Updates in the Diagnosis & Management of Preeclampsia and Hypertensive Disorders of Pregnancy
ACOG and CMQCC Guidelines

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I have no financial disclosures to report

2014 Guidelines for the Management of Hypertension in Pregnancy from ACOG and CMQCC

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Learning objectives

✓ To review the most current recommendations for the diagnosis and management of hypertensive disorders of pregnancy from ACOG and the California Preeclampsia Task Force (PTF) of CMQCC.

✓ To review the impact of hypertensive disorders of pregnancy on maternal and perinatal morbidity and mortality.

✓ To delineate the most common causes of maternal morbidity and mortality secondary to hypertensive disorders of pregnancy.

✓ To outline a management algorithm to optimize care for patients with hypertensive disorders of pregnancy.
How often do you encounter preeclampsia in your practice?

1. Almost daily
2. Approximately once per week
3. At least once per month
4. Rarely, approximately a handful of times per year

“Over the past year, I have seen preeclampsia mismanaged either by the OB provider, nurse, or anesthesiologist”

1. True
2. False

“In my hospital, the entire care team (OB providers, nursing, anesthesiology) is dedicated to managing acute severe hypertension rapidly”

1. True
2. False

“I’ve had enough of preeclampsia talks, I’m going out to get some coffee outside – see ya!”

1. True
2. False
The summary

• Classification: 1) Preeclampsia (PE)
  • 2) Chronic hypertension (CHTN)
  • 3) CHTN+PE
  • 4) Gestational hypertension

• Management: 1) Blood pressure control!
  • 2) Seizure prevention
  • 3) Delivery - 34 weeks vs. 37 weeks
  • 4) Post partum surveillance

Executive Summary:

Hypertension in Pregnancy

American College of Obstetricians and Gynecologists
James Martin, Jr, MD

Obstet Gynecol 2013;122:1122-31
The Scope of the Problem

Why is preeclampsia important?

• The incidence of preeclampsia has increased by 25% in the United States during the past two decades.

• Preeclampsia is a leading cause of maternal and perinatal morbidity and mortality, with an estimated 50,000-60,000 preeclampsia-related deaths per year worldwide.

Ref: ACOG – HIP, 2013

Why is preeclampsia important?

• For every preeclampsia-related death that occurs in the United States, there are probably 50-100 other women who experience “near miss” significant maternal morbidity that stops short of death but still results in significant health risk and health care cost.

• What can be considered “less than optimal” care of patients with preeclampsia and other hypertensive disorders of pregnancy reportedly occurs with some frequency worldwide, contributing to maternal and perinatal injury that might have been avoidable.

Ref: ACOG – HIP, 2013

Cause of U.S. maternal mortality

• CDC Review of 14 years of coded data: 1979-1992

• 4024 maternal deaths

• 790 (19.6%) from preeclampsia

**Maternal mortality rate, California residents: 1970-2010**

- **ICD-8 codes**: 1970-1978
- **ICD-9 codes**: 1979-1998
- **ICD-10 codes**: 1999-2010

**CA-PAMR causes of death 2002-2004**

<table>
<thead>
<tr>
<th>Grouped Cause of Death, per CA-PAMR Committee</th>
<th>Pregnancy-Related Deaths N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular disease</td>
<td>29 (20)</td>
</tr>
<tr>
<td>Cardiomyopathy</td>
<td>19 (13)</td>
</tr>
<tr>
<td>Other cardiovascular</td>
<td>10 (7)</td>
</tr>
<tr>
<td>Preeclampsia/eclampsia</td>
<td>25 (17)</td>
</tr>
<tr>
<td>Obstetric hemorrhage</td>
<td>16 (11)</td>
</tr>
<tr>
<td>Amniotic fluid embolism</td>
<td>15 (10)</td>
</tr>
<tr>
<td>DVT/ PE</td>
<td>15 (10)</td>
</tr>
<tr>
<td>Other</td>
<td>45 (31)</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>145</strong></td>
</tr>
</tbody>
</table>

Pregnancy-Related Mortality Rate: 1.6 deaths /100,000 live births

**California pregnancy-associated mortality review (CA-PAMR) quality improvement**

1. Identification of cases
2. Information collection, review by multidisciplinary committee
3. Cause of Death, Contributing Factors and Quality Improvement (QI) Opportunities identified
4. Strategies to improve care and reduce morbidity and mortality
5. Evaluation and Implementation of QI strategies and tools

