OBSTETRIC LIFE SUPPORT®

PREHOSPITAL DIVISION

Case-Based Maternal Cardiac Arrest Resuscitation through OBLS

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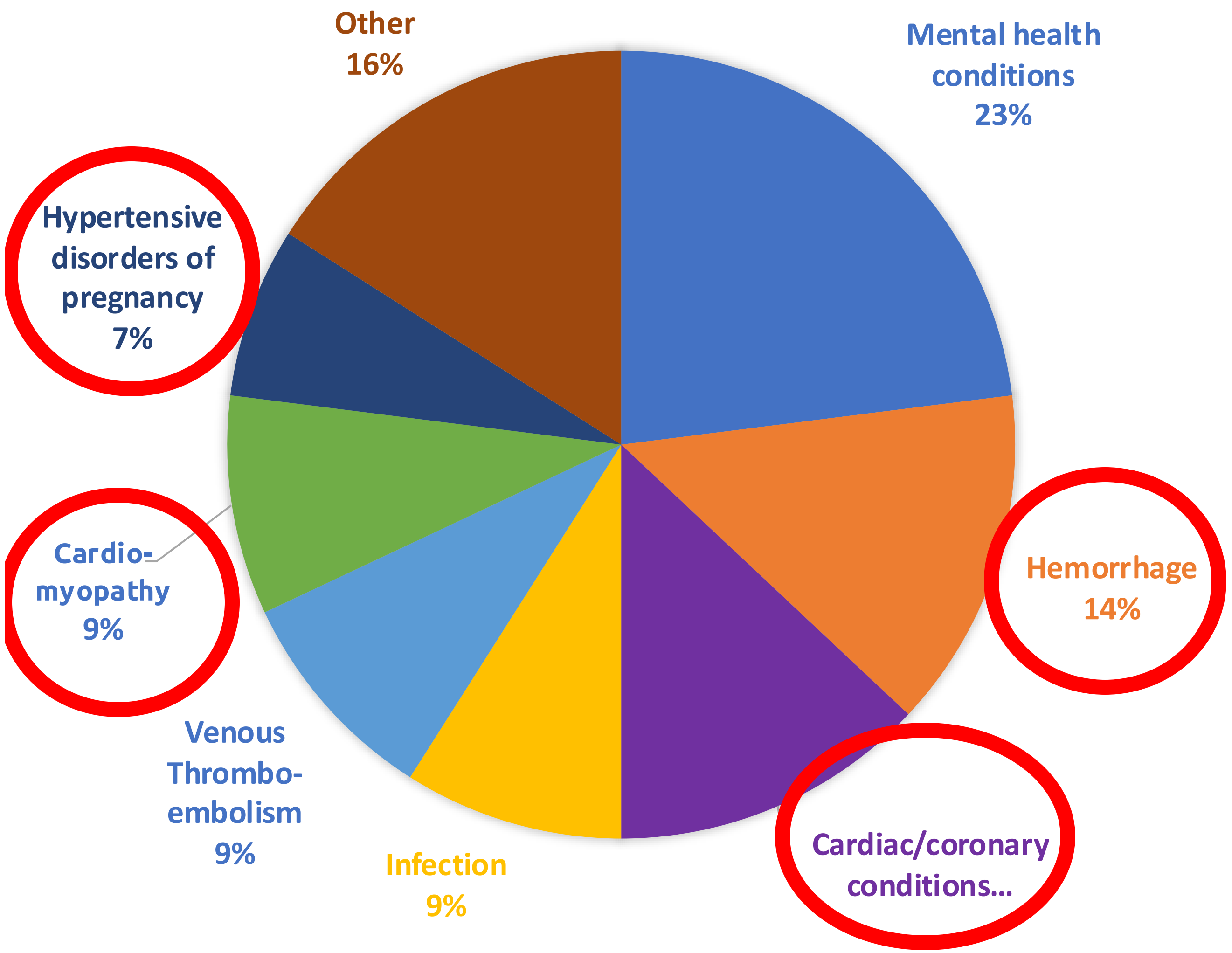
Learning Objectives

- Review management for EMS care of hypertensive disorders of pregnancy, including eclampsia
- Review management for EMS care of postpartum hemorrhage
- Review general management principles for EMS care of cardiac disease in pregnancy



Anatomy and Physiology Changes in Pregnancy

Parameter	Values in Pregnancy
Heart rate (HR)	↑ 20%
Stroke volume (SV)	↑ 30%
Cardiac output (CO)	↑ by more than 40%
Systemic vascular resistance (SVR)	↓ by more than 30%, nadir at 32 weeks
Oncotic pressure	↓ due to hemodilution and decreased serum albumin
Uterus	At 20 weeks gestation with a single fetus, can ↓ preload and cardiac output
Breast tissue	Can be dense and enlarged and interfere with chest compression and pad placement

Heart Rate Changes in Pregnancy

- Increases by 10–20 beats per minute.
- Normal resting HR in pregnancy: 80–100 bpm.
- This increase supports greater cardiac output and oxygen delivery to the placenta.

Blood Pressure Changes in Pregnancy

- Slight decrease in the first and second trimesters due to vasodilation from progesterone.
  - Systolic ↓ by ~5–10 mmHg
  - Diastolic ↓ by ~10–15 mmHg
- BP returns to pre-pregnancy levels by the third trimester.
- Be cautious: hypertension after 20 weeks may indicate preeclampsia.

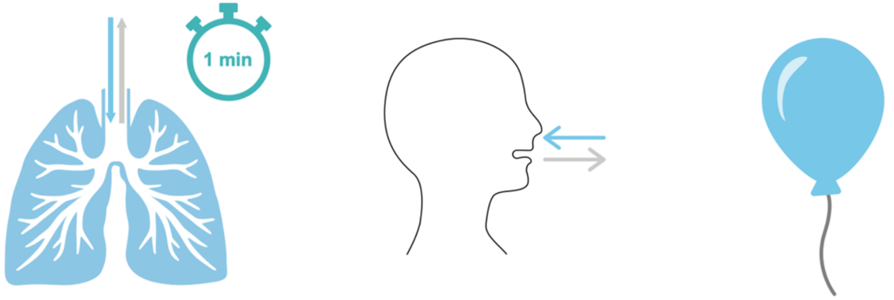
Respiratory Changes in Pregnancy

- Edema in airway leading to more difficult airway interventions due to hormone changes & increased blood volume.

