Maternal Safety: Best Practices in Hypertension
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Executive Summary

Between 2008 and 2016, Ohio women died from pregnancy-related causes at a rate of 14.7 per 100,000 live births.\textsuperscript{1} In addition, severe maternal morbidity (SMM) affects women at a much higher rate, occurring in 143 per 10,000 deliveries in 2013.\textsuperscript{2} The Ohio Department of Health’s (ODH) Pregnancy-Associated Mortality Review (PAMR) indicates that 57% of pregnancy-related deaths are preventable,\textsuperscript{1} preeclampsia and eclampsia were the leading cause of maternal death in 12% of pregnancy-related deaths during this period, a mortality ratio of 1.7 per 100,000 live births, with preventability for hypertensive disorders of pregnancy determined to be 85%.\textsuperscript{1}

Health Disparities

There are significant disparities in SMM and mortality in Ohio. From 2008 to 2016, the pregnancy related-mortality ratio (PRMR) was 29.5 for Black women and 11.5 for white women. Black women also experienced SMM at a higher rate, 210 per 10,000 deliveries, when compared to white women, 124 per 10,000 deliveries.\textsuperscript{1} In addition, mothers covered by Medicaid were over two times more likely to die from a pregnancy-related death than mothers covered by private insurance. From 2008 to 2016, mothers with Medicaid coverage had a PRMR of 22.2 and mothers with private insurance had a PRMR of 9.4.\textsuperscript{1}
About the Ohio Maternal Safety Quality Improvement Project

To address the issues of severe maternal morbidity and mortality due to hypertensive disorders of pregnancy and their contributing factors, the Ohio Department of Health, in collaboration with The Ohio State University Wexner Medical Center, University Hospitals Cleveland Medical Center, MetroHealth Medical Center, Ohio Hospital Association (OHA), the Ohio Perinatal Quality Collaborative (OPQC) and the Ohio Colleges of Medicine Government Resource Center (GRC), has initiated the Maternal Safety Quality Improvement Project (QIP), funded by the Health Resources and Services Administration (HRSA). The project aims to reduce the rate of hypertension-related maternal morbidity and mortality in Ohio for pregnant and postpartum women. The SMART aims for the work are:

1. Reduce the rate of severe maternal morbidity (SMM) across Ohio in pregnant and postpartum women related to HTN* by 20% by September 2024.

2. Reduce the rate of maternal mortality in pregnant and postpartum women with HTN* across Ohio from X% to X% by September 2024.

3. Reduce disparities in maternal morbidity and mortality with HTN* across Ohio by 25% by September 2024.

* Includes chronic HTN, gestational HTN, preeclampsia, eclampsia, or preeclampsia superimposed on pre-existing HTN

The Maternal Safety QIP utilizes quality improvement science to achieve the SMART aims and reduce maternal morbidity and mortality throughout the project implementation period. Utilizing a modified version of the Institute for Healthcare Improvement (IHI) Model for Improvement, participating sites will form a project team and develop rapid feedback Plan-Do-Study-Act cycles to test interventions designed to equip providers with best clinical practices to provide care to pregnant and postpartum mothers.

This toolkit was developed by the project team, based on the Alliance for Innovation on Maternal Health's Severe Hypertension in Pregnancy patient safety bundle, to inform best clinical practices.

Introduction to the Model for Improvement and PDSAs

The Model for Improvement is a powerful tool for accelerating improvement. The model is not meant to replace change models that organizations may already be using, but rather to accelerate improvement. The model has three fundamental questions. The third question relates to the Plan-Do-Study-Act (PDSA) cycle, which tests changes in real work settings. The PDSA cycle guides the test of a change to determine if the change is an improvement.
Step 1: Form a Project Team
Having the right people on a quality improvement team is essential. Teams can vary in size and composition based on the organization and the complexity of the improvement effort. An effective team includes a Project Champion, someone in a leadership position who can get buy-in from staff members required for change to occur. The Project Champion may represent the following:

- Organizational Leadership
- Program Expertise
- Day-to-Day Leadership

Step 2: Set Aims
“*What are we trying to accomplish?*”
For example: The SMART aims for the Maternal Safety QIP are to:

1. Reduce the rate of severe maternal morbidity (SMM) across Ohio in pregnant and postpartum women related to HTN by 20% by September 2024.

2. Reduce the rate of maternal mortality in pregnant and postpartum women with HTN across Ohio from X% to X% by September 2024.

3. Reduce disparities in maternal morbidity and mortality with HTN across Ohio by 25% by September 2024.

Once you know your organization’s data, these aims can be adapted for your setting.
Step 3: Establish Measures
“How will we know that a change is an improvement?”

<table>
<thead>
<tr>
<th>Process Measures</th>
<th>Balancing Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Timely Blood Pressure Treatment</td>
<td>- Mean Arterial Pressure (MAP) Decrease</td>
</tr>
<tr>
<td>- Appropriate Medical Management</td>
<td>- Fetal Heart Rate (FHR) Deterioration</td>
</tr>
<tr>
<td>- Discharge Education Materials</td>
<td>- Fetal Heart Rate (FHR) Deterioration – MAP Decrease</td>
</tr>
<tr>
<td>- Follow-up Appointment Scheduled</td>
<td></td>
</tr>
<tr>
<td>- Follow-up for Patient with Rx</td>
<td></td>
</tr>
<tr>
<td>- Postpartum Bundle Implementation</td>
<td></td>
</tr>
</tbody>
</table>

Step #4: Select Changes
“What changes can we make that will result in improvement?”

Changes are necessary to make improvements. Rather than completely reconfiguring your current process, develop, test, and implement changes on a small scale. What are the low-hanging fruits? Your team can also use previously gathered observations to determine the changes. Examples:

- Ensure appropriate blood pressure measurement protocol
- Utilize care checklists for care of hypertensive disorders of pregnancy
Step #5: Test Changes
Start testing the selected changes! By testing these strategies on a small scale, you will learn what will work in your setting. Your team can start testing changes in order to figure out what strategies are appropriate for your practice setting.

Follow the Plan-Do-Study-Act (PDSA) cycle:

ACT
Develop a plan to test the change (Who? What? When? Where? What data need to be collected?)

PLAN
Based on your analysis, refine the change. Determine what modification should be made and plan for the next test.

DO
Implement the test on a small scale.

STUDY
Use data to analyze the results of the change and determine if it made a difference.

