



Baby on Board!

The Pregnant Trauma Patient

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Disclosures

- No financial disclosures
- These views do not represent the views of the US Army, USUHS, or Department of Defense
- Focus on patient care and not politics







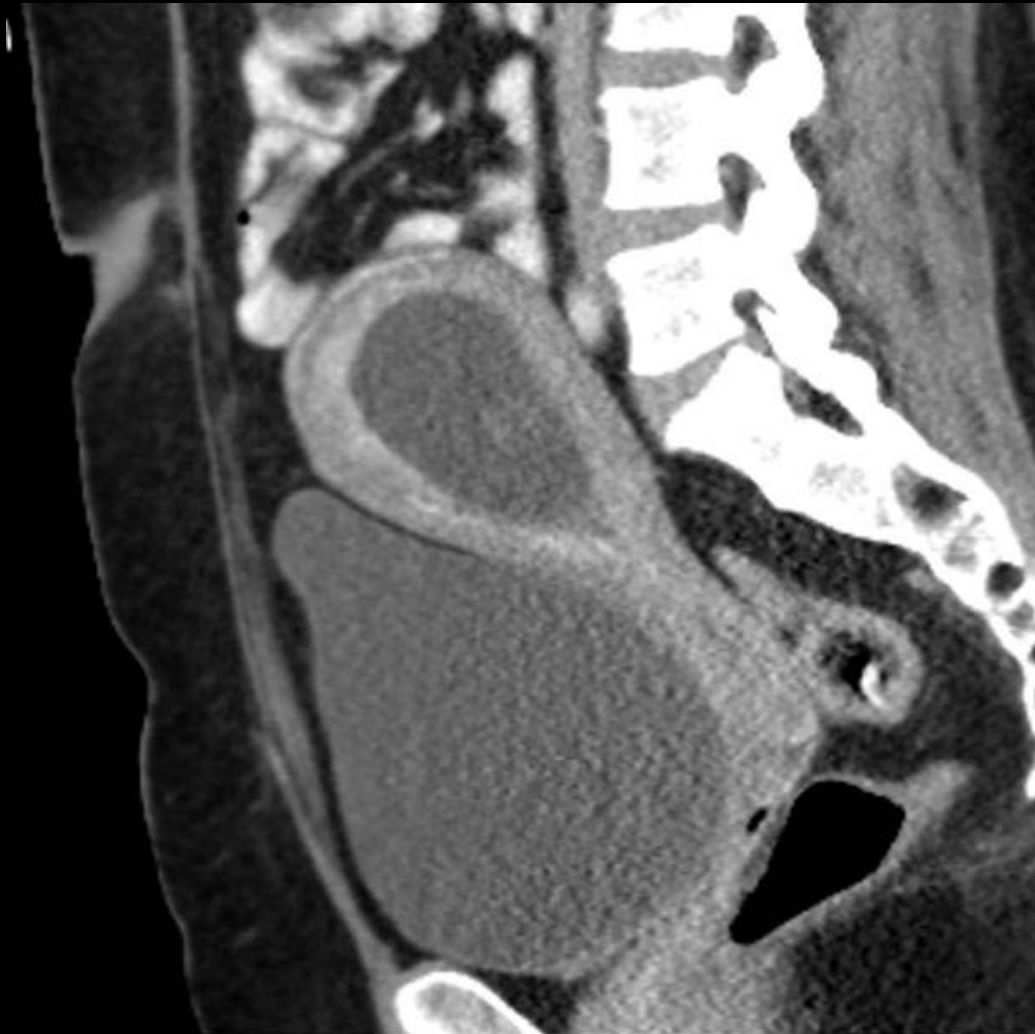
OBJECTIVES

1. Maternal-fetal anatomy & physiology
2. Impact of pregnancy on labs and imaging
3. Uterine pathology/ fetal monitoring
4. Complications of pregnancy and abortion
5. Peri-mortem cesarean delivery (PMCD)
6. Evidence based approach for resuscitation

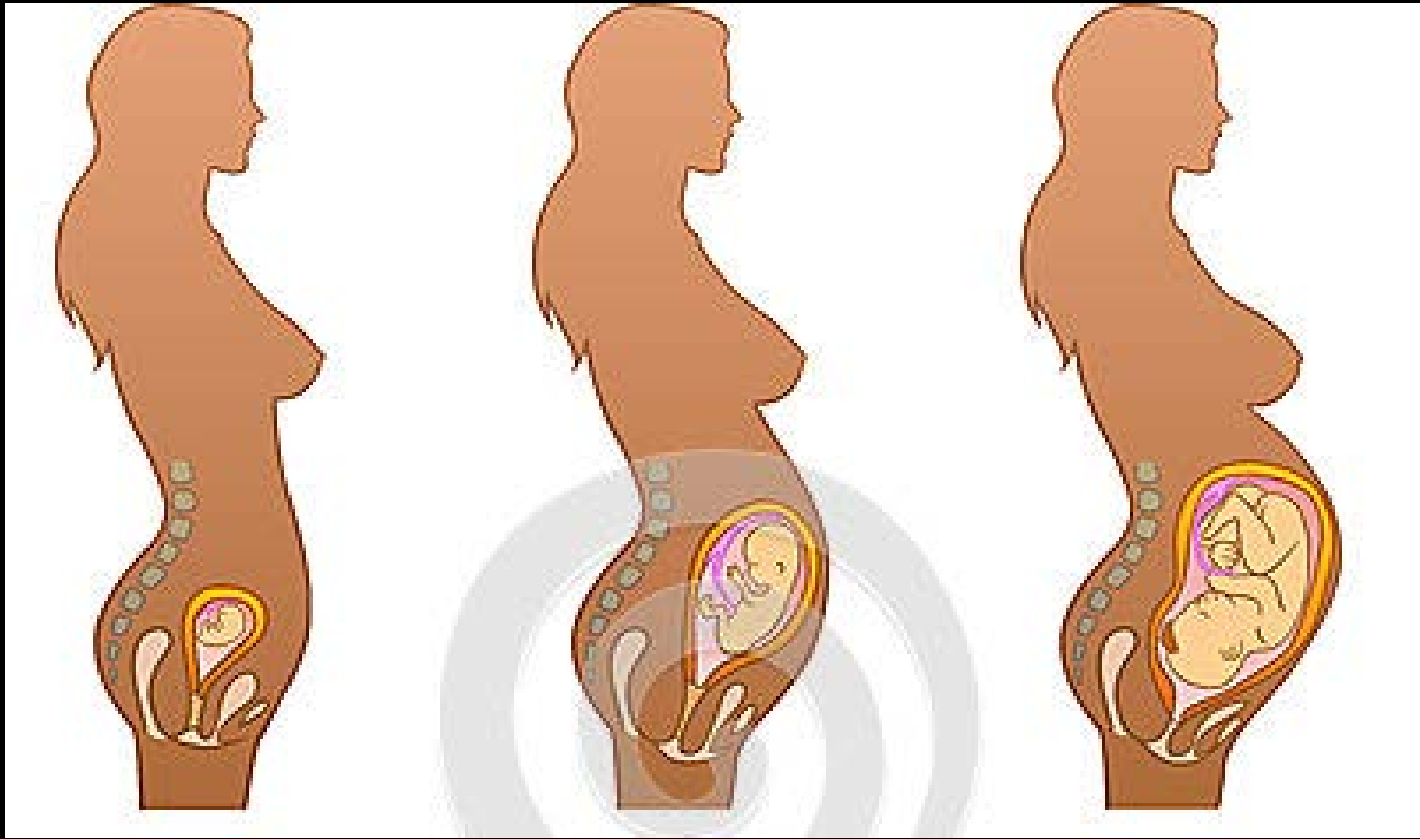
Trauma in Pregnancy:

