Preeclampsia & Eclampsia:
Hypertensive Disorders of Pregnancy

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Goals and Objectives

1

Define clinical criteria for:

- Gestational hypertension
- Preeclampsia
- Eclampsia
- HELLP syndrome

2

Describe alterations of maternal physiology in preeclampsia

3

Prioritize care of the eclamptic patient during a convulsion

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Hypertensive Disorders of Pregnancy: 4 Classifications

1) Chronic Hypertension
2) Chronic Hypertension + Preeclampsia
3) Gestational Hypertension
4) Preeclampsia
    a) Severe Preeclampsia
        a) Eclampsia
        b) HELLP syndrome

2022 OSDH: 8.8% or 1 in 11 pregnant Oklahomans experienced a hypertensive disorder of pregnancy.

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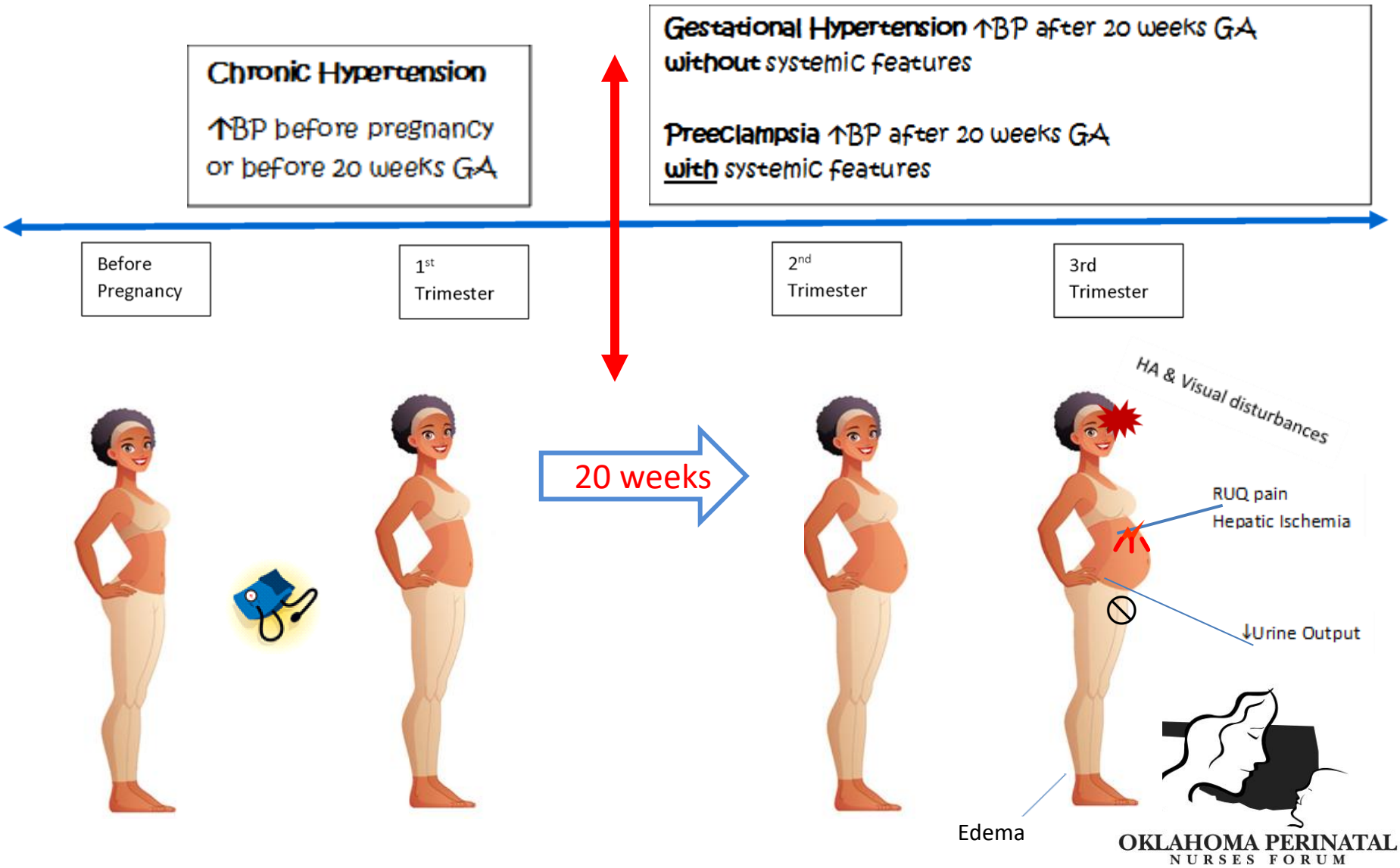
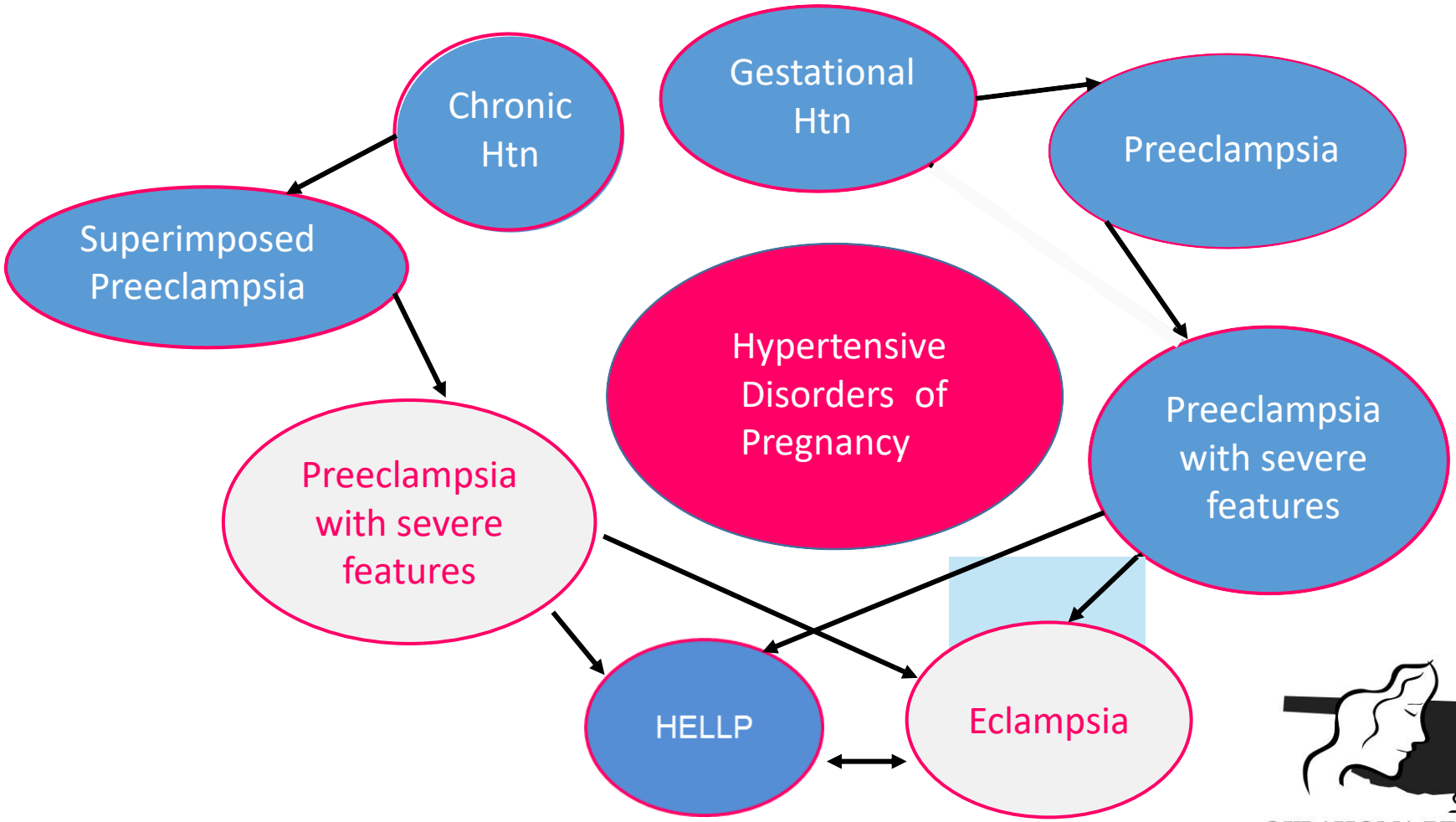
Chronic Hypertension vs. Gestational Hypertension



