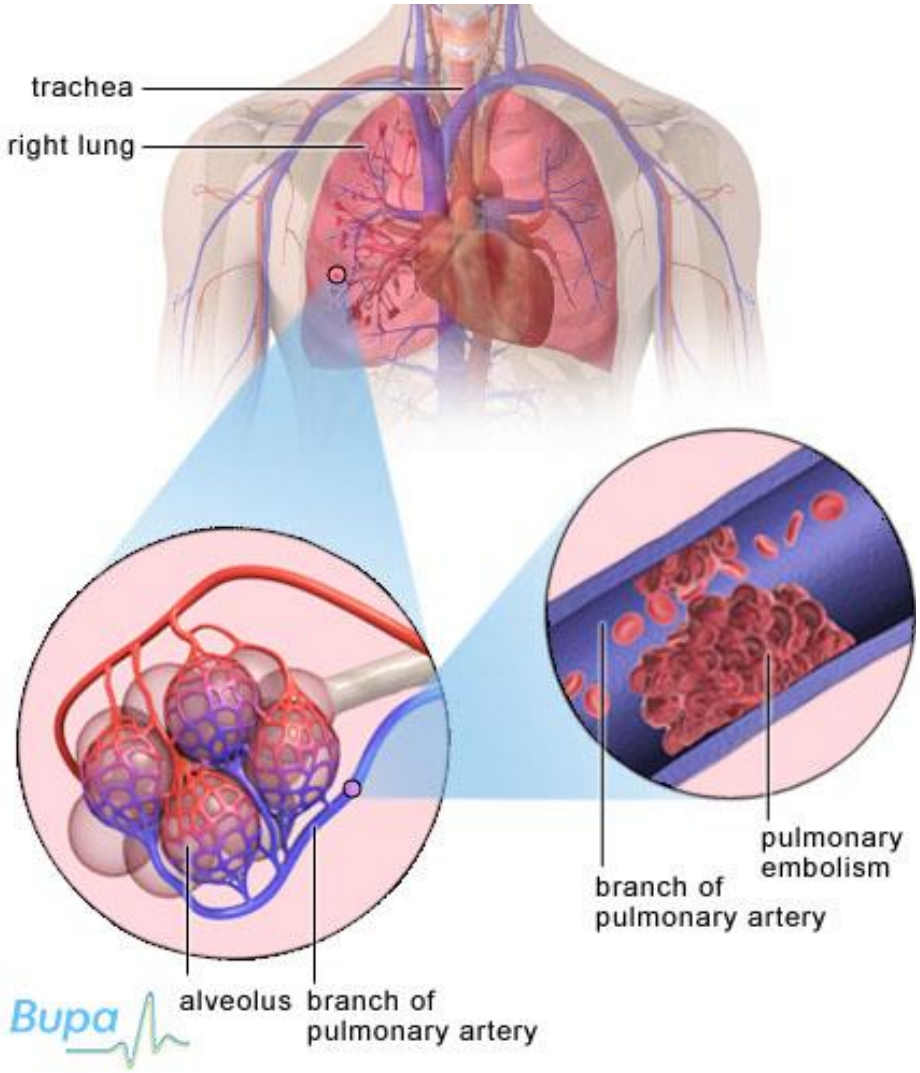
D'Alton, M. E., et.al.(2016). National Partnership for Maternal Safety: Consensus bundle on venous thromboembolism. *Journal of Obstetric, Gynecologic and Neonatal Nursing,* 45, 706–717. *http://dx.doi.org/10.1016/j.jogn.2016.07.001*.

Pulmonary Embolism

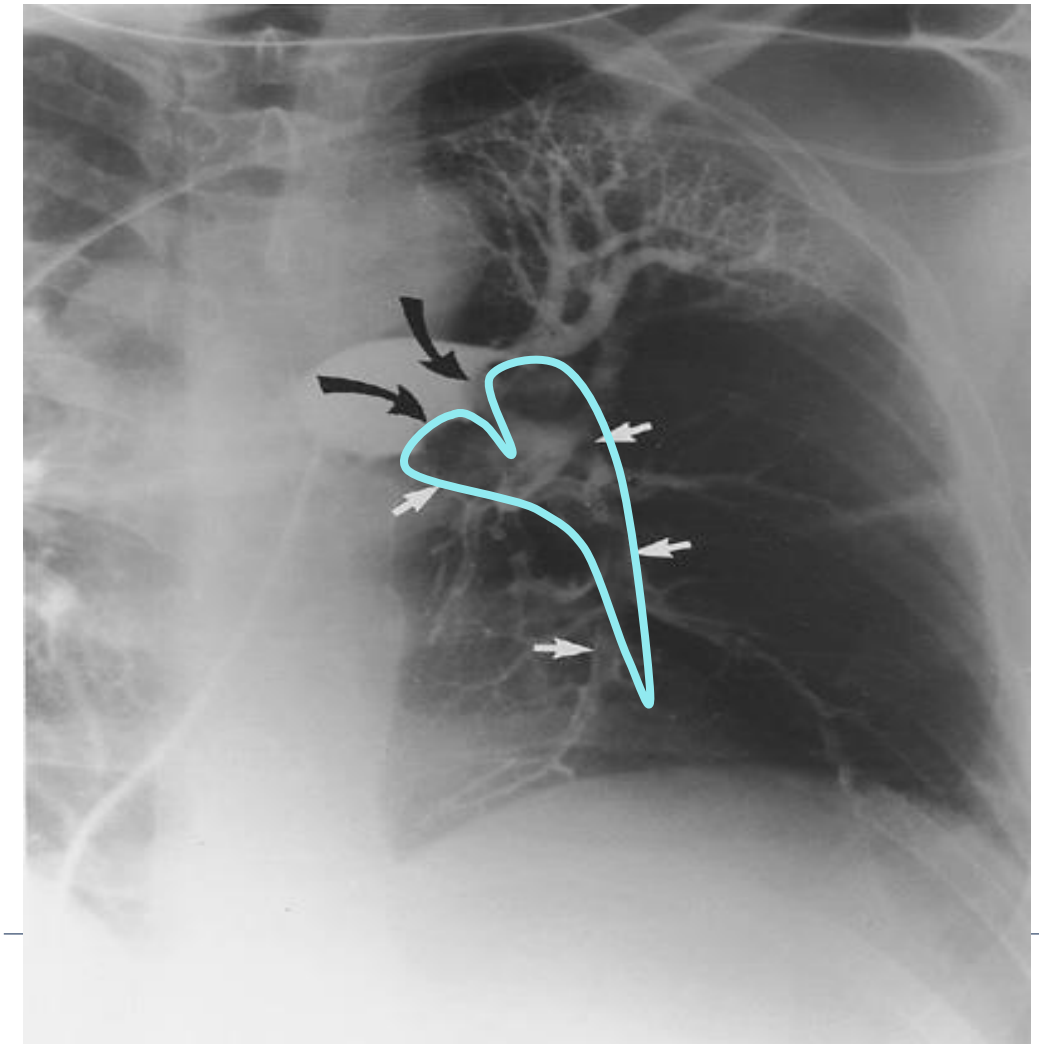
- Classic Triad (25%)
  - Dyspnea
  - Pleuritic Chest Pain
  - Hemoptysis
- May Display Hypoxia

Diagnostics

- Blood Gas Studies
- VQ Scan
- CT
- Pulmonary Angiography



Pulmonary Arteriogram



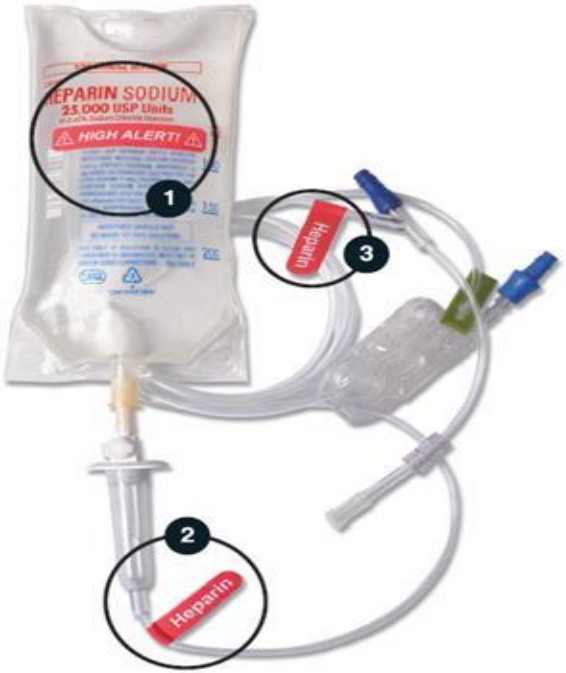
- Black arrows
  - The meniscus of contrast outlines the trailing edge of the thrombus
- White arrows
  - A rim of contrast around the body of the thrombus

Nursing Care: Pulmonary Embolism

- Elevate HOB
- Administer Oxygen 10L/min nonrebreather mask
- O2 Sat Monitor
- Rapid Response Team
- Heparin
- Dopamine
- Morphine
- ICU Transfer

Heparin *"High Alert"*

- Maintain therapeutic Heparin level
  - (aPTT >1.5 -2.5)
- Protocol provides management guidelines
- Continue for 5 days postpartum
  - Clinical improvement
- Begin oral anticoagulant therapy
  - Warfarin

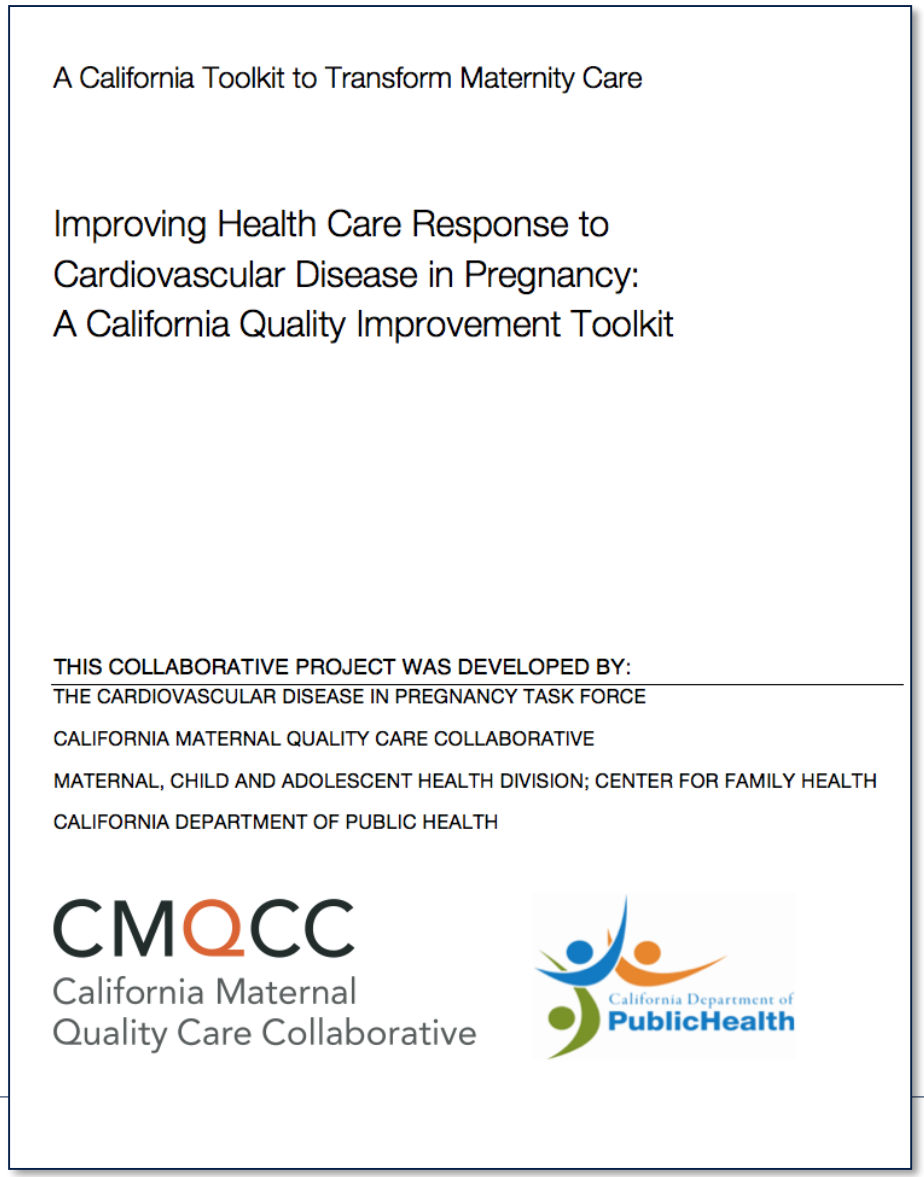


CVD Case Presentation

- 25 year old obese (BMI 38) African-American G2P2 presents 10 days after an uncomplicated vaginal delivery with fatigue and persistent cough since delivery.
- BP 110/80, HR 110, RR 28, afebrile, with O2 sat 94% on room air.
- She gets diagnosed with respiratory infection and is prescribed an antibiotic. Fatigue is attributed to lack of sleep.

CVD Case Presentation (*CONTINUED*)

- One week later, she presents again with continued symptoms. Antibiotics are switched and beta-agonists are added for presumptive “new-onset asthma.”
- Two days later, the patient experiences cardiac arrest at home and resuscitation attempts are unsuccessful.
- Autopsy findings were indicative of cardiomyopathy.



For More Information and to Download the Toolkit

- Visit
- www.cmqcc.org
- https://www.cdph.ca.gov
- Contact: info@cmqcc.org

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Rationale for Toolkit

Cardiovascular Disease is

- the leading cause of maternal mortality in CA and U.S.
- under-recognized in pregnant or postpartum women
- higher among African-American women

- 25% of deaths attributed to cardiovascular disease may have been prevented if the woman's heart disease had been diagnosed earlier.

- Pregnancy is a period of frequent interaction with health care providers and offers an opportunity to detect and treat heart disease, improve pregnancy outcomes, and affect future cardiovascular health.

Hameed A, Lawton E, McCain CL, et al. Pregnancy-Related Cardiovascular Deaths in California: Beyond Peripartum Cardiomyopathy. *American Journal of Obstetrics and Gynecology* 2015; DOI: 10.1016/j.ajog.2015.05.008

CVD Toolkit Goals

Given that CVD is the leading cause of maternal mortality & morbidity in California, the Toolkit aims to:

- Encourage obstetric and other healthcare providers to retain a high index of suspicion for CVD, particularly among women with risk factors who present with symptoms in late pregnancy or early postpartum period

- To serve as resource for generalists who provide maternity care to women, with special emphasis on
  - Prenatal visits
  - Postpartum encounters
  - Emergency room visits

Hameed, AB, Morton, CH, Main, EK, Wong, K. Improving Health Care Response to Cardiovascular Disease in Pregnancy and Postpartum Developed under contract #11-10006 with the California Department of Public Health, Maternal, Child and Adolescent Health Division. Published by the California Department of Public Health, 2017.