- Most common cause of traumatic maternal deaths are due to *hemorrhage shock*

Anatomic Changes

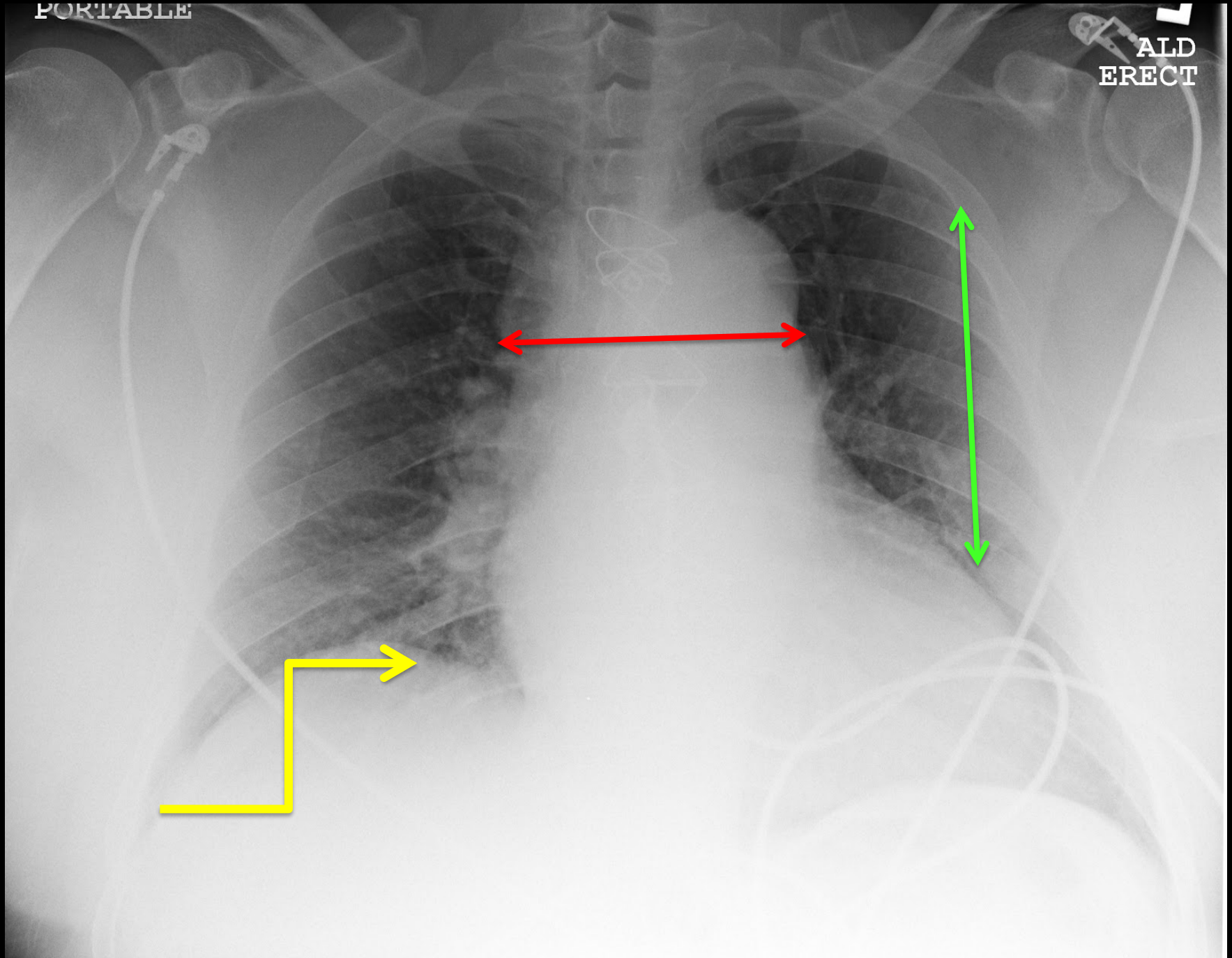


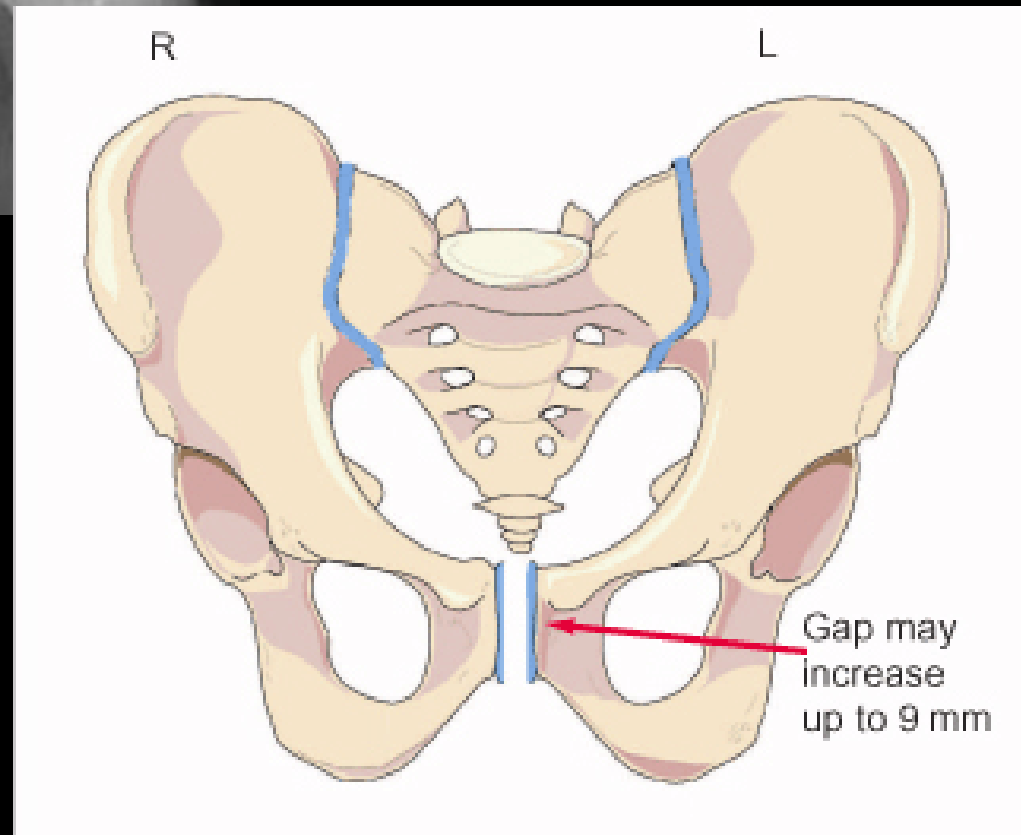
Anatomic Changes



PORTABLE

ALD
ERECT





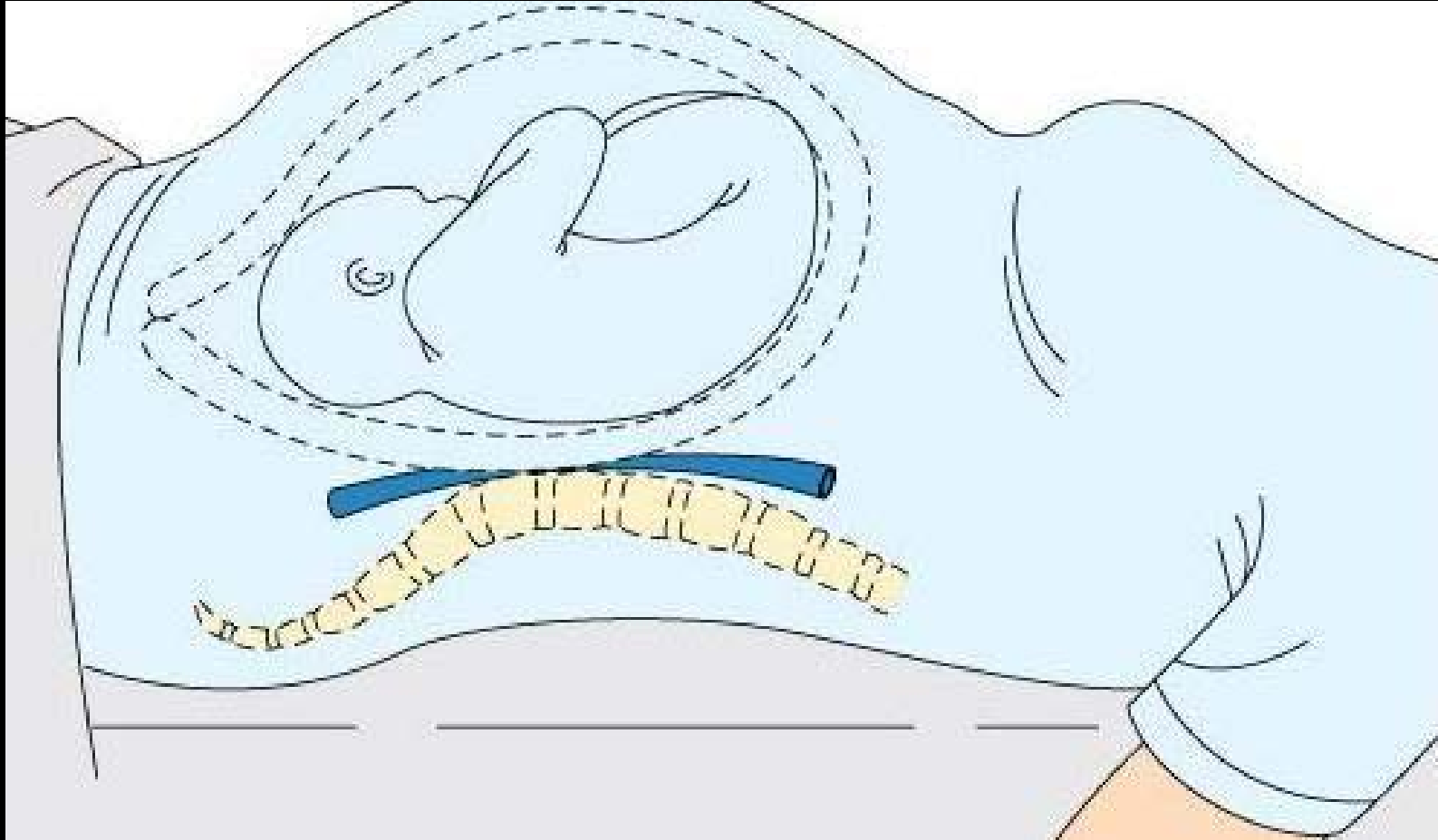
Changes to the Circulatory System

- HR increases 10-20 bpm
- BP decreases by 10-15 mmHG
- Can lose 30-35% circulating blood volume before manifesting clinical signs of shock!

Blood volume



Supine Hypotension Syndrome




Venous Thromboembolism

- The risk is increased five fold during pregnancy
- (DVT) and (PE) may occur in all three trimesters and the postpartum period
- The majority of DVTs in pregnancy are ileofemoral and are thus more likely to embolize
- Either IV unfractionated heparin or adjusted-dose subcutaneous low- molecular weight heparin (LMWH) are the treatment of choice because heparin does not cross the placenta

Changes to the Pulmonary System

Faster
desaturation

A pregnant woman with long brown hair and bangs is sitting in a hospital bed. She is wearing a yellow hospital gown. Her hands are resting on her pregnant belly. The background shows a hospital room with white walls and a sink. A black rectangular text box is overlaid on the lower half of the image, containing white text.

Increased minute ventilation
Relative hypocapnea

Adaptation of the Respiratory System

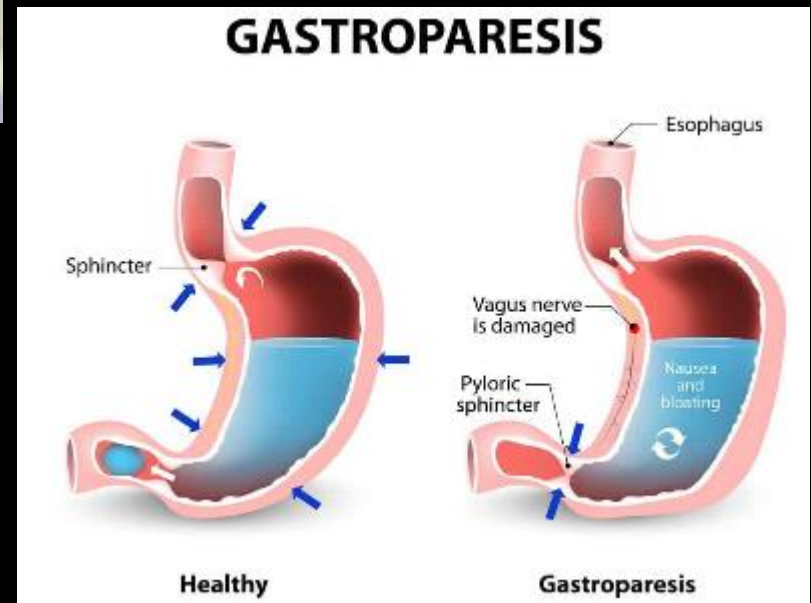