Spectrum of Hypertensive Disorders of Pregnancy



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Definitions: 140/90 = Hypertension
160/110 = Severe Hypertension

Chronic (preexisting)Hypertension	Gestational Hypertension
• Onset prior to 20th week gestation • May continue through 12 wks PP	• Occurring after 20 weeks gestation in a previously normotensive woman • Resolves by 12 wks PP

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Preeclampsia

Syndrome defined by hypertension & proteinuria
(proteinuria is not a requirement for diagnosis)

- Gestational Hypertension (140/90) + any of the following:
  - Proteinuria
    - ≥ 300mg/24 hr. or
    - Protein/Creatinine ratio ≥ 0.3
    - Dipstick ≥ 2+
  - Cerebral or visual symptoms
  - Epigastric or right upper quadrant pain
  - Oliguria < 500 ml. over 24 hours
  - Thrombocytopenia < 100K plt.
  - Elevated liver enzymes (twice normal)
  - Pulmonary edema
  - New onset headache unresponsive to medications

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Severe Preeclampsia

- Systolic BP ≥160, or diastolic BP ≥110
  - *Elevated SBP is better indicator of stroke than DBP
  - (95.8%) women with systolic BP > 160mm Hg →stroke
  - (12.5%) women with diastolic BP > 110mm Hg →stroke
- Severe headache and vision changes
- Persistent epigastric or right upper quadrant pain
- Oliguria < 500 ml. over 24 hours
- Nausea & vomiting
- Thrombocytopenia
- Elevated liver enzymes (twice normal)
- Development of Eclampsia
- Development of HELLP syndrome
- Pulmonary edema

* Martin JN et al. Stroke and Severe Preeclampsia and Eclampsia: A Paradigm Shift Focusing on Systolic Blood Pressure, Obstet Gynecol 2005

Risk Factors for Preeclampsia

- Nulliparity
- Multifetal gestations
- Preeclampsia in a previous pregnancy
- Chronic hypertension
- Pregestational diabetes
- Gestational diabetes
- Thrombophilia
- Systemic lupus erythematosus
- Prepregnancy body mass index greater than 30
- Maternal age 35 years or older
- Antiphospholipid antibody syndrome
- Kidney disease
- Assisted reproductive technology
- Obstructive sleep apnea

Gestational Hypertension and Preeclampsia: ACOG Practice Bulletin, Number 222. Obstet Gynecol. 2020 Jun;135(6):e237-e260. doi: 10.1097/AOG.0000000000003891. PMID: 32443079.

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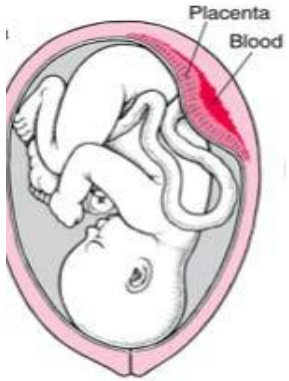
Maternal Complications

- Stroke from cerebral hemorrhage
- Placental abruption
- Eclamptic seizures
- Cerebral Edema
- Liver hematoma/rupture
- Pulmonary edema
- Acute renal failure
- Hemorrhage/DIC
- Cardiomyopathy

Eclamptic Seziure

Cerebral Edema

Placental Abruption



Placental Abruption

Hemorrhage

Pulmonary Edema

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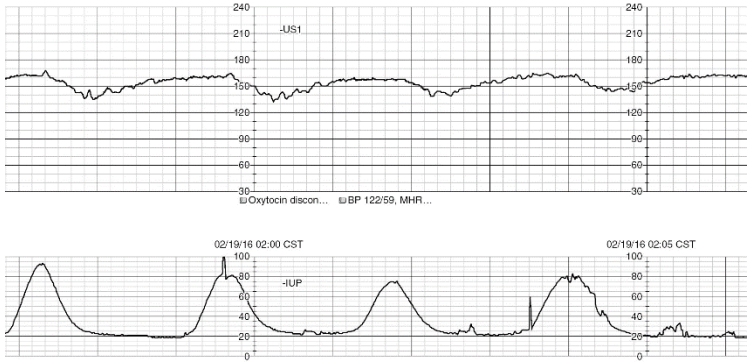
Fetal Complications

- IUGR
- Premature birth
- Fetal intolerance to labor
- Hypoxia
- Death



What is the process behind the disease?

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Pathophysiology

Failure of normal physiologic adaptations to pregnancy

Normal Pregnancy	Preeclampsia
↑ plasma volume	↓ plasma volume
↓ vascular resistance	↑ vascular resistance
↑ renal blood flow	↓ renal blood flow

Probably multiple etiologies cause the syndrome – “Disease of Theories”

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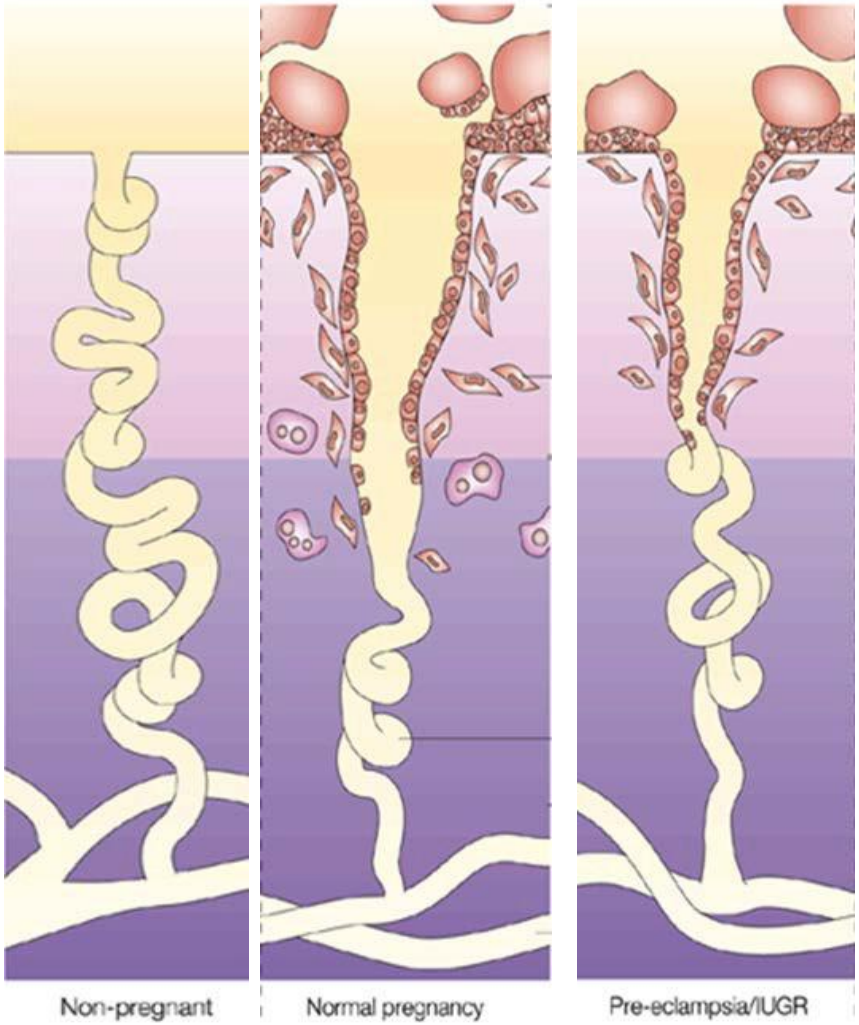

