Improving Health Care Response to Hypertensive Disorders of Pregnancy

A California Quality Improvement Toolkit
November 2021
Instructions

- You are welcome to use any of the slides provided for educational purposes.
- If you modify or add a slide, please substitute your institutional logo and *do not use* the CMQCC logos.
- We welcome your feedback and recommendations for improving the slide set.
- This deck includes screen captures of sample algorithms, a case study, and additional slides appropriate for use to certain audiences.
This slide set is considered an educational resource but does not define the standard of care in California or elsewhere. Readers are advised to adapt the guidelines and resources based on their local facility’s level of care and patient populations served and are also advised to not rely solely on the guidelines presented here.
Notes on terminology

➢ Throughout the toolkit, the terms ‘mother’ or ‘maternal’ or ‘she’ or ‘her’ are used in reference to the birthing person. We recognize not all birthing people identify as mothers or women. We believe all birthing people are equally deserving of patient-centered care that helps them attain their full potential and live authentic, healthy lives.

➢ The term family is used to refer to any persons the pregnant or postpartum patient designates as such (alternatives: partners, husbands, support persons, loved ones).

➢ The term clinician is used to denote nursing and medical staff; whereas the term providers refers to clinicians with diagnosing and prescribing authority.

➢ The language around disclaimers and terminology are committee opinions and your own institution should be consulted for appropriate language to utilize.
Learning Objectives

- Know the impact of Hypertensive Disorders of Pregnancy (HDP) on morbidity and mortality
- Define the current terminology and understand the updated diagnostic criteria for HDP
- Describe the management guidelines for HDP
- Identify systems of support on your unit for women and families before, during and after a severe HDP experience
California Maternal Quality Care Collaborative

- Multi-stakeholder collaborative founded in 2006, Celebrating 15 years!
- Launched with funding from California Department of Public Health to address rise in maternal mortality
- Maternal Mortality Reviews to Action:
  - Quality Improvement Toolkits
  - Large-scale QI Change Collaboratives
  - Partner with everyone
  - Maternal Data Center

CMQCC Mission: End preventable morbidity, mortality and racial disparities in maternity care

Maternal Mortality Ratio in U.S. and California, 1999-2016

CMQCC Hypertensive Disorders of Pregnancy (HDP) Task Force Chairs

- Maurice Druzin, MD
- Nancy Peterson, MSN, RNC-OB, PNNP
- Larry Shields, MD
- Valerie Cape
- Christa Sakowski, MSN, RN, C-EFM, CLE
- Christine H. Morton, PhD

Stanford School of Medicine (SoM)
CommonSpirit Health
CommonSpirit Health
Stanford SoM, CMQCC
Stanford SoM, CMQCC
Stanford SoM, CMQCC
<table>
<thead>
<tr>
<th>CMQCC HDP Task Force Members</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Kelley Brennan Lee, MSN, RN, WHNP-BC, C-EFM</strong></td>
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<td><strong>Holly Champagne, RNC, CNS</strong></td>
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<tr>
<td><strong>Jennifer Lucero, MD</strong></td>
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<td><strong>Elliott Main, MD</strong></td>
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<td><strong>Eleni Tsigas</strong></td>
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</tr>
</tbody>
</table>
Hypertensive Disorders of Pregnancy in the U.S. and California
Maternal Hypertension in the U.S., 1993-2014

Hypertensive disorders of pregnancy
- Gestational hypertension
- Preeclampsia
- Eclampsia
- Chronic hypertension

Source: National Inpatient Sample, CDC
https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pregnancy-complications-data.htm
Pregnancy-Related Deaths by Cause, California 2008-2016 (N=608)

<table>
<thead>
<tr>
<th>Cause</th>
<th>Count (n)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVD (Cardiovascular disease)</td>
<td>167</td>
<td>28%</td>
</tr>
<tr>
<td>- Cardiomyopathy</td>
<td></td>
<td>16%</td>
</tr>
<tr>
<td>- Other Cardiovascular</td>
<td></td>
<td>12%</td>
</tr>
<tr>
<td>Sepsis (Sepsis or infection)</td>
<td>104</td>
<td>17%</td>
</tr>
<tr>
<td>- Sepsis/infection</td>
<td></td>
<td>13%</td>
</tr>
<tr>
<td>- H1N1</td>
<td>4%</td>
<td></td>
</tr>
<tr>
<td>Hemorrhage (Hem)</td>
<td>88</td>
<td>15%</td>
</tr>
<tr>
<td>Hypertensive disorders of pregnancy (HDP)</td>
<td>80</td>
<td>13%</td>
</tr>
<tr>
<td>Thrombotic pulmonary embolism (TPE)</td>
<td>43</td>
<td>7%</td>
</tr>
<tr>
<td>Amniotic fluid embolism (AFE)</td>
<td>41</td>
<td>7%</td>
</tr>
<tr>
<td>Cerebrovascular accident (CVA)</td>
<td>16</td>
<td>3%</td>
</tr>
<tr>
<td>Anesthesia complications (Anes)</td>
<td>7</td>
<td>1%</td>
</tr>
<tr>
<td>Other medical conditions (Other)</td>
<td>58</td>
<td>10%</td>
</tr>
</tbody>
</table>

Pregnancy-related deaths include deaths within a year of pregnancy from causes related to or aggravated by the pregnancy or its management, as determined by expert committee review. Abbreviations: CVD = Cardiovascular disease; Sepsis = Sepsis or infection; Hem = Hemorrhage; HDP = Hypertensive disorders of pregnancy; AFE = Amniotic fluid embolism; TPE = Thrombotic pulmonary embolism; CVA = Cerebrovascular accident; Anes = Anesthesia complications; Other = Other medical condition(s).