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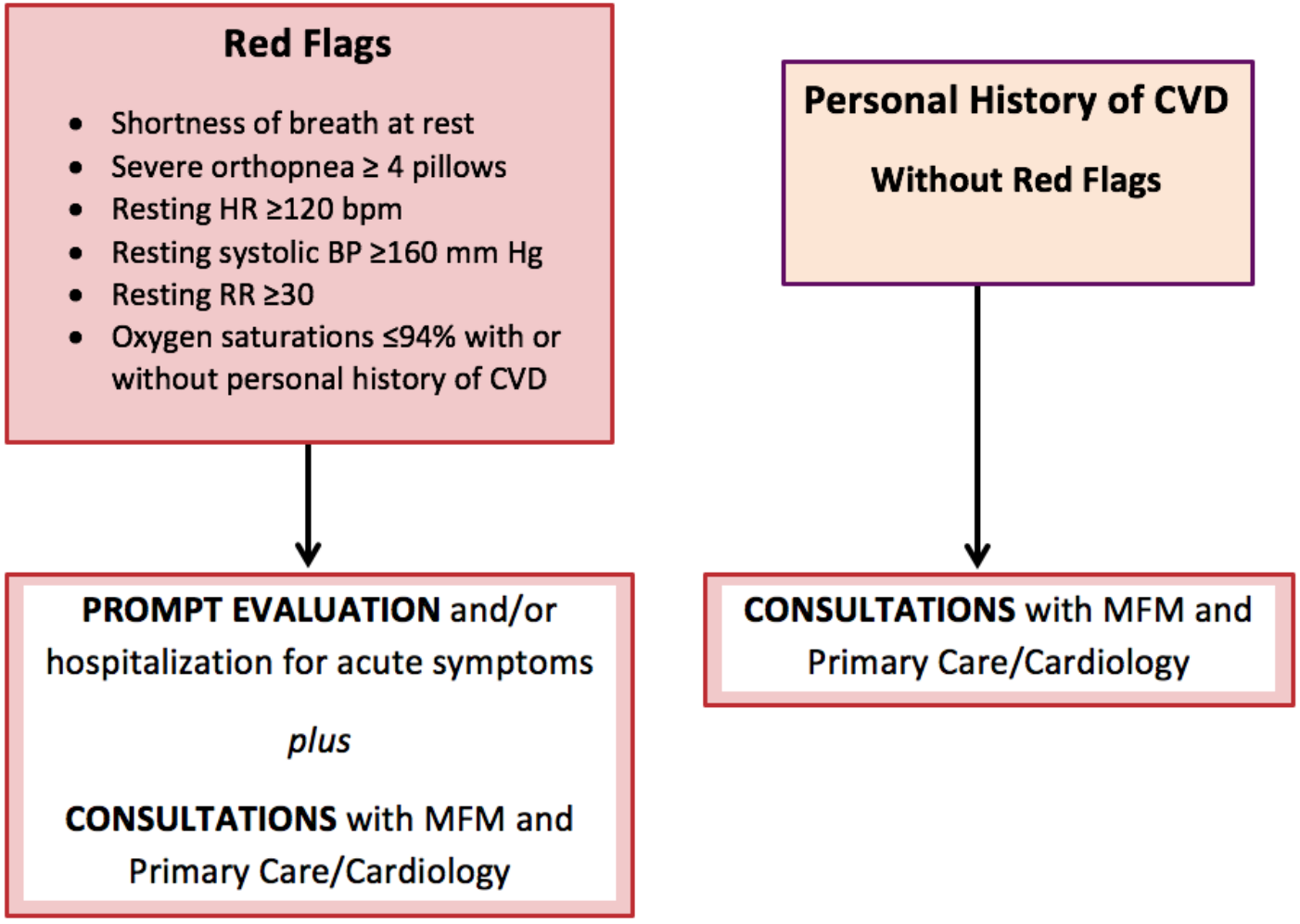
CVD Assessment Algorithm
For Pregnant and Postpartum Women



CARDIOVASCULAR DISEASE ASSESSMENT IN PREGNANT and POSTPARTUM WOMEN

(No Red Flags and/or no personal history of CVD, and hemodynamically stable)

SYMPTOMS

*NYHA class > II

Suggestive of Heart Failure:
- Dyspnea
- Mild orthopnea
- Tachypnea
- Asthma unresponsive to therapy

Suggestive of Arrhythmia:
- Palpitations
- Dizziness/syncope

Suggestive of Coronary Artery Disease:
- Chest pain
- Dyspnea

VITAL SIGNS

- Resting HR ≥110 bpm
- Systolic BP ≥140 mm Hg
- RR ≥24
- Oxygen sat ≤96%

RISK FACTORS

- Age ≥40 years
- African American
- Pre-pregnancy obesity (BMI ≥35)
- Pre-existing diabetes
- Hypertension
- Substance use *(nicotine, cocaine, alcohol, methamphetamines)*
- History of chemotherapy

**PHYSICAL EXAM

ABNORMAL FINDINGS

Heart: Loud murmur or

Lung: Basilar crackles

NO YES

≥ 1 Symptom + ≥ 1 Vital Signs Abnormal + ≥ 1 Risk Factor or

ANY COMBINATION ADDING TO ≥ 4

Consultation indicated:

MFM *and* Primary Care/Cardiology

Obtain: **EKG and BNP**
- **Echocardiogram +/- CXR** if HF or valve disease is suspected, or if the BNP levels are elevated
- 24 hour Holter monitor, if arrhythmia suspected
- Referral to cardiologist for possible treadmill echo vs. CTA vs. alternative testing if postpartum

Consider: **CXR**, **CBC**, Comprehensive metabolic profile, Arterial blood gas, Drug screen, TSH, etc.

Follow-up within one week

Results negative

Signs and symptoms resolved

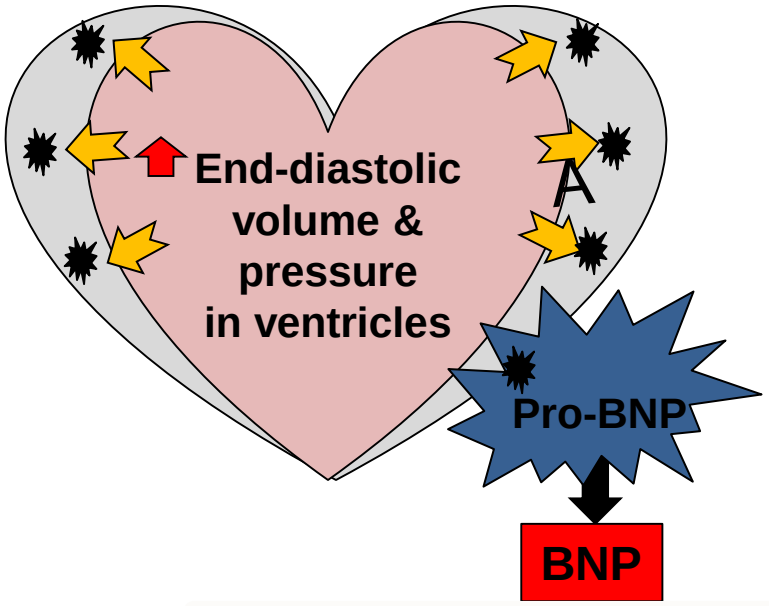
Reassurance and routine follow-up

Results abnormal

CVD highly suspected

B Type Natriuretic Peptide (BNP)

Neurohormone secreted by the cardiac ventricles in response to ventricular volume expansion and pressure overload



Relaxes vascular smooth muscle

Inhibits renin-angiotensin-aldosterone system

Increases natriuresis and diuresis

Image Credit: Afshan Hameed, MD. Used with permission

Clinical Uses of BNP in Pregnancy

- Diagnosis of heart failure
  - In pregnant women with dilated CMP, higher BNP predicts adverse cardiovascular outcomes
- Asymptomatic left ventricular function
  - Useful to evaluate shortness of breath
- Predictor of cardiovascular outcome
  - In pregnant women with congenital heart disease, higher BNP levels are associated with poor outcomes

- Blatt A, Svirski R, Morawsky G, et al. Short and long-term outcome of pregnant women with preexisting dilated cardiomypathy: An NTproBNP and echocardiography-guided study. *The Israel Medical Association journal : IMAJ.* Oct 2010;12(10):613-616.
- Tanous D, Siu SC, Mason J, et al. B-type natriuretic peptide in pregnant women with heart disease. *J Am Coll Cardiol.* Oct 5 2010;56(15):1247-1253.
- Kansal M, Hibbard JU, Briller J. Diastolic function in pregnant patients with cardiac symptoms. *Hypertens Pregnancy.* 2012;31(3):367-374.

Key Clinical Pearls

- First presentation of cardiovascular disease may be during pregnancy or early postpartum.
- The highest risk period for CVD worsening is between 24-28 weeks or postpartum.
- CVD symptoms or vital sign abnormalities should not be ignored in pregnant/postpartum women.
- New onset or persistent asthma may be a sign of heart failure.
- Bilateral infiltrates on chest x-ray may be due to heart failure rather than pneumonia.

Hameed AB, Morton CH, and A Moore. Improving Health Care Response to Cardiovascular Disease in Pregnancy and Postpartum Developed under contract #11-10006 with the California Department of Public Health, Maternal, Child and Adolescent Health Division. Published by the California Department of Public Health, 2017.

Key Clinical Pearls (continued)

- Pregnancy or postpartum women with significant risk factors should be counseled regarding future CVD risk.
- Women with known CVD should receive pre- & inter-conception counseling by an experienced perinatologist and cardiologist.
- Contraception choices should be tailored to the individual.
- Provider and patient education is essential.
- High index of suspicion, early diagnosis, appropriate referrals and follow up are the key elements to a successful outcome.

Hameed AB, Morton CH, and A Moore. Improving Health Care Response to Cardiovascular Disease in Pregnancy and Postpartum Developed under contract #11-10006 with the California Department of Public Health, Maternal, Child an Adolescent Health Division. Published by the California Department of Public Health, 2017.

Postpartum Presentations to the ED, PCP or OB Provider

When a woman presents in the postpartum period with complaints of shortness of breath, ask if she has experienced:

- Worsened level of exercise tolerance
- Difficulty performing activities of daily living; Unexpected fatigue
- Symptoms that are deteriorating, especially chest pain, palpitations, or dizziness
- New onset of cough or wheezing
- Leg edema and if it is improving or deteriorating
- Inability to lay flat; if this is a change; how many pillows she uses to sleep
- Failure to lose weight or unusual weight gain, and how much
- A history of cardiac or pulmonary conditions
- A history of substance abuse and/or cigarette use
- Or has been seen by other providers or in other Emergency Departments since giving birth.

Postpartum Presentations to the ED, PCP or OB Provider

Key Points (1)

- Symptoms related to physiologic changes of pregnancy should be improving in the postpartum period.
- Any visits to Emergency Department for dyspnea should raise suspicion for cardiovascular disease.
- Women of childbearing age should be questioned about recent pregnancies, in addition to their last menstrual period (LMP).
- Postpartum dyspnea or new onset cough is concerning for cardiovascular disease.

Postpartum Presentations to the ED, PCP or OB Provider

Key Points (2)

- New onset asthma is rare in adults.
- Bilateral crackles on lung examination are most likely associated with Congestive Heart Failure (CHF).
- Improvement of dyspnea with bronchodilators does not confirm the diagnosis of asthma, as CHF may also improve with bronchodilators. Likewise, a lack of response to bronchodilators should prompt the entertainment of a diagnosis other than asthma.

Racial Disparities in CVD
Clinical Implications

- **Listen to women.** Take patient complaints seriously, and maintain a high index of suspicion for CVD especially in ALL African-American women.
- Any co-morbidity should further heighten the clinical index of suspicion.
- African-American women with chronic or gestational hypertension, high BMI (>35) who present with symptoms suggestive of CVD or vital signs indicated in the CVD Assessment Algorithm should be evaluated carefully and thoroughly for potential CVD.

Hameed AB, Morton CH, and A Moore. Improving Health Care Response to Cardiovascular Disease in Pregnancy and Postpartum Developed under contract #11-10006 with the California Department of Public Health, Maternal, Child an Adolescent Health Division. Published by the California Department of Public Health, 2017.

Guide to Contraception Information for Women with Cardiovascular Disease

Patients with cardiovascular disease including hypertension, congenital heart defects, arrhythmia and heart failure should be educated about contraceptive choices to improve overall health and prevent unwanted pregnancy.

- **Non-hormonal methods** are the preferred contraception in patients with cardiovascular disease, given the minimal risk of thromboembolism with their use.
- **Hormonal methods** containing estrogen products and depot medroxy-progesterone acetate injection should be used with caution in patients who have multiple risk factors or a history of cardiovascular disease.

Lifetime Risks of Heart Disease After Pregnancy Complications

- Pregnancy complications increase heart disease (CVD) risk:
  - Gestational hypertension, preeclampsia and HELLP syndrome
  - Gestational diabetes
  - Preterm birth.
- Women are often unaware of their CVD risk but are enthusiastic to learn more.
- Hypertension and diabetes in pregnancy = wake-up call for women and families.
- Future CVD risk can be reduced by 4-13% with healthy lifestyle changes.

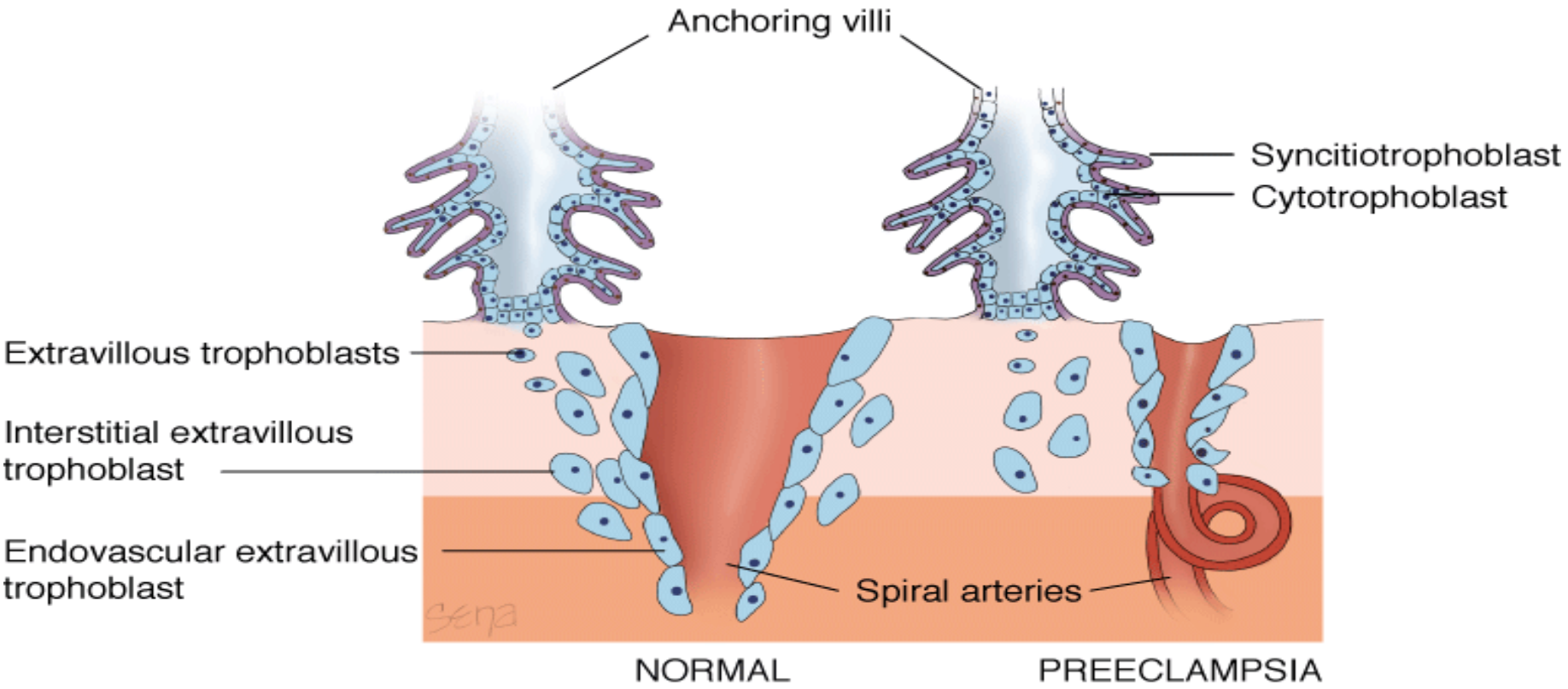
Hypertensive Disorders

- Most common medical complication of pregnancy
- **Chronic hypertension** is increasing in the general population
- Native American, African American, and Hispanic women affected disproportionately
- **Preeclampsia**
  - Complicates 3% to 6% of all pregnancies
  - Reason for up to 25% of VBLW births
  - Highest Morbidity occurs when GA <35 weeks (early onset)


LET'S START
AT THE VERY
BEGINNING
memegenerator.net

Preeclampsia

- A multiorgan syndrome characterized by endothelial damage and vasospasm



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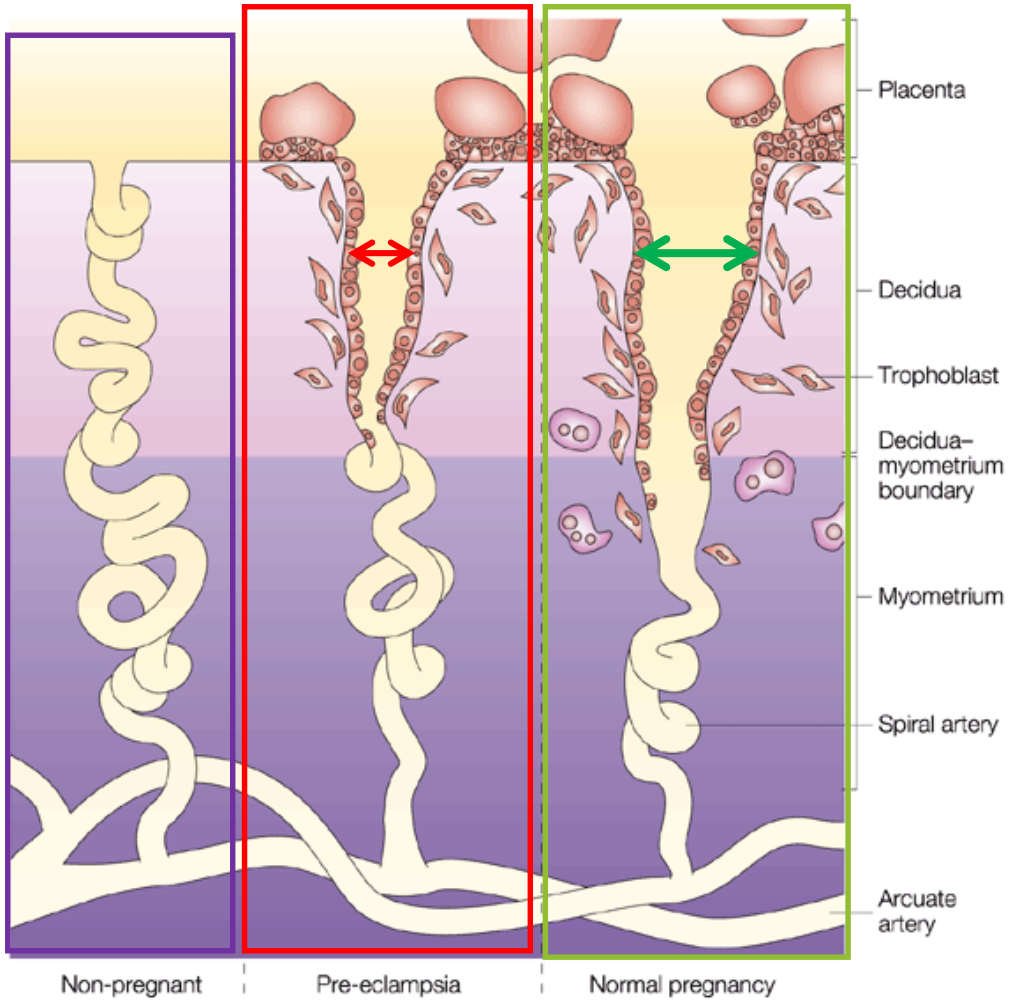
Pathophysiology of Preeclampsia