Spiral arteries
Normal pregnancy
Dilates →
increased bloodflow

Spiral arteries
Preeclampsia:
Fibrous→narrow
Less bloodflow

Pathophysiology

- Stage 1: Poor placentation
  - Incomplete invasion of spiral arterioles results in ↓uteroplacental blood flow
- Stage 2: Inflammation
  - The ischemic placenta induces widespread endothelial cell damage and maternal systemic inflammatory response

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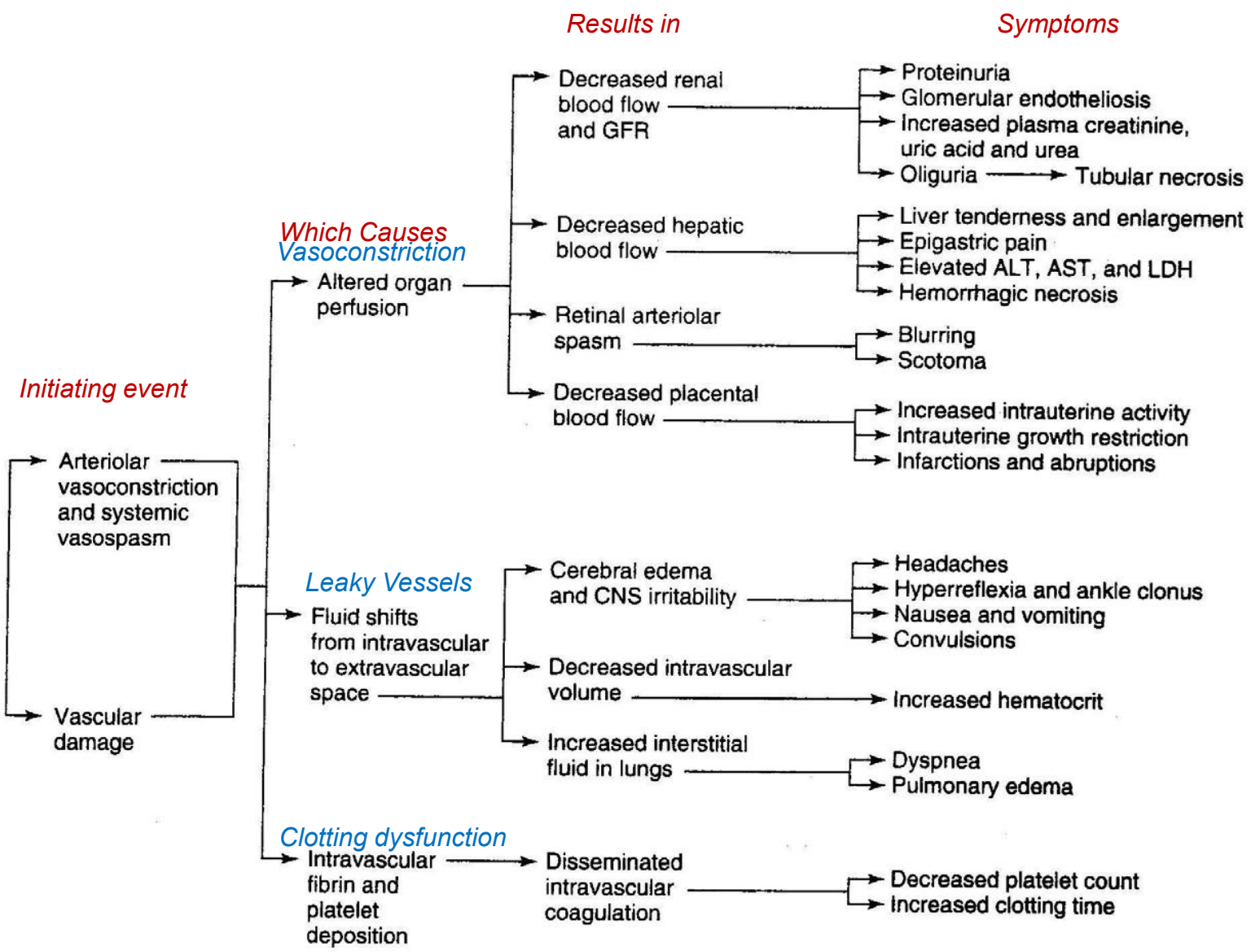
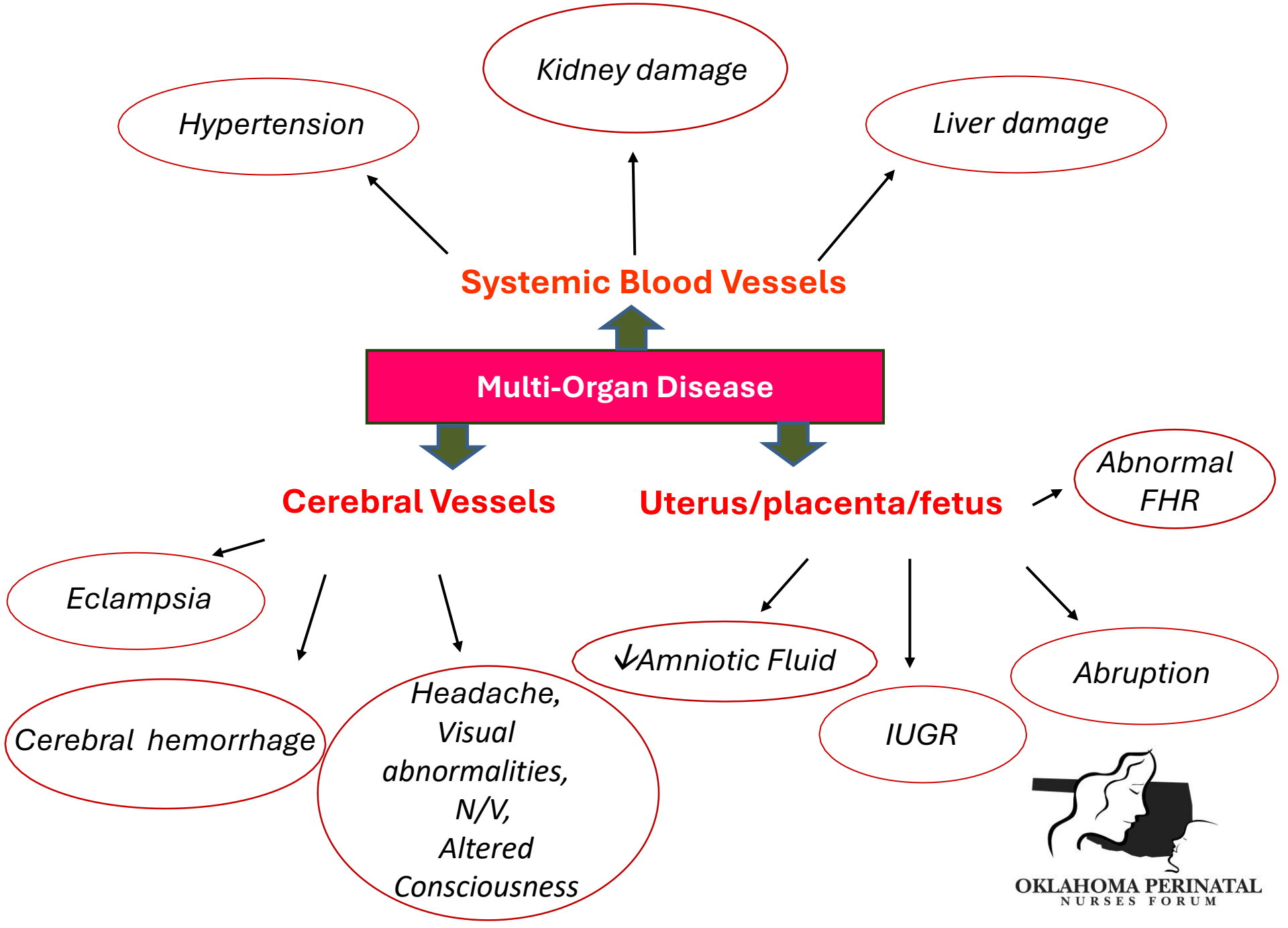
Alteration in Systems Function