- Oxygen consumption increases 35%
- progesterone → respiratory stimulation → 30% increase in V_t .
- Minute ventilation is increased above the level needed to eliminate CO_2 and P_{CO_2} falls to 27 to 32 mm Hg
- Renal compensation results in a maternal pH 7.40 to 7.45, with serum bicarbonate decreasing to 18 to 21 mEq/L

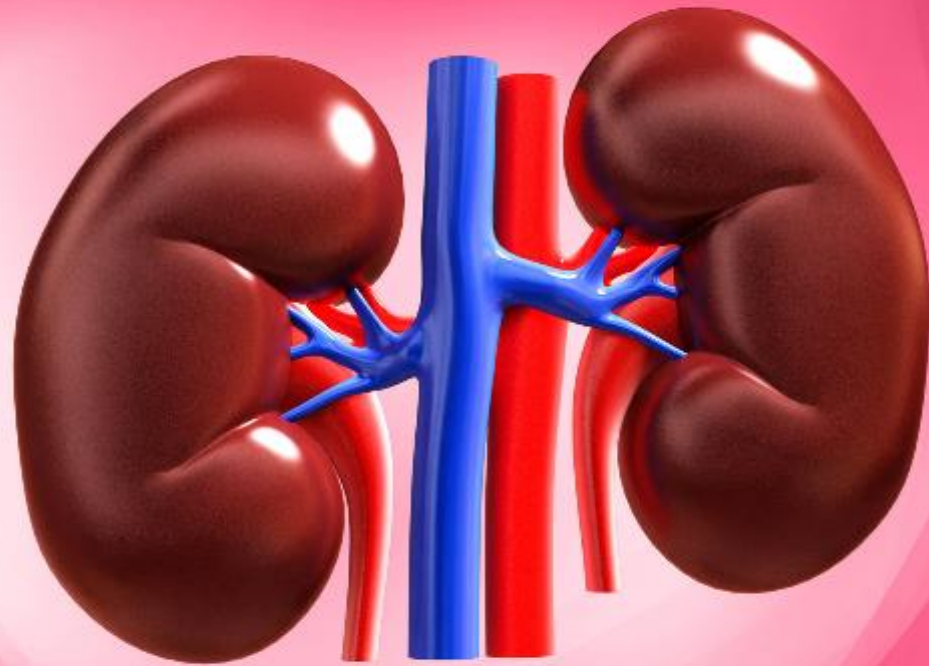
| Parameters | Direction |
|---------------------|-----------|
| Oxygen consumption | Increases |
| Respiratory rate | Unchanged |
| V_T | Increases |
| Total lung capacity | Unchanged |
| FRC | Decreases |
| FVC | Unchanged |
| FEV ¹ | Unchanged |

decreased FRC and increased oxygen consumption makes pregnant woman and fetus more vulnerable to hypoxia in the event of hypoventilation or apnea.

| Variables | P_{aO_2} , mm Hg | P_{aCO_2} , mm Hg | pH | Alveolar- Arterial Pressure Gradient, mm Hg |
|------------------------|--------------------|---------------------|------|---|
| Nonpregnant | 98 | 40 | 7.40 | 2 |
| Term pregnancy, seated | 101 | 28 | 7.45 | 14 |
| Term pregnancy, supine | 95 | 28 | 7.45 | 20 |

Gastrointestinal Changes





A meme featuring Steve Moss from the TV show 'The Mindy Project'. He is in an office setting, wearing a light blue dress shirt, a patterned tie, and dark suspenders. He has a surprised or excited expression on his face. The background shows a typical office environment with cubicles and fluorescent lighting.