Note: Deaths with undetermined cause were excluded from analysis (n=4).
Introducing the Toolkit
Summary of Changes from Improving Health Care Response to Preeclampsia (2013)

- Expanded scope to address all hypertensive disorders of pregnancy (HDP)
- Alignment with ACOG definition of severe hypertension with explanation for consideration of treatment at lower “borderline” values
- Low-dose aspirin for prevention of preeclampsia
- Long term follow up after HDP
Spectrum of Hypertensive Disorders in Pregnancy

Outdated terminology

- Severe or mild preeclampsia
- Toxemia
- Pregnancy-induced hypertension (PIH)
- Atypical preeclampsia


This figure was adapted from the Improving Health Care Response to Preeclampsia: A California Quality Improvement Toolkit, funded by the California Department of Public Health, 2014; supported by Title V funds.
Guidelines for Management of HDP

1. Recognize symptoms and diagnose HDP
2. Blood pressure control
3. Seizure prevention
4. Delivery
   - 34 weeks – preeclampsia with severe features
   - 37 weeks – preeclampsia without severe features or gestational hypertension
5. Postpartum surveillance
4 Rs of Quality Improvement
AIM Patient Safety Bundle: Severe Hypertension

**Readiness:**
*Every Unit*
- Preparations (e.g., rapid availability of meds)
- Education
- Simulations

**Recognition & Prevention:**
*Every Patient*
- Screening
- Diagnosis and classification
- Prevention approaches

**Response:**
*Every Event/Case*
- Management and treatment
- Patient education

**Reporting and Systems Learning:**
*Every Unit*
- Debriefs and multidisciplinary reviews
- QI measures
- Documentation and coding

Improving Health Care Response to Hypertensive Disorders of Pregnancy

- Risk Factors
- Implementation

Readiness
Risk Factors for Preeclampsia

- Prior history of preeclampsia
- Multifetal gestations
- Chronic hypertension
- Pregestational diabetes
- Systemic lupus erythematosus
- *Obstructive sleep apnea*
- Nulliparity
- Gestational diabetes
- Pre-pregnancy BMI > 30
- Antiphospholipid antibody syndrome
- Maternal age 35+ years
- Thrombophilia
- *Assisted reproductive technology*

*Gestational Hypertension and Preeclampsia, ACOG Practice Bulletin #222, 2020*
The Joint Commission’s Maternal Safety Standards

These can function as a bundle checklist to guide this toolkit’s implementation

1) Develop written evidence-based procedures for measuring and remeasuring blood pressure

2) Develop written evidenced-based procedures for managing pregnant and postpartum patients with severe hypertension/preeclampsia

3) Provide role-specific education to all staff and providers who treat pregnant/postpartum patients about the hospital’s evidence-based severe hypertension/preeclampsia procedure

4) Conduct drills at least annually to determine system issues as part of ongoing quality improvement efforts

5) Review severe hypertension/preeclampsia cases that meet criteria established by the hospital

6) Provide printed education to patients

TJC Standards for Maternal Safety
Implementation is not a ‘one-size fits all’ endeavor

- Perinatal quality, safety, and performance improvement is a continuous and adaptive process
- Identify and optimize existing data resources such as internal/external databases or dashboards, data reports, patient safety incident reporting systems and department review workflows
- Development of a data monitoring and communication plan that clarifies what measures to track, trend, and monitor; and where they need to be reported to align with regulatory and system goals is key
Equity and Targeting Racial Disparities as Top Priorities for Quality Improvement in the Management of HDP

- Foster individual, organizational and professional accountability
- Ensure that the patient, her family and the clinicians caring for her are well supported especially in the face of biases such as structural or interpersonal racism
- Hospital leaders should demonstrate an openness to feedback and reporting of concerning situations
- Many institutions have well-developed approaches for addressing potential sources of conflict, including communication tools and team training
- Hospital leaders need to make equity and targeting racial disparities their top priorities for quality improvement, and ensure that clinicians are trained on implicit bias and interpersonal, institutional and systemic racism

Please visit the CMQCC Birth Equity Resources Webpage
Improving Health Care Response to Hypertensive Disorders of Pregnancy

Recognition

- Accurate Blood Pressure Measurement
- Diagnostic Updates
Accurate Blood Pressure Measurement

- Accurate blood pressure (BP) measurement is essential to guide management decisions in order to avoid over- or under-treatment leading to adverse outcomes.
- Minimize factors that decrease the accuracy of BP measurements, and be consistent: same arm, same position, and correct cuff size.
- A severe-range BP obtained with an automated BP device should be validated with a manual measurement for accuracy.
- Evaluate BP trends vs. isolated values.

**Steps**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Prepare equipment</td>
</tr>
<tr>
<td>2.</td>
<td>Prepare the patient</td>
</tr>
<tr>
<td>3.</td>
<td>Take measurement</td>
</tr>
<tr>
<td>4.</td>
<td>Record measurement</td>
</tr>
</tbody>
</table>
Quality Improvement Opportunities to Improve Recognition of HDP