- Failure of maternal spiral artery remodeling in early second trimester sets the stage
- Leads to release of vascular damaging agents



Nature Reviews | Immunology

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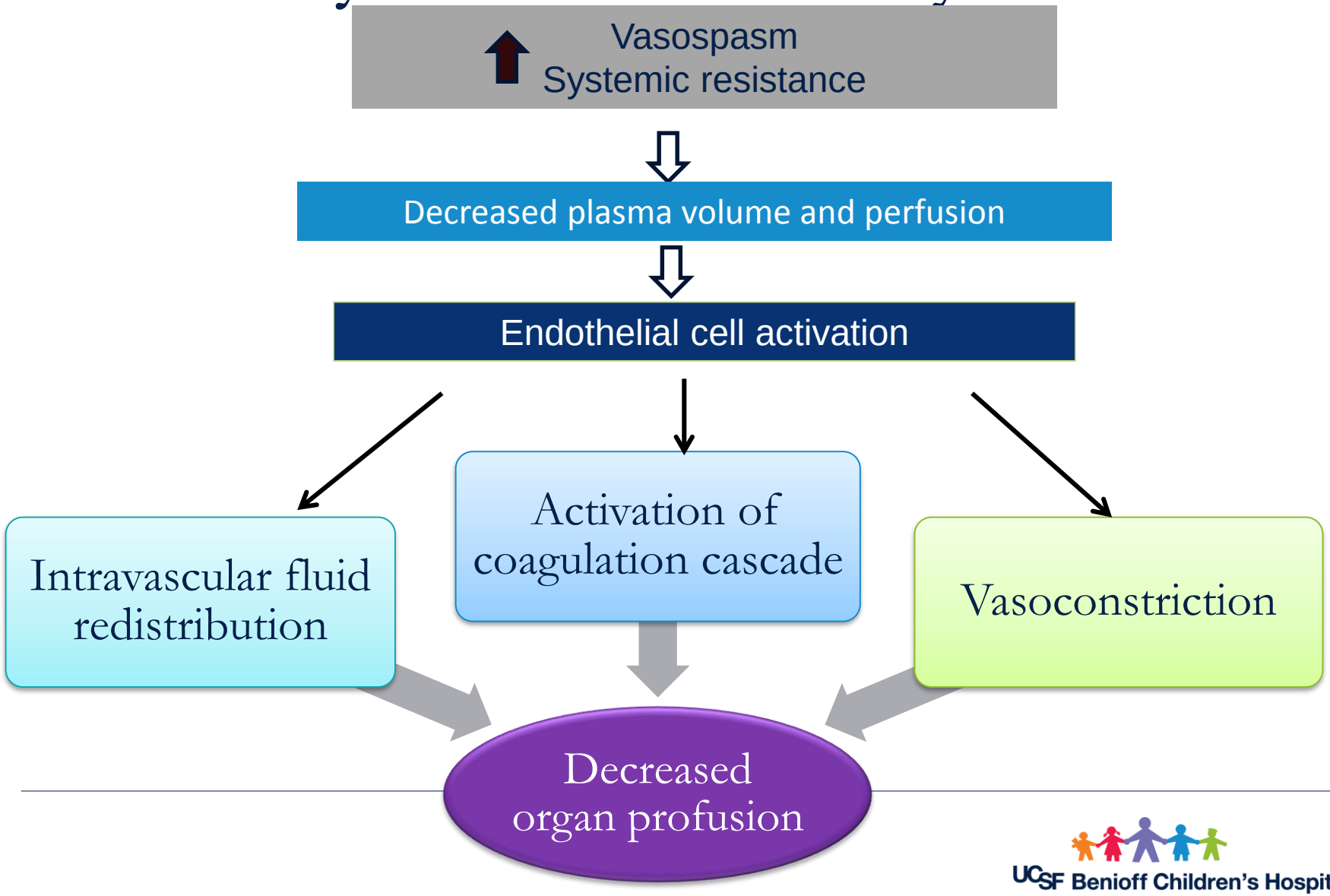
Cycle of reactivity



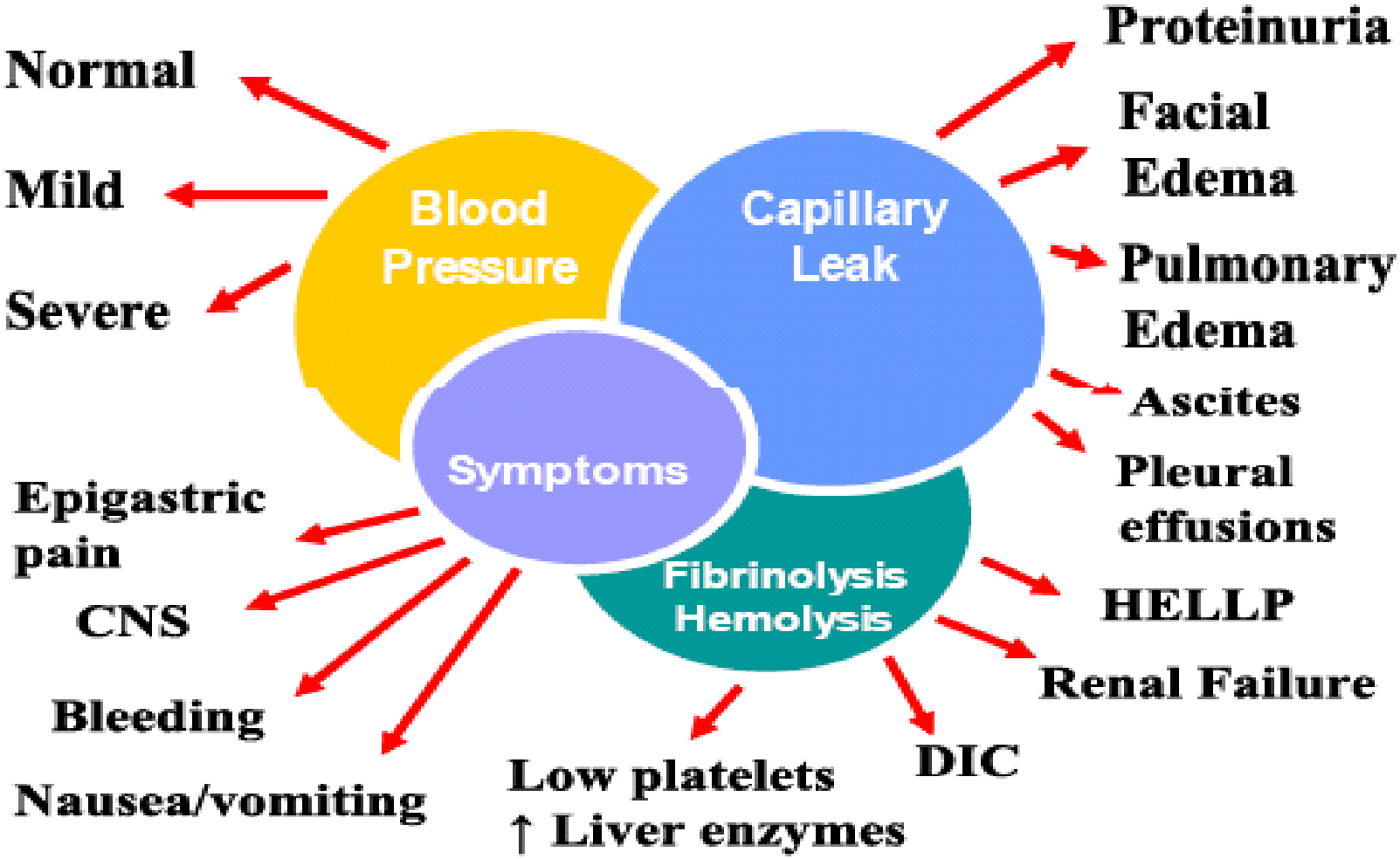
Pathophysiology of Preeclampsia

Maternal artery endothelial cell dysfunction causes:

- Vasoconstriction
- Hypertension
- Edema
  - Pulmonary edema
  - Headache
  - Epigastric pain
  - Oliguria

Pathophysiology

FIGURE 1
Overlapping role of hypertension, capillary leak, maternal symptoms, and fibrinolysis/hemolysis in the spectrum of atypical preeclampsia



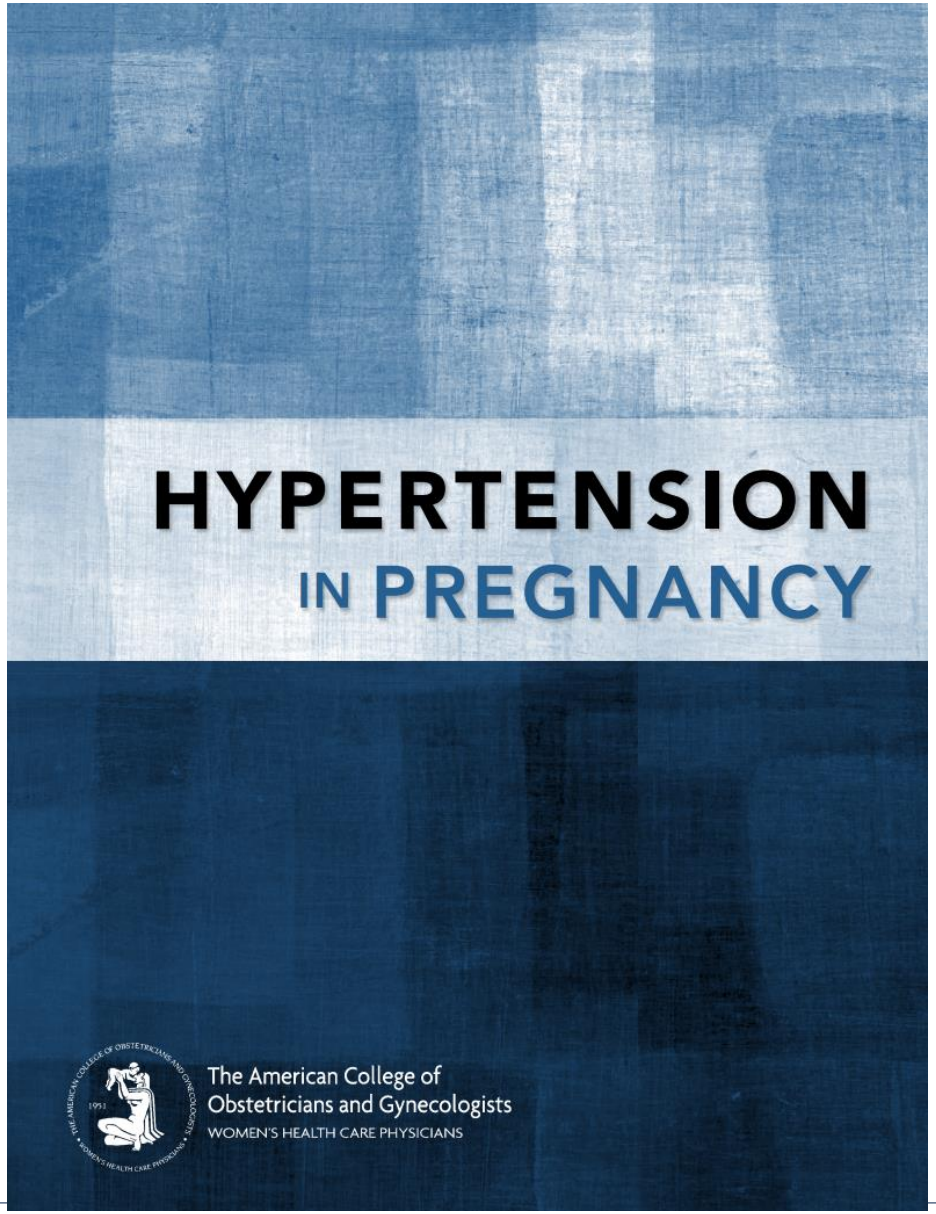
Sibai. Diagnosis and management of a typical preeclampsia-eclampsia. Am J Obstet Gynecol 2008.

The Deadly Triad

Severe Preeclampsia + HELLP Syndrome + Eclampsia

- **Associated with an increased risk of adverse outcomes such as:**
  - Placental Abruption
  - Renal Failure
  - Subcapsular Hepatic Hematoma
  - Preterm Delivery
  - Fetal or Maternal Death
  - Recurrent Preeclampsia

ACOG Practice Bulletin #33, Reaffirmed 2012; ACOG Committee Opinion #514, 2012; Tuffnell D, Jankowitcz D, Lindow S, et al. BJOG 2005;112:875-880



American College of Obstetricians and Gynecologists (ACOG), 2013. Executive summary: Hypertension in Pregnancy. *Obstetrics and Gynecology, 122*(5), 1122–1131.

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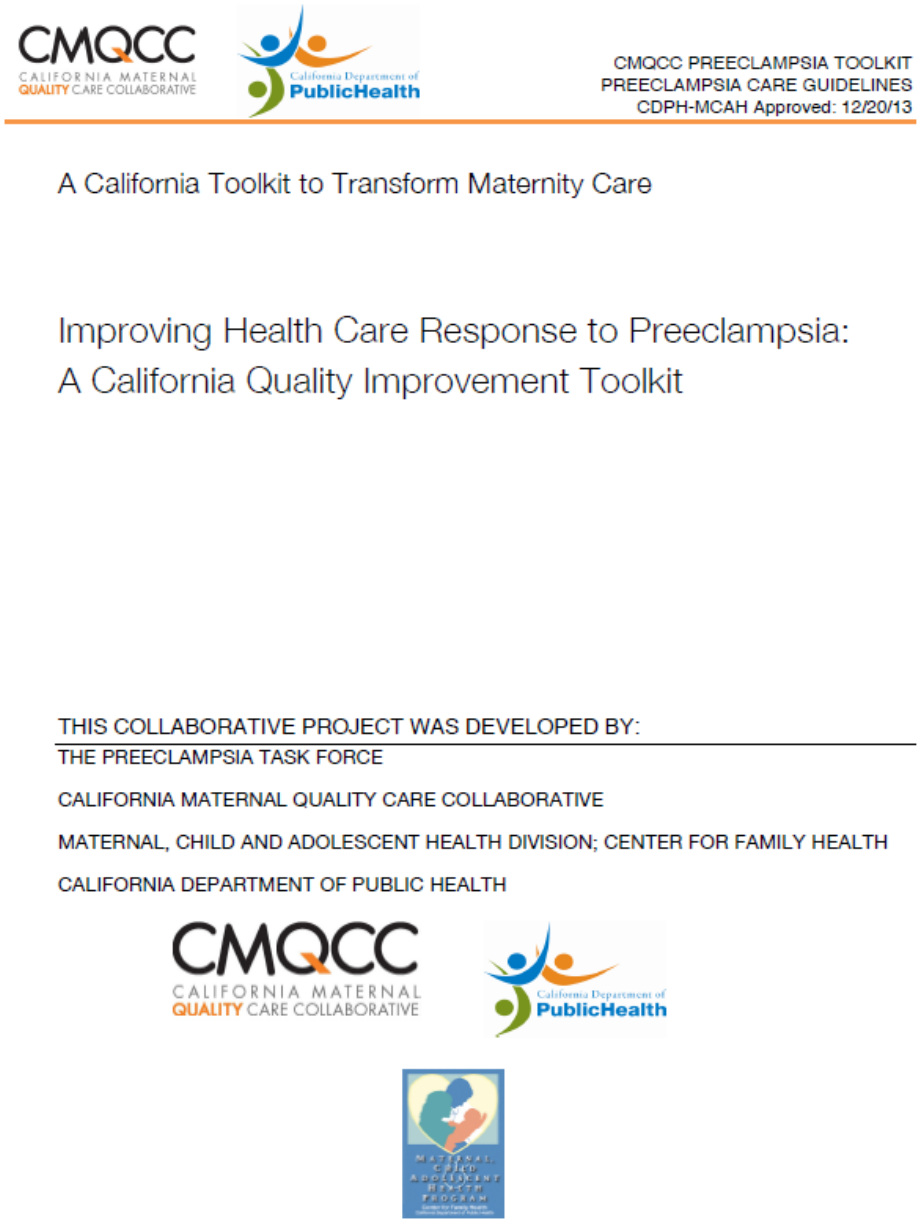
Development of the California Toolkit 'Improving Health Care Response to Preeclampsia' was funded by the California Department of Public Health (CDPH), Center for Family Health, Maternal Child and Adolescent Health (MCAH) Division, using federal Title V MCH funds.