**YEAH, SO IF THIS BABY WOULD
JUST GO AHEAD AND BE BORN**

THAT'D BE GREAT

BABY REGISTRY ITEMS:

PREGNANT  CHICKEN +  @MACGYVERINGMOM22 

1st baby:

crib
car seat
stroller
swing
bouncy chair
teething toys
pacifier
wipes warmer
breast pump
rocking chair
baby food maker

diapers
wipes
diaper bag
diaper genie
baby books
tummy time mat
playmat
bathing apparatus
mobile
butt cream
monogrammed onesies

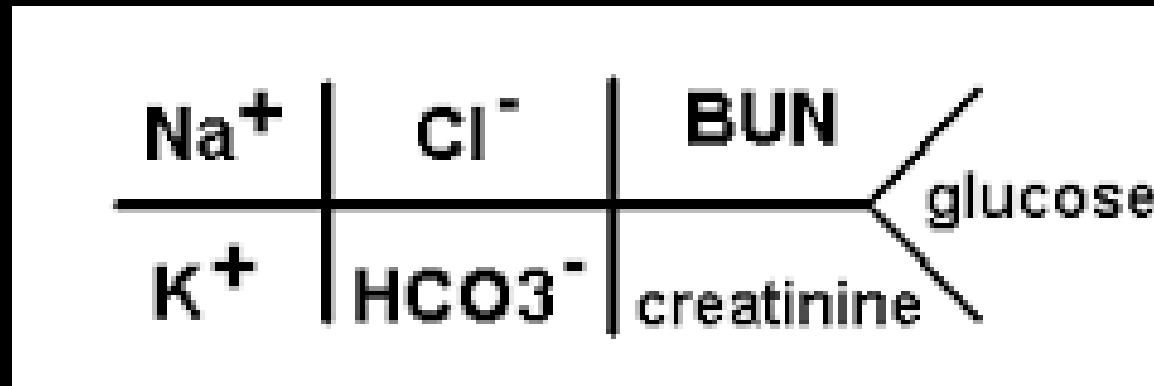
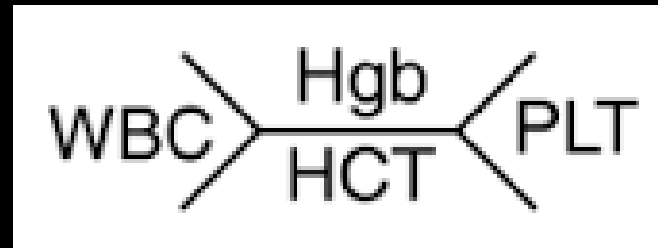
2nd:

coffee
diapers
extra car seat
frozen meals
wine

3rd:

90 day kid &
spouse-free
trip to Tahiti
vasectomy
appointment
therapist

Labs



Approach to Resuscitation:



ADEQUATE RESUSCITATION OF MOTHER

The WOMAN Trial: Early TXA in Post-Partum Hemorrhage



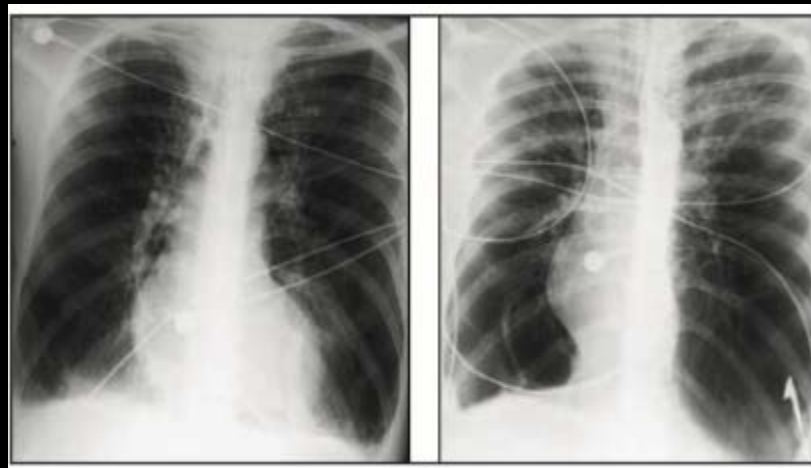
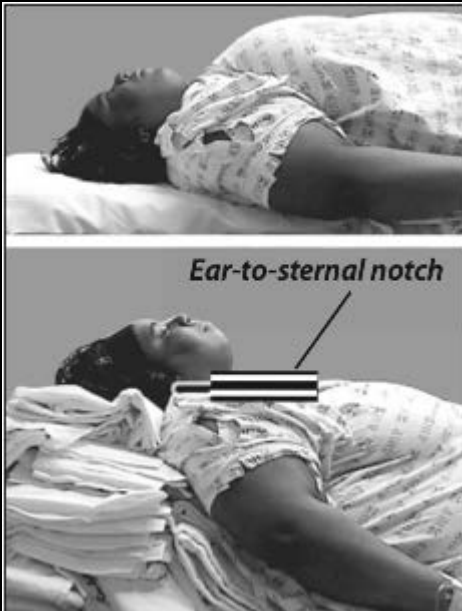
Vital Signs in Pregnancy

- Normal is NOT necessarily normal
- Up to 30% (2 L) loss of blood volume before vital signs change
- Maternal shock = fetal survival 20%

Airway: early RSI

- ↑ risk difficult intubation
- Failed intubation 8x ↑
 - ↑ Weight gain (aspirate)
 - ↑ Respiratory tract mucosal edema
 - Smaller tube
 - ↓ FRC
 - ↑ Airway resistance
 - ↓ Respiratory system compliance
 - ↑ Oxygen requirements

Breathing and Circulation



Mechanical Ventilation

- The initial ventilator settings should be aimed at achieving Pco₂ of 28 to 35 mm Hg.
- Further Respiratory alkalosis reduces fetal oxygenation and decrease uteroplacental flow
- ARDS net; The safety of this permissive hypercapnia in pregnancy remains to be determined
- continuous fetal monitoring should be conducted after each ventilator setting change

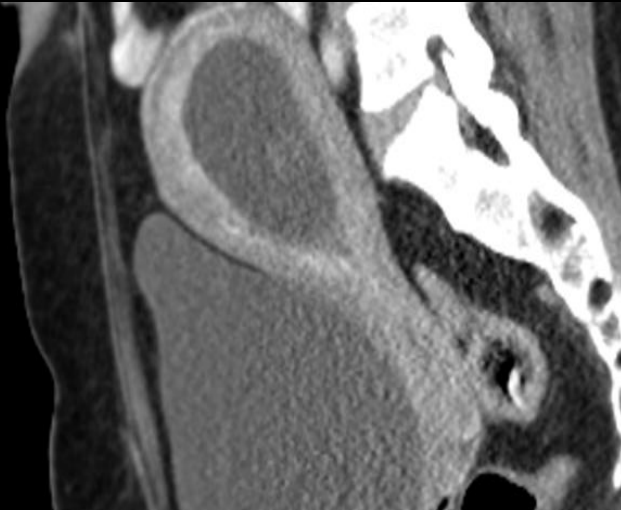
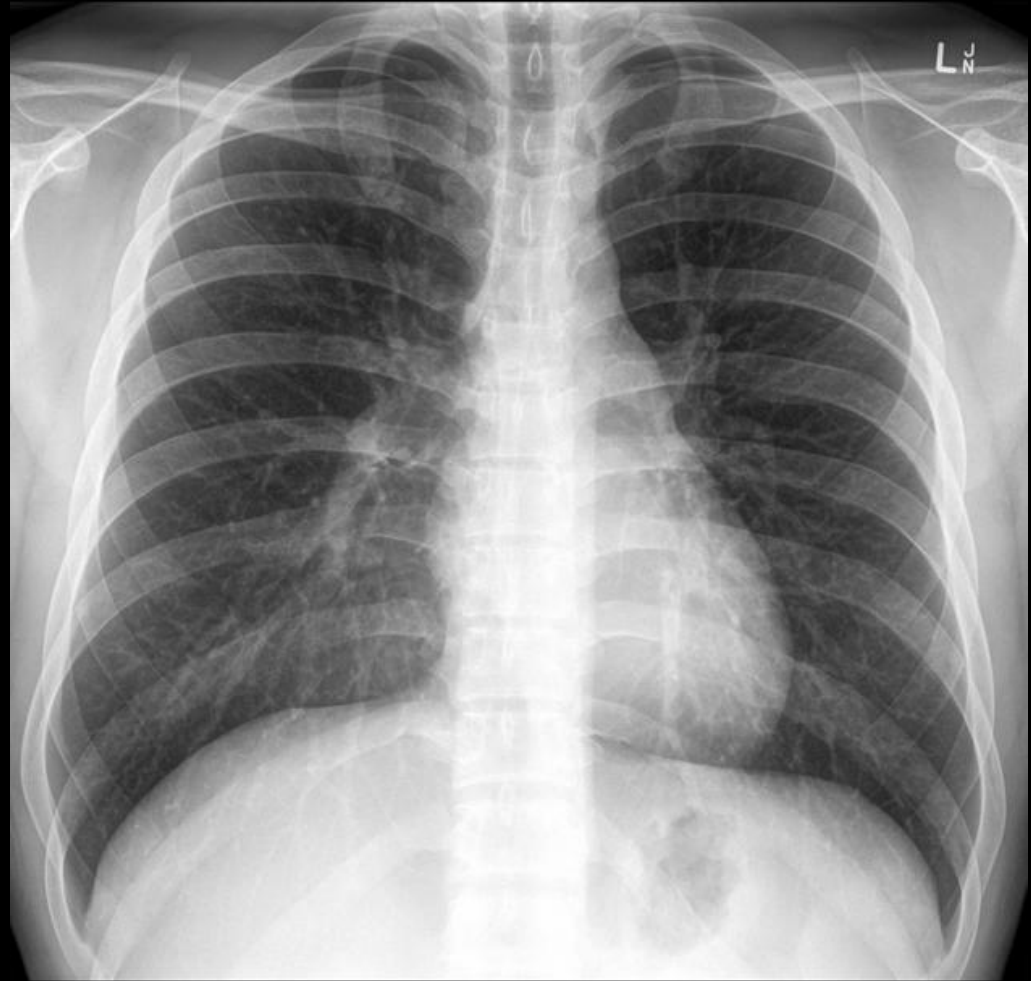
Approach to Resuscitation: Secondary Survey