<table>
<thead>
<tr>
<th>Missed Symptoms: (didn't see it)</th>
<th>Misdiagnosed: (saw it as something else)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Headache</td>
<td>• Seizure disorder</td>
</tr>
<tr>
<td>• Elevated blood pressures</td>
<td>• Gallstones</td>
</tr>
<tr>
<td>• Abnormal fetal heart rate tracings</td>
<td>• Chronic hypertension</td>
</tr>
<tr>
<td>• Blurred vision</td>
<td>• New onset asthma</td>
</tr>
<tr>
<td>• Low oxygen saturation</td>
<td>• Postpartum psychosis</td>
</tr>
<tr>
<td>• Severe pain, epigastric pain, chest pain</td>
<td></td>
</tr>
<tr>
<td>• Altered behavior (confusion, combative)</td>
<td></td>
</tr>
<tr>
<td>• Tea colored urine, oliguria</td>
<td></td>
</tr>
<tr>
<td>• Bleeding, anemia, coagulopathy</td>
<td></td>
</tr>
<tr>
<td>• Cough, wheezing, shortness of breath</td>
<td></td>
</tr>
<tr>
<td>• Proteinuria</td>
<td></td>
</tr>
<tr>
<td>• Abnormal lab values</td>
<td></td>
</tr>
</tbody>
</table>

### Physiological Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>(Yellow) Triggers (Two or more)</th>
<th>(Red) Triggers (One or more)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systolic BP, mm Hg (repeat in 15 min)</td>
<td>&lt; 90 or &gt; 155* – 159</td>
<td>≥ 160</td>
</tr>
<tr>
<td>Diastolic BP, mm Hg (repeat in 15 min)</td>
<td>105* - 109</td>
<td>≥ 110</td>
</tr>
<tr>
<td>Mean Arterial Pressure: mm Hg</td>
<td>&lt; 65 or &gt; 110</td>
<td>&lt; 55 or &gt; 120</td>
</tr>
<tr>
<td>Heart Rate: beats per min</td>
<td>&lt; 50 or 110-120</td>
<td>&gt; 120</td>
</tr>
<tr>
<td>Respiratory Rate: breaths per min</td>
<td>&lt; 12 or 25-30</td>
<td>&gt; 30</td>
</tr>
<tr>
<td>Oxygen Saturation: % on room air</td>
<td>&lt; 95</td>
<td>&lt; 93</td>
</tr>
<tr>
<td>Oliguria: ml/hr for ≥ 2 hours</td>
<td>35-49</td>
<td>&lt; 35</td>
</tr>
</tbody>
</table>

### Severe (Red) triggers

- Altered mental status: Maternal agitation, confusion or unresponsiveness
- Neurologic: Unrelenting, severe headache unresponsive to medication
- Visual Disturbances: Blurred or impaired vision
- Physical: Shortness of breath or epigastric pain

### If "Yellow" or "Red" BP Triggers, recheck BP within 15 minutes

*Lowering the threshold for treatment should be considered at systolic BP of 155 mm Hg or diastolic BP of 105 mm Hg. See Borderline Severe-range Blood Pressures Section*

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### Abnormal Maternal Assessment

**If sustained for 15 minutes OR**

- If the nurse is clinically concerned with patient status
  - REQUEST PROVIDER EVALUATION

**Sustained BP ≥ 160 systolic OR ≥ 110 diastolic**

Initiate Hypertension in Pregnancy Protocol:

- Treat blood pressure with antihypertensive therapy within 1 hour and
- Treat with Magnesium Sulfate – 4-6** gm bolus, followed by maintenance dose 1-2 gm per hour based upon renal status
  - **Use 6 gm if BMI > 35

**If O2 Sat < 93% or RR > 24**

CONSIDER PULMONARY EDEMA
Clinical Pearl

Forty percent of patients with **new-onset** hypertension or **new-onset** proteinuria will develop preeclampsia.

ACOG Diagnostic Criteria for Preeclampsia in Pregnancy/Postpartum

Gestational Hypertension and Preeclampsia, ACOG Practice Bulletin #222, 2020

**Blood Pressure**
- Systolic blood pressure of ≥ 140 mm Hg OR diastolic blood pressure of ≥ 90 mm Hg on two occasions at least 4 hours apart after 20 weeks of gestation in a woman with a previously normal blood pressure
  
- Systolic blood pressure of 160 mm Hg or more or diastolic blood pressure of 110 mm Hg or more. (Confirmed within a short interval [15 minutes] to facilitate timely hypertensive therapy.)

**Proteinuria**
- 300 mg or more per 24-hour urine collection
- Protein/creatinine ratio of 0.3 or more
  
- Dipstick reading of 2+ (used only if other quantitative methods not available)

*Note: The total amount of proteinuria > 5g in 24 hours has been eliminated from the diagnosis of preeclampsia with severe features as an indication for immediate delivery*
Laboratory Evaluation of Preeclampsia

- Complete blood count (CBC) with platelet count
- Aspartate aminotransferase (AST)
- Alanine aminotransferase (ALT)
- Lactate Dehydrogenase (LDH)
- Creatinine
- Bilirubin
- Glucose
- Comprehensive metabolic panel (CMP)
- Uric acid (optional)

For patients with acute abdominal pain add:
Serum amylase, lipase, and ammonia
Diagnosis of Preeclampsia with Severe Features

- Thrombocytopenia
- Impaired liver function
- Renal insufficiency
- Pulmonary edema
- New onset headache unresponsive to medication and not accounted for by alternative diagnoses
- Visual disturbances
- Systolic blood pressure of 160 mm Hg or more or diastolic blood pressure of 110 mm Hg or more on two occasions at least 4 hours apart “unless antihypertensive therapy is initiated before this time”

**ANTIHYPTERTENSIVE TREATMENT SHOULD BE INITIATED WITHIN THE HOUR IF SEVERE BP IS CONFIRMED IN 15 MINUTES**

For example: A confirmed BP $\geq 160/110$ should be treated with an antihypertensive within one hour and magnesium sulfate started immediately following antihypertensive therapy.
Diagnosis of Chronic Hypertension and Superimposed Preeclampsia

- **Chronic HTN**
  - Hypertension diagnosed or present before pregnancy or before 20 weeks of gestation