Druzin, Shields, Peterson, Cape.

2013.

Preeclampsia Toolkit: Improving Health Care Response to Preeclampsia (California Maternal Quality Care Collaborative Toolkit to Transform Maternity Care) Developed under contract #11-10006 with the California Department of Public Health: Maternal, Child and Adolescent Health Division.

Published by the California Maternal Quality Care Collaborative.

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Outdated Terms

- PIH (pregnancy induced hypertension)
- Toxemia
- PET (preeclampsia/toxemia)
- Mild preeclampsia

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Hypertension in Pregnancy

Four Categories

1. Preeclampsia-Eclampsia
2. Chronic Hypertension (any cause)
3. Chronic Hypertension with Superimposed Preeclampsia
4. Gestational Hypertension

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Hypertension in Pregnancy

What is the definition of hypertension?

- Systolic BP 140 mm Hg or greater
  and/OR
- Diastolic BP of 90 mm Hg or greater

- Considered mild until SBP ≥ 160 mm Hg or DBP ≥ 110 mm Hg

- Diagnosis **requires two** abnormal BP values at least 4 hours apart

How to Accurately Measure Blood Pressure

- Patient seated comfortably, legs uncrossed, back and arm supported
- Use the correct sized cuff so that it **fits correctly** around the upper arm and line the middle of the BP cuff with the level of the right atrium (middle of the sternum)
- Patient should be **relaxed** and instructed **not to talk** during the measurement
  - Ideally a resting time of several minutes should elapse before the BP is taken

- If initial assessment elevated
  - Repeat after several minutes to determine if hypertension persists

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What about this position?

“Her blood pressure was elevated when she first presented to triage but I had her rest on her side to cycle her blood pressures and all other measurements have been within normal limits”

Hypertension in Pregnancy

Four Categories

1. Preeclampsia-Eclampsia
2. Chronic Hypertension (any cause)
3. Chronic Hypertension with Superimposed Preeclampsia
4. Gestational Hypertension

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Hypertension in Pregnancy

PREECLAMPSIA-ECLAMPSIA

- New onset hypertension
  - Usually **after 20 weeks** gestation
  - Most common form of high BP to complicate pregnancy
  - Multisystem involvement
  - **May** have proteinuria and/or other organ involvement

- Eclampsia is the presence of seizures with preeclampsia

Hypertension in Pregnancy

PREECLAMPSIA-ECLAMPSIA

- Two subsets

1. Preeclampsia **WITHOUT** severe features

OR

2. Preeclampsia **WITH** severe features

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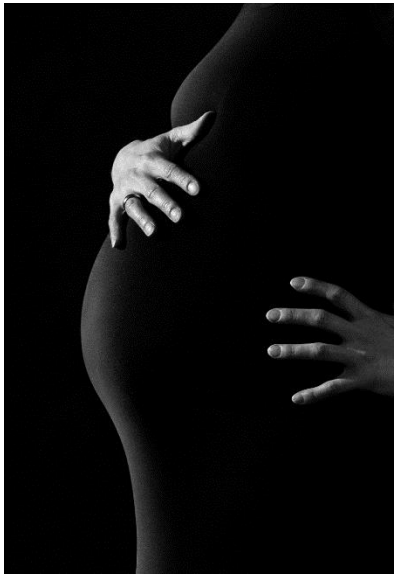
Hypertension in Pregnancy

CHRONIC HYPERTENSION

- Hypertension present before pregnancy
  - Or detected early in pregnancy (before 20 weeks)



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Hypertension in Pregnancy

CHRONIC HYPERTENSION WITH SUPERIMPOSED PREECLAMPSIA

- Diagnosis most common in:
  - Suddenly HTN **exacerbated**

    or
  - pt requires ↑ anti HTN **meds** when previously well controlled
    - If **only symptom** is ↑ BP but < 160 mm Hg systolic and < 110 mmHg diastolic
    - **Considered preeclampisa without severe features**

Hypertension in Pregnancy

CHRONIC HYPERTENSION WITH SUPERIMPOSED PREECLAMPSIA

Considered preeclampisa WITH severe features

- If diagnosis made with:
  - Increase in liver enzymes
  - Platelet levels of under 100,000/mL
  - Right upper quadrant pain or severe headaches
  - Pulmonary congestion or edema
  - Renal insufficiency
  - Sudden substantial increases in proteinuria

Hypertension in Pregnancy

GESTATIONAL HYPERTENSION

- New onset elevations in blood pressure **after 20 weeks** gestation **without proteinuria**
- Often **close to term**
- If blood pressure does not normalize postpartum, actually chronic hypertension

What about postpartum?

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Diagnostic Criteria

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Diagnostic Criteria

TABLE E-1. Diagnostic Criteria for Preeclampsia ⇦

Blood pressure	• Greater than or equal to 140 mm Hg systolic or greater than or equal to 90 mm Hg diastolic on two occasions at least 4 hours apart after 20 weeks of gestation in a woman with a previously normal blood pressure • Greater than or equal to 160 mm Hg systolic or greater than or equal to 110 mm Hg diastolic, hypertension can be confirmed within a short interval (minutes) to facilitate timely antihypertensive therapy
and	
Proteinuria	• Greater than or equal to 300 mg per 24-hour urine collection (or this amount extrapolated from a timed collection) or • Protein/creatinine ratio greater than or equal to 0.3* • Dipstick reading of 1+ (used only if other quantitative methods not available)
Or in the absence of proteinuria, new-onset hypertension with the new onset of any of the following:	
Thrombocytopenia	• Platelet count less than 100,000/microliter
Renal insufficiency	• Serum creatinine concentrations greater than 1.1 mg/dL or a doubling of the serum creatinine concentration in the absence of other renal disease
Impaired liver function	• Elevated blood concentrations of liver transaminases to twice normal concentration
Pulmonary edema	
Cerebral or visual symptoms	

* Each measured as mg/dL.

ACOG, 2013, Htn in Pregnancy, p. 4

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Severe Features of Preeclampsia

BOX E-1. Severe Features of Preeclampsia (Any of these findings)

- Systolic blood pressure of 160 mm Hg or higher, or diastolic blood pressure of 110 mm Hg or higher on two occasions at least 4 hours apart while the patient is on bed rest (unless antihypertensive therapy is initiated before this time)
- Thrombocytopenia (platelet count less than 100,000/microliter)
- Impaired liver function as indicated by abnormally elevated blood concentrations of liver enzymes (to twice normal concentration), severe persistent right upper quadrant or epigastric pain unresponsive to medication and not accounted for by alternative diagnoses, or both
- Progressive renal insufficiency (serum creatinine concentration greater than 1.1 mg/dL or a doubling of the serum creatinine concentration in the absence of other renal disease)
- Pulmonary edema
- New-onset cerebral or visual disturbances

ACOG, 2013, Htn in Pregnancy, p. 3

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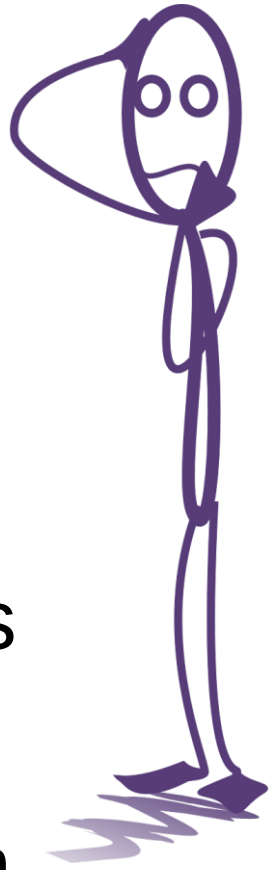
If you combine the two…

Characteristics of Preeclampsia		
Measurement	**Description**	**Severe Feature**
Blood pressure	• ≥140* systolic or ≥90* diastolic (2 occasions ≥4 hr apart, after 20 weeks, previously normal BPs) OR • ≥160* systolic or ≥110* diastolic (can be confirmed in a short time [min] to encourage antihypertensive therapy)	• No • Yes
And		
Proteinuria	• ≥300 mg/24 hr urine collection OR • Protein/creatinine ratio ≥0.3**	• No • No
or if no proteinuria, new-onset HTN*** w/ new onset of ANY of the following:		
Thrombocytopenia	• Platelet count < 100,000/μL	• Yes
Renal insufficiency	• Serum creatinine > 1.1** or doubled from previous values (in absence of other renal disease)	• Yes
Impaired liver function	• Elevated serum liver transaminases to double normal values	• Yes—with or without persistent right upper quadrant/epigastric pain not responsive to pain medication
Pulmonary edema	• Fluid collection in the lungs	• Yes
New-onset visual or cerebral changes	• Blurred vision or scotoma • Headache • Stroke • Seizure	• Yes • Yes • Yes • Eclampsia

Note. Adapted from ACOG (2013). Executive Summary: Hypertension in Pregnancy. Box E-1 & Table E-1 *mm Hg; **mg/dL; ***hypertension

Killion, M. (2015). New HTN in Preg Guidelines. *MCN, 40*(2), p. 128

What Changed?



- No more mild preeclampsia
- No more proteinuria requirements
- Edema not a diagnostic factor
- IUGR interventions separate from preeclampsia management

Photo from creative commons/pixabay

Proteinuria

Proteinuria: ≥ 300 mg in 24 hour collection

- No longer a required component of diagnosis
- Still tested
- What if > 5 grams in 24 hours?

ACOG, 2013;
Photo from creative commons/pixabay

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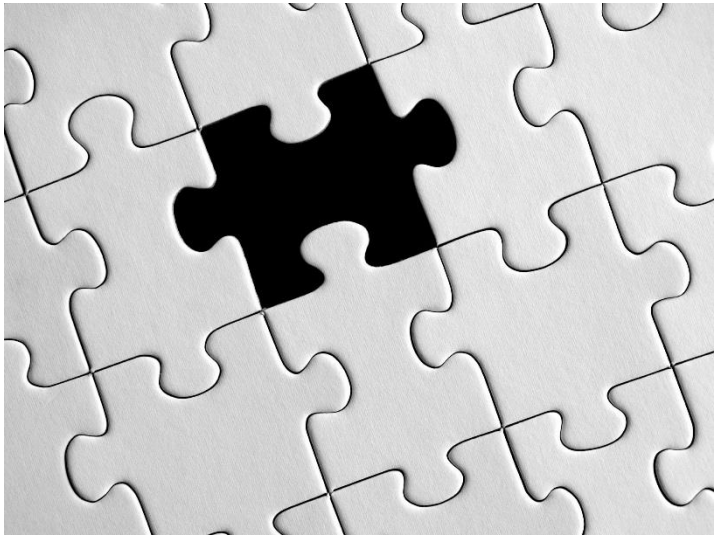
IUGR

Intrauterine Growth Restriction

- Still associated with preeclampsia
- No longer counted as indicative of severe preeclampsia
  - Managed similarly in women with and without preeclampsia

Photo from creative commons/pixabay

Who did we miss?



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HELLP

A variant of severe preeclampsia

- **H**emolysis
  - Red blood cell destruction – hemolysis on peripheral smear
- **E**levated **L**iver Enzymes
  - Elevated bilirubin ≥ 1.2 mg/dL
  - Elevated LDH > 600
  - Elevated AST ≥ 70
- **L**ow **P**latelets
  - Decreased < 100,000

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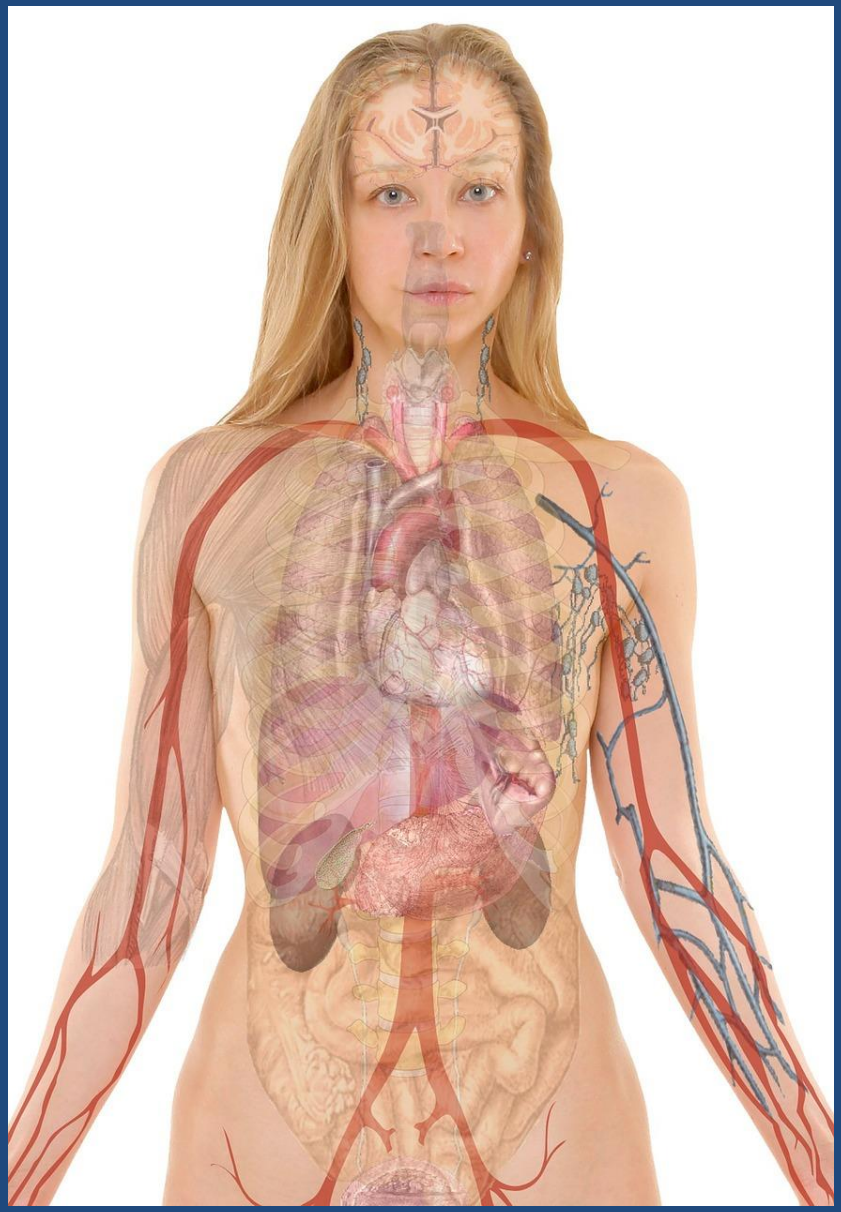
Let's review some physiology…



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Physiologic Changes

- Pregnancy is a high volume, low resistance state
- Circulating blood volume increases up to 45%
  - Volume 1200 to 1600 mL greater than non-pregnant
  - More pronounced in multiple gestation pregnancies

Physiologic Changes, continued

- Cardiac output increases up to 50%
  - 30% increase in stroke volume
  - Heart rate increases by 10 to 15 beats per minute
- Mild decrease in mean blood pressure

Physiologic Changes, continued

- Increased glomerular filtration rate
- Pregnancy is a hypercoagulable state
  - Factors VII, VIII, X, and fibrinogen are increased

Changes at Birth

- Delivery of the uterine contents can cause significant maternal hemodynamic shifts
  - Blood loss at delivery
  - Decreased systemic vascular resistance occurs due to the absence of placental blood flow
  - *What medication should we avoid when treating excessive blood loss in women with hypertension?*

CA-PAMR: Chance to Alter Outcome
Grouped Cause of Death; 2002-2004 (N=145)

Grouped Cause of Death	Chance to Alter Outcome			
	Strong / Good (%)	Some (%)	None (%)	**Total** N (%)
Obstetric hemorrhage	69	25	6	16 (11)
Deep vein thrombosis/ pulmonary embolism	53	40	7	15 (10)
Sepsis/infection	50	40	10	10 (7)
Preeclampsia/eclampsia	**50**	**50**	**0**	**25 (17)**
Cardiomyopathy and other cardiovascular causes	25	61	14	28 (19)
Cerebral vascular accident	22	0	78	9 (6)
Amniotic fluid embolism	0	87	13	15 (10)
All other causes of death	46	46	8	26 (18)
Total (%)	**40**	**48**	**12**	**145**

Cause of U.S. Maternal Mortality

- CDC Review of 14 years of coded data: 1979-1992
- 4024 maternal deaths
- 790 (19.6%) from preeclampsia

Table 2. Specific Causes of Death Among Women Who Died of Preeclampsia or Eclampsia

Cause of death	Percent of deaths		
	Preeclampsia	Eclampsia	Total
Cerebrovascular events	17.3	21.4	38.7
Cerebrovascular hemorrhage	15.8	18.8	34.7
Cerebral edema	1.1	1.8	2.9
Cerebral embolus	0.4	0.8	1.1
Renal or hepatic failure	7.2	5.4	12.5
HELLP syndrome	4.8	2.3	7.1
Other complications of hypertension	13.9	11.8	25.7
Not specified hypertension	7.6	8.3	15.9
Preeclampsia and eclampsia	50.8	49.2	100

HELLP = hemolysis, elevated liver enzymes, and low platelet count syndrome.