Step #6: Implement Changes
After several PDSA cycles, your changes can be tested on a broader scale. Implementation is a permanent change to the current process. It may affect documentation, written policies, hiring, training, compensation, and organizational infrastructure. Implementation also requires following the PDSA cycle for continuous testing and monitoring.

Step #7: Spread Changes
After successful tests, your changes can be spread and implemented to other parts of your organization.
Readiness

The Readiness Domain ensures that hospital units are prepared to treat and address hypertensive emergencies. This is accomplished through the implementation of best clinical practices to prevent delays in treatment and to prepare for optimal management of severe hypertension, preeclampsia, and eclampsia. The five key elements of the Readiness domain are:

1. Standards for early warning signs, diagnostic criteria, monitoring and treatment of severe preeclampsia/eclampsia (include order sets and algorithms).

2. Unit education on protocols, unit-based drills (with post-drill debriefs).

3. Process for timely triage and evaluation of pregnant and postpartum women with hypertension including ED and outpatient areas.

4. Rapid access to medications used for severe hypertension/eclampsia: Medications should be stocked and immediately available on labor and delivery and in areas where patients may be treated. Include brief guide for administration and dosage.

5. System plan for escalation, obtaining appropriate consultation, and maternal transport, as needed.
Standards for Early Warning Signs

Units

- Labor & Delivery
- Triage
- Antepartum
- Postpartum
- Emergency Department
- Non-OB inpatient units

Expectation

- Treatment with appropriate therapy within 60 minutes of diagnosis of hypertensive emergency
- System plan for escalation, obtaining appropriate consultation, and maternal transport, as needed

Table 1. Stages of HTN Emergency

<table>
<thead>
<tr>
<th>Stage 1</th>
<th>Initial treatment and therapy escalation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Protocol activation and bedside care by primary nurse or primary provider</td>
</tr>
<tr>
<td></td>
<td>Notify charge nurse or lead nurse for nursing staff</td>
</tr>
<tr>
<td>Stage 2</td>
<td>Continued therapy escalation if needed with alternative agent</td>
</tr>
<tr>
<td></td>
<td>Bedside care by primary nurse and additional support nurse or obstetrical provider if available</td>
</tr>
<tr>
<td></td>
<td>Notification of charge nurse, anesthesia staff, intensivist staff if need for additional assistance</td>
</tr>
<tr>
<td>Stage 3</td>
<td>Continued therapy escalation and transfer to intensive care unit if:</td>
</tr>
<tr>
<td></td>
<td>a) Transfer arrangements have not been made</td>
</tr>
<tr>
<td></td>
<td>b) Patient remains unstable for transport</td>
</tr>
<tr>
<td></td>
<td>Bedside care with primary nurse and additional support nurse, obstetrical provider, anesthesia staff, intensivist staff</td>
</tr>
<tr>
<td></td>
<td>Notification of charge nurse, anesthesia staff, intensivist staff</td>
</tr>
<tr>
<td></td>
<td>If planning to potentially emergently deliver, consider notification of pediatrics staff for resuscitation and neonatal care</td>
</tr>
</tbody>
</table>
Consultation Consideration

- Any instances of Stage 1, 2, or 3 HTN
- Other signs, symptoms, findings, or clinical conditions of concern to the primary assessment care team or the items listed below in Table 2

Laboratory

Stat laboratory analysis for:

- Complete blood count (CBC)
- Comprehensive metabolic profile (CMP)
- Lactate dehydrogenase (LDH)
- Coagulation panel (PT/INR, PTT, Fibrinogen)
- Random urine protein to creatinine ratio

<table>
<thead>
<tr>
<th>Pulmonary/ Fluids</th>
<th>Pulmonary edema</th>
<th>Fluid overload</th>
<th>Leaky membrane</th>
<th>Low colloid oncotic pressure</th>
<th>Unresponsive to diuretics</th>
<th>Shortness of breath</th>
<th>Unresponsive asthmatic therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac</td>
<td>Cardiac pump failure (such as peripartum cardiomyopathy)</td>
<td>Arrhythmia</td>
<td>Hypoxia</td>
<td>Chest trauma</td>
<td>Allergic reaction</td>
<td>Magnesium toxicity</td>
<td></td>
</tr>
<tr>
<td>Neurologic</td>
<td>Seizures (eclampsia)</td>
<td>Unresponsive seizures to typical therapy (magnesium followed by anti-epileptics)</td>
<td>Altered mental status</td>
<td>Cerebrovascular accident</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hematologic</td>
<td>Disseminated intravascular coagulation</td>
<td>Thrombocytopenia (platelet &lt; 50,000)</td>
<td>Coagulopathy</td>
<td>Obstetrical hemorrhage</td>
<td>Anticoagulation use</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pharmacy

Readily available agents and appropriate dosages for initial emergent hypertension therapy including:

- IV labetalol: 20 mg, 40 mg, and 80 mg
- IV Hydralazine: 5 mg and 10 mg
- PO Nifedipine immediate release: 10 mg and 20 mg
- Calcium gluconate: 1g IV in 10% solution (10 mL)
- Magnesium sulfate
  a) IV – 6 g bolus and 2 g continuous infusion with 10% solution
  b) IM – 5 g injections with 50% solution with two initial injections and one injection every 4 hours thereafter
Second-line agents to be considered in an ICU setting where appropriate (but do not need to be readily available in obstetrical units).

- Nicardipine infusion infusion initially at 5 mg/hr with a maximum dose of 15 mg/hr
- Esmolol infusion
  - Immediate: 1000 mcg/kg over 30 sec followed by 150 mcg/kg/min infusion with maximum of 300 mcg/kg/min
  - Gradual: 500 mcg/kg over 1 min followed by 50 mcg/kg/min over 4 min with either continuing the 50 mcg/kg/min rate thereafter or titrating up 50 mcg/kg/min over 4 min up to a maximum of 300 mcg/kg/min

Radiology
- Stat portable chest X-ray availability

Equipment
- The following should be available to monitor the patient's status:
  - Maternal pulse oximetry
  - Supplemental oxygen
  - Bag-mask ventilation
  - Suction
  - Padding for the patient's bed
  - Continuous external fetal monitoring

Unit Education on Protocols, Unit-based Drills

Health Equity Education
It is important to understand the implications of health equity and disparities on outcomes of maternal hypertension, particularly when considering the differences in outcomes for African American mothers, who experience maternal mortality at a rate greater than 2.5 times that of white women. As such, several resources may be utilized to educate an organization’s providers and staff on the concepts of health equity.