OR

- Hypertension diagnosed for the first-time during pregnancy and does not resolve in the postpartum period

- **Superimposed preeclampsia**
  - Preeclampsia with a history of hypertension before pregnancy or before 20 weeks gestation

**NOTE:** Preexisting proteinuria prior to 20 weeks gestation would be suggestive of chronic renal disease, often associated with longstanding hypertension and/or diabetes, or autoimmune disease.
The Spectrum of Preeclampsia is Variable

- **Preeclampsia with severe features**
- **HELLP Syndrome**
  - Hemolysis, Elevated Liver enzymes, Low Platelets
  - Preeclampsia with severe features develops hepatic and hematologic manifestations

**Note:** HELLP syndrome can occur without hypertension or proteinuria

ACOG Practice Bulletin #222 Gestational Hypertension and Preeclampsia, 2020
HELLP associated with increased risk of adverse outcomes

- Placental Abruption
- Renal Failure
- Subcapsular Hepatic Hematoma
- Preterm Delivery
- Fetal or Maternal Death
- Recurrent Preeclampsia
Response

- Blood Pressure Control
- Seizure Prophylaxis and Management
- Delivery and Expectant Management
- Postpartum Surveillance
Hypertensive Emergency in Pregnancy/Postpartum

Applies to all forms of HDP: chronic, gestational, and preeclampsia with or without severe features

<table>
<thead>
<tr>
<th>Systolic</th>
<th>Diastolic</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 160</td>
<td>≥ 110</td>
<td>Repeat BP within 15 minutes. If BP remains within severe-range - treat within 30-60 minutes (ideally ASAP).</td>
</tr>
</tbody>
</table>

DO NOT WAIT TO TREAT THE HYPERTENSIVE EMERGENCY
Clinical Pearl

Controlling blood pressure is the optimal intervention to prevent deaths due to stroke in women with preeclampsia.
Addressing Critical Maternal Blood Pressure

- **At the time of presentation** whether the patient has preeclampsia with severe features, severe gestational hypertension, superimposed CHTN or an exacerbation of CHTN is *not* known.

- The **initial stabilization** of the patient should be timely treatment of BP (labetalol, hydralazine or nifedipine) and prevention of seizure (magnesium sulfate).
# Medication Protocols: First Line Agents in Preeclampsia

<table>
<thead>
<tr>
<th>Medication Agents</th>
<th>Labetalol IV&lt;sup&gt;A&lt;/sup&gt;</th>
<th>Hydralazine IV&lt;sup&gt;B,C&lt;/sup&gt;</th>
<th>Nifedipine (Immediate release)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route</td>
<td>IV</td>
<td>IV</td>
<td>PO</td>
</tr>
<tr>
<td>Initial therapy</td>
<td>20 mg</td>
<td>5-10 mg</td>
<td>10 mg</td>
</tr>
<tr>
<td>Onset&lt;sup&gt;E,F,G&lt;/sup&gt;</td>
<td>2-5 minutes</td>
<td>5-20 minutes</td>
<td>5-20 minutes</td>
</tr>
<tr>
<td>Peak&lt;sup&gt;E,F,G&lt;/sup&gt;</td>
<td>5 minutes</td>
<td>15-30 minutes</td>
<td>30-60 minutes</td>
</tr>
<tr>
<td>Max dose&lt;sup&gt;D&lt;/sup&gt; (Before switching agents)</td>
<td>140 mg</td>
<td>20 mg</td>
<td>50 mg</td>
</tr>
</tbody>
</table>
| **Mechanism of action** | • Combined α and β-blocking agent  
• Arteriolar dilator  
• Decreases heart rate | • Arteriolar dilator | • Calcium channel blocker  
• Arterial smooth muscle dilator |
| **Side effects** | • Use with caution in patients with known asthma  
• Flushing, light headedness, palpitations and scalp tingling  
• Safe for use after cocaine and amphetamine use (including methamphetamine)<sup>A</sup> | • Tachycardia, headache<sup>E</sup>  
• Upper abdominal pain (rare)  
• Flushing  
• Nausea<sup>B</sup> | • Reflex tachycardia  
• Headache  
• Flushing  
• Nausea  
• Vomiting |

**Acute Treatment Algorithm**

**Evaluation and Treatment of Antepartum and Postpartum Preeclampsia/Eclampsia**

**Part 2: Antihypertensive Treatment Algorithm for Hypertensive Emergencies**

**Target BP: 130-150/80-100 mm Hg**

- Once BP threshold is achieved:
  - Q10 min for 1 hr
  - Q15 min for 1 hr
  - Q30 min for 1 hr
  - Q1hr for 4 hrs

*Intravenous hydralazine or labetalol should be given over 2 minutes. In the presence of sinus bradycardia or a history of asthma, hydralazine or nifedipine are preferred as initial agents. If maternal HR > 110, labetalol is preferred.