**Maternal morbidity and Mortality: Preeclampsia**

- **Near Misses**: 380/year (ICU admissions)
- **Serious Morbidity**: 3400/year (prolonged postpartum length of stay)

Source: 2007 All-California Rapid Cycle Maternal/Infant Database for CA Births; CMQCC
Impact of hypertension in CA-PAMR cohort, 2002-2004

• Cohort of pregnancy-related deaths, N=145
  – 25 (17%) of deaths were grouped as “Preeclampsia/Eclampsia” cause of death

• Over half of all pregnancy-related deaths had HTN diagnoses
  – 50 (34%) had inpatient diagnosis of HTN
  – 57 (39%) had any diagnosis of HTN (inpatient, prenatal, preexisting)

CA-PAMR: Chance to alter outcome grouped cause of death; 2002-2004 (N=145)

<table>
<thead>
<tr>
<th>Grouped Cause of Death</th>
<th>Chance to Alter Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strong / Good (%)</td>
</tr>
<tr>
<td></td>
<td>Some (%)</td>
</tr>
<tr>
<td></td>
<td>None (%)</td>
</tr>
<tr>
<td></td>
<td>Total (%)</td>
</tr>
<tr>
<td>Obstetric hemorrhage</td>
<td>69</td>
</tr>
<tr>
<td>Deep vein thrombosis/</td>
<td>53</td>
</tr>
<tr>
<td>pulmonary embolism</td>
<td></td>
</tr>
<tr>
<td>Sepsis/infection</td>
<td>50</td>
</tr>
<tr>
<td><strong>Preeclampsia/eclampsia</strong></td>
<td><strong>50</strong></td>
</tr>
<tr>
<td>Cardiomyopathy and other cardiovascular</td>
<td></td>
</tr>
<tr>
<td>causes</td>
<td>25</td>
</tr>
<tr>
<td>Cerebral vascular accident</td>
<td>22</td>
</tr>
<tr>
<td>Amniotic fluid embolism</td>
<td>0</td>
</tr>
<tr>
<td>All other causes of death</td>
<td>46</td>
</tr>
<tr>
<td><strong>Total (%)</strong></td>
<td><strong>40</strong></td>
</tr>
</tbody>
</table>

• New best practice recommendations are greatly needed to guide clinicians in the care of women with all forms of preeclampsia and hypertension that occur during pregnancy, particularly women with acute severe hypertension and superimposed preeclampsia.

• Identification of patients with severe forms of preeclampsia continues to challenge clinicians.

• Also needed is a system for continually updating these guidelines and integrating them into daily obstetric practice.

• Improved patient education and counseling strategies are needed to convey more effectively the dangers of preeclampsia and hypertension and the importance of early detection to women with varying degrees of health literacy.

• Research on preeclampsia and other hypertensive disorders of pregnancy in both the laboratory and clinical arenas require continued emphasis and funding.
Classification of hypertensive disorders of pregnancy

1) Preeclampsia-eclampsia after 20 weeks
2) Chronic hypertension (of any cause) predating pregnancy
3) Chronic hypertension with superimposed preeclampsia
4) Gestational hypertension after 20 weeks
Key clinical pearl

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


Key clinical pearl

Patients presenting with vague symptoms of:
- headache
- abdominal pain
- shortness of breath
- generalized swelling
- complaints of “I just don’t feel right”

**should be evaluated for atypical presentations of preeclampsia or “severe features”**


Laboratory evaluation of preeclampsia

- Initial lab studies should include:
  - CBC with platelet count
  - AST, ALT, LDH (hemolysis)
  - Creatinine, Bilirubin, Uric acid, Glucose
- For women with acute abdominal pain, add:
  - Serum amylase, lipase and ammonia

Do not wait when a patient has severe-range hypertension!

- Acute onset, persistent (lasting 15 min or more), severe systolic ($\geq 160$ mm Hg) or severe diastolic hypertension ($\geq 110$ mm Hg) or both in pregnant or postpartum women with preeclampsia/eclampsia constitutes a hypertensive emergency* and it is inadvisable to wait 4 hours for treatment.

*Emergent Therapy for Acute-Onset, Severe Hypertension With Preeclampsia or Eclampsia, ACOG Committee Opinion, # 514, December 2011

The deadly triad

Severe preeclampsia - HELLP syndrome - Eclampsia

Associated with an increased risk of adverse outcomes:

- Placental Abruption
- Renal Failure
- Sub-capsular Hepatic Hematoma
- Preterm Delivery
- Fetal or Maternal Death
- Recurrent Preeclampsia


ACOG executive summary on hypertension in pregnancy, Nov 2013

1. The term “mild” preeclampsia is discouraged for clinical classification. The recommended terminology is:
   a. “preeclampsia without severe features” (mild)
   b. “preeclampsia with severe features” (severe)

2. Proteinuria is not a requirement to diagnose preeclampsia with new onset hypertension.

3. The total amount of proteinuria > 5g in 24 hours has been eliminated from the diagnosis of preeclampsia with severe features.