- Respiratory Rate (RR)
  - Usually unchanged or slightly increased.
  - Normal: 12–20 breaths per minute.
  - However, tidal volume and minute ventilation increase due to progesterone-driven respiratory center sensitivity to CO_2.
  - Normal end tidal CO2 30-40 (slightly lower than non-pregnant)

Clinical Implications

- **Preoxygenation prior to intubation**
- When $PaCO_2$ values are >42mmHg →evaluate for respiratory decompensation
- Lower threshold for intubation

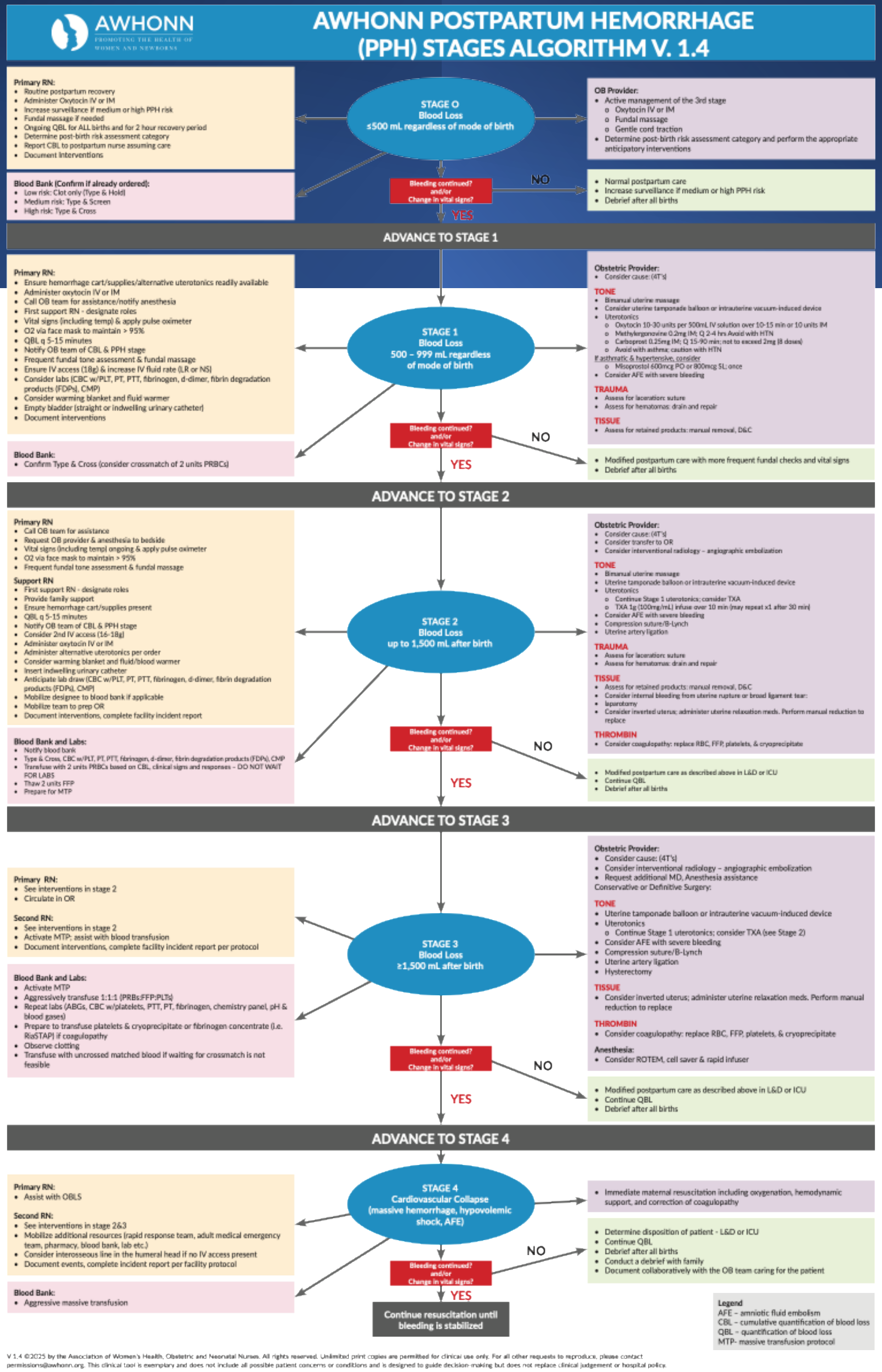


Minute ventilation = respiratory rate (RR) × tidal volume (V_T)

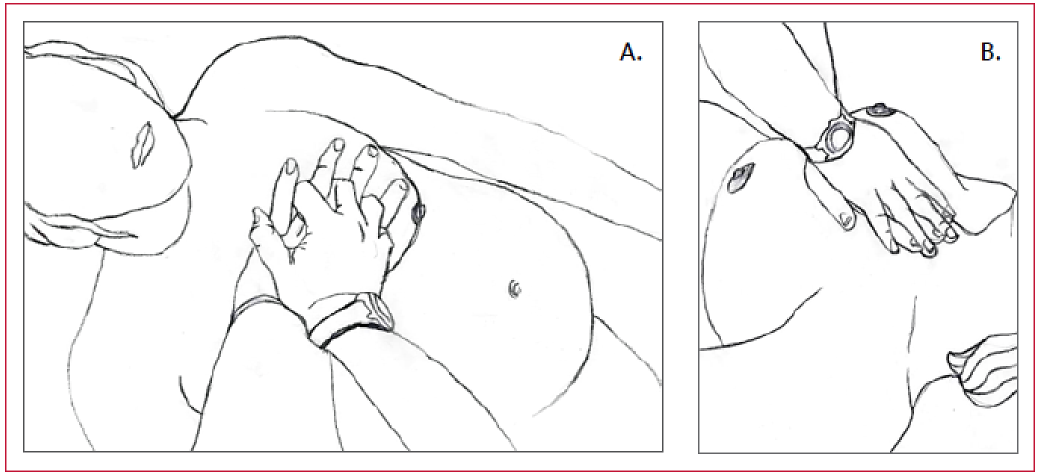
Normal Vital Signs per Stage of Pregnancy

	First Trimester	Second Trimester	Third Trimester	Postpartum ≤14 days	Postpartum >14 days
Systolic blood pressure (mmHg)	95 - 138	96 - 136	102 - 144	79 - 121	90 - 120
Diastolic blood pressure (mmHg)	56 - 87	57 - 87	62 - 95	61 - 94	60 - 80
Pulse	63 – 105	67 - 113	65 - 114	59 – 110	60 - 100
Respirations	8 - 24	8 - 24	8 - 24	10 – 22	12 - 20
Oxygen Saturation (%)	94 - 99	93 - 99	93 - 99	93 – 98	95 - 100