<table>
<thead>
<tr>
<th>Table 3. Training Opportunities</th>
</tr>
</thead>
</table>
Unit Education
Organizations may utilize the following resources to conduct unit-based drills for their units and staff.

<table>
<thead>
<tr>
<th>Table 4. Unit-based Drills</th>
</tr>
</thead>
</table>

Process for Timely Triage and Evaluation of Pregnant and Postpartum Women with Hypertension
These checklists may be utilized when evaluating and triaging patients.

<table>
<thead>
<tr>
<th>Table 5. Triage Resources</th>
</tr>
</thead>
</table>
### Table 6. Sample L&D Severe Preeclampsia & Eclampsia Box – Content and Dose Guideline

<table>
<thead>
<tr>
<th>Medication</th>
<th>Dose/Route</th>
</tr>
</thead>
</table>
| Magnesium 20 grams/500 ml bag      | **IV (Use Magnesium Sulfate Continuous Infusion under L&D protocol in Alaris Pump Library):**<br>
|                                   | **Initial (Loading Dose):** 4-6 g (100 ml – 150 ml) over 20-30 minutes<br>
|                                   | **Maintenance Dose:** 1-2 g/hour (25 ml/hr – 50 ml/hr) continuous infusion<br>
|                                   | **Intramuscular Injection (in case of difficulty establishing venous access):**<br>
|                                   | **Initial (Loading Dose):** 10 g (20 ml)<br>
|                                   | **Maintenance Dose:** 5 g (10 ml) q 4 hours                                  |
| Labetalol 100 mg/20 ml vial        | **Initial:** Draw 4 ml from the vial<br>
|                                   | 10–20 mg (2 ml - 4ml) IV, then 20–80 mg (4ml - 16ml) every 10–30 minutes to a maximum cumulative dosage of 300 mg (60 ml); or constant infusion 1-2 mg/min IV |
| Hydralazine 20 mg/ml vial          | **Initial:** Draw 0.25 ml from the vial<br>
|                                   | 5 mg IV or IM, then 5–10 mg IV every 20–40 minutes to a maximum cumulative dosage of 20 mg; or constant infusion of 0.5–10 mg/hr |
| Nifedipine 10 mg PO                | 10–20 mg orally, repeat in 20 minutes if needed; then 10–20 mg every 2–6 hours; maximum daily dose is 180 mg |
| Calcium gluconate 1000 mg/10 ml vial | 10% solution, 10 ml IV over 3 minutes                                       |
| Supply contents                    | 3 ml, 10 ml, and 20 ml syringes, appropriate needles and appropriate tubing sets |
| Esmolol 100 mg/10 ml vial (By Anesthesiologists ONLY) | Requires coordination with Anesthesiologist |
| Propofol 10 mg/ml, 20 ml vial (By Anesthesiologists ONLY) | Requires coordination with Anesthesiologist |

**System Plan for Escalation**

Please see Appendix B for a sample form that may be used as a tool to aid in communication when transferring pregnant patients to a higher level of care.11
The Hypertension Maternal Safety Bundle Recognition and Prevention Domain is intended to ensure that hospital units are prepared to identify and assess every patient for hypertensive emergency. This is accomplished through the implementation of standards for patient assessment, early warning signs, and patient education. There are three key elements in the Recognition and Prevention domain.  

1. Establishing a standard protocol for measurement and assessment of BP and urine protein for all pregnant and postpartum women.

2. Standard response to maternal early warning signs including listening to and investigating patient symptoms and assessment of key laboratory values.

3. Facility-wide standards for educating prenatal and postpartum women on signs and symptoms of hypertension and preeclampsia.
Standard Protocol for Measurement and Assessment
Blood Pressure Measurement

The graphic below from the American Heart Association\(^2\) may be used as a guide for clinicians and providers regarding appropriate and accurate blood pressure measurement. Additional information regarding blood pressure measurement may be found in Appendix C.

Proteinuria Recommendations

1. As a heterogeneous and progressive syndrome, preeclampsia may present in some women with hypertension and other clinical features/symptoms in the absence of proteinuria.

2. A urine protein-to-creatinine ratio is considered an alternative to a 24 hour urine collection for assessment of proteinuria in pregnancy as a urine protein-to-creatinine ratio may be performed more rapidly.

3. While proteinuria remains one of the diagnostic criteria for preeclampsia, the quantity of proteinuria is NOT predictive of perinatal outcomes and should NOT be used to define the severity of disease (see box – severe features).

4. HELLP syndrome and eclampsia can occur in the absence of proteinuria.

5. In patients at a high risk for preeclampsia or preexisting renal disease (such as chronic hypertension, diabetes, or lupus among other comorbidities), a baseline quantitative assessment of proteinuria should be obtained early in pregnancy.

6. In pregnancy, the presence of proteinuria in the absence of hypertension requires close clinical surveillance for evolving preeclampsia and consideration of other underlying etiologies (medical renal disease).
Standard Response to Maternal Early Warning Signs

Risk Assessment – Preeclampsia Early Recognition Tool (PERT)

Anytime there is a concern for hypertensive disorders of pregnancy, the components of the tool should be covered and reviewed this includes:

- Initial and on-going assessments in outpatient Obstetrical care settings, OB Triage, Labor and Delivery, Antepartum, Postpartum, Emergency Department, and non-obstetrical inpatient units

Centers should utilize the tool to develop:

- A process for the recognition and appropriate response in the event of a patient’s deteriorating condition
- Written criteria describing early warning signs and intervention strategies
  - When possible, these criteria should be built into the EMR system
- Magnesium sulfate toxicity monitoring and magnesium levels should only be considered if the patient is receiving magnesium sulfate infusion for seizure prophylaxis or treatment of eclampsia

The flowchart below may be used to evaluate a patient’s risk level for a hypertensive emergency, and indicates which tool should be referenced.4

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**Diagram:**

```
General assessment for patient that is high risk for hypertensive emergency

Two SBP of at least 140/90mmHg in last hour?

No

Hx of CHTN, GHTN, preeclampsia, morbid obesity, pre-gestational diabetes or recent stimulant ingestion?

No

Utilize PERT tool

Yes

High risk for hypertensive emergency

Severely elevated BP (SBP >160 or DBP >110)?

No

Proceed to Stages of Care - Stage 0

Yes

Proceed to Stages of Care - Stage 1
```

4 Recognition 17
Use the PERT tool when there is any concern that a patient is experiencing a hypertensive disorder of pregnancy.