- Head to toe exam
- Abdominal exam / fetal viability
- GU exam
- Fetal monitoring / early OB consultation
- Early NG tube placement/ IVF/ blood
- **ADEQUATE RESUSCITATION OF MOTHER**

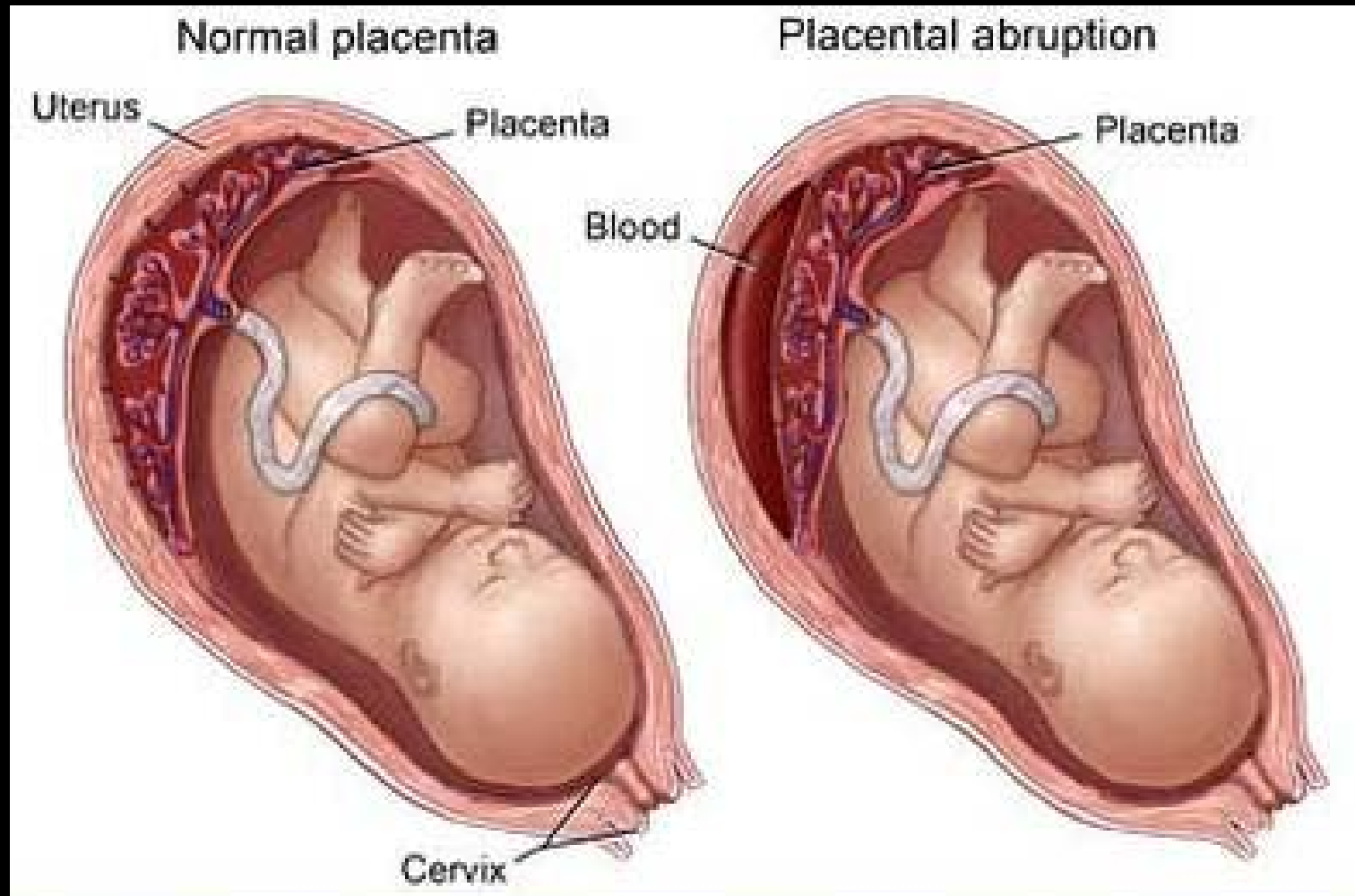




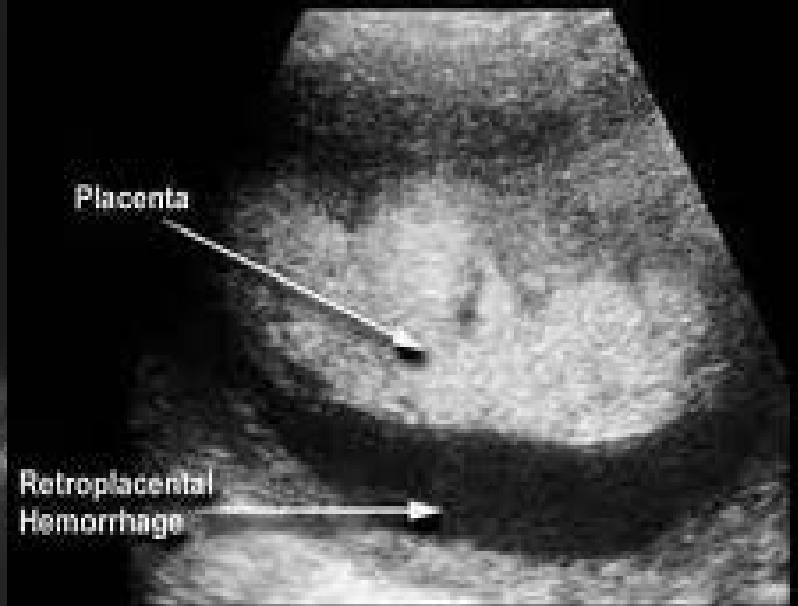
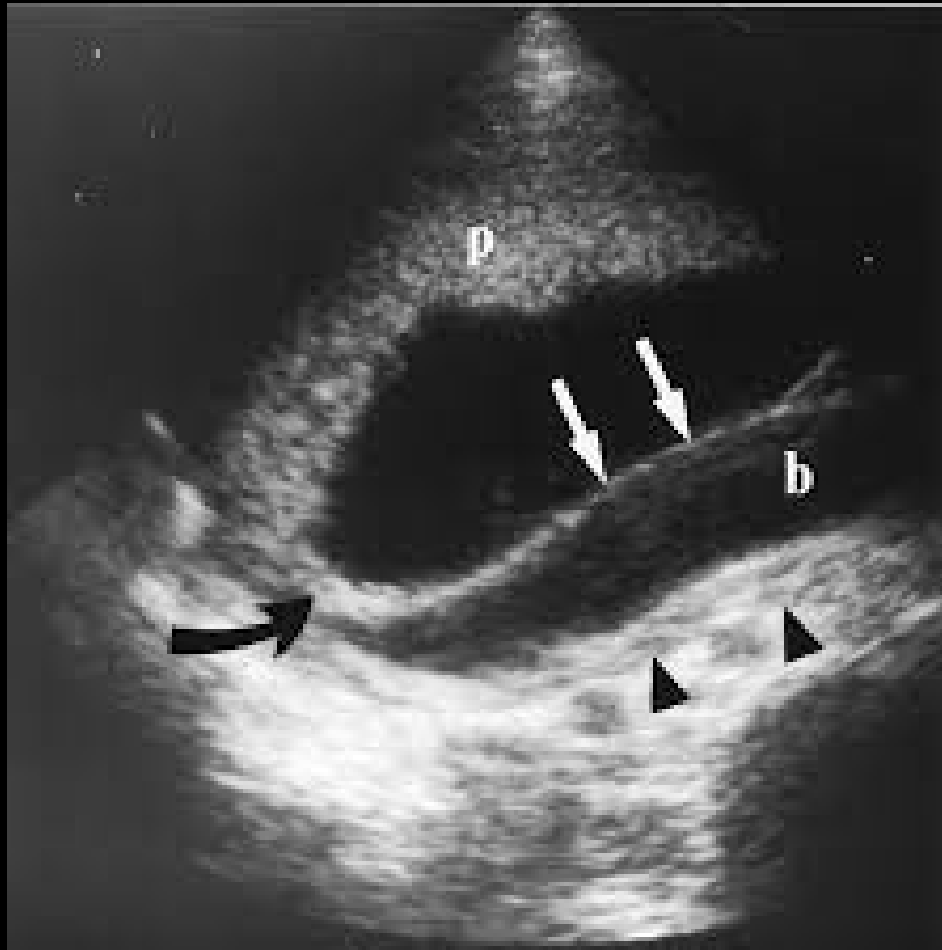
Imaging in Pregnancy