AWHONN PPH Stages



Maternal Cardiac Arrest Procedures

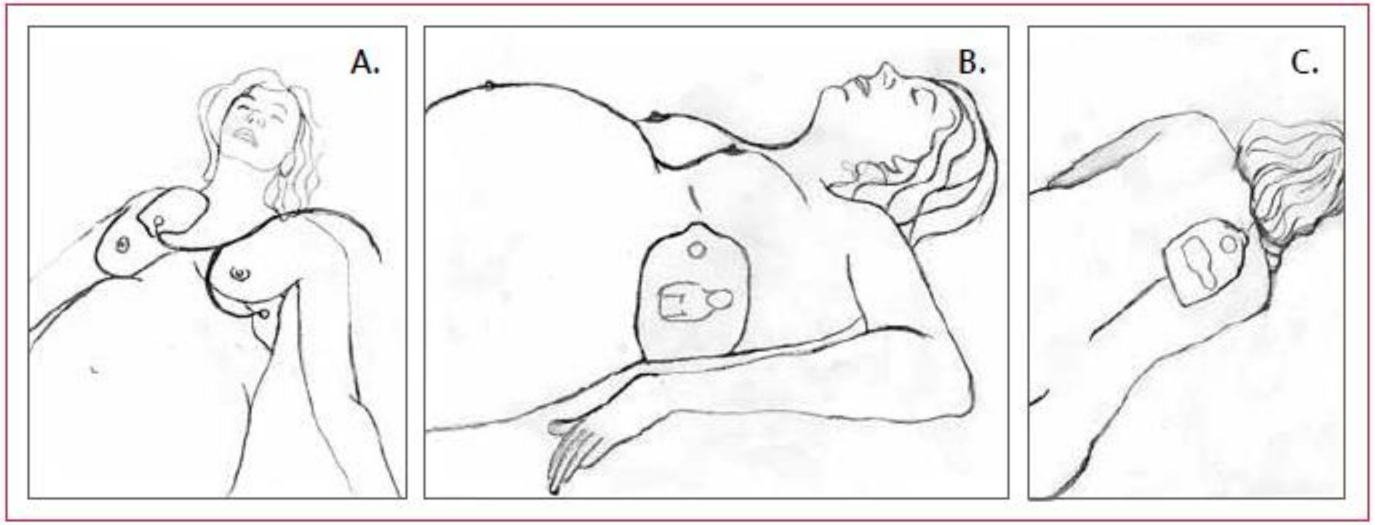


A. Proper hand placement in a pregnant patient
B. If breast tissue is in the way, as can occur with large, pendulous breasts, slightly rotate hand position to a more vertical position towards the patient's head to allow the proper delivery of downward force.

KEY POINTS OF HIGH-QUALITY CPR

- ◊ Effective chest compressions of 100-120/minute, with chest compression of 2 inches or 1/3 of chest depth with full recoil of the chest.
- ◊ Minimize interruptions in chest compressions. Pulse and rhythm checks should be < 10 seconds and performed every 2 minutes.
- ◊ Switch CPR compressors at least every 2 minutes to avoid fatigue.
- ◊ Avoid over-ventilating a patient. Focus one breath every 5-6 seconds; alternatively, a 30:2 compression/respiratory ratio is acceptable. Prompt defibrillation of a shockable rhythm can be life-saving and should be administered as soon as feasible.

Maternal Cardiac Arrest Procedures



A. Right anterior position B. Left anterolateral position C. Posterior position

*Posterior pad placement is not recommended in patients with suspected spinal cord injury, to limit movement and potential further injury

Use hands to pull the uterus up and over towards the maternal right to lift the uterus off the great vessels.

Maternal Cardiac Arrest Etiologies

BAACC	**B**leeding **A**nesthesia **A**FE **C**ardiovascular/cardiomyopathy **C**lot/cerebrovascular
TO	**T**rauma **O**verdose (magnesium sulfate/opioids/other)
LIFE	**L**ung injury/ARDS **I**ons (glucose/K+) **F**ever (sepsis) **E**mergency hypertension/eclampsia

Maternal Cardiac Arrest Interventions

- Medications are the same as ACLS, with possible exception of fibrinolytics
- Early Advanced Airway – do not stop CPR
- End-tidal capnography
  - (P)ETCO2 or waveform capnography should be >10mmHg with CPR
  - If (P)ETCO2 is <10mmHg, CHANGE something, ROSC at 35-40 mmHg

Maternal Cardiac Arrest Interventions

- Resuscitative Cesarean Delivery (RCD) is a resuscitative maneuver
  – ideally start at 4 minutes, complete by 5 minutes
- DO NOT "Stay and play" in field – she needs to get to a facility ASAP with a surgeon who can perform an RCD
  - STROKE, STEMI, ***MAMA***, TRAUMA
- Do not stop CPR

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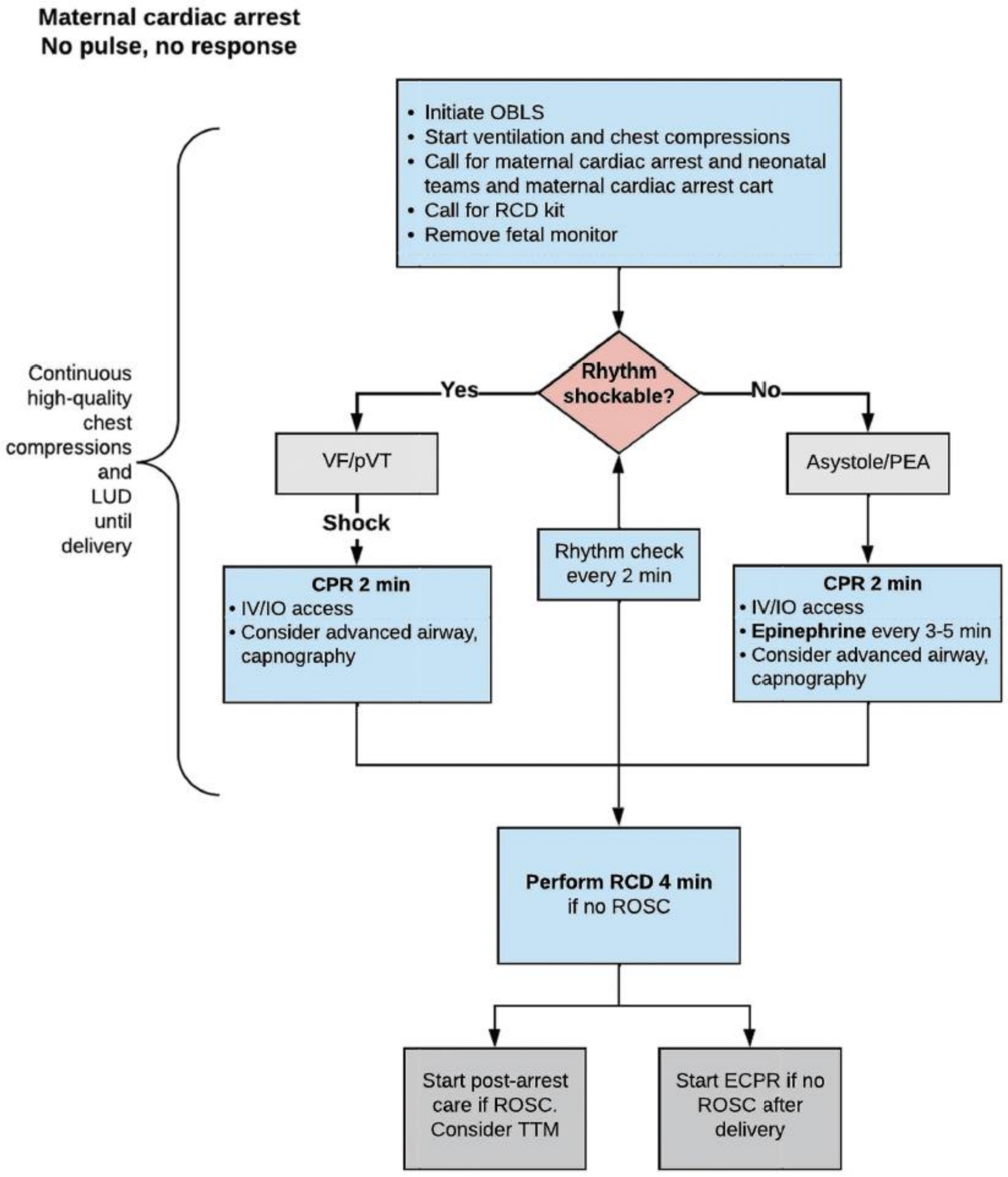
Pregnant Female
No pulse, no response