Kidney damage
Hypertension
Liver damage
Systemic Blood Vessels
Multi-Organ Disease
Cerebral Vessels
Uterus/placenta/fetus
Abnormal FHR
Eclampsia
↓Amniotic Fluid
Abruption
Cerebral hemorrhage
Headache, Visual abnormalities, N/V, Altered Consciousness
IUGR
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What are best practices to care for these women?

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5 Management Objectives

1. **Recognize the situation (signs & symptoms)**
   2 elevated BP within 15 min. → notify physician
   Initiate anti-hypertensive treatment ASAP

2. **Control BP with antihypertensive agents**
   ↓ Arterial spasm to prevent vascular injury to brain, kidneys, and heart
   Diastolic not below 90: placenta needs adequate profusion

3. **Prevent or control seizure activity**
   Magnesium Sulfate infusion

4. **Delivery of fetus**
   Consider GA and delivery route

5. **Postpartum surveillance**
   3-10 day follow-up in provider office (72 hours)

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Delivery Timing Considerations

37 weeks – deliver

34 weeks – deliver after maternal stabilization AND

- Antenatal steroids –Betamethasone
- Deliver in 48 hours

Deliver as soon as maternal stabilization with following complications:

- Concerning FHR pattern, poor Doppler studies…
- Abruption
- Pulmonary edema
- Eclampsia –stabilized
- DIC
- Persistent/worsening symptoms

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Medications for Severe Hypertension

Treatment of critically elevated BP with either

- IV labetalol
- IV hydralazine
- Oral nifedipine

⃠Oral labetalol onset is slow and peaks at 1-4 hours. Expected to be less effective.

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Medications for Treatment of HTN

	Initial Dose	2nd dose	3rd dose
Labetolol IV Beta Blocker SE: Lower HR, bronchoconstriction Contraindicated in asthma patients	20mg IVP over 2 min Recheck BP in 10 min	40mg IVP over 2 min Recheck BP in 10 min	80mg IVP over 2 min Recheck BP in 10 min
Hydralazine IV Vasodilator SE: Tachycardia, hypotension, flushing, headache	5-10mg IVP over 2 min Recheck BP in 20 min	10mg IVP over 2 min Recheck BP in 20 min	20mg IVP over 2 min Recheck BP in 20 min
Nifedipine PO Calcium Channel Blocker SE: Hypotension, low HR, dizziness	10mg Immediate release capsule PO Recheck BP in 20min	20mg Immediate release capsule PO Recheck BP in 20min	20mg Immediate release capsule PO Recheck BP in 20min

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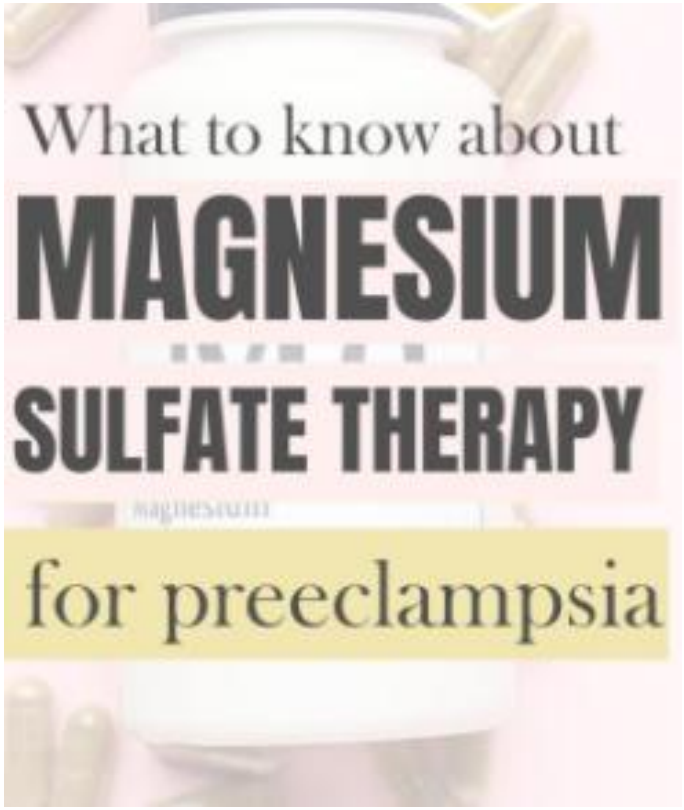
Magnesium Sulfate Therapy

- Use extreme caution when administering drug
  - High alert drug (ISMP)
- Monitor output- renal excretion
- Monitor deep tendon reflexes (DTRs)
- Monitor respirations
- Monitor LOC



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Magnesium Toxicity

- Therapeutic: 4-8mg/dl
- Loss of DTR's: 9-12mg/dl
- Respiratory arrest/muscle paralysis: 12-18mg/dl
- Cardiac arrest: 25-30mg/dl

Renal excretion – beware of DM and other ⬇ renal function.

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Magnesium Toxicity

Antidote

Calcium Gluconate 10%

- 1g/10ml IV over 3 minutes

Airway and ventilatory support as needed

O2 and suction set up and ready

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Management of Preeclampsia

Magnesium Sulfate is drug of choice

- Acts at neuromuscular junction to produce muscular relaxation.
- Small vessel vasodilation.

Loading dose of 4-6g over 15-30 minutes

Followed by maintenance dose of 2-3 g per hour

Magnesium Sulfate is NOT an antihypertensive medication.

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Magnesium Sulfate Therapy

Increases Ca+ excretion

Crosses placenta – be prepared for a lethargic infant – may require resuscitation

Increases possibility of postpartum hemorrhage

- NO Methergine, Cytotec preferable.