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

Cause of U.S. maternal mortality

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

90% of CVA were from hemorrhage

How do women die of preeclampsia in CA?

CA-PAMR Final Cause of Death Among Preeclampsia Cases, 2002-2004 (n=25)

<table>
<thead>
<tr>
<th>Final Cause of Death</th>
<th>Number</th>
<th>%</th>
<th>Rate/100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke</td>
<td>16</td>
<td>64%</td>
<td>1.0</td>
</tr>
<tr>
<td>Hemorrhagic</td>
<td>14</td>
<td>87.5%</td>
<td>.125</td>
</tr>
<tr>
<td>Thrombotic</td>
<td>2</td>
<td>12.5%</td>
<td>.10</td>
</tr>
<tr>
<td>Hepatic (liver) Failure</td>
<td>4</td>
<td>16.0%</td>
<td>.25</td>
</tr>
<tr>
<td>Cardiac Failure</td>
<td>2</td>
<td>8.0%</td>
<td>.06</td>
</tr>
<tr>
<td>Hemorrhage/DIC</td>
<td>1</td>
<td>4.0%</td>
<td>.00</td>
</tr>
<tr>
<td>Multi-organ failure</td>
<td>1</td>
<td>4.0%</td>
<td>.00</td>
</tr>
<tr>
<td>ARDS</td>
<td>1</td>
<td>4.0%</td>
<td>.00</td>
</tr>
</tbody>
</table>

How do women die of preeclampsia in CA?

Preeclampsia mortality rates in California and UK

<table>
<thead>
<tr>
<th>Cause of Death among Preeclampsia Cases</th>
<th>CA-PAMR (2002-04) Rate/100,000 Live Births</th>
<th>UK CMACE (2003-05) Rate/100,000 Live Births</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke</td>
<td>1.0</td>
<td>.47</td>
</tr>
<tr>
<td>Pulmonary/Respiratory</td>
<td>.06</td>
<td>.00</td>
</tr>
<tr>
<td>Hepatic</td>
<td>.25</td>
<td>.19</td>
</tr>
<tr>
<td>OVERALL</td>
<td>1.6</td>
<td>.66</td>
</tr>
</tbody>
</table>

The overall mortality rate for preeclampsia in California is greater than 2 times that of the UK, largely due to differences in deaths caused by stroke.

Key clinical pearl

Controlling blood pressure is the optimal intervention to prevent deaths due to stroke in women with preeclampsia.

Over the last decade, the UK has focused QI efforts on aggressive treatment of both systolic and diastolic blood pressure and has demonstrated a reduction in deaths.

Gestational age groups of CA-PAMR deaths, 2002 to 2004

<table>
<thead>
<tr>
<th>GESTATIONAL AGE GROUPS</th>
<th>2002-2004 CA-PAMR PREECLAMPSIA DEATHS (N=25)</th>
<th>CA-PAMR NON-PREECLAMPSIA DEATHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;24 weeks</td>
<td>0 (0)</td>
<td>2 (2%)</td>
</tr>
<tr>
<td>24-31w6d</td>
<td>2 (8%)</td>
<td>13 (11%)</td>
</tr>
<tr>
<td>32-36w6d</td>
<td>12 (48%)</td>
<td>29 (24%)</td>
</tr>
<tr>
<td>≥37 weeks</td>
<td>11 (44%)</td>
<td>76 (63%)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>25</td>
<td>120</td>
</tr>
</tbody>
</table>

Early Preterm Birth Preeclampsia Deaths: 36% (n=9) were <34 weeks gestation
In patients with preterm preeclampsia with severe features, the disease can rapidly progress to significant maternal morbidity and/or mortality.