<table>
<thead>
<tr>
<th>Preeclampsia Early Recognition Tool (PERT)</th>
<th>Patient Signs/Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal (green)</td>
</tr>
<tr>
<td>Awareness</td>
<td>Alert/Oriented</td>
</tr>
<tr>
<td></td>
<td>Worrisome (yellow)</td>
</tr>
<tr>
<td></td>
<td>Agitated/confused</td>
</tr>
<tr>
<td></td>
<td>Drowsy</td>
</tr>
<tr>
<td></td>
<td>Difficulty speaking</td>
</tr>
<tr>
<td></td>
<td>Unresponsive</td>
</tr>
<tr>
<td>Headache</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Mild headache</td>
</tr>
<tr>
<td></td>
<td>Nausea/vomiting</td>
</tr>
<tr>
<td></td>
<td>Unrelieved headache</td>
</tr>
<tr>
<td>Vision</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Blurred or impaired</td>
</tr>
<tr>
<td></td>
<td>Temporary blindness</td>
</tr>
<tr>
<td>Shortness of breath</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Present</td>
</tr>
<tr>
<td></td>
<td>Present</td>
</tr>
<tr>
<td>Pain</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Nausea/vomiting</td>
</tr>
<tr>
<td></td>
<td>Chest pain</td>
</tr>
<tr>
<td></td>
<td>Abdominal pain</td>
</tr>
<tr>
<td></td>
<td>Nausea/vomiting</td>
</tr>
<tr>
<td></td>
<td>Chest pain</td>
</tr>
<tr>
<td></td>
<td>Abdominal pain</td>
</tr>
<tr>
<td>Vital Signs</td>
<td></td>
</tr>
<tr>
<td>Systolic BP (mmHg)</td>
<td>100-139</td>
</tr>
<tr>
<td></td>
<td>140-159</td>
</tr>
<tr>
<td></td>
<td>≥160</td>
</tr>
<tr>
<td>Diastolic BP (mmHg)</td>
<td>50-89</td>
</tr>
<tr>
<td></td>
<td>90-110</td>
</tr>
<tr>
<td></td>
<td>≥110</td>
</tr>
<tr>
<td>Heart rate (bpm)</td>
<td>61-110</td>
</tr>
<tr>
<td></td>
<td>111-129</td>
</tr>
<tr>
<td></td>
<td>≥130</td>
</tr>
<tr>
<td>Respiration rate</td>
<td>12-24</td>
</tr>
<tr>
<td></td>
<td>25-30</td>
</tr>
<tr>
<td></td>
<td>&lt; 10 or &gt; 30</td>
</tr>
<tr>
<td>O2 saturation</td>
<td>≥95</td>
</tr>
<tr>
<td></td>
<td>91-94</td>
</tr>
<tr>
<td></td>
<td>≤90</td>
</tr>
<tr>
<td>Urine output (mL/hr)</td>
<td>≥50</td>
</tr>
<tr>
<td></td>
<td>30-49</td>
</tr>
<tr>
<td></td>
<td>≤30 (over 2 hours)</td>
</tr>
<tr>
<td>Magnesium sulfate toxicity monitoring*</td>
<td>DTR + 1</td>
</tr>
<tr>
<td></td>
<td>Depressed patellar</td>
</tr>
<tr>
<td></td>
<td>reflexes</td>
</tr>
<tr>
<td></td>
<td>Respiratory rate &lt; 12</td>
</tr>
<tr>
<td>Fetal Monitoring</td>
<td></td>
</tr>
<tr>
<td>Fetal HR tracing</td>
<td>Category 1</td>
</tr>
<tr>
<td></td>
<td>Category 2</td>
</tr>
<tr>
<td></td>
<td>Category 3</td>
</tr>
<tr>
<td>NST</td>
<td>Reactive</td>
</tr>
<tr>
<td></td>
<td>Nonreactive</td>
</tr>
<tr>
<td></td>
<td>Nonreactive</td>
</tr>
</tbody>
</table>
### Laboratory Findings

<table>
<thead>
<tr>
<th></th>
<th>Protein/creatinine ratio</th>
<th>Urine protein/creatinine ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proteinuria</td>
<td>&lt; 0.3</td>
<td>≥ 0.3</td>
</tr>
<tr>
<td></td>
<td>24 hour &lt; 300 mg</td>
<td>24 hour ≥ 300 mg</td>
</tr>
<tr>
<td>Platelets</td>
<td>&gt; 100,000 / µL</td>
<td>50,000 – 100,000 / µL</td>
</tr>
<tr>
<td></td>
<td>&lt; 50,000 / µL</td>
<td></td>
</tr>
<tr>
<td>AST or ALT</td>
<td>&lt; 70 IU / L</td>
<td>&gt; 70 IU / L</td>
</tr>
<tr>
<td>Creatinine</td>
<td>&lt; 0.8 mg / dL</td>
<td>0.9 – 1.1 mg / dL</td>
</tr>
<tr>
<td>Magnesium*</td>
<td>4.8 – 6.6 mg / dL</td>
<td>6.6 – 8.4 mg / dL</td>
</tr>
<tr>
<td></td>
<td>≥ 8.4 mg / dL</td>
<td></td>
</tr>
</tbody>
</table>

### Response to PERT Tool

- **1 trigger** – notify provider for additional assessment
- **≥ 2 triggers** – proceed to “Stages of Care - Stage 0” for further care
- Proceed with usual care either inpatient or outpatient
- *Consider inpatient surveillance*

Proceed to “Stages of care – Stage 1” for further care
- *Inpatient surveillance recommended*

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### Facility-wide Standards for Educating Prenatal and Postpartum Women

For additional educational resources for the healthcare team and patients, please see Appendix C.