- Known pregnancy
- Fundus ≥ umbilicus
- In-hospital

Abbreviations

CPR - cardiopulmonary resuscitation
ECPR - extracorporeal cardiopulmonary resuscitation
IO - intraosseous
IV - intravenous
LUD - left uterine displacement
OBLS - Obstetric Life Support
PEA - pulseless electrical activity
pVT - ventricular tachycardia
RCD - resuscitative cesarean delivery
ROSC - return of spontaneous circulation
TTM - targeted temperature management
VF - ventricular fibrillation

B	Bleeding
A	Anesthesia
A	Amniotic fluid embolism
C	Cardiovascular/cardiomyopathy
C	Clot/cerebrovascular
T	Trauma
O	Overdose (magnesium sulfate/opioids/other)
L	Lung injury/Acute respiratory distress syndrome
I	Ions (glucose/K+)
F	Fever (sepsis)
E	Emergency hypertension/eclampsia



Unconscious female, reproductive age

No pulse, no or agonal breathing

OBSTETRIC LIFE SUPPORT

Unconscious female, reproductive age.
No pulse, no or agonal breathing
OBLS should be done simultaneously with ongoing, high-quality CPR

Abbreviations
ALS - Advanced Life Support
BDP - biparietal diameter
CPR - cardiopulmonary resuscitation
EGA - estimated gestational age
FL - femur length
LUD - left uterine displacement
OBLS - Obstetric Life Support
POC-US - point-of-care ultrasound
RCD - resuscitative cesarean delivery
ROSC - return of spontaneous circulation

B	- **B**leeding
A	- **A**nesthesia
A	- **A**mniotic fluid embolism
C	- **C**ardiovascular/cardiomyopathy
C	- **C**lot/cerebrovascular
T	- **T**rauma
O	- **O**verdose (magnesium sulfate/opioids/other)
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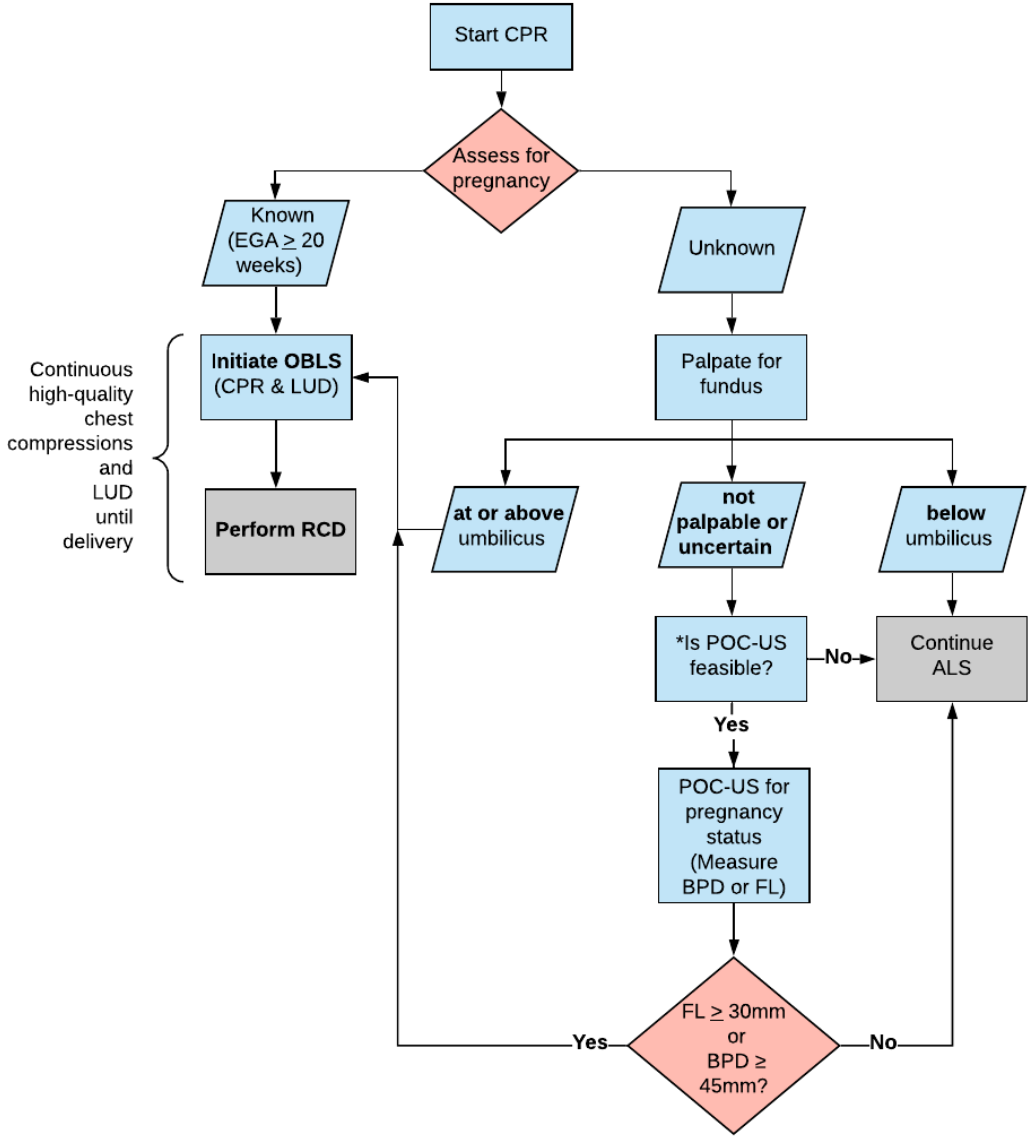
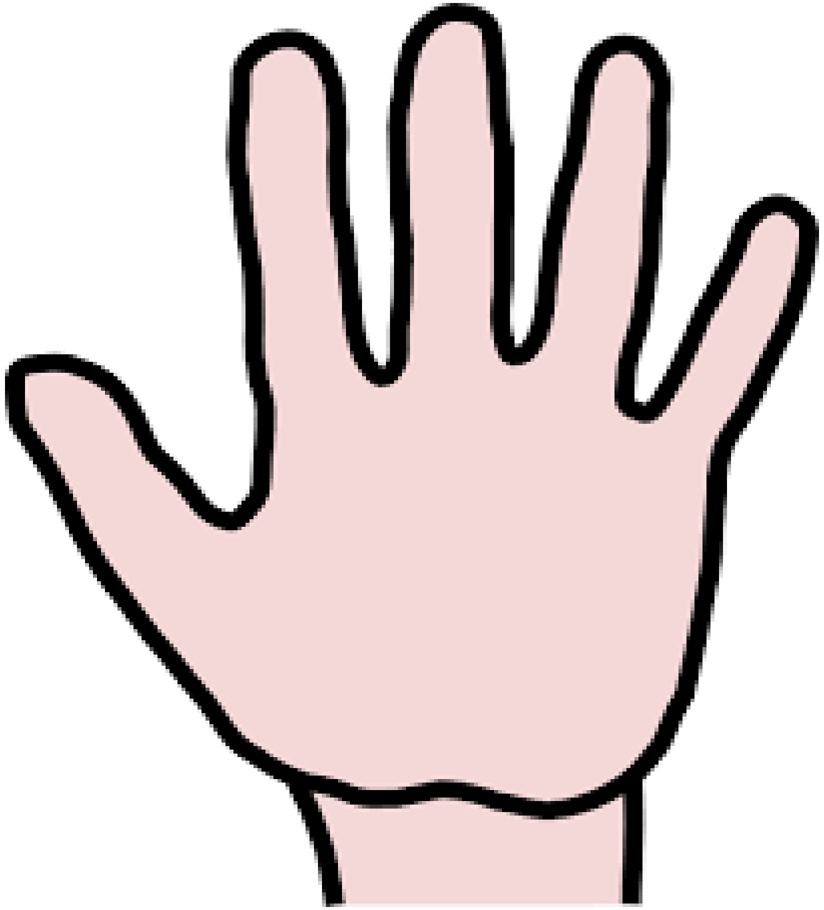