Expectant management in pregnancies with preeclampsia with severe features 24-34 weeks

Expectant management recommendations:

- With stable maternal/fetal conditions, continued pregnancy should be undertaken only at facilities with adequate maternal and neonatal intensive care resources

- Administer corticosteroids for fetal lung maturity benefit


Expectant management of pregnancies with preeclampsia < 34 weeks gestation

Maternal Stabilization refers to:
- Seizure prophylaxis
- BP control
- Adequate maternal cardio-pulmonary function
- AND
- Consultation with:
  - NICU
  - MFM
  - Anesthesia and/or
  - Critical care services

Management of suspected preeclampsia with severe features < 34 weeks gestation

Initial 24-48 hours observation
- Initiate antenatal corticosteroids if not previously administered
- Initiate 24 hour urine monitoring as appropriate
- Ongoing assessment of maternal symptoms, BP, urine output
- Daily lab evaluation (minimum) for HELLP and renal function
- May observe on an antepartum ward after initial evaluation

Proceed to delivery for:
- Recurrent severe hypertension despite therapy
- Other contraindications to expectant management

Antenatal corticosteroid treatment completed:
- Expectant management not contraindicated
- Consider ongoing in-patient expectant management

ACOG task force recommendations

- For women with gestational hypertension, less than 160/110 or preeclampsia without severe features at or beyond 37 0/7 weeks of gestation, delivery rather than continued observation is suggested.

Eclampsia is defined as NEW ONSET grand mal seizures in a woman with preeclampsia.

- Incidence is 1 in 1,000 deliveries in U.S.
- Mortality from eclampsia ranges from approximately 1% in the developed world, to as high as 15% in the developing world.


Eclampsia: maternal-perinatal outcome in 254 consecutive cases over 12 years

- 83,720 deliveries, for an incidence of one in 330
- 49 patients (19%) did not have proteinuria
- 58 patients (23%) did not have hypertension


Eclampsia: Maternal-perinatal outcome in 254 consecutive cases over 12 years

- 73 (29%) occurred postpartum.
- Over half of postpartum cases, (40 cases/16%) occurred in the late postpartum period (>48 hrs)
- 18 of these 40 cases were normotensive; all 18 had symptoms of headache or visual disturbance

Key clinical pearl

- The critical initial step in decreasing maternal morbidity and mortality is to administer anti-hypertensive medications within 60 minutes of documentation of persistent (retested within 15 minutes) BP ≥ 160 systolic, and/or > 105-110 diastolic.
- Ideally, antihypertensive medications should be administered as soon as possible, and availability of a "preeclampsia box" will facilitate rapid treatment.
- In Martin et al., stroke occurred in:
  - 23/24 (95.8%) women with systolic BP ≥ 160 mm Hg
  - 24/24 (100%) had a BP ≥ 155 mm Hg
  - 3/24 (12.5%) women with diastolic BP > 110 mm Hg
  - 5/28 (20.8%) women with diastolic BP > 105 mm Hg


Hypertensive medication administration:

Oral versus IV

- First line therapy recommendations for acute treatment of critically elevated BP in pregnant women (160/105-110) are with either IV labetalol or hydralazine.
- In the event that acute treatment is needed in a patient without IV access oral nifedipine may be used (10 mg) and may be repeated in 30 minutes.
- Oral labetalol would be expected to be less effective in acutely lowering the BP due to its’ slower onset to peak and thus should be used only if nifedipine is not available in a patient without IV access.


Magnesium Sulfate

- Primary effect is via CNS depression
- Improves blood flow to CNS via small vessel vasodilation
- Blood pressure after magnesium infusion:
  - 6 gm loading then 2 gm/hr.

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

Magnesium sulfate should not be considered a antihypertensive medication


Magnesium sulfate in the management of Preeclampsia

Magpie Trial Collaboration Group. Do women with pre-eclampsia, and their babies, benefit from magnesium sulfate?

- 58% reduction in seizures
- 45% reduction in maternal death*
- 33% reduction in placental abruption

*The 45% reduction in maternal death is not statistically significant but clinically important.

Recommendations for women who should be treated with magnesium

<table>
<thead>
<tr>
<th></th>
<th>Preeclampsia without severe features</th>
<th>Severe Preeclampsia</th>
<th>Eclampsia</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACOG</td>
<td>**</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>NICE</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>SOGC</td>
<td>X*</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>CMQCC</td>
<td>X*</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>WHO</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

**ACOG Executive Summary, 2013: for preeclampsia without severe features, it is suggested that magnesium sulfate not be administered universally for the prevention of eclampsia.