**Table 7. Educational Resources on Signs and Symptoms of Hypertension and Preeclampsia**

<table>
<thead>
<tr>
<th>Alliance for Innovation on Maternal Health (AIM) eModules: Severe Hypertension (HTN) in Pregnancy</th>
<th><a href="https://safehealthcareforeverywoman.org/aim-emodules/#link_acc-1-5-d">https://safehealthcareforeverywoman.org/aim-emodules/#link_acc-1-5-d</a></th>
</tr>
</thead>
</table>
Response

The Hypertension Maternal Safety Bundle Response Domain is intended to ensure that hospital units employ standard and appropriate interventions to treat and address hypertensive emergencies. This is accomplished through the implementation of best clinical practices and protocols to prevent delays in treatment and to encourage standards of practice for the response and treatment of severe hypertension, preeclampsia, and eclampsia. There are three key elements that each organization should utilize to fulfill the requirements of the Response domain.¹

1. Facility-wide standard protocols with checklists and escalation policies for management and treatment of: severe hypertension, eclampsia, seizure prophylaxis, magnesium over-dosage, and postpartum presentation of severe hypertension/preeclampsia.

2. Minimum requirements for protocol:
   
   a) Notification of physician or primary care provider if systolic BP ≥160 or diastolic BP ≥ 110 for two measurements within 15 minutes.
   
   b) After the second elevated reading, treatment should be initiated ASAP (preferably within 60 minutes of verification).
c) Includes onset and duration of magnesium sulfate therapy.

d) Includes escalation measures for those unresponsive to standard treatment.

e) Describes manner and verification of follow-up within seven to 14 days postpartum.

f) Describe postpartum patient education for women with preeclampsia.

3. Support plan for patients, families, and staff for ICU admissions and serious complications of severe hypertension.

Facility-wide Standard Protocols with Checklists and Escalation Policies for Management and Treatment of:

<table>
<thead>
<tr>
<th>Severe Hypertension</th>
<th>ACOG Hypertensive Emergency Checklist²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eclampsia, seizure prophylaxis, and magnesium over-dosage</td>
<td>ACOG Eclampsia Checklist³</td>
</tr>
<tr>
<td>Postpartum presentation of severe hypertension/preeclampsia</td>
<td>ACOG Postpartum Preeclampsia Checklist⁴</td>
</tr>
</tbody>
</table>

Minimum Requirements for Protocol

- Notification of physician or PCP if Systolic BP ≥ 160 or Diastolic BP ≥ 110 for 2 measurements within 15 minutes
- After the second elevated BP reading, treatment should be initiated ASAP (within 60 minutes of verification)
- Protocol includes onset and duration of magnesium sulfate therapy
- Protocol includes escalation measures for those unresponsive to standard treatment
- Protocol describes manner and verification of follow-up within 7-14 days postpartum
- Protocol describes postpartum education for women with preeclampsia

Stage System for Hypertensive Emergency⁵

1. Primary nurse or Obstetrical provider initiates protocol.

2. Once activated, orders should be placed for appropriate anti-hypertensive therapy based on the patient’s past medical history, allergies, and clinical findings.
<table>
<thead>
<tr>
<th>Conditions</th>
<th>Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspicion for underlying heart failure, asthma, cocaine or methamphetamine abuse, bradycardia (HR &lt; 60 bpm)</td>
<td>Recommend hydralazine or immediate-release nifedipine (avoid labetalol)</td>
</tr>
<tr>
<td>Predominantly systolic hypertension and pulse pressure &gt; 70</td>
<td>Recommend labetalol</td>
</tr>
<tr>
<td>Predominantly diastolic hypertension and pulse pressure &lt; 50</td>
<td>Recommend hydralazine</td>
</tr>
<tr>
<td>If mixed systolic or diastolic hypertension and pulse pressure</td>
<td>Recommend labetalol</td>
</tr>
<tr>
<td>If no IV access</td>
<td>Recommend immediate release nifedipine</td>
</tr>
</tbody>
</table>

**Initiate magnesium for seizure prophylaxis**

3. Continue assessments until two consecutive BP readings no sooner than 15 minutes apart are obtained that are < 160 mmHg (systolic) and < 110 mmHg (diastolic) appropriately measured.

4. Once BP thresholds are achieved, repeat BP measurement every 15 min for one hour, then every 30 minutes for one hour, then every hour for four hours.

5. Ensure the patient's family is supported and well-apprised of the situation at each stage.

**Stage 1**

**Definition**

**Hypertensive Emergency:**
- SBP ≥ 160 or
- DBP ≥ 110

**Notes:**
- Separated by 15 minutes within 1 hour
- Values do not need to be consecutive

**Care team**

**At Bedside: Level 3**
- Primary nurse
- Primary resident
- In-house OB (if available)
- If in ER, primary ER provider (if available)

**Notify: Level 3**
- Charge nurse
- Chief resident
- In-house OB provider
- Consider telephone MFM consultation if coexisting medical issue if not immediately available
### Monitoring

<table>
<thead>
<tr>
<th>Labs:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Complete blood count</td>
</tr>
<tr>
<td>- Comprehensive metabolic panel</td>
</tr>
<tr>
<td>- Uric acid</td>
</tr>
<tr>
<td>- Coagulation panel</td>
</tr>
<tr>
<td>- Lactic dehydrogenase</td>
</tr>
<tr>
<td>- Consider placement of Foley catheter</td>
</tr>
</tbody>
</table>

- Continuous external fetal monitoring
- Continuous pulse oximetry
- IV access: single 18g

### Therapy - Content and Dose Guidelines (See Appendix D)

#### Labetalol Protocol
- 20 mg IV over 2 min initially
- Recheck BP in 15 min
- If BP still ≥ 160/110, give 40 mg IV over 2 min
- Recheck BP in 15 min
- If BP still ≥ 160/110, give 80 mg IV over 2 min
- Recheck BP in 15 min and if BP ≥ 160/110 move to Stage 2

#### Hydralazine Protocol
- 5 or 10 mg IV over 2 min initially
- Recheck BP in 15 min
- If BP still ≥ 160/110, give 10 mg IV over 2 min
- Recheck BP in 15 min and if BP ≥ 160/110 move to Stage 2

#### Nifedipine Immediate-Release Protocol (No IV access)
- 10 mg PO initially
- Recheck BP in 15 min
- If BP still ≥ 160/110, give 20 mg PO
- Recheck BP in 15 min
- If BP still ≥ 160/110, give 20 mg PO
- Recheck BP in 15 min and if BP ≥ 160/110 move to Stage 2

If adequate decrease (SBP ≥ 20 mmHg or a DBP ≥ 10 mmHg) occurs, withhold additional treatment dosages for 10 minutes and repeat BP measurements