ACOG Practice Bulletin 203, 2019
Preventing Stroke from Preeclampsia
Significance of Systolic Hypertension and Alternative Blood Pressure Triggers

<table>
<thead>
<tr>
<th>Measure</th>
<th>Judy et al. Pre-stroke (mm Hg)</th>
<th>Martin et al. Pre-stroke (mm Hg)</th>
<th>Total N=54</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Women with maternal mortality from stroke and preeclampsia N=26</td>
<td>Women with strokes N=28</td>
<td></td>
</tr>
<tr>
<td>Systolic BP range</td>
<td>134-238 mm Hg</td>
<td>159-198 mm Hg</td>
<td>N= 52 / 54</td>
</tr>
<tr>
<td>Systolic BP % ≥ 160</td>
<td>96% (n=25)</td>
<td>95.2% (n=27)</td>
<td>(&lt; 160, n=2)</td>
</tr>
<tr>
<td>Diastolic BP range</td>
<td>79-148 mm Hg</td>
<td>81-113 mm Hg</td>
<td>n= 20 / 54</td>
</tr>
<tr>
<td>Diastolic BP % ≥ 110</td>
<td>65% (n=17)</td>
<td>12% (n=3)</td>
<td>n= 24 / 54</td>
</tr>
<tr>
<td>Diastolic BP % ≥ 105</td>
<td>73% (n=19)</td>
<td>20.8 (n=5)</td>
<td>(105-110, n=4)</td>
</tr>
</tbody>
</table>

Borderline Severe-Range Blood Pressure Recommendations

- Physician notification of borderline severe BPs
- Physician evaluation of the patient
- Continuous electronic fetal monitoring
- Inpatient observation for a minimum of 24-48 hours
- Vital signs and symptom assessment every 2 hours for a minimum of 24 hours
- Serial assessment of serum labs at least daily for 2 days

*Refer to Toolkit Section: Borderline Severe-range Blood Pressures: A Clinical Conundrum

Consider antihypertensive therapy and magnesium sulfate at
≥ 155-159/
≥ 105-109 mm Hg
Magnesium Sulfate

Magnesium sulfate for seizure prophylaxis is indicated for:

- Preeclampsia with **severe features** and **severe gestational hypertension**
- All cases of severe (≥ 160 mm Hg / ≥ 110 mm Hg), sustained (lasting 15 minutes or more) hypertension **regardless of classification**

Magnesium Sulfate is **not** universally recommended for preeclampsia without severe features
Magnesium Sulfate

- Primary effect is via CNS depression
- Improves blood flow to CNS via small vessel vasodilation
- Blood pressure after magnesium infusion of 4-6 gm loading, then 2 gm/hour

<table>
<thead>
<tr>
<th></th>
<th>sBP mm Hg</th>
<th>sBP 30 min</th>
<th>sBP 120 min</th>
<th>dBP mm Hg</th>
<th>dBP 30 min</th>
<th>dBP 120 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild Group</td>
<td>145±10</td>
<td>143±13</td>
<td>141±14</td>
<td>87±10</td>
<td>79±9</td>
<td>82±9</td>
</tr>
</tbody>
</table>

Eclampsia

- Eclampsia is defined as NEW ONSET tonic-clonic, focal, or multifocal seizures in absence of other causative conditions, such as epilepsy, cerebral arterial ischemia, intracranial hemorrhage, or drug use.
- U.S. Incidence - 1 in 1,000 deliveries.
- Mortality from eclampsia ranges from ~1% in the developed world, to as high as 15% in the developing world.

Gestational Hypertension and Preeclampsia, ACOG Practice Bulletin #222, 2020
Characterization of Symptoms Immediately Preceding Eclampsia

- 3,267 deliveries with 46 cases of eclampsia (1.4%)
- Most common prodromal neurological symptoms--regardless of the degree of hypertension OR whether the seizure occurred antepartum or postpartum
  - **Headaches** (80%)
  - **Visual disturbance** (45%)
- 20% of women with eclampsia reported no neurologic symptoms before the seizure

Gestational Age and Preeclampsia

- 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.
- Induction of labor at 37 weeks is indicated for women with preeclampsia without severe features and gestational hypertension.
Clinical Pearl

In patients with preterm preeclampsia (< 34 weeks) with severe features, the disease can rapidly progress to significant maternal morbidity and/or mortality.
Considerations for expectant management of clinically stable patients with preeclampsia with severe features < 34 weeks

ACOG Practice Bulletin 222, Gestational Hypertension and Preeclampsia, 2020

Maternal Stabilization:
- BP control
- Seizure prophylaxis
- Adequate cardio-pulmonary function
- Absence of:
  - Severe headache or CNS findings
  - Renal failure
  - HELLP syndrome
  - Pulmonary edema

Additional Management:
- Consultation with
  - NICU
  - MFM
  - Anesthesia and/or Critical care services
  - Administer corticosteroids for fetal lung maturity

NOTE: Continued pregnancy should be undertaken only at facilities with appropriate levels of maternal and neonatal care
Management of Suspected Preeclampsia with Severe Features < 34 Weeks Gestation
Proceed to delivery if any of the following are present:

- Recurrent symptoms of severe preeclampsia
- Recurrent severe hypertension despite therapy
- HELLP syndrome or other abnormal lab criteria
- Abruptio placentae
- Severe fetal growth restriction, oligohydramnios, or abnormal fetal testing

Gestational Hypertension and Preeclampsia, ACOG Practice Bulletin #222, 2020
Outpatient Management of Preeclampsia

- Should only be considered for patients that meet all following criteria:
  - *Without severe features*
  - With stable disease
  - Reassuring fetal assessment
  - Able to follow the recommended outpatient management plan

- Hospital admission is necessary for any patient who develops *preeclampsia with severe features*

- If the patient is > 34 weeks gestation at time of diagnosis of *preeclampsia with severe features*, proceed to delivery

- Those with preeclampsia *without* severe features should be admitted and delivered at 37 weeks gestation

Patients with ongoing borderline severe BPs should undergo inpatient observation for 24-48 hrs to evaluate severity of disease.
Clinical Pearl

At the time of discharge, women and families should be given clear written educational materials outlining signs and symptoms to alert them when they need further assessment requiring return to their provider’s office or the hospital.

*Home blood pressure monitoring by the patient should be encouraged whenever possible.
# Pregnancy-Related Deaths by Cause and Timing to Death, California 2008-2016 (N=608)


Pregnancy-related deaths include deaths within a year of pregnancy from causes related to or aggravated by the pregnancy or its management, as determined by expert committee review.