90% of CVA were from hemorrhage

MacKay AP, Berg CJ, Atrash HK. Obstetrics and Gynecology 2001;97:533-538

ACOG Executive Summary on Hypertension In Pregnancy, Nov 2013

1. The term “mild” preeclampsia is discouraged for clinical classification. The recommended terminology is:
    a. “**preeclampsia without severe features**” (mild)
    b. “**preeclampsia with severe features**” (severe**)**
2. Proteinuria **is not** a requirement to diagnose preeclampsia with **new onset** hypertension.
3. The **total** amount of proteinuria > 5g in 24 hours has been eliminated from the diagnosis of severe preeclampsia.
4. **Early** treatment of **severe** hypertension is mandatory at the threshold levels of **160 mm Hg** systolic or **110 mm Hg** diastolic.
5. Magnesium sulfate for seizure prophylaxis is **indicated** for **severe** preeclampsia and **should not** be administered universally for preeclampsia without severe features (mild).

ACOG Executive Summary on Hypertension In Pregnancy, Nov 2013

6. Preeclampsia with onset **prior to 34 weeks** is most often **severe** and should be managed at a facility with appropriate resources for management of serious maternal **and** neonatal complications.

7. Induction of labor **at 37 weeks** is indicated for preeclampsia **and** gestational hypertension.

8. The **postpartum period** is potentially dangerous. Patient education for early detection **during** and **after** pregnancy is important.

9. Long-term health effects should be discussed.

Postpartum Case Study

- 24 year-old G2, P0-0-1-0 @ 39 wks
- Prenatal course unremarkable, GBS (+)
- Blood pressure normal throughout prenatal period
- Presented to the office with complaint of regular uterine contractions
- Cervical exam: 3 cm dilated
- BP: 142/95
- Urinalysis negative for protein

Postpartum Case Study (continued)
Status on Admission

- The patient was admitted for spontaneous labor and gestational hypertension
- On admission to Labor and Delivery
  - BP 133/74
  - Urinalysis negative
  - Platelet count: 187,000/unit
  - AST 14
  - ALT 18
  - Uric Acid 5.5

Postpartum Case Study (continued)
Course in Labor

- BP remained modestly elevated throughout labor and the postpartum stay
- Fetal heart rate consistently Category 1 (normal) tracing
- Patient had primary late term c/section for failure to progress on day 2
- Postpartum course was unremarkable. No documented complaints of headache, blurred vision or epigastric pain

Postpartum Case Study (continued)
Post-op Day # 3

- Patient complained of “acute, crushing headache”, pain rated 8/10. D/C orders already written
- Received hydrocodone 15 mg/acetaminophen 650 mg
- Discharged 30 minutes later; no follow-up of headache documented

Postpartum Case Study (continued) Post Discharge

- Post-op day #4: Patient reported worsening headache to family
- Post-op day #5: Progressively worsening headache and new-onset visual changes
- 911 call placed by family
- Initial seizure occurred shortly thereafter
- Multiple seizures witnessed by family
- Intubated in the field and transported to hospital
  - Started on MgSO4, ativan, keppra, labetalol
- Helicopter transport to tertiary center, neurology ICU

Postpartum Case Study (continued)
Post-op Day 6 to 9

- Extubated shortly after admission
- BP's remained elevated; BP max 148/98; SBP mostly 130's; DBP mostly 80's
- Platelet count 370,000, AST 30, ALT 33, Creatinine 0.9 mg/dl
- Urinalysis: Negative for protein
- Persistent, mild headache with some postural component
  - Anesthesia consult obtained; Conservative treatment
- MRI: "no evidence of ischemic injury"; no parieto-occipital edema suggestive of PRES*

*PRES: Posterior Reversible Encephalopathy Syndrome

Eclampsia Observations from 67 recent cases

- 67 cases of eclampsia managed over 4 years
- 1:310 deliveries
- 21% had no proteinuria
- 21% had no DBP in excess of 90 mmHg
- 37% of first eclamptic seizures occurred postpartum
- 16% of first eclamptic seizures occurred late postpartum (3-11 days postpartum)

Sibai BM, McCubbin JH, Anderson GD, et al. Eclampsia. Observations from 67 Recent Cases. Obstet Gynecol; 58:609, 1981.

The American College of
Obstetricians and Gynecologists
WOMEN'S HEALTH CARE PHYSICIANS

COMMITTEE OPINION

Number 623 • February 2015 *(Replaces Committee Opinion Number 514, December 2011)*

Committee on Obstetric Practice

This document reflects emerging clinical and scientific advances as of the date issued and is subject to change. The information should not be construed as dictating an exclusive course of treatment or procedure to be followed.

Emergent Therapy for Acute-Onset, Severe Hypertension During Pregnancy and the Postpartum Period

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Antihypertensive Medications

SBP ≥ 160 OR DBP ≥ 105-110?

- Medications should be given NO MORE than 1 hour after presenting in hypertensive emergency*
  - Aim for no more than 30 minutes
- This is the biggest step in decreasing morbidity and mortality
- Aim to return BP to a range where intracranial hemorrhage not a risk, but not to normal range
  - Goal:140-160/90-100

*Hypertensive emergency: acute-onset, severe hypertension that persists for ≥ 15 minutes

Anithypertensive Medications

First Line Agents

	IV Labetalol	IV Hydralizine
Dose (IVP over 2 minutes)	20 mg	5-10 mg
Onset	2-5 minutes	5-20 minutes
Peak	5 minutes	15-30 minutes
24 hour max	220 mg	25 mg

** If no IV access, PO nifedipine should be used

- Nifedipine PO 10 mg may repeat in 30 min
- Onset: 5-20 min
- Peak 30-60 min

Anithypertensive Medications

Oral Agents for CHTN

- Chronic Hypertension
  - Persistent SBP ≥ 160 mmHg or DBP ≥ 105 mmHg
    - Antihypertensive therapy recommended
    - Goal SBP 120-160 & DBP 80-105
  - BPs not persistently ≥ 160 mmHg or ≥ 105 mmHg and no evidence of end-organ involvement or damage
    - **No antihypertensive therapy recommended**

ACOG, 2013

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Question

- Multiple choice

- Your patient is sitting up in bed on PP day #1.
- You introduce yourself and take her vitals.
- You note the BP is 156/114.
- What should you do?

A. Lower her head, turn her on her side and retake her blood pressure with the cuff on the up arm
B. The BP cuff looks a little small so go get a larger one and see if it's lower with the larger cuff
C. Retake the BP in her lower leg, it's the same as the arm
D. Let her eat breakfast and recheck it after she's eaten
E. Ask her if she is in pain and offer her pain medication
F. None of the above

Preeclampsia Early Recognition Tool

ASSESS	NORMAL (GREEN)	WORRISOME (YELLOW)	SEVERE (RED)
Awareness	Alert/oriented	•Agitated/confused •Drowsy •Difficulty speaking	•Unresponsive
Headache	None	•Mild headache •Nausea, vomiting	•Unrelieved headache
Vision	None	•Blurred or impaired	•Temporary blindness
Systolic BP (mm HG)	100-139	140-159	≥160
Diastolic BP (mm HG)	50-89	90-105	≥105
HR	61-110	111-129	≥130
Respiration	11-24	25-30	<10 or >30
SOB	Absent	Present	Present
O2 Sat (%)	≥95	91-94	≤90
Pain: Abdomen or Chest	None	•Nausea, vomiting •Chest pain •Abdominal pain	•Nausea, vomiting •Chest pain •Abdominal pain
Fetal Signs	•Category I •Reactive NST	•Category II •IUGR •Non-reactive NST	•Category III
Urine Output (ml/hr)	≥50	30-49	≤30 (in 2 hrs)
Proteinuria (Level of proteinuria is not an accurate predictor of pregnancy outcome)	Trace	•≥ +1** •≥300mg/24 hours	
Platelets	>100	50-100	<50
AST/ALT	<70	>70	>70
Creatinine	<0.8	0.9-1.1	>1.2
Magnesium Sulfate Toxicity	•DTR +1 •Respiration 16-20	•Depression of patellar reflexes	•Respiration <12

SEVERE HYPERTENSION IN PREGNANCY

UCSF Benioff Children's Hospitals

COUNCIL ON PATIENT SAFETY IN WOMEN'S HEALTH CARE

safe health care for every woman

PATIENT SAFETY BUNDLE

Hypertension

READINESS

Every Unit

- Standards for early warning signs, diagnostic criteria, monitoring and treatment of severe preeclampsia/eclampsia (include order sets and algorithms)
- Unit education on protocols, unit-based drills (with post-drill debriefs)
- Process for timely triage and evaluation of pregnant and postpartum women with hypertension including ED and outpatient areas
- Rapid access to medications used for severe hypertension/eclampsia: Medications should be stocked and immediately available on L&D and in other areas where patients may be treated. Include brief guide for administration and dosage.
- System plan for escalation, obtaining appropriate consultation, and maternal transport, as needed

RECOGNITION & PREVENTION

Every Patient

- Standard protocol for measurement and assessment of BP and urine protein for all pregnant and postpartum women
- Standard response to maternal early warning signs including listening to and investigating patient symptoms and assessment of labs (e.g. CBC with platelets, AST and ALT)
- Facility-wide standards for educating prenatal and postpartum women on signs and symptoms of hypertension and preeclampsia

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PATIENT SAFETY BUNDLE

Hypertension

RESPONSE

Every case of severe hypertension/preeclampsia

- Facility-wide standard protocols with checklists and escalation policies for management and treatment of:
  - Severe hypertension
  - Eclampsia, seizure prophylaxis, and magnesium over-dosage
  - Postpartum presentation of severe hypertension/preeclampsia
- Minimum requirements for protocol:
  - Notification of physician or primary care provider if systolic BP =/> 160 or diastolic BP =/> 110 for two measurements within 15 minutes
  - After the second elevated reading, treatment should be initiated ASAP (preferably within 60 minutes of verification)
  - Includes onset and duration of magnesium sulfate therapy
  - Includes escalation measures for those unresponsive to standard treatment
  - Describes manner and verification of follow-up within 7 to 14 days postpartum
  - Describe postpartum patient education for women with preeclampsia
- Support plan for patients, families, and staff for ICU admissions and serious complications of severe hypertension

REPORTING/SYSTEMS LEARNING

Every unit

- Establish a culture of huddles for high risk patients and post-event debriefs to identify successes and opportunities
- Multidisciplinary review of all severe hypertension/eclampsia cases admitted to ICU for systems issues
- Monitor outcomes and process metrics

Note: "Facility-wide" indicates all areas where pregnant or postpartum women receive care. (E.g. L&D, postpartum critical care, emergency department, and others depending on the facility).

CMQCC
CALIFORNIA MATERNAL QUALITY CARE COLLABORATIVE

California Partnership for Maternal Safety

PATIENT SAFETY BUNDLE

PREECLAMPSIA

READINESS

Every unit

- ✓ Adopt standards for early warning signs, diagnostic criteria, monitoring and treatment for severe preeclampsia/eclampsia to include order sets and algorithms
- ✓ Unit team education, reinforced by regular unit-based drills
- ✓ Process for timely triage and evaluation of pregnant and postpartum women with hypertension including ED and outpatient areas
- ✓ Rapid access to medications used for severe hypertension/eclampsia: Medications should be stocked and readily available on L&D and in other areas where patients may be treated. Include brief guide for administration and dosage
- ✓ System plan for escalation, obtaining appropriate consultation and maternal transport, as needed

RECOGNITION & PREVENTION

Every patient

- ✓ Adoption of a standard process for the measurement and assessment of BP and urine protein for all pregnant and postpartum women
- ✓ Implementation of standard response to maternal early warning criteria
- ✓ Implementation of facility-wide standards for educating prenatal and postpartum women on signs and symptoms of preeclampsia and hypertension

RESPONSE

All severe hypertension/preeclampsia

- ✓ Facility-wide standard processes with checklists for management and treatment of:
  - Severe hypertension
  - Eclampsia, seizure prophylaxis, and magnesium over-dosage
  - Postpartum, emergency department and outpatient presentation of severe hypertension/preeclampsia
- ✓ Support plan for patients, families and staff for ICU admissions and serious complications of severe hypertension

REPORTING/SYSTEMS LEARNING

Every unit

- ✓ Implementation of a huddle for high risk cases and post-event team debrief
- ✓ Review all severe hypertension/eclampsia/ICU cases for systems issues
- ✓ Monitor outcomes and process metrics
- ✓ Documentation of education of pregnant and postpartum women about symptoms of preeclampsia

This bundle was developed by the Council On Patient Safety in Women's Health Care, National Partnership for Maternal Safety 2015

COUNCIL ON PATIENT SAFETY IN WOMEN'S HEALTH CARE
safe health care for every woman

Readiness

- Standards for early warning signs, diagnostic criteria, monitoring and treatment of severe preeclampsia/eclampsia (include order sets and algorithms)
- Unit education on protocols, unit-based drills (with post-drill debriefs)
- Process for timely triage and evaluation of pregnant and postpartum women with hypertension including ED and outpatient areas
- Rapid access to medications used for severe hypertension/eclampsia: Medications should be stocked and immediately available on L&D and in other areas where patients may be treated. Include brief guide for administration and dosage.
- System plan for escalation, obtaining appropriate consultation, and maternal transport, as needed

Recognition and Prevention

- Standard protocol for measurement and assessment of BP and urine protein for all pregnant and postpartum women
- Standard response to maternal early warning signs including listening to and investigating patient symptoms and assessment of labs (e.g. CBC with platelets, AST and ALT)
- Facility-wide standards for educating prenatal and postpartum women on signs and symptoms of hypertension and preeclampsia

Monitoring

Nursing Assessment Frequency

A. Preeclampsia Without Severe Features (Mild)

	Preeclampsia without Severe Features (mild)		
	Antepartum*	Intrapartum*	Postpartum*
BP, Pulse, Respiration, SaO2	Every 4 hours	Every 60 min	Every 4 hours
Lung sounds	Every 4 hours	Every 4 hours	Every 4 hours
Deep consciousness Edema Assessment for headache, visual disturbances, epigastric pain	Every 8 hours	Every 8 hours	Every 8 hours
Fetal status and uterine activity	Every shift	Continuous	N/A
Temperature	Per facility protocol		
Intake and output	Every 1 hour with totals every 8 and 24 hours		

*This is the minimum frequency recommended for the patient NOT on magnesium sulfate.

CMQCC Preeclampsia Toolkit (2013): Section: AP, IP, PP Nsg Mgmt & Assessment of PreE: Maternal/Fetal Assessment & Monitoring Recs, **Table 1, p. 38-39**

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Monitoring

Nursing Assessment Frequency

B. Severe Preeclampsia Nursing Assessment Frequency

	Severe Preeclampsia Intrapartum and Postpartum for women on Magnesium Sulfate

BP, Pulse, Respiration, SaO2	• Every 5 mins during loading dose and q30 mins during maintenance of magnesium sulfate infusion
	• Can change to every 60 mins if any one or more of the following criteria are met:
	  ○ Preeclampsia without severe features (mild)
	  ○ BP stable without increases for a minimum of 2 hours
	  ○ No antihypertensives within last 6 hours
	  ○ Antepartum patient
	  ○ Latent phase of labor
	• Continuous SaO2 during magnesium infusion for intrapartum. For postpartum patient, check with vital signs

Lung sounds	Every 2 hours
Deep tendon reflexes & clonus, Level of consciousness Edema Assessment for headache, visual disturbances, epigastric pain	Every 4 hours
Temperature	Per facility protocol
Intake and output	Intake: • IV solutions and medication drips should all be on a pump • Total hourly intake should be ≤ 125 ml/hr • NPO with ice chips or as permitted by practitioner Output: • Insert foley with urometer Calculate hourly, end of shift, and 24-hour totals
Fetal status and uterine activity	Continuous fetal monitoring

CMQCC Preeclampsia Toolkit (2013): Section: AP, IP, PP Nsg Mgmt & Assessment of PreE: Maternal/Fetal Assessment & Monitoring Recs**, Table 1, p. 38-39**

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Response

- **Facility-wide standard protocols with checklists and escalation policies for management and treatment of:**
  - Severe hypertension
  - Eclampsia, seizure prophylaxis, and magnesium over-dosage
  - Postpartum presentation of severe hypertension/preeclampsia
- **Minimum requirements for protocol:**
- Notification of physician or primary care provider if systolic BP ≥160 or diastolic BP ≥110 for two measurements within 15 minutes

Team Reporting

Hospital Name:

"Readiness"

- ❑ Adopt standards for early warning signs, diagnostic criteria, monitoring and treatment for severe preeclampsia/eclampsia to include order sets and algorithms
- ❑ Unit team education, reinforced by regular unit-based drills
- ❑ Process for timely triage and evaluation of pregnant and postpartum women with hypertension including ED and outpatient areas
- ❑ Rapid access to medications used for severe hypertension/eclampsia: Medications should be stocked and readily available on L&D and in other areas where patients may be treated. Include brief guide for administration and dosage
- ❑ System plan for escalation, obtaining, appropriate consultation and maternal transport, as needed

"Recognition and Prevention"

- ❑ Preeclampsia/Hypertension in Pregnancy
- ❑ Adoption of a standard process for the measurement and assessment of blood pressure and urine protein for all pregnant and postpartum women
- ❑ Implementation of standard response to maternal to maternal early warning criteria
- ❑ Implementation of facility-wide standards for educating women on signs and symptoms of preeclampsia and hypertension – prenatal and postpartum

Notes:

CMQCC
CALIFORNIA MATERNAL QUALITY CARE COLLABORATIVE

Repeat and Treat

Algorithums - Checklists - Escalation policies

Early treatment of **severe** hypertension is mandatory at the threshold levels of **160 mm Hg** systolic or **110 mm Hg** diastolic.