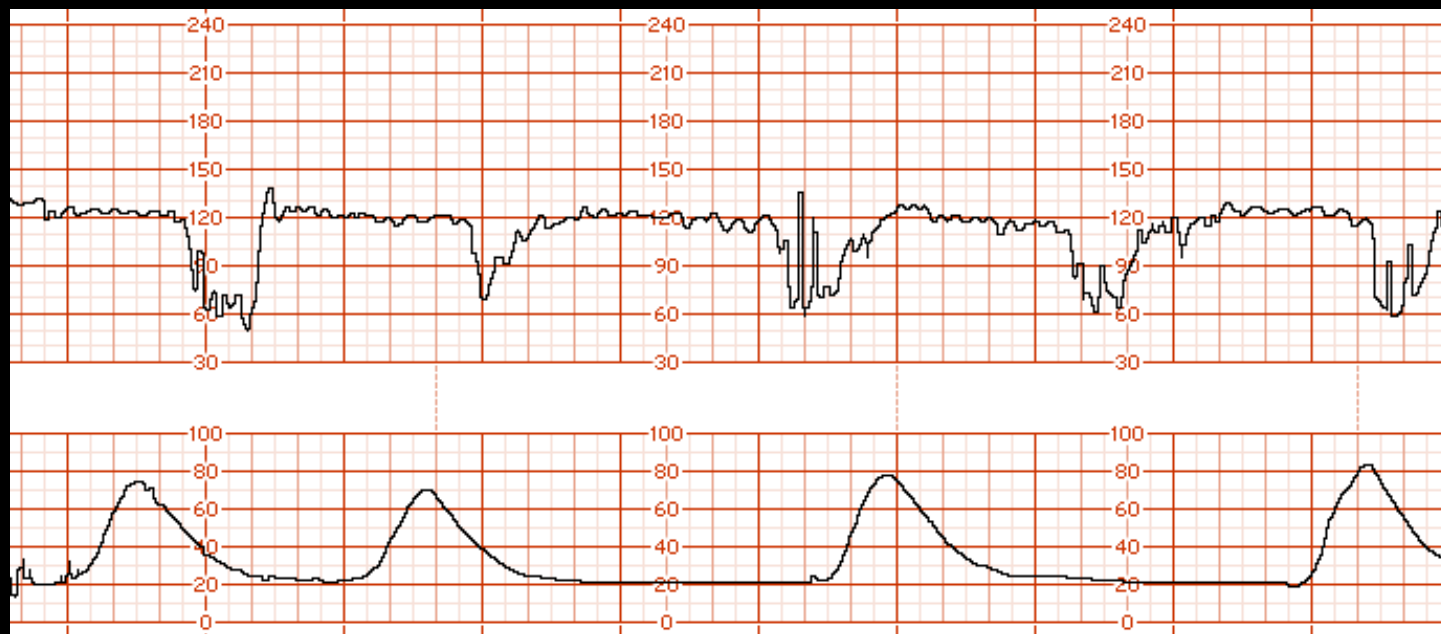


Placental Abruption

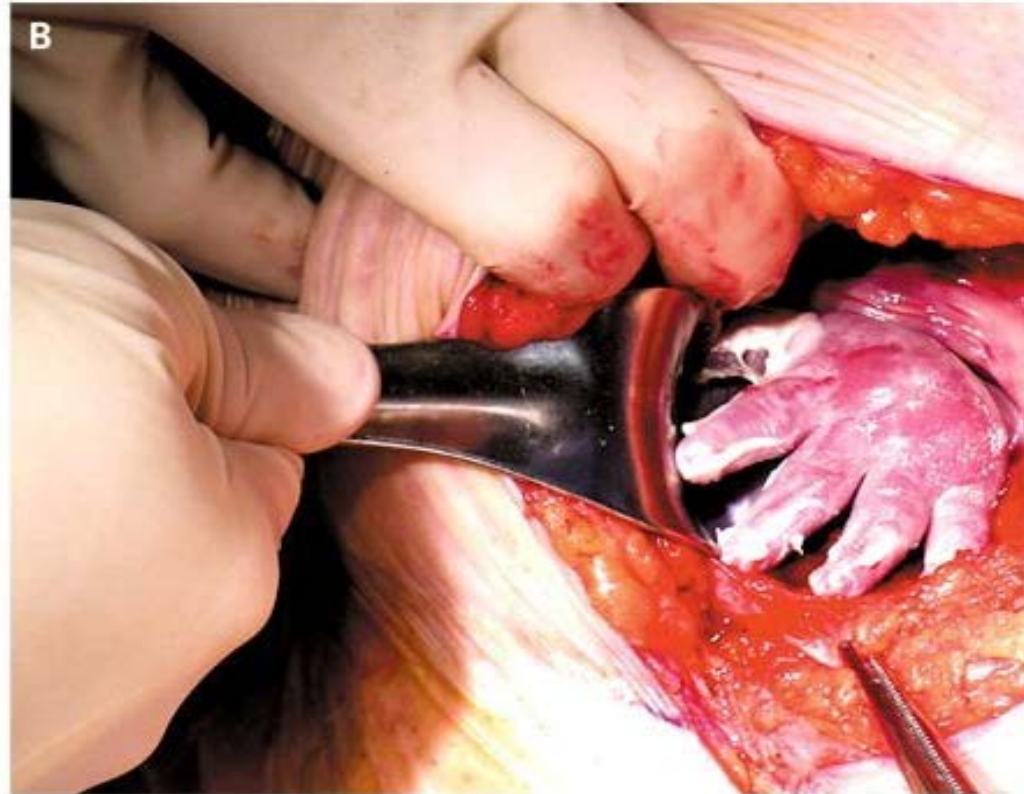
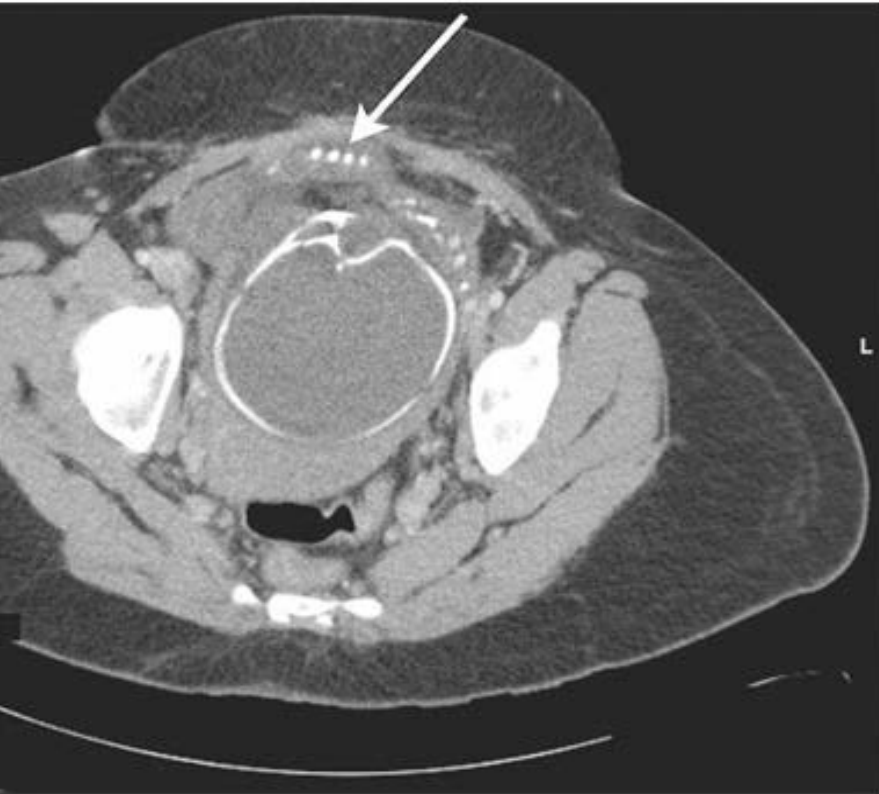


Placental Abruption





Uterine Rupture



Penetrating Trauma







Trauma and Pregnancy

- Intimate partner violence
 - Homicides (57-63%)
 - Accidents (12-34%)
 - MVC, falls
 - Suicides (9-13%) *

* Cook County Medical Examiner medical record review: 1986-1989 and
New York City Medical Examiner review: 1987-1991

Intimate Partner Violence

- Focus is on the fetus
 - Abdomen (60%)
- ↑ Preterm delivery
- ↑ Fetal demise



Domestic Violence

- Think about it
- Ask when patient is alone
- Social services evaluation or referral



Injury Prevention





Complications of Unsafe and Self-Managed Abortion

Lisa H. Harris, M.D., Ph.D., and Daniel Grossman, M.D.