<table>
<thead>
<tr>
<th>Cause</th>
<th>Pregnant</th>
<th>0-6 days</th>
<th>7-42 days</th>
<th>43-365 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVD (n=167)</td>
<td>19%</td>
<td>24%</td>
<td>24%</td>
<td>33%</td>
</tr>
<tr>
<td>Sepsis (n=104)</td>
<td>12%</td>
<td>38%</td>
<td>39%</td>
<td>11%</td>
</tr>
<tr>
<td>Hem (n=88)</td>
<td>17%</td>
<td>76%</td>
<td>7%</td>
<td></td>
</tr>
<tr>
<td>HDP (n=80)</td>
<td>8%</td>
<td>63%</td>
<td>28%</td>
<td>3%</td>
</tr>
<tr>
<td>TPE (n=43)</td>
<td>47%</td>
<td>28%</td>
<td>16%</td>
<td>9%</td>
</tr>
</tbody>
</table>

Legend: Pregnant, 0-6 days, 7-42 days, 43-365 days.
Late Postpartum Eclampsia

- > 48 hours following delivery, up to 6 weeks PP
- Accounts for approximately 26% of cases of eclampsia
- 78% had no antepartum hypertensive diagnosis
- The magnitude of blood pressure elevation does not appear to be predictive of eclampsia
- The most common presenting symptom was headache, occurring in ~70% of patients
  - Other prodromal symptoms included shortness of breath, blurred vision, nausea, vomiting, edema, neurological deficit, and epigastric pain

Clinical Pearl

Postpartum women who present to the emergency department and have “trigger or critical hypertension” or suspected preeclampsia should be assessed by and/or admitted to obstetrical service.
Preeclampsia in the Emergency Department

- Most important 1st step is to identify whether the patient is or has been pregnant in the last 6 weeks
  - If YES → assess immediately
- ED and OB clinicians should be notified of the patient’s arrival immediately to expedite evaluation and treatment
Preeclampsia in the Emergency Department

- The “trigger” BP in pregnancy/postpartum (≥ 160/110) is lower than values for hypertensive emergencies in non-OB patients
- ED personnel should be familiar with risk factors and signs and symptoms of postpartum preeclampsia and eclampsia
- Develop a workflow for your hospital between ED and OB teams

ED clinicians should focus on:
- Maternal resuscitation
- BP management
- Seizure prophylaxis
- Notifying OB team
Long-Term Risk after Hypertensive Disorders of Pregnancy

- Patients with a history of HDP during pregnancy or the postpartum period are at increased risk for:
  - **Pulmonary edema**
  - **Cardiomyopathy**

- Those with low oxygen saturation, shortness of breath, or dyspnea should be evaluated and treated
  - BNP, EKG, CXR, cardiac echo, cardiology consultation

- Patients should be counseled that HDP increases risk of future cardiovascular disease and their primary care provider should be made aware of their pregnancy history
Talking with Women and their Families About HDP

To ensure optimal physical and emotional wellbeing:

- Educate women and families about how to identify early warning signs and when to seek medical care
- Acknowledge the impact of HDP diagnoses on women’s lives and mental health to promote effective communication and education
- Talk with birthing people and their support persons in a way that is mindful of a variety of emotional states, education levels, health literacy, cultural practices and languages spoken.
- Rely on evidence-based communication protocols when sharing information to ensure woman-centered care, promote shared decision-making and embrace the diversity of family structures and cultural practices.
Prevention: Low-Dose Aspirin (LDA)

- Effective mechanism for prevention of preeclampsia in high-risk patients
  - Mainly those with a history of preeclampsia
- LDA: anti-inflammatory, anti-angiogenesis, anti-platelet
- 81 mg/day prophylaxis recommended for women at high risk of preeclampsia
  - Initiated between 12-28 weeks gestation (optimally before 16 weeks)
  - Should be continued daily until delivery
Risk Reduction for Future Pregnancies

U.S. Preventative Services Task Force (USPSTF)

Clinical Risk Assessment for Preeclampsia and Low-dose Aspirin Administration

<table>
<thead>
<tr>
<th>Risk level</th>
<th>Risk factors</th>
<th>Recommendation to Initiate LDA</th>
</tr>
</thead>
</table>
| High       | a. History of preeclampsia  
b. Multifetal gestation  
c. Chronic hypertension  
d. Type 1 or 2 diabetes  
e. Renal disease  
f. Autoimmune disease (systemic lupus erythematosus, antiphospholipid syndrome)  
g. Combinations of multiple moderate risk factors | If one or more risk factors exist, recommend low-dose aspirin. |
| Moderate    | a. Nulliparity (never having given birth)  
b. Obesity (body mass index > 30 kg/m²) at first appointment  
c. Family history of preeclampsia (mother or sister)  
d. Black persons (due to social rather than biological factors)  
e. Lower income  
f. Age ≥ 35 years  
g. Personal history factors (e.g., low birth weight or small for gestational age, previous adverse pregnancy outcome, > 10-year pregnancy interval)  
h. In vitro conception | If two or more risk factors exist, recommend low-dose aspirin. If one risk factor exists, consider low-dose aspirin. |
| Low         | Previous uncomplicated full-term delivery | Do not recommend low-dose aspirin. |
Improving Health Care Response to Hypertensive Disorders of Pregnancy

- Debriefs & Case Reviews
- Process Measures
- Outcome Measures
Debriefs and Case Reviews

Debriefs and multidisciplinary reviews are foundational learning about improvement activities for creating a highly-reliable clinical team and maintaining a culture of safety.