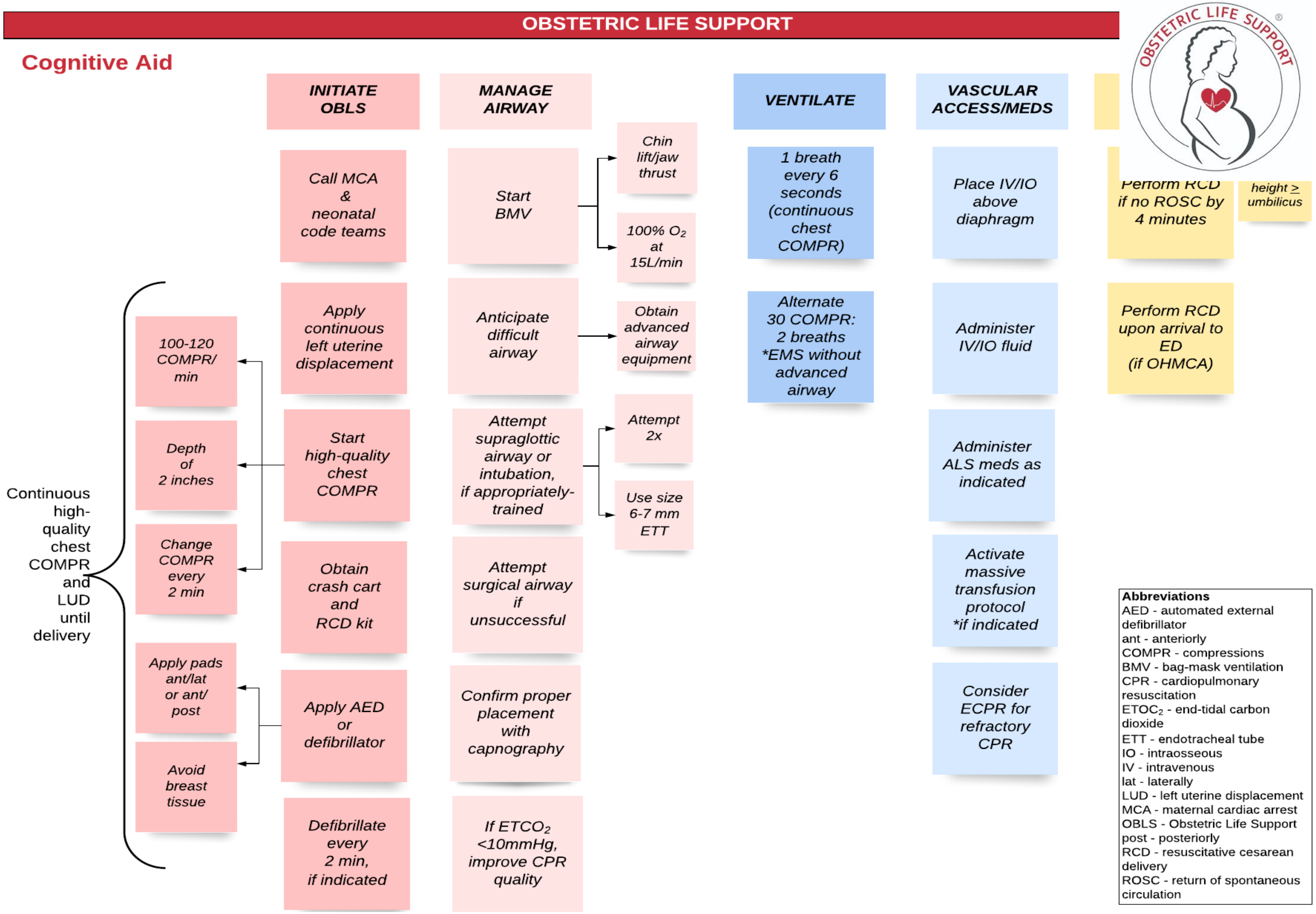
Maternal Cardiac Arrest ALIVE @ 5

Coding the Pregnant Patient

- **A**ctivate OBLS
- **L**eft uterine displacement
- **I**V placement above diaphragm/**I**ntubate early
- **V**erify gestational age and equipment
- **E**xtract fetus and placenta at 4 minutes



Cognitive Aid



ACOG Hypertensive Emergency in Pregnancy

SBP 140–159 or DBP 90–109 mm Hg: Abnormal, possible preeclampsia

SBP 140–159 or DBP 90–109 mm Hg with ANY of the following: severe headache, blurred vision, or right upper quadrant or epigastric abdominal pain: Abnormal, preeclampsia with severe features