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Eclampsia

New onset of convulsions and/or coma in a woman with signs of preeclampsia

50% antepartum	25% intrapartum	25% postpartum

Mechanism: cerebral edema, ischemia, hemorrhage or vasospasm

Complications of Eclampsia

- Placental abruption
- Pulmonary edema
- Aspiration pneumonia
- Cerebral hemorrhage
- Renal tubular necrosis
- Liver rupture
- Retinal detachment
- Dissemination intravascular coagulation (DIC)

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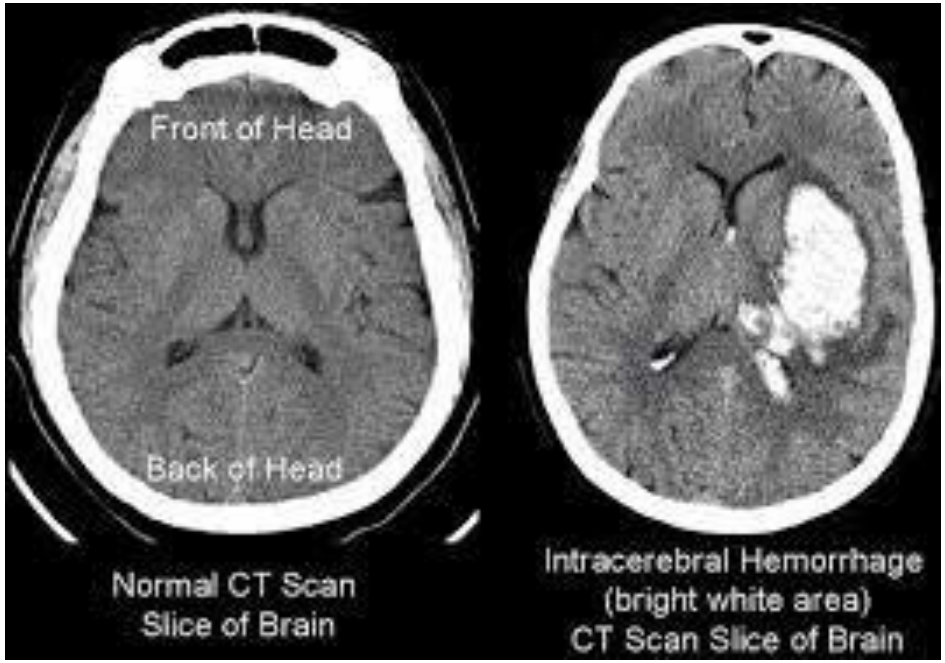
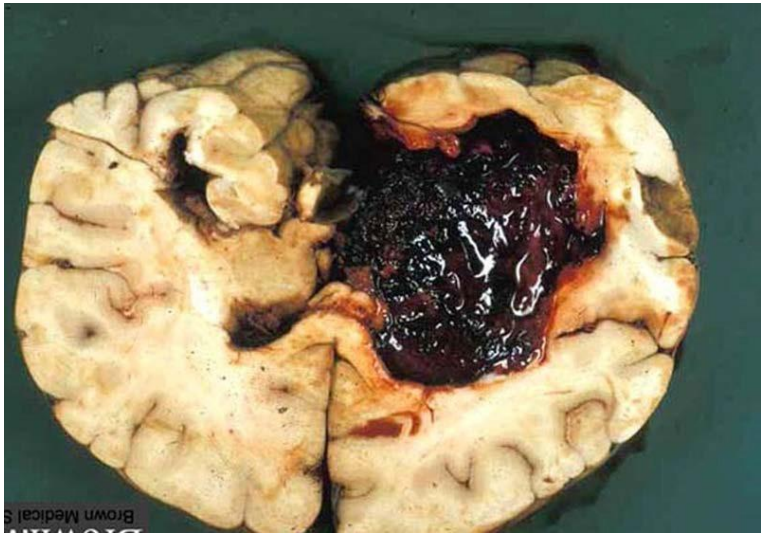
Cerebral Hemorrhage

****Cerebral hemorrhage is a common autopsy finding**





Section of brain at autopsy

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Eclampsia

Indicators of Seizure

- Headache – most common indicator
- Visual disturbances – i.e. seeing spots, loss of vision, etc
- Epigastric Pain – RUQ pain
- NO INDICATORS – just suddenly occurs

Management of Eclamptic Convulsion

Life-threatening emergency requiring *immediate* action

- Prevent injury to woman
- Maintain airway
- Magnesium Sulfate to control convulsion

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Management of Eclamptic Convulsion

Magnesium Sulfate Regimen

4-6g loading dose given over 15 min followed by 2-3g/hr maintenance – onset of action is immediate.

If seizure reoccurs, may administer another 2g over 5 min.

If seizure continues or reoccurs may sedate, intubate and ventilate.

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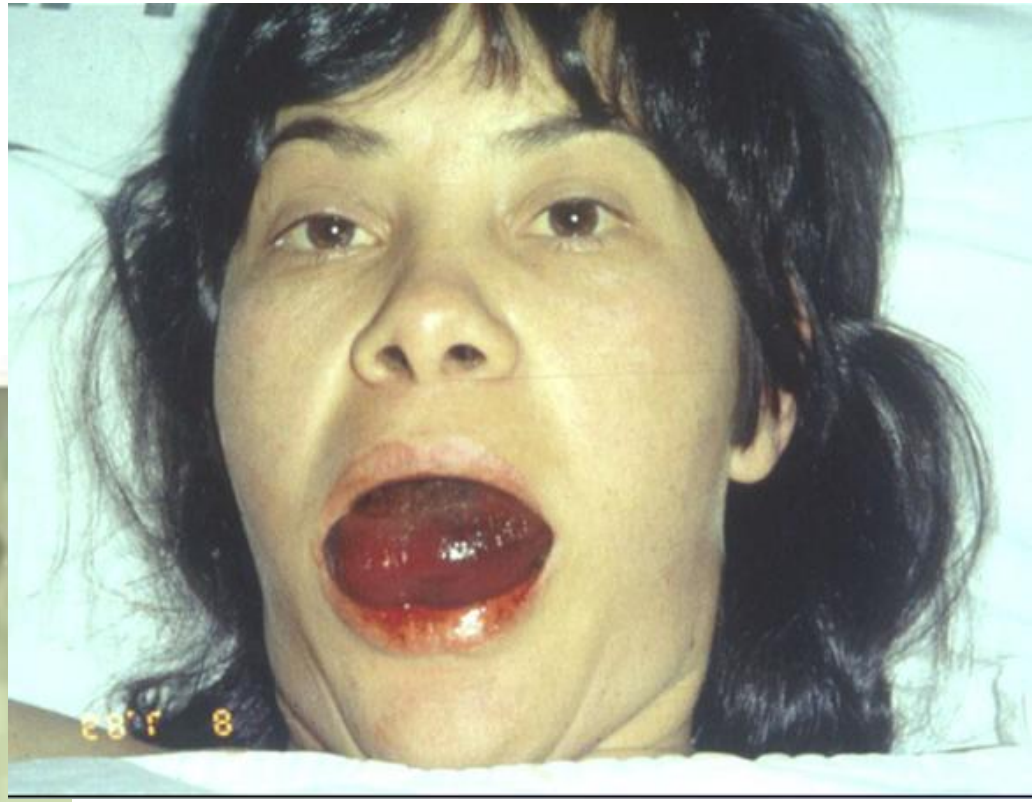
Hematoma following seizure



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Post Seizure Care

Do not leave patient alone

- Maintain quiet environment
- O_2 at 8-10L/min. per mask
- VS Frequently
- Monitor SaO_2 : $\geq$95%

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Post Seizure Care

Maintain magnesium infusion as ordered

Labs and chest x-ray

If undelivered:

- Monitor FHR and uterine activity
- Consider route of delivery

Designate someone to keep family informed

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Post Seizure Care

Observe for signs of:

- Abruption if undelivered
- Pulmonary edema
- Neurologic deterioration
- Oliguria - output < 30cc/hr
- Signs of magnesium toxicity:
- ↓ DTR's, respirations < 12/min.