**Debrief**
- Allows the team to reflect on performance and problem-solve in real time.
- Should become a routine part of activities on the unit.

**Case Review**
- Thorough and structured evaluation of patient care.
- Identified deficits are used to inform and guide system-level improvements to prevent similar morbidities in the future.

A multi-faceted communication plan is needed to share meaningful learnings and subsequent process improvement work to the clinical team.
Process Measures and Outcome Measures

- **Timely Treatment of Hypertension – strongly recommended**
  - *Most important action to reduce severe maternal mortality and morbidity from hypertensive disorders of pregnancy is the rapid timely treatment of severe hypertension*

- **Severe Maternal Morbidity (SMM)**
  - At a minimum, serves as an indicator for multidisciplinary case review
  - The AIM Program and CMQCC are using the CDC metric to track the rate of SMM complications in women with HDP (with and without transfusions)
Thank you!

For More Information and to Download the Toolkit

[www.CMQCC.org/toolkits]

Contact us:

[info@cmqcc.org]
Appendix –
Optional Slides
Hypertensive Disorders of Pregnancy Toolkit
Treatment Algorithms
### Physiological Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>(Yellow) Triggers (Two or more)</th>
<th>(Red) Triggers (One or more)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systolic BP, mm Hg (repeat in 15 min)</td>
<td>&lt; 90 or &gt; 155(^*) – 159</td>
<td>≥ 160</td>
</tr>
<tr>
<td>Diastolic BP, mm Hg (repeat in 15 min)</td>
<td>105(^*) - 109</td>
<td>≥ 110</td>
</tr>
<tr>
<td>Mean Arterial Pressure: mm Hg</td>
<td>&lt; 65 or &gt; 110</td>
<td>&lt; 55 or &gt; 120</td>
</tr>
<tr>
<td>Heart Rate: beats per min</td>
<td>&lt; 50 or 110-120</td>
<td>&gt; 120</td>
</tr>
<tr>
<td>Respiratory Rate: breaths per min</td>
<td>&lt; 12 or 25-30</td>
<td>&gt; 30</td>
</tr>
<tr>
<td>Oxygen Saturation: % on room air</td>
<td>&lt; 95</td>
<td>&lt; 93</td>
</tr>
<tr>
<td>Oliguria: ml/hr for ≥ 2 hours</td>
<td>35-49</td>
<td>&lt; 35</td>
</tr>
</tbody>
</table>

**Severe (Red) triggers**

- Altered mental status: Maternal agitation, confusion or unresponsiveness
- Neurologic: Unrelenting, severe headache unresponsive to medication
- Visual Disturbances: Blurred or impaired vision
- Physical: Shortness of breath or epigastric pain

### If "Yellow" or "Red" BP Triggers, recheck BP within 15 minutes

*Lowering the threshold for treatment should be considered at systolic BP of 155 mm Hg or diastolic BP of 105 mm Hg. See Borderline Severe-range Blood Pressures Section

### Abnormal Maternal Assessment

**If sustained for 15 minutes OR**
If the nurse is clinically concerned with patient status
REQUEST PROVIDER EVALUATION

### Sustained BP ≥ 160 systolic OR ≥ 110 diastolic
Initiate Hypertension in Pregnancy Protocol:
- Treat blood pressure with antihypertensive therapy within 1 hour
- Treat with Magnesium Sulfate – 4-6\(^*\) gm bolus, followed by maintenance dose 1-2 gm per hour based upon renal status
- **Use 6 gm if BMI > 35**

IF O₂ Sat < 93% or RR > 24
CONSIDER PULMONARY EDEMA
Suspected Preeclampsia Algorithm

The management and decision to deliver baby applies equally to Preeclampsia and Gestational Hypertension

TREAT BP ACCORDINGLY

If abnormal labs or symptoms, proceed to delivery
Acute Treatment Algorithm
Evaluation and Treatment of Antepartum and Postpartum Preeclampsia/Eclampsia
Part 1: Diagnostic Algorithm

Preeclampsia with severe features:
- SBP ≥160 mm Hg or DBP ≥ 110 mm Hg on 2 occasions at least 4 hours apart (unless antihypertensive therapy is initiated before this time)
- Thrombocytopenia
- Impaired liver function that is not accounted for by alternative diagnoses indicated by abnormally elevated liver enzymes or by severe persistent right upper quadrant or epigastric pain
- Renal insufficiency
- Pulmonary edema
- New-onset headache unresponsive to medication and not accounted for by alternative diagnoses
- Visual disturbances

ACOG Practice Bulletin 222, 2020
Acute Treatment Algorithm
Evaluation and Treatment of Antepartum and Postpartum Preeclampsia/Eclampsia

Part 2: Antihypertensive Treatment Algorithm for Hypertensive Emergencies

Target BP: 130-150/80-100 mm Hg

Once BP threshold is achieved:
- Q10 min for 1 hr
- Q15 min for 1 hr
- Q30 min for 1 hr
- Q1 hr for 4 hrs

*Troxivert IV as Primary Antihypertensive

Initial dose: 5 - 10 mg nitrovasodilator IV
Repeat BP in 10 minutes

SBP ≥ 160 or DBP ≥ 110
Give 20 mg labetalol IV
Repeat BP in 10 minutes

SBP ≥ 160 or DBP ≥ 110
Give 40 mg labetalol IV
Repeat BP in 10 minutes

SBP ≥ 160 or DBP ≥ 110
Give 80 mg labetalol IV
Repeat BP in 10 minutes

SBP ≥ 160 or DBP ≥ 110
Give hydralazine 10 mg IV
Repeat BP in 20 minutes

SBP ≥ 160 or DBP ≥ 110
Give hydralazine 10 mg IV
Repeat BP in 20 minutes

SBP ≥ 160 or DBP ≥ 110
Give hydralazine 10 mg IV and obtain emergent consultation from maternal-fetal medicine, anesthesiology, and critical care for transfer of care or continuous IV infusion