- Requires treatment with **MAGNESIUM SULFATE**

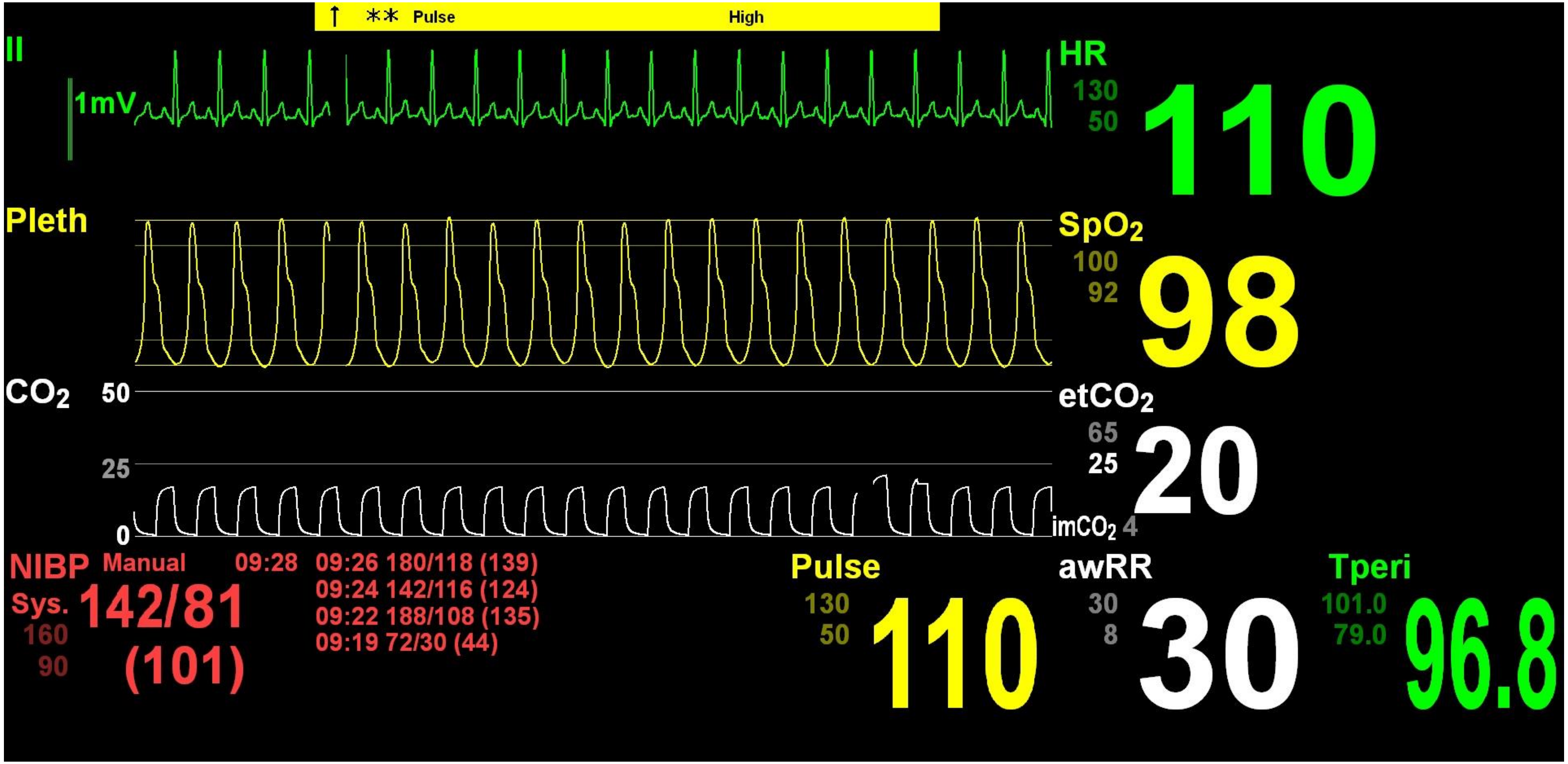
SBP ≥ 160 or DBP ≥ 110 mm Hg: Abnormal, preeclampsia with severe features, even without other symptoms

- Requires treatment with **ANTIHYPERTENSIVES AND MAGNESIUM SULFATE**

Scenario 3, Part 1 - Background

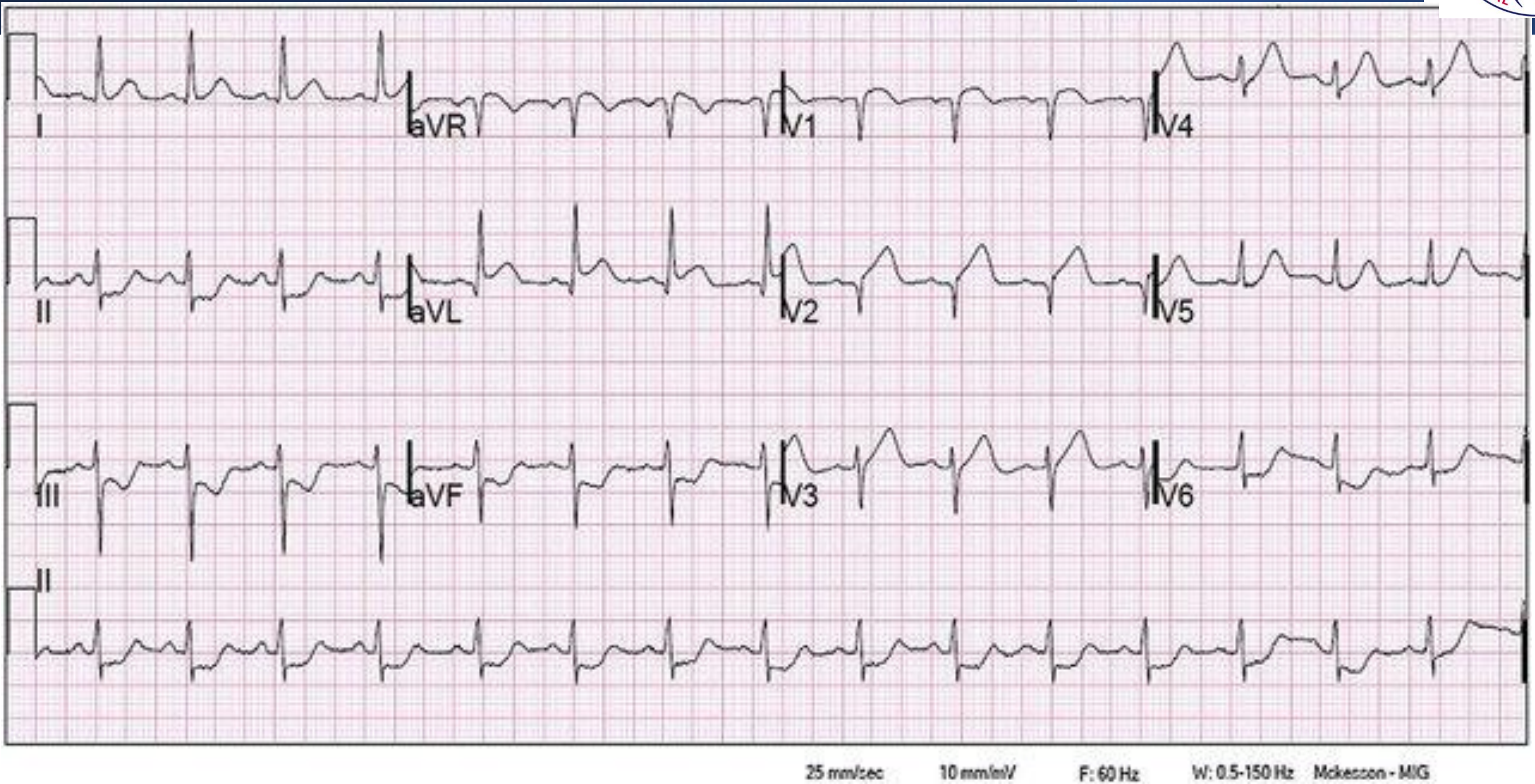
- A 40 year old female G4P4 is 4 months postpartum and called 911 with severe chest pain. She says she has been very fatigued with shortness of breath which she attributes to losing sleep due to breastfeeding her infant. She has been sleeping on the recliner as she cannot lay flat. She stared having bad heartburn 30 minutes ago, now feels like someone is sitting on her chest and the pain is radiating into her jaw and down her left arm. EMS arrives on scene and the patient is sitting on the floor clutching her chest and asking for pain relief. On exam, she has a loud systolic murmur with bilateral crackles and distended neck veins. The first set of vital signs are:

Scenario 3 Part 1 – Vital signs



- BP 142/81
- Pulse 110
- RR 30
- O2 sat 98% on room air
- ETCO2=20

Scenario 3 Part 1 – EKG



Scenario 3, Part 1 – Postpartum Screen

Ask your patient:

"Are you pregnant or have you been pregnant in the last 12 months?"