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Eclampsia – Documentation of Occurrence

Document

- Start time and duration of seizure
- Care provided
- Maternal and fetal responses
- Duration of postictal phase
- Duration of unconsciousness (if unconscious)

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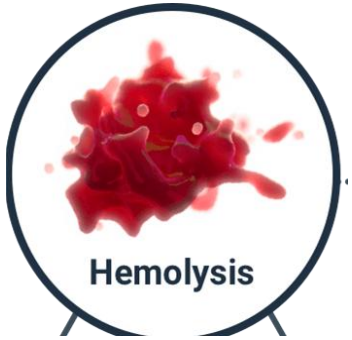
HELLP Syndrome



- **H**emolysis
  - Abnormal peripheral blood smear- schistocytes & burr cells
  - ↑ bilirubin

- **E**levated **L**iver enzymes -2X upper limits of normal
  - LDH > 600 IU/L
  - ALT>70 IU/L

- **L**ow **P**latelets
  - Thrombocytopenia < 100,000mm^3
  - Severe <50,000mm^3

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HELLP Syndrome

- Frequently does not present with classic preeclamptic symptoms of hypertension & proteinuria.
  - Malaise - 90%
  - R ↑ quad. Pain - 65%
  - N/V - 50%
  - Worsening edema
  - Abdominal, flank or shoulder pain
  - Hematuria
  - Hypoglycemia

HELLP Syndrome

May be misdiagnosed as:	Any pregnant woman presenting with these symptoms should have:
• Gall bladder disease • Gastritis • Appendicitis • Pyelonephritis • Acute Fatty Liver of Pregnancy	• CBC with peripheral smear • Liver Function Tests

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Maternal Morbidity and Mortality

- Cardiovascular disease is the most prevalent preventable cause of maternal mortality in developed countries
- In the US, one-third of pregnancy-related deaths are attributed to cardiovascular conditions, and approximately 60% of these deaths are deemed preventable
- Maternal stroke is an infrequent but debilitating complication of pregnancy and it accounts for at least 7.7% of pregnancy-related deaths in the US
- Specific pregnancy-related conditions often trigger maternal stroke, many of which are potentially preventable
- The risk of stroke among pregnant and post-partum women is ~3 times increased compared with non-pregnant women of similar age

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Maternal Stroke

Table 1:

Rates of maternal stroke across different nations

Study	Country	Enrollment period	Pregnant/post-partum women, n	Incidence of maternal stroke (per 100,000)	Mean age of women with stroke, years
Elgendy et al.[16]	USA	2007–2015	37,360,772	45	30
Liu et al.[17]	Canada	2003–2016	3,907,262	13.4	NR
Yoshida et al.[19]	Japan	2012–2013	2,115,949	10.2	32.2
Sharshar et al.[8]	France	1989–1992	669,680	4.6	30.6
Bashiri et al.[20]	Israel	1988–2004	173,803	9.2	35.5
Liang et al.[21]	Taiwan	1992–2004	66,781	47.9	30.1
Prabhu et al.[12]	India	2006–2008	39,211	66	22

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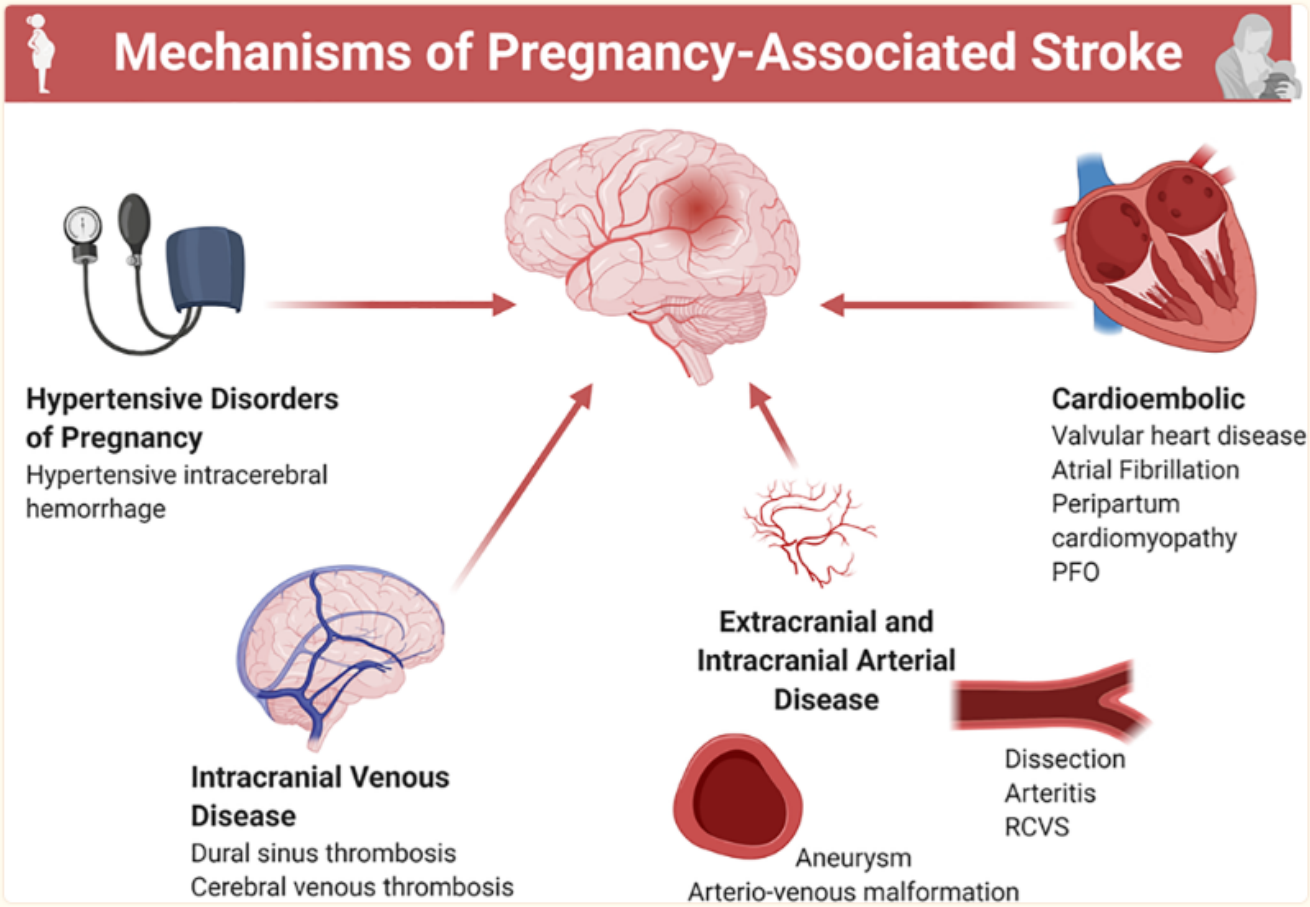

Figure 3:

Potential mechanisms of maternal stroke.

Summary of possible mechanisms of maternal stroke.

PFO= patent foramen ovale; RCVS= reversible cerebral vasoconstriction syndrome

What do the facts tell us about Severe Maternal Morbidity (SMM)?