[Article](#)[Figures/Media](#)[Metrics](#)[50 References](#)[22 Citing Articles](#)

WHEN ABORTION IS LEGALLY RESTRICTED OR OTHERWISE INACCESSIBLE, girls, women, and those who care about them look outside formal medical care to end pregnancies.¹ Worldwide, people increasingly choose misoprostol or a combination of mifepristone and misoprostol to end pregnancies on their own (referred to as self-managed abortion).²⁻⁴ These medications are safer and more effective than older, invasive techniques of self-managed abortion, and patients who have used these medications may be clinically indistinguishable from those who have had uncomplicated spontaneous pregnancy loss.¹⁻⁵ Similarly, patients with complications of self-managed medication-induced abortion and those with complications of miscarriage may have identical clinical presentations.

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Editors

Edward W. Campion, M.D., Editor

Related Articles

PERSPECTIVE JUN 2, 2022

[Navigating Loss of Abortion Services — A Large Academic Medical Center Prepares for the Overtur](#)
[Roe v. Wade](#)

SEPTIC ABORTION

PRESENTATION

Fever
Abdominal pain
Vaginal discharge
Vaginal bleeding
History of recent pregnancy

ETIOLOGY

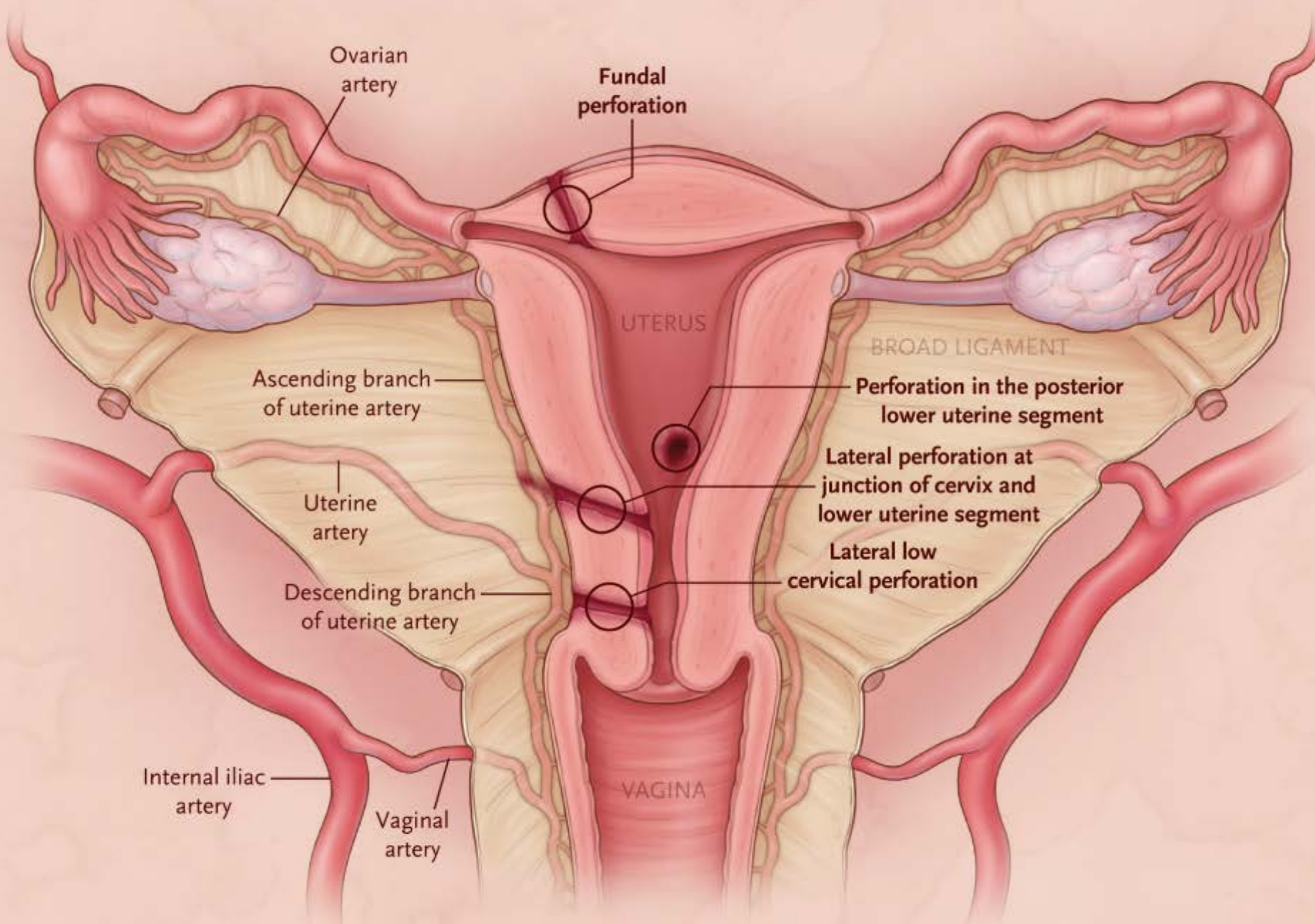
Retained products of conception (POCs) due to incomplete spontaneous or therapeutic abortion and secondary infection

WORKUP

Beta- HCG
CBC
Blood type and Rh
Urinalysis
Ultrasound for retained POCs

TREATMENT

Fluid resuscitation
Obstetric Consultation ASAP (Need evacuation of uterus)
Ampicillin-Sulbactam 3 g IV OR Clindamycin 600 mg IV
+
GENTAMICIN 1-2 mg/kg IV



Ovarian artery

Fundal perforation

UTERUS

BROAD LIGAMENT

Ascending branch of uterine artery

Perforation in the posterior lower uterine segment

Uterine artery

Lateral perforation at junction of cervix and lower uterine segment

Descending branch of uterine artery

Lateral low cervical perforation

Internal iliac artery

Vaginal artery

VAGINA

Pre-eclampsia

- complicates 5 to 10% of all pregnancies
- 10 to 15% of maternal deaths
- occurs most often in nulliparous women after the 20th week of gestation, typically near term
- may occur postpartum
- hypertension, proteinuria, and generalized edema, and hyperuricemia
- may progress without warning to a convulsive and potentially lethal phase, *eclampsia*.

Maternal complications

- seizures (eclampsia)
- cerebral hemorrhage or edema
- renal dysfunction
- pulmonary edema
- placental abruption with DIC
- HELLP syndrome
- and hepatic infarction, failure, sub capsular hemorrhage, or rupture

Management of preeclampsia

- Immediate delivery if >34 wks
- Magnesium sulfate
- BP control is best controlled with IV labetalol

Magnesium Dosing in Severe Preeclampsia/Eclampsia

| Variables | Normal Renal Function | Renal Insufficiency, Creatinine >1.0 mL/dL |
|-------------------|---|---|
| Initial | 6 g IV over 15–20 min | 4–6 g IV over 15–20 min |
| Maintenance | 2 g/h infusion | 1 g/h infusion |
| Serum levels | 4.8 to 8.4 mg/dL | Monitor every 6 h |
| Monitor | Patellar reflex present Respiratory rate >12 breaths/min Urine output >100 mL/4 h | Patellar reflex present Respiratory rate >12 breaths/min Urine output >100 mL/4 h |
| Adverse effects | Hypotension/asystole Respiratory depression | Hypotension/asystole Respiratory depression |
| Drug interactions | Calcium-channel blockers may enhance adverse/toxic effects | Calcium-channel blockers may enhance adverse/toxic effects |

When people point at my
pregnant belly and ask if I know
what it's going to be,
I like to say,
"We're hoping
it's a baby."