If yes, symptoms may be related to pregnancy and can occur up to 12 months postpartum.

CVD can happen in this patient group regardless of age. Don't ignore red flags!

Scenario 3, Part 1 Answers

	First Trimester	Second Trimester	Third Trimester	Postpartum ≤14 days	Postpartum >14 days
Systolic blood pressure (mmHg)	95 - 138	96 - 136	102 - 144	79 - 121	90 - 120
Diastolic blood pressure (mmHg)	56 - 87	57 - 87	62 - 95	61 - 94	60 - 80
Pulse	63 – 105	67 - 113	65 - 114	59 – 110	60 - 100
Respirations	8 - 24	8 - 24	8 - 24	10 – 22	12 - 20
Oxygen Saturation (%)	94 - 99	93 - 99	93 - 99	93 – 98	95 - 100

What vital signs/physical exam findings are concerning and why?

- BP is mild-range (140/80)
- Mild tachycardia (110 bpm)
- Tachypnea (30 breaths/min) which may be due to pain
- Low end tidal CO2 (18)

Scenario 3, Part 1 Answers

What are cardiac red flags in this scenario?

- Shortness of breath at rest
- Chest pain at rest
- Severe orthopnea
- Resting RR >= 25
- Loud systolic murmur
- Bilateral crackles
- Distended neck veins

Scenario 3, Part 1 Answers

Based on her clinical findings, what are the potential etiologies?

- AMI including SCAD
- Peripartum cardiomyopathy
- Congestive heart failure
- Arrythmia
- Aortic dissection
- PE

Scenario 3, Part 1 Answers

What are the initial steps to take in this scenario:

- Perform initial assessment and anticipate providing treatments for severe-range BP and chest pain
- Place 2 large bore IVs
- Obtain ECG (show ECG of AMI)

Red Flags for Cardiovascular Disease

- Shortness of breath at rest
- Chest pain at rest, with minimal exertion or ripping/tearing in quality
- Palpitations associated with near syncope
- Severe orthopnea
- Resting HR ≥ 120 bpm
- Resting systolic BP ≥ 160 or < 90
- Resting RR ≥ 25
- Oxygen saturation ≤ 94%, with or without personal history of CVD
- Loud systolic murmur, diastolic murmur, S3, or S4
- Wheezing, crackles on lung exam
- Distended neck veins

Consider in your differential diagnosis:

Myocardial infarction (including spontaneous coronary artery dissection), peripartum cardiomyopathy, congestive heart failure, arrhythmia, aortic dissection

Key Work-up

- EKG
- Obtain BNP and troponin, if available
- Obtain chest X-ray, if available, and if it can be interpreted immediately either by the ordering clinician or by on-demand radiology

Management While Awaiting Transport:

- Transport patient to a facility with obstetric capabilities, if available, for further evaluation.
- While awaiting transport, evaluate and treat similarly to patient who is not pregnant or postpartum.
- Do not send patient home!

Other Signs and Symptoms

may be vague but can include:

Chief Complaints

- Dyspnea
- Edema
- Cough
- Change in exercise tolerance
- Paroxysmal nocturnal dyspnea (PND)

Physical exam findings

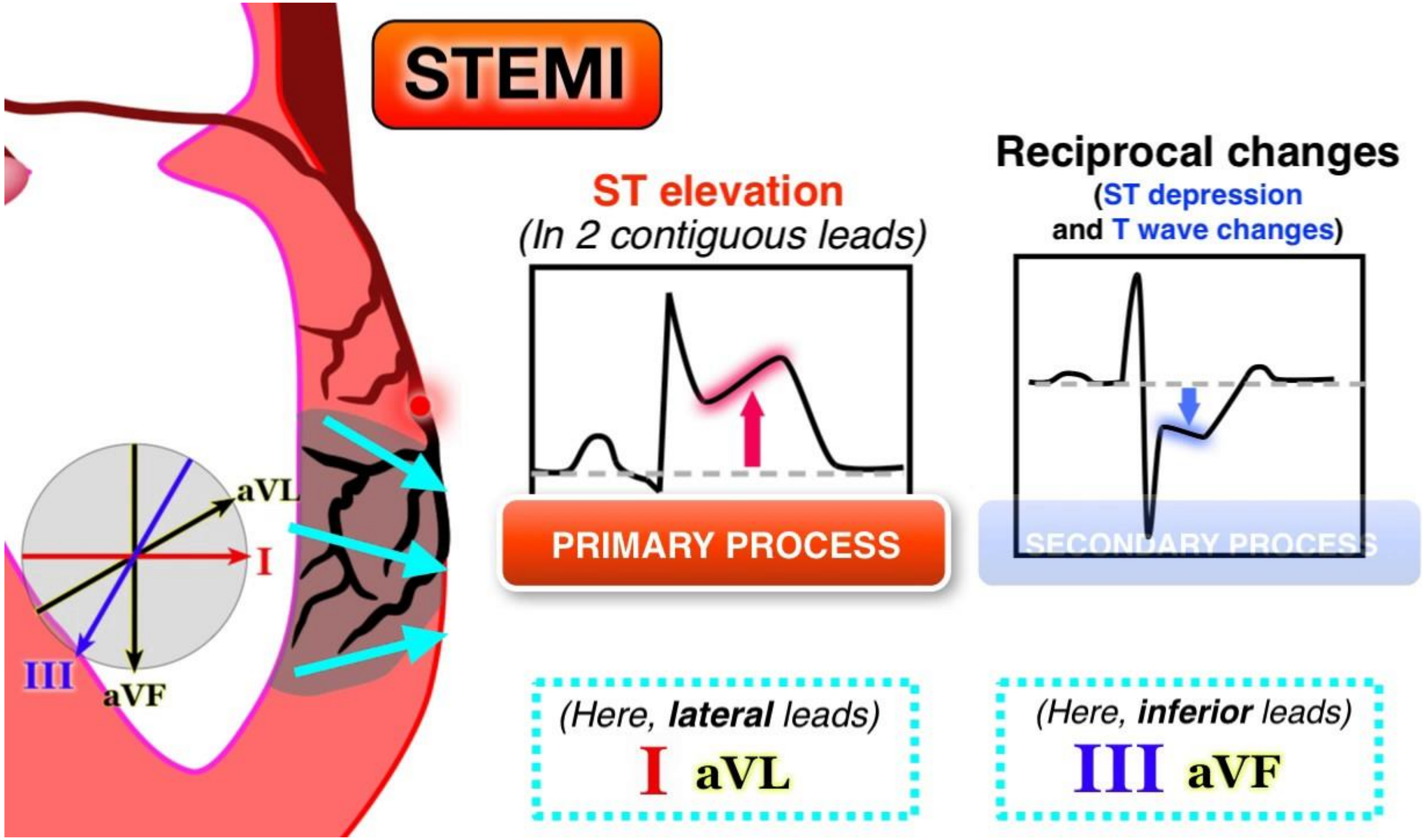
- Desaturation with ambulation
- Murmur
- Peripheral edema

Scenario 3, Part 1 Answers

What does EKG demonstrate.