If progression to Stage 2 becomes necessary:
1. Contact the charge nurse, attending OB, anesthesia staff, intensivist staff, or maternal-fetal medicine specialist where appropriate;
2. Bring an additional staff nurse to the patient's room to aid in care;
3. A “huddle” should be performed at the bedside with the team leader, nursing, and recorder/time keeper.
## Stage 2
### Definition

**Persistent Hypertensive Emergency:**
- SBP ≥ 160 or
- DBP ≥ 110 after giving maximum dose of one type of medication from Stage 1

### Care team

**At Bedside: Level 3**
- Primary nurse
- Charge nurse
- Primary resident
- Chief resident
- In-house OB (if available)
- If in ER, primary ER provider (if available)

**Notify: Level 3**
- Charge nurse
- Chief resident
- In-house OB provider
- Anesthesia staff
- Consider telephone MFM consultation if coexisting medical issue if not immediately available

### Monitoring
- Continuous external fetal monitoring
- Continuous pulse oximetry
- IV access: single 18g
- Foley catheter with urometer

### Therapy - Content and Dose Guidelines (See Appendix D)

#### Labetalol Protocol
- Consider repeat 80 mg IV over 2 min or switch to Hydralazine 10 mg IV over 2 min
- Recheck BP in 15 min if Labetalol given OR if hydralazine given
- If BP ≥ 160/110 move to Stage 3

#### Hydralazine Protocol
- Switch to Labetalol 20 mg IV over 2 min
- Recheck BP in 15 min
- If BP still ≥ 160/110, give Labetalol 40 mg IV over 2 min
- Recheck BP in 15 min and if BP ≥ 160/110 move to Stage 3
- Hydralazine administered at 30 min

#### Nifedipine Immediate Release Protocol
- Switch to Labetalol 20 mg IV over 2 min
- Recheck BP in 10 min and if BP ≥ 160/110 move to Stage 3

#### Magnesium Sulfate Protocol
- 6g IV bolus of 10% solution followed by 2g maintenance OR
- 5g IM injection of 50% solution in each buttock (2 injections) with additional 5g injections (1 injection) every 4 hours
  - May give lidocaine to reduce pain

If adequate decrease (SBP ≥ 20 mmHg or a DBP ≥ 10 mmHg) occurs, withhold additional treatment dosages for 10 minutes and repeat BP measurements.

If progression to Stage 2 becomes necessary:
1. Contact the charge nurse, attending OB, anesthesia staff, intensivist staff, or maternal-fetal medicine specialist where appropriate
2. Bring an additional staff nurse to the patient's room to aid in care
3. A “huddle” should be performed at the bedside with the team leader, nursing, and recorder/time keeper.
### Stage 3

#### Definition

**Persistent Hypertensive Emergency:**
- SBP ≥ 160 or
- DBP ≥ 110 after giving maximum dose of medication from Stage 2

#### Care team

**At Bedside: Level 3**
- Primary nurse
- Charge nurse
- Primary resident
- Chief resident
- In-house OB (if available)
- If in ER, primary ER provider (if available)
- Anesthesia staff
- Intensivist staff
- Maternal-Fetal Medicine (if available)

**Notify: Level 3**
- Charge nurse
- Chief resident
- In-house OB provider
- Anesthesia staff
- Intensivist staff
- Maternal-Fetal Medicine

#### Monitoring

- Continuous external fetal monitoring
- Continuous pulse oximetry
- IV access: two 18 g
- Foley catheter with urometer

- Telemetry
- Consider arterial line
- Consider repeat labs from Stage 1

#### Therapy - Content and Dose Guidelines (See Appendix D)

**Labetalol Protocol**
May continue with dosing escalation up to:
- Labetalol 200 mg IV cumulatively (in 20-80 mg dose increments)
- Hydralazine 20 mg IV cumulatively (in 5-10 mg dose increments)
- Nifedipine 180 PO cumulatively (in 10-20 mg dose increments)

**Second-Line Suggested Protocols (only to be used in conjunction with Anesthesia or ICU providers)**
- Nicardipine infusion initially at 5 mg/hr with a maximum dose of 15 mg/hr
- Esmolol
  - Immediate: 1000 mcg/kg over 30 sec followed by 150 mcg/kg/min infusion with maximum of 300 mcg/kg/min
  - Gradual: 500 mcg/kg over 1 min followed by 50 mcg/kg/min over 4 min with either continuing the 50 mcg/kg/min rate thereafter or titrating up 50 mcg/kg/min over 4 min up to a maximum of 300 mcg/kg/min

***Patient should be transferred to ICU***
Support Plan for Patients, Families, and Staff
For more support and response resources, please see Appendix D.

<table>
<thead>
<tr>
<th>Support Plan for ICU Admissions and Serious Complications of Severe Hypertension</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Disclosure and Discussion of Adverse Events</strong>⁸</td>
</tr>
<tr>
<td><strong>Emergent Therapy for Acute-Onset, Severe Hypertension During Pregnancy and the Postpartum Period</strong>⁹</td>
</tr>
</tbody>
</table>
Reporting

The Hypertension Maternal Safety Bundle Reporting is intended to ensure that hospital units have systems in place to review patient care, risks, and events. This is accomplished through the implementation of practices such as huddles and debriefs, multidisciplinary committee reviews, and monitoring of contribution metrics. There are three key elements in the Reporting domain.¹

1. Establishing a culture of huddles for high risk patients and post-event debriefs to identify successes and opportunities.

2. Conducting a multidisciplinary review of all severe hypertension/eclampsia cases admitted to ICU for systems issues.

3. Monitoring outcomes and process metrics.

Establish a Culture of Huddles and Post-Event Debriefs

A standardized system of briefs, huddles, and debriefs should be established to coordinate patient care, identify potential risks and events, acknowledge successes and opportunities for growth, and promote team-centered approaches for the treatment and management of severe maternal hypertension. In addition, facilities should develop a system to perform debriefs and case reviews for select
Meetings to fulfill planning functions such as forming the team, designating roles, and establishing goals. They should engage the entire team in patient planning. Patients should be involved in the plan of care and briefings to promote active involvement and shared decision making. 

Briefs

Huddles

Debriefs

Brief, informal feedback sessions that take place after an event has occurred. They are intended to identify opportunities for improvement in teamwork, skills, and outcomes.