Magnesium sulfate for seizure prophylaxis is **indicated** for **severe** preeclampsia and **should not** be administered universally for preeclampsia without severe features (mild).

The **postpartum period** is potentially dangerous.

Patient education for early detection **during** and **after** pregnancy is important.

Long-term health effects should be discussed.

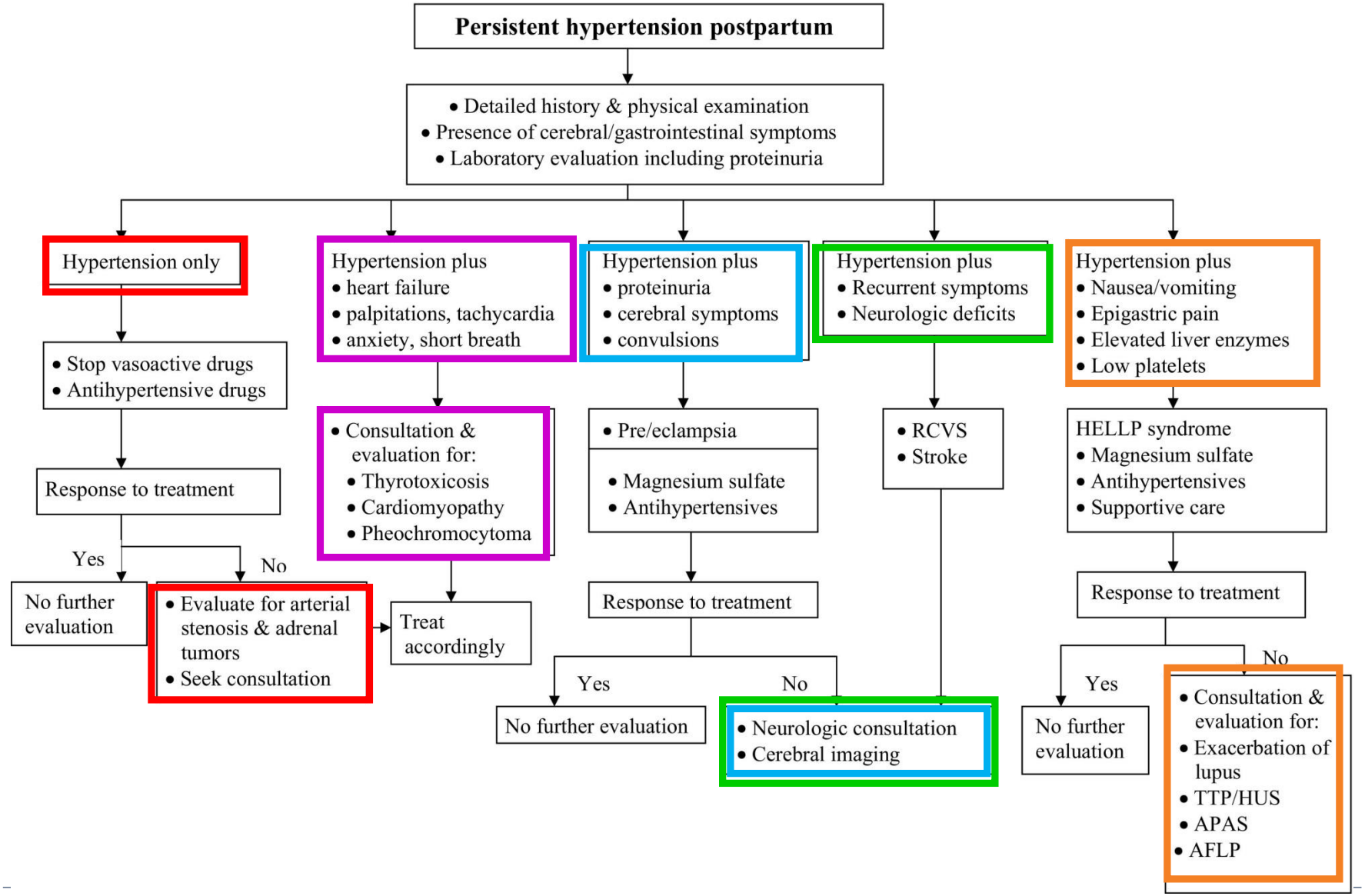
ACOG Executive Summary:

Hypertension in Pregnancy

For women in the **postpartum period** who present with **new onset** hypertension associated with headaches or blurred vision or preeclampsia with severe hypertension, the parenteral **administration of magnesium sulfate** is suggested

ACOG Executive Summary: Hypertension in Pregnancy Patient Education Materials

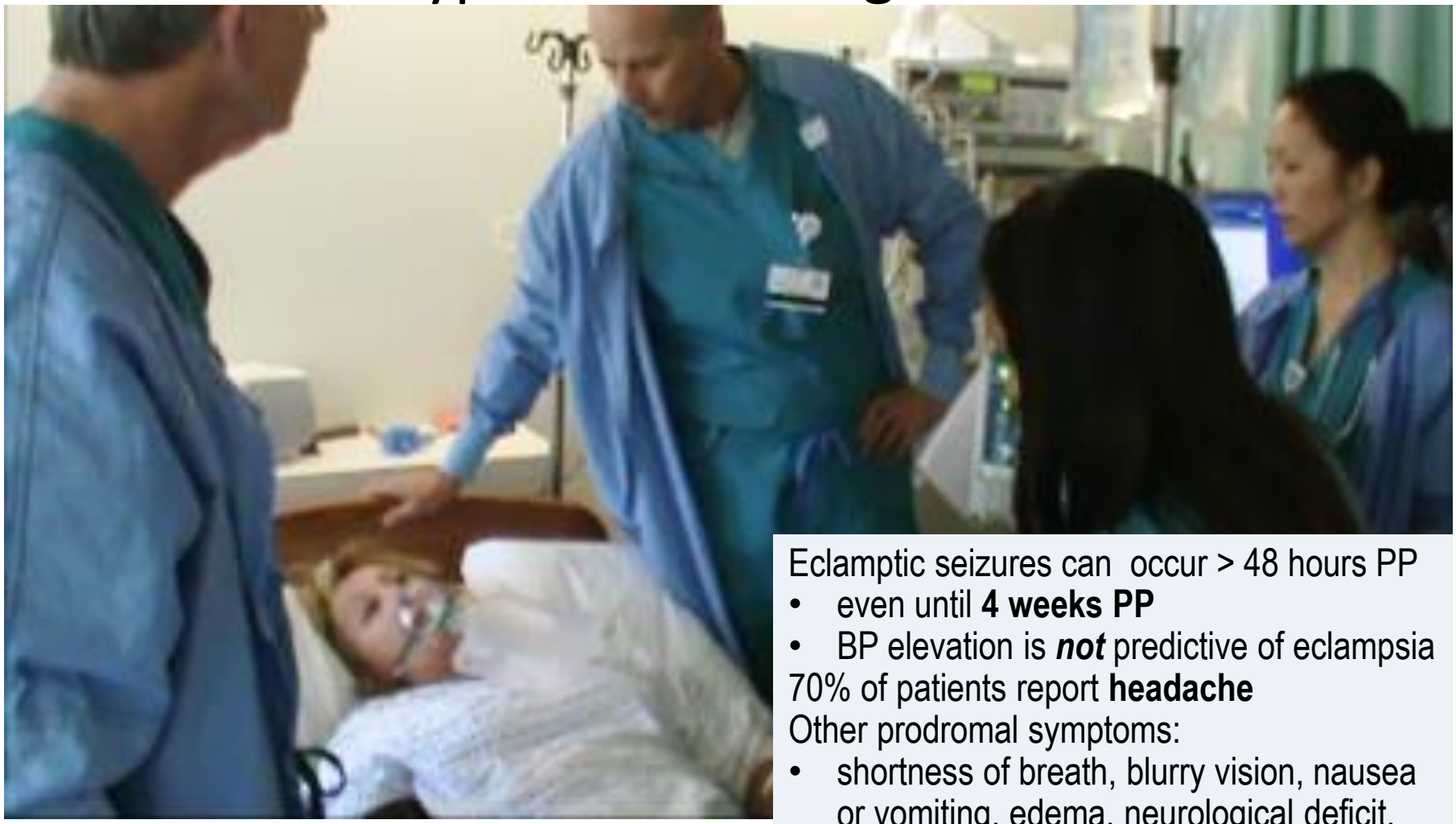
For women with persistent hypertension, systolic **BP ≥ 150** or diastolic **BP ≥ 100** on at least 2 occasions 4-6 hours apart, antihypertensive therapy is suggested. Persistent **BP ≥ 160** or diastolic **BP ≥ 110 should be treated within 1 hour**



American Journal of Obstetrics & Gynecology 2012 206, 470-475DOI: (10.1016/j.ajog.2011.09.002)

15% of Eclampsia occurs Postpartum

63% had NO Hypertension Diagnosis



Eclamptic seizures can occur > 48 hours PP

- even until **4 weeks PP**
- BP elevation is ***not*** predictive of eclampsia

70% of patients report **headache**

Other prodromal symptoms:

- shortness of breath, blurry vision, nausea or vomiting, edema, neurological deficit, and epigastric pain

Eclampsia: Definition

- New onset of seizures before, during or after labor that is not attributable to other causes in a woman with preeclampsia
  - Tonic-clonic seizure
  - Generally lasts about 60-75 seconds, rarely longer than 3 minutes
  - Followed by a postictal period

Lipstein H 2003, Sibai BM 2005

Tonic phase
10-20 seconds

- Sudden loss of consciousness
- Loss of posture
- Brief flexion of arms
- Eyes deviate upward
- Extension of back, neck
- Involuntary verbal cries
- Shallow breathing may become cyanotic

Clonic Phase
30-90 seconds

- Brief violent flexor contractions, each getting a longer period of relaxation between flexing
- Cyanosis
- Cheek or tongue biting
- Foamy saliva
- Possible loss of bladder or bowel control
- Ends with deep inspiration

Postictal Phase
Minutes to several hours

- Headache
- Confusion
- Muscles sore
- Fatigue
- Tachycardia
- Hypertension
- Respiratory and metabolic acidosis
- Dilated pupils

Monitoring

Nursing Assessment Frequency

C. Post Eclamptic Seizure and Magnesium Sulfate Toxicity

Post Eclamptic Seizure and Magnesium Sulfate Toxicity for Ante, Intra and Postpartum	
BP, Pulse, Respiration	Every 5 min until stable
O2 Sat & LOC	Every 15 min for a minimum of 1 hour
Fetal Assessment and Uterine Activity	Continuous

D. Acute BP Treatment with IV Medication

Acute BP Treatment with IV Medication: Ante, Intra and Postpartum	
BP, Pulse, Respiration	Every 5-15 min until stable
SAO2 and LOC	Every 5-15 min for a minimum of 1 hour
Fetal assessment and uterine activity	Continuous

CMQCC Preeclampsia Toolkit (2013): Section: AP, IP, PP Nsg Mgmt & Assessment of PreE: Maternal/Fetal Assessment & Monitoring Recs**, Table 1, p. 38-39**

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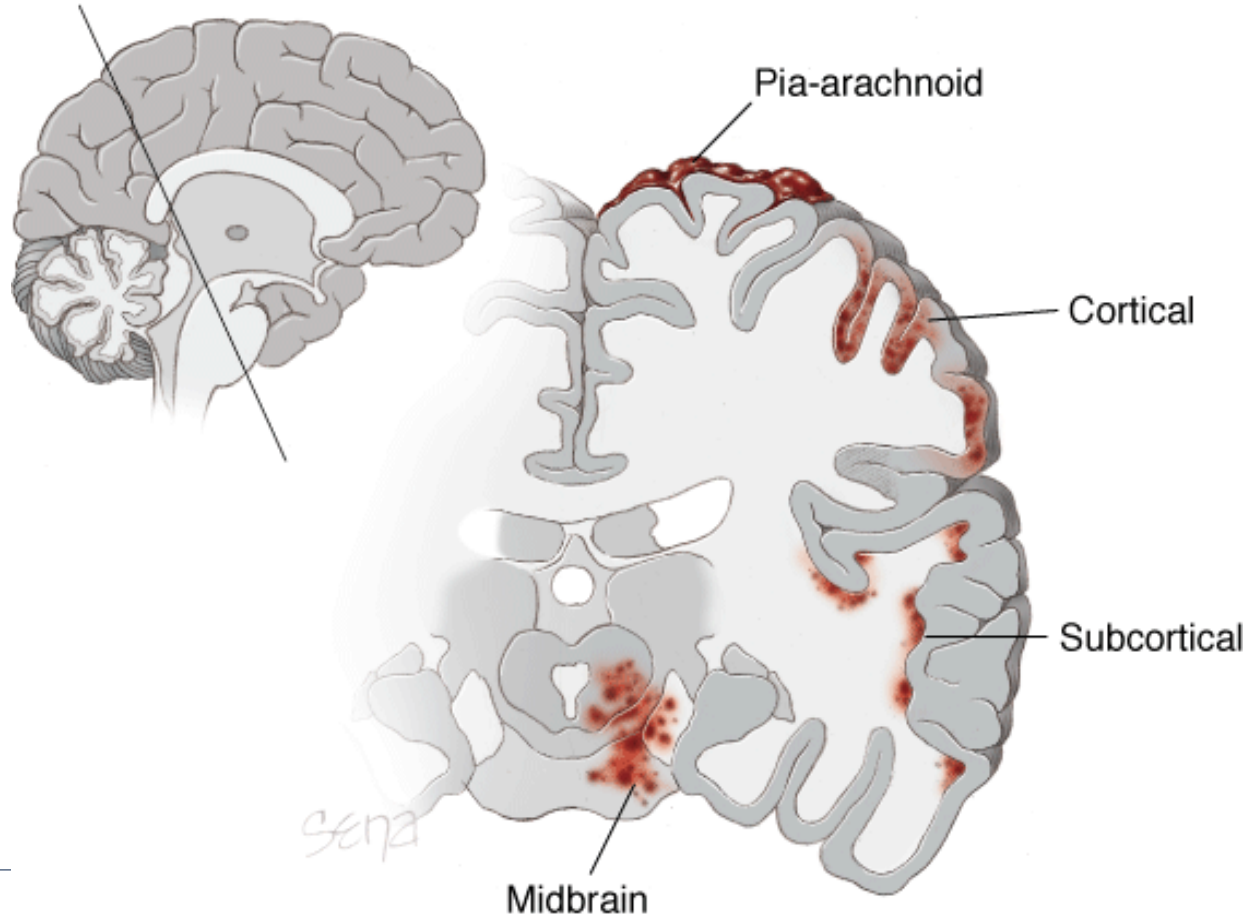
Cerebral Hemorrhages and Petechiae

- Cerebral hyperperfusion
- Microvessel clotting
- Capillary fluid is forced interstitially
- Endothelial activation
- Perivascular edema results



Source: Cunningham FG, Leveno KJ, Bloom SL, Hauth JC, Rouse DJ, Spong CY: *Williams Obstetrics, 23rd Edition:* http://www.accessmedicine.com

Magnesium Sulfate – High Alert Medication

- Safety Considerations
  - Precautions
    - Renal function
  - Standard Protocols
    - Rapid access (Eclampsia Supply Box)
    - Premix solutions
    - Independent double checks
    - Monitoring parameters
  - Guidelines
    - Staffing

Question:

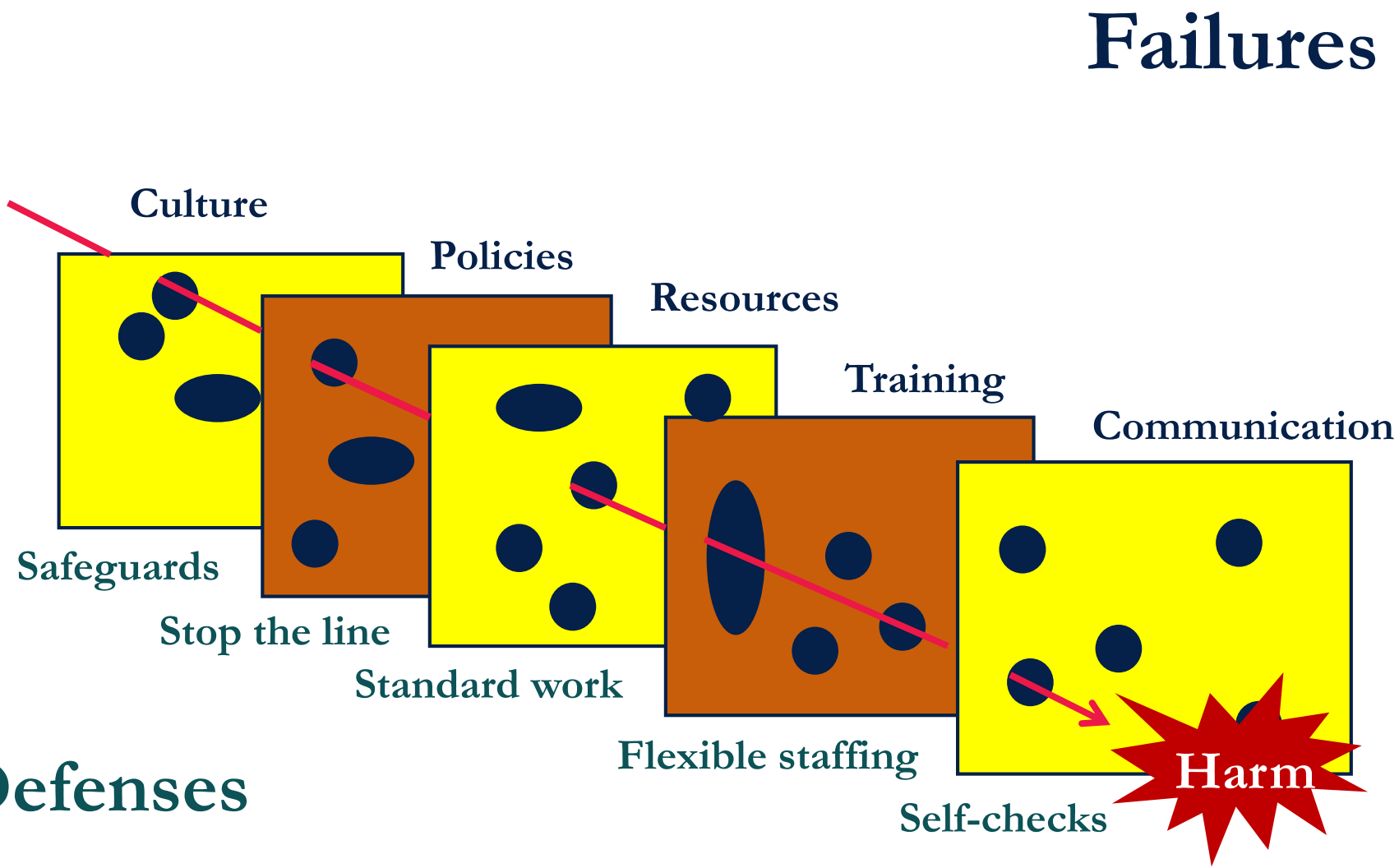
True or False

- The risk of eclampsia or severe morbidity associated with preeclampsia ends once the patient has given birth
- A. True
- B. False

Case Presentation

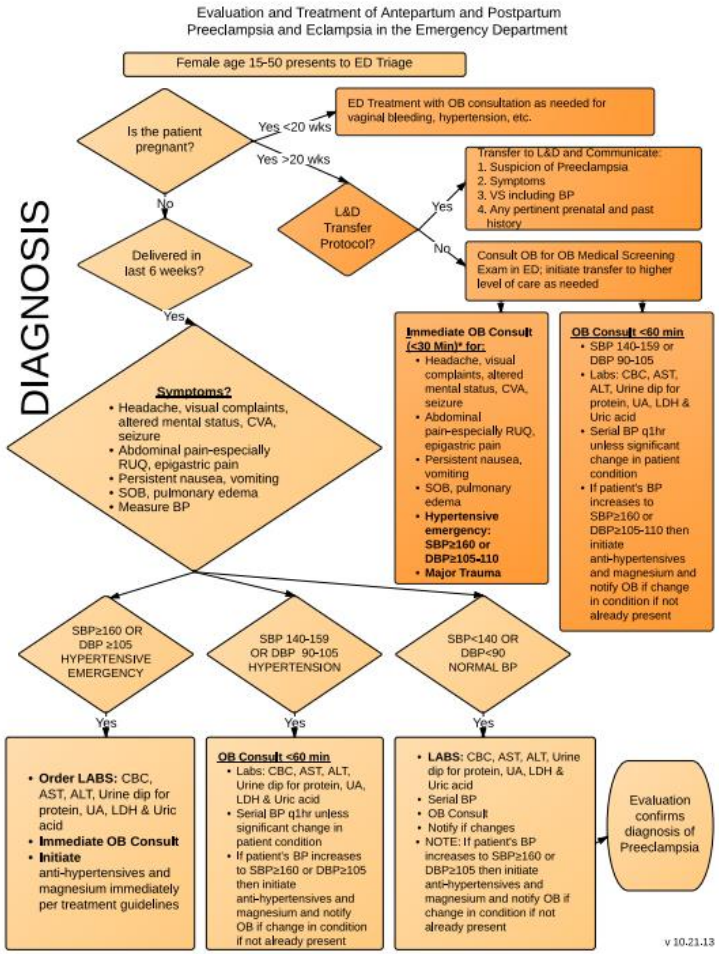
- 36 yo G3 P2, 37 + 2
- Spanish speaking woman admitted to L&D with her English speaking cousin as her support person. FOB not involved.
- Hx GDM diet controlled
- Precipitous birth 37+2 – Apgar 8, 9
  - Blood glucose at delivery 130
- IV Fentanyl x 1: (Repair of 2nd) Pain= 4/10
- Patient complaining of headache
  - **T: 98.8, Pulse: 96 BP: 156/92, R: 20**

How Errors Occur

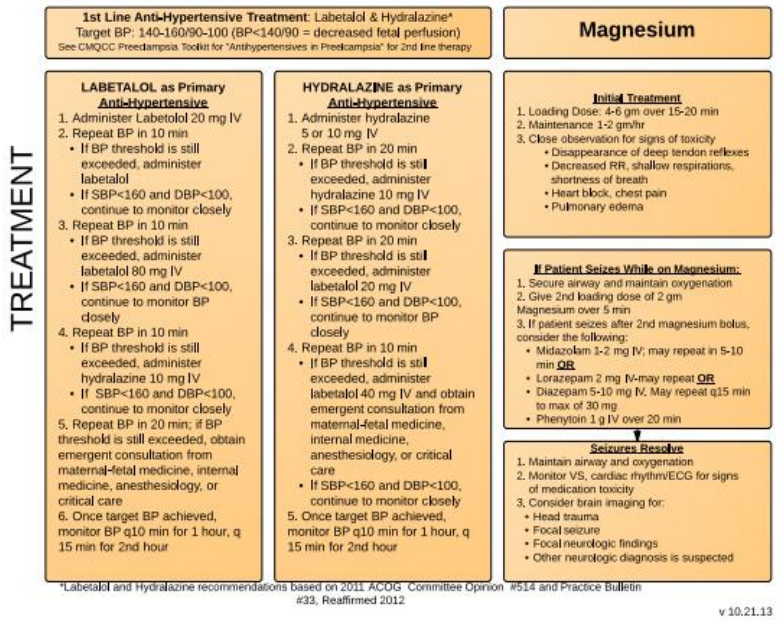


Original figure based on Swiss Cheese Model concept from Reason, J. (1990) Human Error. Cambridge: University Press, Cambridge.

Part 1 of 2: Diagnosis - Evaluation and Treatment of Antepartum and Postpartum Preeclampsia and Eclampsia in the Emergency Department



2 of 2: Treatment - Evaluation and Treatment of Antepartum and Postpartum reeclampsia and Eclampsia in the Emergency Department



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ACOG Executive Summary: Hypertension in Pregnancy Patient Education Materials

For all women in the postpartum period (**not just women with preeclampsia**), it is suggested that **discharge instructions** include information about the **signs and symptoms** of preeclampsia as well as the importance of **prompt reporting** of this information to their health care providers.

ACOG Executive Summary: Hypertension in Pregnancy Patient Education Materials

www.preeclampsia.org/market-place

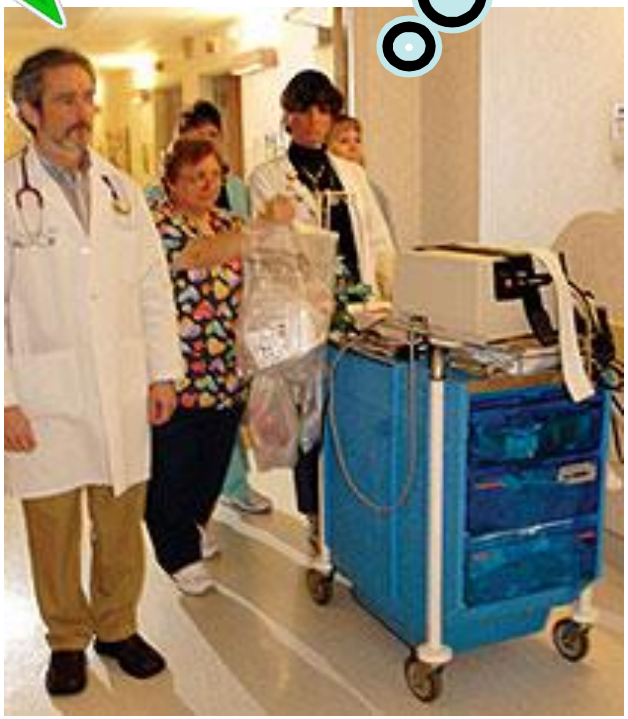
Postpartum

Monitoring & Early Post Discharge Follow-up

- CMQCC - Preeclampsia/Eclampsia
  - 3-7 days if antihypertensives used during L&D or PP
  - 7-14 days if no medications used
- ACOG - Gestational HTN, Preeclampsia, Superimposed PreE
  - BP monitoring & surveillance
    - For 72 hours PP (in- or outpatient)
    - At 7-10 days after birth (or earlier if symptoms)

Call for Help Early

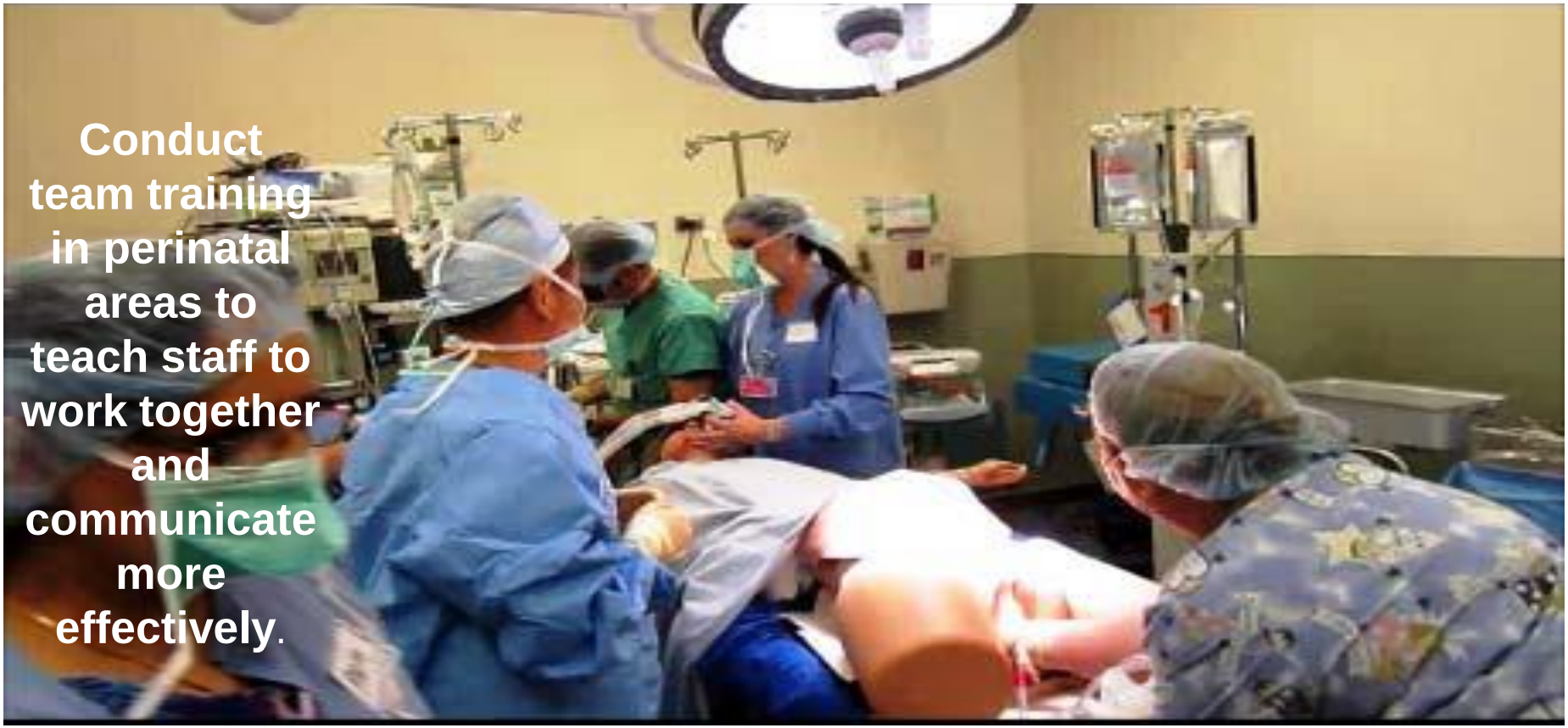
- Detect abnormal VS and clinical changes
- Alert the Team
- Mobilize a response
- Optimal patient outcome



Escalation

- An abnormal parameter requires:
  - Prompt reporting to a physician or other qualified clinician
  - Prompt bedside evaluation by a physician or other qualified clinical provider **with the ability to activate resources** in order to **initiate** emergency diagnostic and therapeutic interventions as needed

Simulated Multidisciplinary Drills



TJC Sentinel Event Alert, Issue 30 -July 21, 2004

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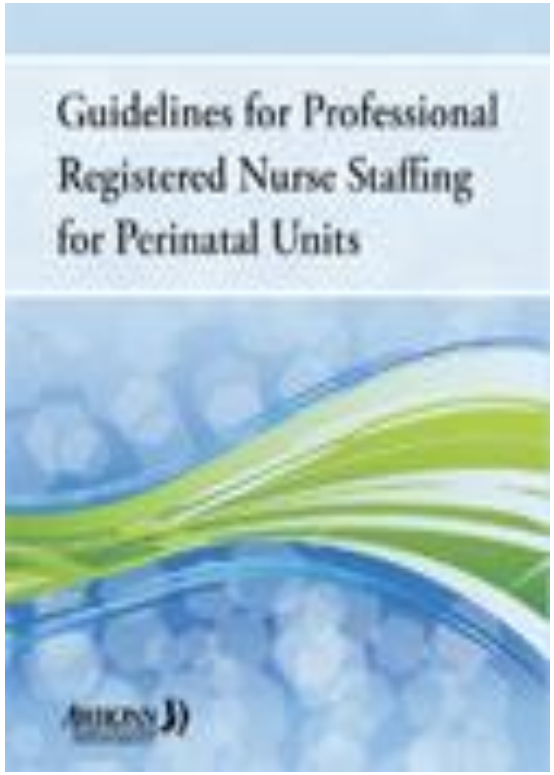
Immediate Postpartum Recovery
1 to 1 Nursing



During the immediate recovery period after vaginal birth there should be:

1 nurse for the mother and
1 nurse for the baby

- **Stable**
- Once the **Critical Elements** are met
  - 1 RN for mother and baby
- 2 hours minimum

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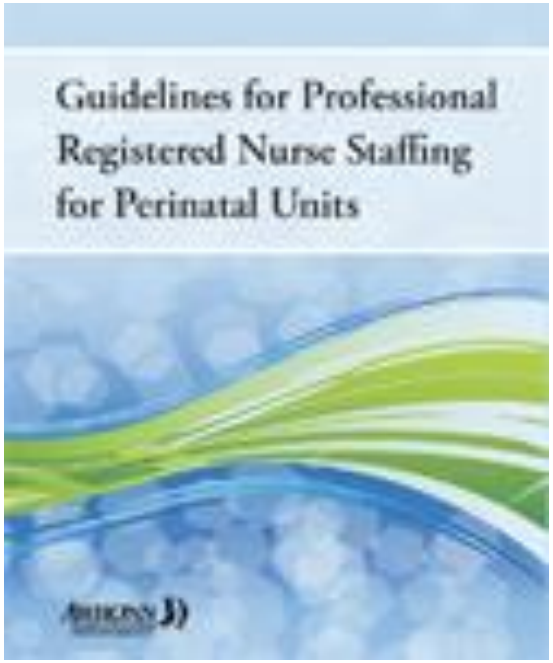
Nurse Staffing: Postpartum



- Healthy mother and baby should remain together
- Ideally mother and baby are cared for in a single family room
- No more than 2 women on the immediate day of C/S as part of 1 nurse to 3 mother-baby couplets

– • Ratios of mother – baby care were based on 16.3% C/S rate from 1983.