- STEMI

Evaluating for STEMI on EKG



Scenario 3, Part 1 Answers

What are the next steps in her management?

- Administer THROMBINS II

  -fentanyl preferred, morphine okay

  -aspirin 325 mg, chewed

  -oxygen to maintain saturations > 94%

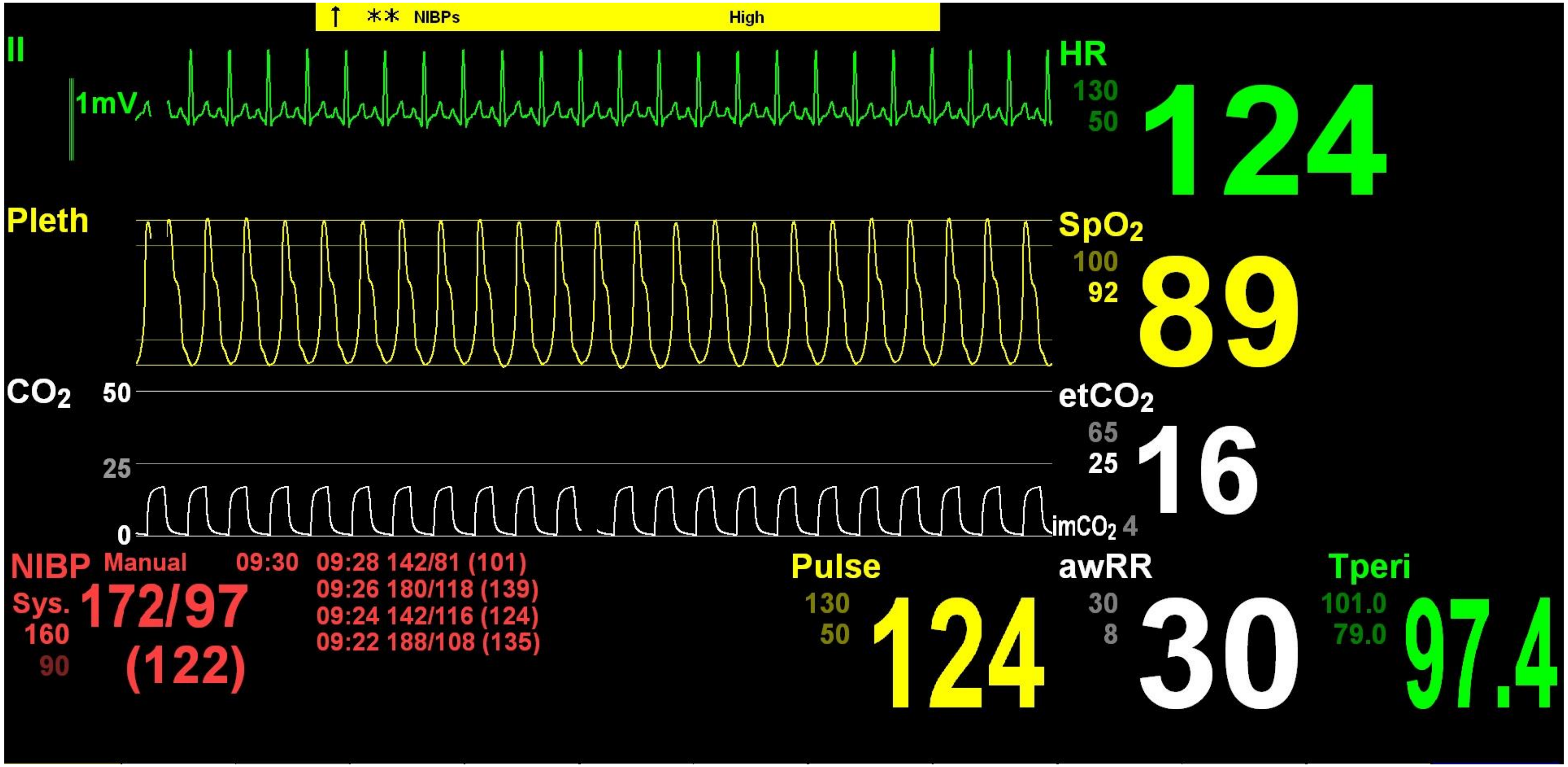
  -nitroglycerin (not with inferior MI)

  -beta blocker, within 24 hours of MI if there is not evidence of heart failure, shock or heart block

Scenario 3, Part 2 - Background

- You are en-route with her to the hospital which is 20 minutes away. She has 2 large bore IVs to keep open and is on 15L of O2 via rebreather. ECG is performed and transmitted. These are her vital signs:

Scenario 3 Part 2 – Vital signs



- BP 172/97
- Pulse 124
- RR 30
- O2 sat 89%
- ETCO2=16

Scenario 3, Part 2 – Questions (3 minutes)

- **What vital signs are concerning?**
- **What are the potential reasons for her increasing oxygen requirement?**
- **What are the next steps in her management?**

Scenario 3, Part 2 Answers

	First Trimester	Second Trimester	Third Trimester	Postpartum ≤14 days	Postpartum >14 days
Systolic blood pressure (mmHg)	95 - 138	96 - 136	102 - 144	79 - 121	90 - 120
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Pulse	63 – 105	67 - 113	65 - 114	59 – 110	60 - 100
Respirations	8 - 24	8 - 24	8 - 24	10 – 22	12 - 20
Oxygen Saturation (%)	94 - 99	93 - 99	93 - 99	93 – 98	95 - 100

What vital signs/physical exam findings are concerning and why ?

- -BP is severe-range (170/95)
- Tachycardia (125 bpm)
- Tachypnea (30 breaths/min)
- Hypoxia (90%)

Scenario 3, Part 2 Answers

What are the potential reasons for her increasing oxygen requirement?

- Heart failure (peripartum cardiomyopathy) with ARDS
- Pulmonary embolism

Scenario 3, Part 2 Answers

What are the next steps in her management?

- Administer antihypertensive therapy
  - metoprolol or labetalol preferred
- Place on gurney and transport to nearest facility with cardia cath lab