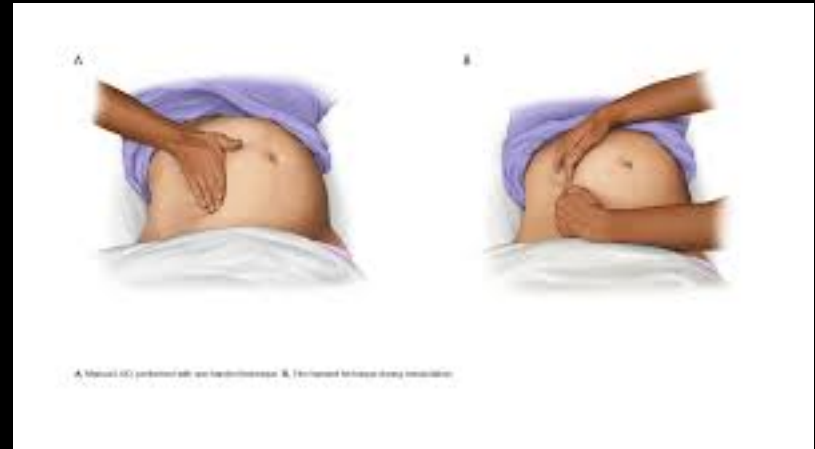
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Resuscitative Hysterotomy



ÆSCVLAPII ORTVS





How to perform CPR Pregnancy







XII

I

II

III

IV

V

VI

VII

VIII

IX

X

XI

What do I need?







Challenging the 4- to 5-minute rule: from perimortem cesarean to resuscitative hysterotomy

Carl H. Rose, MD; Arij Fakih, DO; Kyle D. Traynor, MD; Daniel Cabrera, MD; Katherine W. Arendt, MD; Brian C. Brost, MD

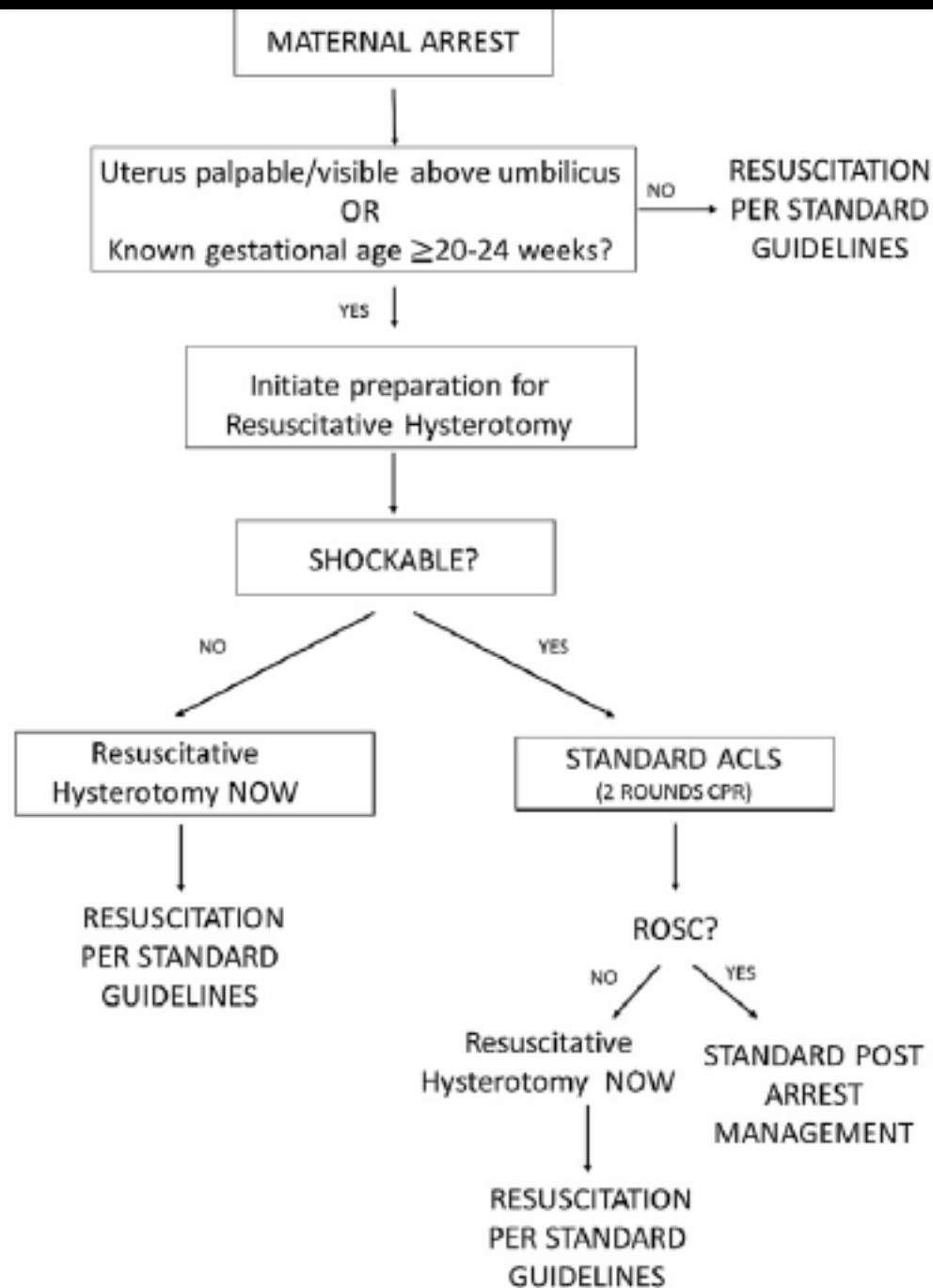
Few obstetrical providers are confronted with an acute MCPA during clinical practice. The complex medical, cognitive, operational, and emotional circumstances surrounding MCPA creates a substantial challenge, particularly while trying to expediently balance competing maternal and fetal priorities. This monograph will review the historical evidence for current practices and suggest modifications based primarily on maternal status.

Introduction

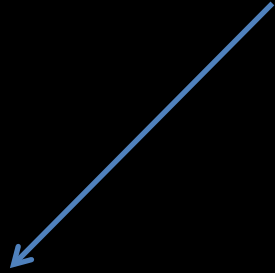
Antepartum maternal cardiac arrest is a fortuitously rare event, with an incidence of approximately 1/12,500 deliveries.¹

THE PROBLEM: Scenario no. 1: emergency medical services transports a young woman to the emergency department following high-speed frontal-impact motor vehicle accident requiring prolonged vehicular extraction. Primary survey reveals multifocal cranial and extremity trauma, and she appears to be approximately 7 months' gestation. While lucid at the scene, she becomes unresponsive and requires airway management with endotracheal intubation. At time of arrival fetal heart tones are unable to be auscultated (suggestive of intrauterine fetal demise), and soon thereafter maternal cardiopulmonary arrest (MCPA) occurs. Scenario no. 2: in the labor and delivery suite, a 25-year-old primigravida at 39 weeks' gestation in active labor at 9-cm dilation suddenly notes onset of dyspnea followed by loss of consciousness. No pulse is palpable. Fetal heart rate tracing previously was category 1 but now demonstrates a prolonged deceleration for 4 minutes.

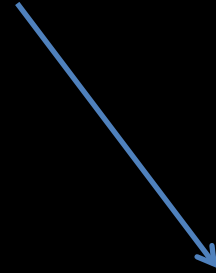
A SOLUTION: As the on-call obstetrician, how do you manage these cases? Is



Treatment Algorithm > 20 weeks



Unstable



Stable



Treatment Algorithm > 20 weeks

Unstable

Stable



FAST Exam/
Ultrasound

+

-

Surgical and OB consultation

Serial exams

CT vs OR

Consider CT

Fetal Monitoring
ADMIT

Fetal Monitoring
OB consultation

Treatment Algorithm > 20 weeks

Stable



CT neg



Tocodynamometer
Monitoring

- Monitoring for 4 hours is sufficient to rule out major trauma-related complications in low risk patients

Hospitalization and intermittent fetal heart rate and uterine activity monitoring by EFM for 24 hours for patients with:

- uterine tenderness, vaginal bleeding
- contractions during a monitoring period of 4 hours
- rupture of the membranes
- atypical or abnormal fetal heart rate
- high risk mechanism of injury (motorcycle, pedestrian, high speed crash)
- serum fibrinogen < 200 mg/dL

Fetomaternal Hemorrhage

- Apt test
- Kleihauer-Betke (KB) test
- Rhogam
- Tetanus



21

810 2998



Take Home Points

- Focus resuscitation on mom
- Not all minor trauma is minor!
- Vital signs not reliable indicators
- Imaging in pregnancy
- PMCS now Resuscitative Hysterotomy

Questions?

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