*Nifedipine PO as Primary Antihypertensive

Initial dose: nifedipine 10 mg PO immediate release
Repeat BP in 20 minutes

SBP ≥ 160 or DBP ≥ 110
Give nifedipine 20 mg PO
Repeat BP in 20 minutes

SBP ≥ 160 or DBP ≥ 110
Give nifedipine 20 mg PO
Repeat BP in 20 minutes

SBP ≥ 160 or DBP ≥ 110
Convert to labetalol pathway and obtain emergent consultation from maternal-fetal medicine, anesthesiology, and critical care for transfer of care or continuous IV infusion

*Intravenous hydralazine or labetalol should be given over 2 minutes. In the presence of sinus bradycardia or a history of asthma, hydralazine or nifedipine are preferred as initial agents. If maternal HR > 110, labetalol is preferred.
Acute Treatment Algorithm
Evaluation and Treatment of Antepartum and Postpartum Preeclampsia and Eclampsia
Part 3: Magnesium Dosing and Treatment Algorithm for Refractory Seizures

**Magnesium: Initial Treatment**
1. Loading Dose: 4-6 gm over 20-30 minutes (6 gm for BMI > 35)
2. Maintenance Dose: 1-2 gm per hour
3. Close observation for signs of toxicity
   - Disappearance of deep tendon reflexes
   - Decreased RR, shallow respirations, shortness of breath
   - Heart block, chest pain
   - Pulmonary edema
4. Calcium gluconate or calcium chloride should be readily available for treatment of toxicity

**For recurrent seizures while on magnesium**
1. Secure airway and maintain oxygenation
2. Give 2nd loading dose of 2-4 gm Magnesium over 5 minutes
3. If patient still seizing 20 minutes after 2nd magnesium bolus, consider one of the following:
   - Midazolam 1-2 mg IV; may repeat in 5-10 min OR
   - Diazepam 5-10 mg IV slowly; may repeat q15 min to max of 30 mg OR
   - Phenytoin 1,250 mg IV at a rate of 50 mg/min
   - Other medications have been used with the assistance of anesthesia providers such as:
     - Sodium thiopental
     - Sodium amobarbital
     - Propofol
4. Notify anesthesia
5. Notify neurology and consider head imaging

**Seizures Resolve**
1. Maintain airway and oxygenation
2. Monitor vital signs, cardiac rhythm/EKG for signs of medication toxicity
3. Consider brain imaging for:
   - Head trauma
   - Focal seizure
   - Focal neurologic findings
   - Other suspected neurologic diagnosis
4. Reassure patient with information, support
5. Debrief with team before shift end
**Eclampsia Algorithm**

**Patient Intervention**

- **When seizure begins**
  1. Call for help
  2. Position patient in a left lateral decubitus position, head of bed down
  3. Prevent maternal injury, side rails up, pad as appropriate
  4. Establish open airway and maintain breathing. Have suction available
  5. Provide oxygen

- **When seizure ends**
  1. Check and treat blood pressure per protocol
  2. Obtain IV access: 1 or 2 large-bore IV catheters as soon as possible
  3. Start magnesium loading dose

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**Medical Intervention**

- **Magnesium Sulfate** 4-6 grams IV loading dose over 20-30 minutes; followed by a 1-2 gram/hour maintenance dose if renal function is normal
  - *BMI >35 requires a 6 gram loading dose and 2 grams per hour maintenance dose*

  - If patient has a recurrent seizure, give additional 2-4 grams of magnesium sulfate over 5 minutes*

  - If patient has a recurrent seizure after 2nd loading dose of magnesium sulfate, administer one of the following and notify anesthesia

  - **Medications**
    - Midazolam 1-2 mg IV; may repeat in 5-10 minutes OR
    - Diazepam 5-10 mg IV slowly; may repeat q15 min to max of 30 mg OR
    - Phenytoin 1,250 mg IV at a rate of 50 mg/minute
    - Other medications have been used with the assistance of anesthesia providers such as:
      - Sodium thiopental
      - Sodium amobarbital
      - Propofol

---

**Resolution**

- **Resolution of seizure**
  1. Maintain magnesium sulfate infusion for at least 24-48 hours after the last seizure or after delivery, whichever is later
  2. Assess for any signs of neurologic injury/focal deficit; head imaging should be considered if neurologic injury is suspected
  3. Once the patient is stabilized preparations should be made for delivery; mode of delivery is dependent upon clinical circumstances surrounding the pregnancy

- **Discontinue therapy**
  For preeclampsia with severe features and eclampsia: 24-48 hours after delivery or after last seizure

  **NOTE:** Administration beyond 24 hours may be indicated if the patient shows no signs of clinical improvement

---

*Monitor respiration and BP, EKG and signs of magnesium toxicity.*
Case Study
Postpartum Case Study

- 24-year-old G2, P0-0-1-0, 39 weeks
- 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

Status on Admission

- The patient 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

Labor course

- BP remained elevated throughout labor and the postpartum stay
- Fetal heart rate consistently Category I (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

Post-op Day #3

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

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 magnesium sulfate, lorazepam, levetiracetam, labetalol
  - Helicopter transport to tertiary center, neurology ICU
Postpartum Case Study

Post-op Day #6 - #9

- Extubated shortly after admission
- BPs remained elevated; BP max 148/98; SBP mostly 130s; 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 (Posterior Reversible Encephalopathy Syndrome)
CMQCC

[Insert Secondary Logo Here]