* Should be considered: Numbers needed to treat (NNT) = 109 for "mild", 63 for "severe"

Key clinical pearl

- Magnesium sulfate therapy for seizure prophylaxis should be administered to any patients with:
  - Preeclampsia with “severe features” i.e., subjective neurological symptoms (headache or blurry vision), abdominal pain, epigastric pain AND
  - should be considered in patients with preeclampsia without severe features

Key clinical pearl

Algorithms for acute treatment of severe hypertension and eclampsia should be readily available or preferably posted in all clinical areas that may encounter pregnant women.
Labor and delivery medication box and dose guidelines for preeclampsia and eclampsia

**L&D Severe Preeclampsia & Eclampsia Box - Content and Dose Guidelines**

<table>
<thead>
<tr>
<th>Medication</th>
<th>Dosage</th>
<th>Route</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnesium 20 grams/500 ml bag</td>
<td>IV (Use Magnesium Sulfate Continuous Infusion under LAD protocol in obstetrics/pulmonary literature).</td>
<td>Maintenance Dose 1-2 g/hour (75 mg/hr - 300 mg/hr)</td>
<td>Continuous infusion</td>
</tr>
<tr>
<td>Labetalol 100mg/20ml vial</td>
<td>Intravenous</td>
<td></td>
<td>Dose IV bolus of 20 mg (or 4 mg if not effective within 15 min) then 40 mg q6h every 10 min. Maximum total dose of 500 mg/day.</td>
</tr>
<tr>
<td>Hydralazine 50mg vials</td>
<td>Intravenous</td>
<td></td>
<td>Dose IV bolus of 5-10 mg (0.25 - 0.5 mg/minute) every 15 - 20 min.</td>
</tr>
<tr>
<td>Esmolol 100mg/10ml vial</td>
<td>Intravenous</td>
<td>Only for Anesthesiologists (ONLY)</td>
<td>Dose IV bolus of 1-2 mg/kg (0.1 - 0.2 mg/kg) every 1 min.</td>
</tr>
<tr>
<td>Propofol 100mg/20ml vial (By Anesthesiologists ONLY)</td>
<td>Intravenous</td>
<td></td>
<td>30 - 40 mg (1 - 4 mg) IV bolus</td>
</tr>
<tr>
<td>Calcium gluconate 1000 mg/10ml vial</td>
<td>Intravenous</td>
<td></td>
<td>Dose IV bolus of 1000 mg/10 ml IV over 2 - 5 min.</td>
</tr>
<tr>
<td>Nifedipine 10 mg PO</td>
<td>Oral</td>
<td></td>
<td>Dose PO and repeat in 30 minutes if needed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Supply includes 2 ml, 10 ml, and 20 ml syringes, appropriate needles, and appropriate tubing sets.</td>
</tr>
</tbody>
</table>

Timing of pregnancy-related deaths

**CA-PAMR, 2002 to 2004**

- **Non-Preeclampsia Deaths** (n=129)
  - 63% within 1 week of birth
  - 87% within 2 weeks of birth
  - 89% within 4 weeks of birth

- **Preeclampsia Deaths** (n=25)
  - 68% within 1 week of birth
  - 96% within 2 weeks of birth
  - 92% within 4 weeks of birth

ACOG task force recommendations postpartum hypertension and preeclampsia

- For women in whom GHN, PE, or superimposed PE is diagnosed, it is suggested that BP be monitored in the hospital or equivalent outpatient surveillance be performed for at least 72 hours postpartum and again 7-10 days after delivery or earlier in women with symptoms.
**Key clinical pearls**

- Early post-discharge follow-up recommended for **all patients** diagnosed with preeclampsia/eclampsia
- Preeclampsia Toolkit recommends post-discharge follow-up:
  - within 3-7 days if medication was used during labor and delivery OR postpartum
  - within 7-14 days if no medication was used
- **Postpartum** patients presenting to the ED with hypertension, preeclampsia or eclampsia should either be assessed by **or admitted to an obstetrical service**

**Key clinical pearls**

- Use of preeclampsia-specific checklists, team training and communication strategies, and continuous process improvement strategies will likely reduce hypertensive related morbidity.
- Use of patient education strategies, targeted to the educational level of the patients, is essential for increasing patient awareness of signs and symptoms of preeclampsia.

**Patient education materials**

This and many other patient education materials can be ordered from [www.preeclampsia.org/](http://www.preeclampsia.org/) **market-place**

**Getting the job done in your institution**

- Establish tools / new recommendations
- Establish champions and collaborators
- Provide **convincing rationale** for change
- Get providers to adopt the changes
- Provide **convincing evidence** that the proposed changes in clinical care will improve outcome

- **Distribute the convincing rationale and evidence**
For More Information and to Download the Toolkit

- Visit our website: www.cmqcc.org
- Or contact us: info@cmqcc.org

Available online at www.cmqcc.org

Thank you