Brief, ad hoc team meetings that are intended to allow the team to regain situational awareness, discuss critical issues and emerging events, anticipate outcomes and contingencies, assign resources, and express any concerns. 

Cases of severe hypertension in pregnant and postpartum mothers. For tools and techniques to implement in these systems, please see Appendix E.²

Multidisciplinary Review of All Severe Hypertension/Eclampsia Cases Admitted to ICU for Systems

Multidisciplinary reviews differ from debriefs and huddles in that they are formal meetings that include the staff members involved in the incident, as well as unit and facility leadership and the risk management team. They are intended to identify any systems issues or breakdowns that contributed to the outcome of the event. The reviews should take place as soon as possible after the event occurs.

Reviews should include an in-depth records review, an event timeline, and a root cause analysis. All hospitals should have a process to perform multidisciplinary systems-level reviews on all severe hypertension cases that are admitted to the intensive-care unit. In addition, all severe hypertension cases in which a quality issue or adverse event was identified should also be reviewed.

If your site is establishing a framework for a safety and quality committee, please see Appendix E for example documents.

A multidisciplinary Perinatal Quality Committee is a practical method to review cases and track process and outcome measures.
Monitor Outcomes and Process Metrics

Process measures are steps in a process or workflow that contribute to specific outcome metrics. They can have a positive or a negative impact, and are a representation of a system’s efforts to apply evidence-based practices or interventions to improvement processes. Process, balancing, and outcomes measures may be found in the executive summary of the toolkit.

Semi-Annual General Assessment

A prospective survey will be administered over the course of the project to determine the availability of the following resources that may help to structure and guide the internal review process:

☐ Does your organization provide educational resources for Maternal Hypertension?

☐ Is there a system in place for interdisciplinary huddles for Hypertension care in your Labor and Delivery, Triage, Antepartum, and Postpartum units?

☐ Is there a system for Quality and Safety Committee Reviews for episodes of severe maternal morbidity?

☐ Does your team have simulation training directed toward Maternal Hypertension?

☐ Does your organization offer education and training for disparities in health care and health equity and training for patients of color?

Health equity is a crucial aspect of maternal safety. Hospitals are encouraged to establish a framework to address disparities for mothers in Ohio. This includes resources for on implicit bias, racial and ethnic disparities, and shared decision making.
Appendix A – Executive Summary

References


Appendix B - Section 1 Readiness
Resources: Tools and Tables

Maternal Transport Summary & Checklist
This form is an example and should be modified to fit each receiving facility’s unique requirements

G_ P_ _ _ _ EDC_______ Gest Age____ wk __ d {or Date Delivered: ______} Pt Weight________

Indication(s) for transfer: □ Maternal________________ □ Fetal________________

Primary Diagnosis:

Secondary Diagnoses:

Pertinent PMH, PSH:

Other services needed on transfer: □ NICU □ ICU □ Cardiac □ Other________________

Referring Hospital: ___________________ Level of Care: Maternal___ Neo___

Referring Physician: ___________________ Phone: ___________________

Primary Obstetrician: ___________________ Phone: ___________________

Receiving Hospital: ___________________ Level of Care: Maternal___ Neo___

Accepting Physician: ___________________ Phone: ___________________

Vitals: Current Time: _______ BP __/___ P ___ R ___ O2 sat: ___ T ___

On transfer Time: _______ BP __/___ P ___ R ___ O2 sat: ___ T ___

Vaginal exam: ____ / ____ / ____ date/time ___________________

Vaginal exam: ____ / ____ / ____ date/time ___________________

Membranes: □ Intact □ Ruptured □ Bulging

Bleeding: □ Yes (EBL: _________ml) □ No

Ultrasound:

Previa: □ Yes □ No □ Unknown

EFW: _________________ g

EFM:

Baseline: _______ Variability: _______ Accels: _______ Decels: _______

Category □ I (normal) □ II (indeterminate) □ III (Abnormal)

Contractions ≥4/hr: □ Yes □ No

Medications: □ Antenatal steroids (1st dose date and time___________)

□ Magnesium Sulfate: Bolus (time)__________, then Drip at________gm/hr

□ Terbutaline (time__________) □ Antibiotics: ________________

□ Other: ___________________

Blood Products: Units Given (___PRBC ___ Cryoprecipitate ___ FFP ___ Platelets)

Transportation: □ Ambulance □ Air □ Private car □ Responsible for arranging: ________________

Monitoring on transport □ Continuous EFM □ Tele □ Medications ________________

□ Physician-to-Physician communication done □ Nurse-to-Nurse communication done

Document Checklist: Documents sent how: □ with patient □ fax to receiving hospital

□ Prenatal record □ Prenatal labs □ Ultrasound reports □ Current labs □ H&P □ Discharge Summary

□ Current admission other relevant notes □ EFM strips if relevant findings

□ Admission face sheet □ Patient consent for transfer □ Copy of this completed form

Notes______________________________

"Ver 4-25-2020"
**MetroHealth Simulation Scenario**

Case Overview: This case will start with a patient brought to labor and delivery by ambulance with severe hypertension and will have an eclamptic seizure that the team will manage.

**Learning Objectives & Key Debriefing Points:**

1) Medical Knowledge
   a) Be familiar with the diagnostic criteria (signs and laboratory values) for preeclampsia and eclampsia
   b) Understand that the fetal heart rate should improve once the seizure resolves

2) Patient Care
   a) Be familiar with the diagnostic criteria (signs and laboratory values) for preeclampsia and eclampsia
   b) Understand that the fetal heart rate should improve once the seizure resolves and an urgent cesarean section is not required during the seizure
   c) Be able to provide appropriate care during the seizure to include supportive care, administration of magnesium sulfate, and antihypertensive medication asindicated
   d) Avoid surgical intervention until mother is stable.
   e) Make plans for delivery and magnesium for seizure prophylaxis

3) Teamwork and Communication
   a) Be able to communicate the critical tasks that should be performed upon diagnosis of an eclamptic seizure
   b) Review interactions with the patient and family in terms of explaining what is happening

**Case Flow Overview:**

Diagnosis of severe preeclampsia and then treatment of an eclamptic seizure

Simulators: The simulator for this simulation will be a high-fidelity mannequin with a wig. It must have the ability to provide feedback in the form of changes in vital signs as well as demonstrate basic physiologic functions such as pulses and breathing. She can seize.