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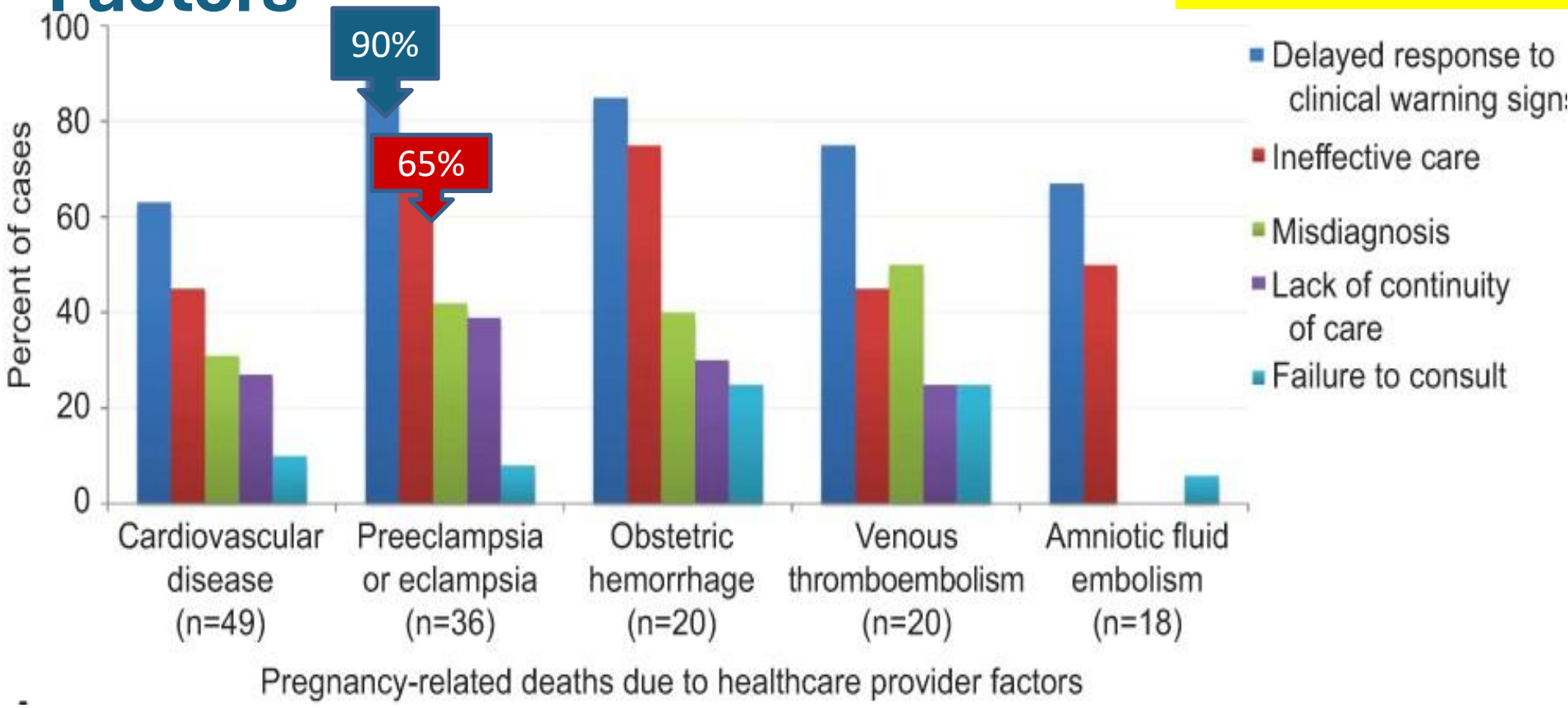
Healthcare Provider Contributing Factors

Highest rates of preventability:
Hemorrhage 70%
Preeclampsia 60%



Health care provider factors were the most common type of contributor identified for all five leading causes of death and were particularly common for preeclampsia and hemorrhage, consistent with their higher degree of preventability.
The most common health care provider factor was delayed response to clinical warning signs followed by ineffective care.

Main et al.2015. Pregnancy-related Mortality in California
Obstetrics & Gynecology

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Poor Management Outcomes

Maternal Death → 32.9:100,000 or aprox. 700/yr.

↑

Near Misses: → 50-100X death rate (50-60K/yr)

↑

(Serious Complications)

"The best way to diagnose preeclampsia is to listen to your patients." ~ Dr. Baha Sibai

Most Common Preventable Errors

See It!

Preeclampsia related

- Failure to adequately control blood pressure in hypertensive women

Believe It!

- Failure to adequately diagnose and treat pulmonary edema in women with preeclampsia

Treat It!

- Failure to pay attention to vital signs following birth

- Hemorrhage following cesarean birth

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The Joint Commission Sentinel Event Alert

Knowledge is Power:

OB Emergencies in the ED

Hear Her Campaign:

https://youtu.be/tXBfzmgJFCU

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Solutions to Reduce the Impact of Maternal Hypertension

Table 4:

Call for action- Clinical practice and healthcare settings

1. Improved prenatal patient education of cardiovascular risk factors, symptoms of cardiovascular complications of pregnancy, and the importance of long-term preventative care among reproductive age women.
2. Implementation of multidisciplinary healthcare team education and maternal stroke toolkits to improve recognition of cardiovascular complications and standardization of maternal healthcare delivery.
3. Reduction of socioeconomic disparities in maternal cardiovascular outcomes, through increased access to healthcare coverage for pregnant and postpartum women, increased access to maternal healthcare in rural areas, and efforts to address systemic racism.
4. Targeted efforts to reduce knowledge gaps in maternal cardiovascular health, through increased funding for maternal cardiovascular research and increased inclusion of pregnant and postpartum women in clinical trials.

Discharge Planning/ Teaching

Why should you care?

What should you pay attention to?

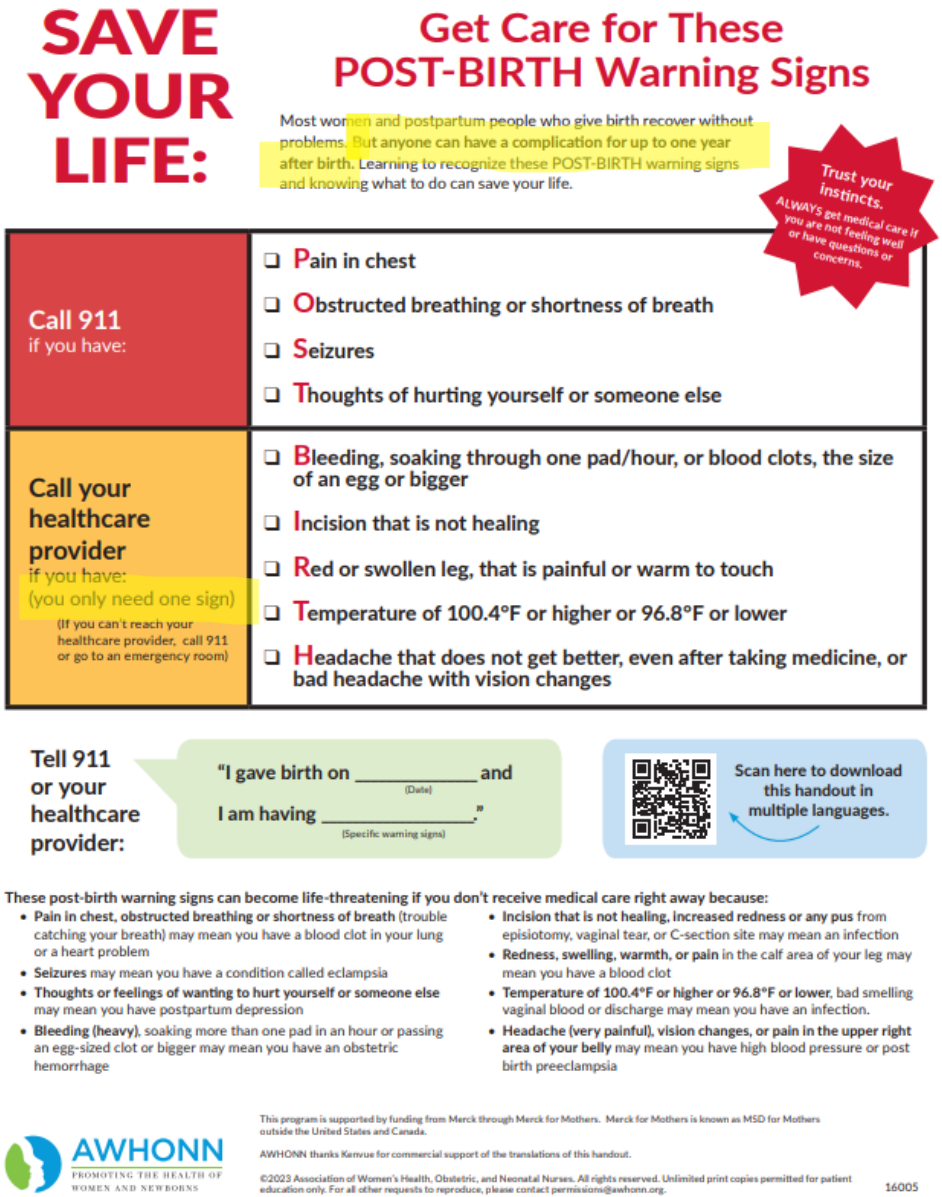
- Any patient treated for hypertension or preeclampsia **f/u in 3-7 days**
- *Delivery is not a cure*- Preeclampsia can occur up to 6 weeks PP
- Teach symptoms of Preeclampsia to **all patients**