Delercq et al., 2006. Listening to Mothers II Survey

Learning from Review

2015 TJC issues new statement

- Definition of sentinel event reporting
  - A patient safety event (not related to the natural course of the patient's illness or underlying condition) that reaches a patient and results in any of the following:
    - Death
    - Permanent harm
    - Severe temporary harm
      - For OB:
        - » 4 or more units of blood
        - » Admission to ICU

Learning from Review

Severe Maternal Morbidity

Adverse Outcome Review

- Why do it?
  - Finger point, blame, punish
  - Learn, improve future outcomes
- ACOG, AWHONN, SMFA –
- Recommend all severe morbidity whether sentinel or not:
  - Undergo review process:
    - thorough, credible, multidisciplinary, comprehensive

The Joint Commission

The American College of Obstetricians and Gynecologists • Women's Health Care Physicians • 1951

AWHONN
PROMOTING THE HEALTH OF WOMEN AND NEWBORNS

Society for Maternal-Fetal Medicine

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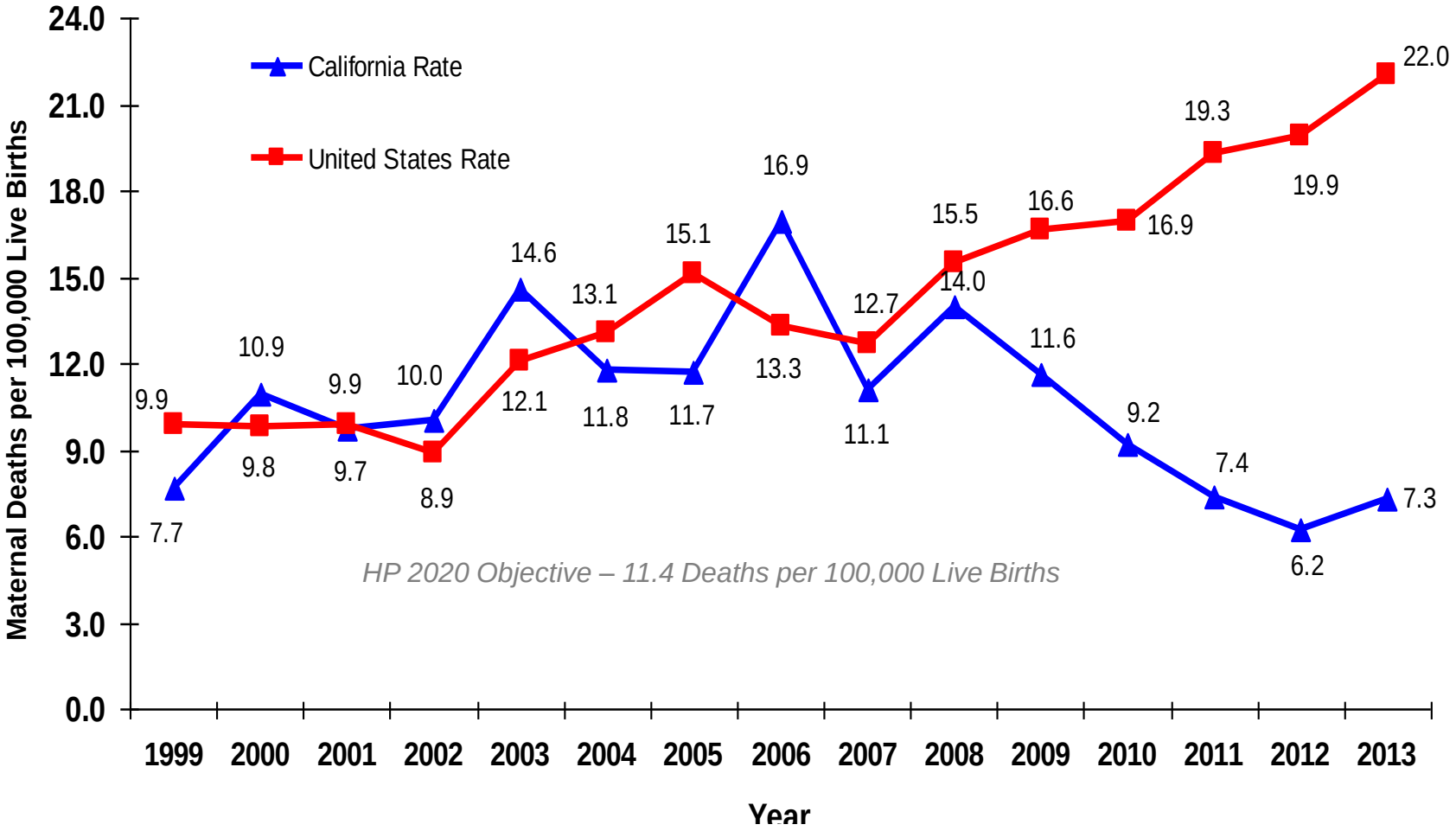
Maternal Mortality Rate, California and United States; 1999-2013



SOURCE: State of California, Department of Public Health, California Birth and Death Statistical Master Files, 1999-2013. Maternal mortality for California (deaths ≤ 42 days postpartum) was calculated using ICD-10 cause of death classification (codes A34, O00-O95,O98-O99). United States data and HP2020 Objective use the same codes. U.S. maternal mortality data is published by the National Center for Health Statistics (NCHS) through 2007 only. U.S. maternal mortality rates from 2008 through 2013 were calculated using CDC Wonder Online Database, accessed at http://wonder.cdc.govon March 11, 2015. Produced by California Department of Public Health, Center for Family Health, Maternal, Child and Adolescent Health Division, March, 2015.

COUNCIL ON PATIENT SAFETY IN WOMEN'S HEALTH CARE

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PATIENT SAFETY BUNDLE

Postpartum Care Basics for Maternal Safety

FROM BIRTH TO THE COMPREHENSIVE POSTPARTUM VISIT

READINESS

Every woman

- Engages with her provider during prenatal care to develop a comprehensive personalized postpartum care plan that includes designation of a postpartum medical home, where the woman can access care and support during the period between birth and the comprehensive postpartum visit.
- Receives woman-centered counseling and anticipatory guidance regarding medical recommendations for breastfeeding in order to make an informed feeding decision.
- Receives woman-centered counseling regarding medical recommendations for birth spacing and the range of available contraceptive options.
- Identifies a postpartum care team, inclusive of friends and family, to provide medical, material, and social support in the weeks following birth.

Every provider

- Ensures that each woman has a documented postpartum care plan and care team identified in the prenatal period.
- Develops and maintains a working knowledge of evidence-based evaluation and management strategies of common issues facing the mother-infant dyad.

Every clinical setting

- Develops and optimizes models of woman-centered postpartum care and education, utilizing adult-learning principles when possible and embracing the diversity of family structures, cultural traditions, and parenting practices.
- Develops systems to connect families with community resources for medical follow up and social and material support.
- Optimizes counseling models, clinical protocols, and reimbursement options to enable timely access to desired contraception.
- Develops systems to ensure timely, relevant communication between inpatient and outpatient providers.
- Develops protocols for screening and treatment for postpartum concerns, including depression and substance abuse disorders, and establishes relationships with local specialists for co-management or referral.

March 2017

UCSF Benioff Children's Hospitals

COUNCIL ON PATIENT SAFETY IN WOMEN'S HEALTH CARE

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MATERNAL MENTAL HEALTH: PERINATAL DEPRESSION AND ANXIETY

READINESS

Every Clinical Care Setting

- Identify mental health screening tools to be made available in every clinical setting (outpatient OB clinics and inpatient facilities).
- Establish a response protocol and identify screening tools for use based on local resources.
- Educate clinicians and office staff on use of the identified screening tools and response protocol.
- Identify an individual who is responsible for driving adoption of the identified screening tools and response protocol.

RECOGNITION & PREVENTION

Every Woman

- Obtain individual and family mental health history (including past and current medications) at intake, with review and update as needed.
- Conduct validated mental health screening during appropriately timed patient encounters, to include both during pregnancy and in the postpartum period.
- Provide appropriately timed perinatal depression and anxiety awareness education to women and family members or other support persons.

PATIENT SAFETY BUNDLE

Maternal Mental Health

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PATIENT SAFETY BUNDLE

Maternal Mental Health

RESPONSE

Every Case

- Initiate a stage-based response protocol for a positive mental health screen.
- Activate an emergency referral protocol for women with suicidal/homicidal ideation or psychosis.
- Provide appropriate and timely support for women, as well as family members and staff, as needed.
- Obtain follow-up from mental health providers on women referred for treatment. This should include the necessary release of information forms.

REPORTING/SYSTEMS LEARNING

Every Clinical Care Setting

- Establish a non-judgmental culture of safety through multidisciplinary mental health rounds.
- Perform a multidisciplinary review of adverse mental health outcomes.
- Establish local standards for recognition and response in order to measure compliance, understand individual performance, and track outcomes.

Standardization of health care processes and reduced variation has been shown to improve outcomes and quality of care. The Council on Patient Safety in Women's Health Care disseminates patient safety bundles to help facilitate the standardization process. This bundle reflects emerging clinical, scientific, and patient safety advances as of the date issued and is subject to change. The information should not be construed as dictating an exclusive course of treatment or procedure to be followed. Although the components of a particular bundle may be adapted to local resources, standardization within an institution is strongly encouraged.

The Council on Patient Safety in Women's Health Care is a broad consortium of organizations across the spectrum of women's health for the promotion of safe health care for every woman.

February 2016

For more information visit the Council's website at www.safehealthcareforeverywoman.org

COUNCIL ON PATIENT SAFETY IN WOMEN'S HEALTH CARE

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PATIENT SAFETY BUNDLE

Obstetric Care for Women with Opioid Use Disorder

READINESS

Every patient/family

- Provide education to promote understanding of opioid use disorder (OUD) as a chronic disease.
  - Emphasize that substance use disorders (SUDs) are chronic medical conditions, treatment is available, family and peer support is necessary and recovery is possible.
  - Emphasize that opioid pharmacotherapy (i.e. methadone, buprenorphine) and behavioral therapy are effective treatments for OUD.
- Provide education regarding neonatal abstinence syndrome (NAS) and newborn care.
  - Awareness of the signs and symptoms of NAS
  - Interventions to decrease NAS severity (e.g. breastfeeding, smoking cessation)
- Engage appropriate partners (i.e. social workers, case managers) to assist patients and families in the development of a "plan of safe care" for mom and baby.

Every clinical setting/health system

- Provide staff-wide (clinical and non-clinical staff) education on SUDs.
  - Emphasize that SUDs are chronic medical conditions that can be treated.
  - Emphasize that stigma, bias and discrimination negatively impact pregnant women with OUD and their ability to receive high quality care.
  - Provide training regarding trauma-informed care.
- Establish specific prenatal, intrapartum and postpartum clinical pathways for women with OUD that incorporate care coordination among multiple providers.
- Develop pain control protocols that account for increased pain sensitivity and avoidance of mixed agonist-antagonist opioid analgesics.
- Know state reporting guidelines regarding the use of opioid pharmacotherapy and identification of illicit substance use during pregnancy.

August 2017

UCSF Benioff Children's Hospitals

COUNCIL ON PATIENT SAFETY IN WOMEN'S HEALTH CARE

safe health care for every woman

PATIENT SAFETY BUNDLE

Obstetric Care for Women with Opioid Use Disorder

- Know federal (Child Abuse Prevention Treatment Act - CAPTA), state and county reporting guidelines for substance-exposed infants.
  - Understand "Plan of Safe Care" requirements.
- Know state, legal and regulatory requirements for SUD care.
- Identify local SUD treatment facilities that provide women-centered care.
  - Ensure that OUD treatment programs meet patient and family resource needs (i.e. wrap-around services such as housing, child care, transportation and home visitation).
  - Ensure that drug and alcohol counseling and/or behavioral health services are provided.
- Investigate partnerships with other providers (i.e. social work, addiction treatment, behavioral health) and state public health agencies to assist in bundle implementation.

RECOGNITION & PREVENTION

Every provider/clinical setting

- Assess all pregnant women for SUDs.
  - Utilize validated screening tools to identify drug and alcohol use.
  - Incorporate a screening, brief intervention and referral to treatment (SBIRT) approach in the maternity care setting.
  - Ensure screening for polysubstance use among women with OUD.
- Screen and evaluate all pregnant women with OUD for commonly occurring co-morbidities.
  - Ensure the ability to screen for infectious disease (e.g. HIV, Hepatitis and sexually transmitted infections (STIs)).
  - Ensure the ability to screen for psychiatric disorders, physical and sexual violence.
  - Provide resources and interventions for smoking cessation.
- Match treatment response to each woman's stage of recovery and/or readiness to change.

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COUNCIL ON PATIENT SAFETY IN WOMEN'S HEALTH CARE

safe health care for every woman

PATIENT SAFETY BUNDLE

Obstetric Care for Women with Opioid Use Disorder

RESPONSE

Every provider/clinical setting/health system

- Ensure that all patients with OUD are enrolled in a woman-centered OUD treatment program.
  - Establish communication with OUD treatment providers and obtain consents for sharing patient information.
  - Assist in linking to local resources (e.g. peer navigator programs, narcotics anonymous (NA), support groups) that support recovery.
- Incorporate family planning, breastfeeding, pain management and infant care counseling, education and resources into prenatal, intrapartum and postpartum clinical pathways.
  - Provide breastfeeding and lactation support for all postpartum women on pharmacotherapy.
  - Provide immediate postpartum contraceptive options (e.g. long acting reversible contraception (LARC)) prior to hospital discharge.
- Ensure coordination among providers during pregnancy, postpartum and the inter-conception period.
  - Provide referrals to providers (e.g. social workers, psychiatry, and infectious disease) for identified co-morbid conditions.
  - Identify a lead provider responsible for care coordination, specify the duration of coordination and assure a "warm handoff" with any change in the lead provider.
  - Develop a communication strategy to facilitate coordination among the obstetric provider, OUD treatment provider, health system clinical staff (i.e. inpatient maternity staff, social services) and child welfare services.
- Engage child welfare services in developing safe care protocols tailored to the patient and family's OUD treatment and resource needs.
  - Ensure priority access to quality home visiting services for families affected by SUDs.

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REPORTING & SYSTEMS LEARNING

Every clinical setting/health system

- Develop mechanisms to collect data and monitor process and outcome metrics to ensure high quality healthcare delivery for women with SUDs.
  - Develop a data dashboard to monitor process and outcome measures (i.e. number of pregnant women in OUD treatment at specified intervals).
- Create multidisciplinary case review teams to evaluate patient, provider and system-level issues.
- Develop continuing education and learning opportunities for providers and staff regarding SUDs.
- Identify ways to connect non-medical local and community stakeholders with clinical providers and health systems to share outcomes and identify ways to improve systems of care.
  - Engage child welfare services, public health agencies, court systems and law enforcement to assist with data collection, identify existing problems and help drive initiatives.

Standardization of health care processes and reduced variation has been shown to improve outcomes and quality of care. The Council on Patient Safety in Women's Health Care disseminates patient safety bundles to help facilitate the standardization process. This bundle reflects emerging clinical, scientific, and patient safety advances as of the date issued and is subject to change. The information should not be construed as dictating an exclusive course of treatment or procedure to be followed. Although the components of a particular bundle may be adapted to local resources, standardization within an institution is strongly encouraged.

The Council on Patient Safety in Women's Health Care is a broad consortium of organizations across the spectrum of women's health for the promotion of safe health care for every woman.

August 2017

For more information visit the Council's website at www.safehealthcareforeverywoman.org

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SIRS Criteria Comparison

Adult Screening Criteria

- Temp > 38°C (100.4°F) or < 36°C (96.8°F)
- *HR > 90 bpm*
- *Resp Rate> 20 breaths/minute*
- WBC >12,000, < 4,000 or >10% *immature neutrophils*
- Blood glucose > 140 mg/dl in the absence of diabetes
- *New mental status change*

Perinatal Screening Criteria

- Temp > 38°C (100.4°F) or < 36°C (96.8°F)
- *HR > 110 bpm*
- *Resp Rate > 24 breaths/ minute*
- *WBC > 15,000 or < 4,000 or > 10 % immature neutrophils*
- Blood glucose > 140 mg/dl in absence of diabetes
- *Mental status change*

Summary

- Consider normal physiologic changes of pregnancy when assessing a decompensating postpartum patient.
- Comorbidities like obesity and preeclampsia increase the risk of a postpartum emergency.
- Nurses play an essential role during the postpartum period to risk assess, recognize, and respond correctly during an emergency.
- The ability to mobilize a multidisciplinary team during a postpartum crisis will optimize women's survival after childbirth.
- Multidisciplinary review of adverse outcomes promotes learning and provides opportunity for quality improvement.

Nurses are a valuable source of information and support for women and their families

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Thank You!

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