What you should you do if you have any signs

Preeclampsia Foundation

AWHONN Post-Birth Warning Signs Handouts

[POST-BIRTH Warning Signs Education Program - AWHONN]



SAVE YOUR LIFE:

Get Care for These POST-BIRTH Warning Signs

Most women and postpartum people who give birth recover without problems. But anyone can have a complication for up to one year after birth. Learning to recognize these POST-BIRTH warning signs and knowing what to do can save your life.

Trust your instincts. ALWAYS get medical care if you are not feeling well or have questions or concerns.

Call 911 if you have:

- ❑ Pain in chest
- ❑ Obstructed breathing or shortness of breath
- ❑ Seizures
- ❑ Thoughts of hurting yourself or someone else

Call your healthcare provider if you have: (you only need one sign)

(If you can't reach your healthcare provider, call 911 or go to an emergency room)

- ❑ Bleeding, soaking through one pad/hour, or blood clots, the size of an egg or bigger
- ❑ Incision that is not healing
- ❑ Red or swollen leg, that is painful or warm to touch
- ❑ Temperature of 100.4°F or higher or 96.8°F or lower
- ❑ Headache that does not get better, even after taking medicine, or bad headache with vision changes

Tell 911 or your healthcare provider:

"I gave birth on _____ (Date) and I am having _____ (Specific warning signs)."

Scan here to download this handout in multiple languages.

These post-birth warning signs can become life-threatening if you don't receive medical care right away because:

- **Pain in chest, obstructed breathing or shortness of breath** (trouble catching your breath) may mean you have a blood clot in your lung or a heart problem
- **Seizures** may mean you have a condition called eclampsia
- **Thoughts or feelings of wanting to hurt yourself or someone else** may mean you have postpartum depression
- **Bleeding (heavy)**, soaking more than one pad in an hour or passing an egg-sized clot or bigger may mean you have an obstetric hemorrhage
- **Incision that is not healing, increased redness or any pus** from episiotomy, vaginal tear, or C-section site may mean an infection
- **Redness, swelling, warmth, or pain** in the calf area of your leg may mean you have a blood clot
- **Temperature of 100.4°F or higher or 96.8°F or lower**, bad smelling vaginal blood or discharge may mean you have an infection.
- **Headache (very painful), vision changes, or pain in the upper right area of your belly** may mean you have high blood pressure or post birth preeclampsia

AWHONN
PROMOTING THE HEALTH OF WOMEN AND NEWBORNS

This program is supported by funding from Merck through Merck for Mothers. Merck for Mothers is known as MSD for Mothers outside the United States and Canada.

AWHONN thanks Kenvue for commercial support of the translations of this handout.

16005

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Prognosis and Long Term Effects of Eclampsia

Women with severe preeclampsia ↑ risk of developing cardiovascular disease later in life

Hypertension, Ischemic heart disease, stroke, dementia

Many women are not aware of the long-term complications associated with preeclampsia

Preeclampsia with preterm delivery is a strong risk factor for CV disease (AHA)

Conclusion of all is that pregnancy may be a screening test for chronic hypertension and CV disease

Long Term Maternal Outcomes

- Chronic hypertension (4 fold)
- Ischemic heart disease (2 fold)
- Stroke (2 fold)
- Venous thromboembolism (2 fold)
- All-cause mortality (1.5 fold)
- Recurrent preeclampsia

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Prevention of Preeclampsia

ACOG recommends the use of low-dose aspirin (81 mg/day), initiated between 12 and 28 weeks of gestation, for the prevention of preeclampsia in individuals with 1 high-risk factor, or 2 or more moderate-risk factors.

TABLE 2

Risk factors and recommendations for preeclampsia[6]

Risk level[a]	Risk factors	Recommendation
High[b]	History of preeclampsia, especially when accompanied by an adverse outcome Multifetal gestation Chronic hypertension Pregestational type 1 or 2 diabetes Kidney disease Autoimmune disease (ie, systemic lupus erythematosus, antiphospholipid syndrome) Combinations of multiple moderate risk factors	Recommend low-dose aspirin if the patient has ≥ 1 of these risk factors.
Moderate[c]	Nulliparity Obesity (ie, body mass index > 30) Family history of preeclampsia (ie, mother or sister) Black individuals (due to social rather than biological factors)[d] Lower income[d] Age ≥ 35 y Personal pregnancy factors (eg, infant of low birth weight or small for gestational age, previous adverse pregnancy outcome, > 10-year pregnancy interval) In vitro conception	Recommend low-dose aspirin if the patient has ≥ 2 moderate risk factors. Consider low-dose aspirin if the patient has 1 of these risk factors.[d]
Low	Previous uncomplicated full-term delivery	Do not recommend low-dose aspirin.

[a] Includes only risk factors that can be obtained from the patient's medical history.

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Case Review:
What would you do?

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24 yo G1P0 at 34 weeks

- Presented to hospital at 2300
- Reports decreased fetal movement and headache
- BP 165/105 Right Arm
- No proteinuria
- Patient to left side
- Reactive NST
- BP now 150/100
- Given Vicodin for HA… HA improved
- DC home

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24 yo G1P0 at 34 weeks

- Presented to hospital at 2300
- Reports decreased fetal movement and headache
- BP 165/105 — BP not treated
- No proteinuria — Not diagnosed with preeclampsia (unaware of updated guidelines)
- Patient to left side — Inappropriate BP assessment
- Reactive NST
- BP now 155/100
- Given Vicodin for HA … better — Ignored symptoms
- DC home

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24 yo G1P0 at 34.1 weeks

- Presented to hospital with HA at 1400 (15 hrs. later)
- BP 175/105, 2+ protein
- NST NR
- Labs sent: plts=55K, Cr=1.6, AST/ALT=320/150, Fibrinogen=175, INR=1.4
- No BP meds
- Mag started , had seizure mid-dose
- C/S for fetal decelerations
- PP hemorrhage with DIC

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24 yo G1P0 at 34.1 weeks

- Presented to hospital with HA at 1400
- BP 175/105, 2+ protein Diagnosed with preeclampsia
- NST NR
- Labs sent: plts=55K, Cr=1.6, AST/ALT=320/150, Fibrinogen=175, INR=1.4
- No BP meds Diastolic BP < 110 but Systolic BP 175
- Mag started , had seizure mid-dose Too late
- Emergent C/S for fetal decelerations Inicated?
- PP hemorrhage with DIC Preventable

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Thank you

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