Personnel Required:
Simulation technician: responsible for the simulator
Simulation facilitator: responsible for guiding the team through the simulation

Roles to be Assigned: OB/MFM Physician #1, OB/MFM Physician #2, OB/MFM Physician #3, OB Nurse #1, Staff Anesthesia

Medical Equipment and Instruments: IV fluids, labeled and available, D5 NS, LR, NS, Fetal monitoring belts (toco/doppler), Intubation equipment, Foley catheter (have dark urine in the bladder if possible), Facemask for O2, Pulse oximeter, Central line kit (they can order this, but will not have them actually place it), AED, EKG/maternal telemetry (vital signs will display on the simulator monitors), Gloves (non-sterile)

Simulated Medications: Medications should be labeled and available: Magnesium sulfate, Labetalol (20-40mg IV), Hydralazine (5-10 mg IV), Ativan 2mg IM, PRBC, FFP, Cryoprecipitate

**Moulage instructions:**
The patient is confused and complaints of headache.
Background information to read to OB Nurse #1: The patient is brought to the hospital with confusion and blood pressure increased to 155/95 with a headache. She received Tylenol at home but it has not helped her headache at all.

Initial Vital Signs:
- Temp: 98.6°F
- Respiration Rate: 12
- Heart Rate: 105
- BP Systolic: 170
- BP Diastolic: 110
- SpO2: 100% on RA
- Weight: 75kg
- Pain Score: 8/10 (headache)

Physical Exam:

- General: Patient appears in no acute distress, except for complaint of severe frontal headache
- HEENT: WNL
- Neck: WNL
- Lungs: WNL
- Heart: Mild tachycardia, regular, no murmurs
- Abdomen: Soft, non-tender, gravid
- Back: WNL
- Extremities: WNL
- Neuro: WNL with no deficits
- Vaginal exam: 2/50%/-3 VTX
- Toco: Irregular uterine contractions (q5-8min)
- Fetal heart rate tracing: Baseline 150’s with average variability and accelerations.

Laboratory Results (only provided if ordered and/or requested by the team)

- CBC: WBC 11.4, Hgb 12.9, Hct 41.3, Platelets 110k
- BMP: Na 135, K 3.8, Cl 106, CO2 21, BUN 15, Cr 0.9, Glucose 90
- AST/ALT: 88/103
- LDH: 770
- Uric Acid: 6.2
- Urine protein/creatinine ratio: 0.25

Vital Signs during Eclamptic Seizure
- Temp: 98.6°F
- Respiration Rate: 8
- Heart Rate: 120
- BP Systolic: 180
- BP Diastolic: 115
- SpO2: 85% on RA or facemask
- Weight: 60kg
- Pain Score: n/a, unconscious
Toco: Irregular uterine contractions (q5-8min)
Fetal heart rate tracing: Baseline 80’s with repetitive late decelerations

No additional lab results will be available during the seizure. They may be ordered after the seizure, but will not come back until part 3 of the simulation.

Vital Signs after Eclamptic Seizure
- Temp: 98.6°F
- Respiration Rate: 8
- Heart Rate: 120
- BP Systolic: 140
- BP Diastolic: 100
- SpO2: 95% on RA or facemask
- Pain Score: n/a, groggy and post-ictal
- Toco: Irregular uterine contractions (q5-8min)
- Fetal heart rate tracing: Baseline recovers to the 120’s

Case Flow:

Set-up simulator as described
↓
MFM Provider #1 enters room with care team for rounds and is briefed by OB Nurse #1
↓
Physical exam is unremarkable, but patient will complain of severe headache and demonstrate severe range hypertension
↓
Provider should address severe range hypertension with IV medications
↓
Patient will not respond to IV medication and then experience Eclamptic Seizure
↓
Team should care for patient during eclamptic seizure, which will last for 2 minutes regardless of interventions*
↓
Team should treat severe range hypertension during seizure with IV medications
↓
Simulation facilitator should prompt team members regarding level of care, question the any medications/dosages given
↓
After the seizure stops, the family should ask what is happening the team will counsel them on the diagnosis and treatment plan (including delivery)

**Patient refuses Cesarean Section if offered or counseled for this**
*If the team attempts to go and do an emergency cesarean section, tell them that the OR technician is on their way and do NOT move to the OR*
### Assessment/Actions/Outcomes:

<table>
<thead>
<tr>
<th>Assessment/Action</th>
<th>Outcome/Result</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recognition of severe preeclampsia prior to eclamptic seizure</td>
<td>No change</td>
<td>Not Done / Done Poorly / Done Well</td>
</tr>
<tr>
<td>Recognition of eclampsia</td>
<td>No change</td>
<td>Not Done / Done Poorly / Done Well</td>
</tr>
<tr>
<td>Supplemental O2 during seizure</td>
<td>No change</td>
<td>Not Done / Done Poorly / Done Well</td>
</tr>
<tr>
<td>Administer correct dose of magnesium sulfate (6 grams IV over 15-20 minutes)</td>
<td>No change</td>
<td>Not Done / Done Poorly / Done Well</td>
</tr>
<tr>
<td>Protects patient during seizure (turns to side/puts bedrails up)</td>
<td>No change</td>
<td>Not Done / Done Poorly / Done Well</td>
</tr>
<tr>
<td>Addresses severe hypertension during seizure with correct IV medications</td>
<td>BP decreases to 140/90 after administration of correct dose</td>
<td>Not Done / Done Poorly / Done Well</td>
</tr>
<tr>
<td>Orders repeat lab evaluation after seizure stops</td>
<td>No change</td>
<td>Not Done / Done Poorly / Done Well</td>
</tr>
<tr>
<td>Continues magnesium sulfate prophylaxis after the seizure</td>
<td>No change</td>
<td>Not Done / Done Poorly / Done Well</td>
</tr>
<tr>
<td>Administration of steroids for fetal lung maturity (if not done previously)</td>
<td>No change</td>
<td>Not Done / Done Poorly / Done Well</td>
</tr>
<tr>
<td>Counsels patient/family regarding plan of care for delivery</td>
<td>No change</td>
<td>Not Done / Done Poorly / Done Well</td>
</tr>
</tbody>
</table>

### Inappropriate Actions:

<table>
<thead>
<tr>
<th>Inappropriate Actions:</th>
<th>Circle YES if Done</th>
<th>- YES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decision to move to emergent cesarean section during seizure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attempts intubation during seizure</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix G: Severe Preeclampsia/Eclampsia In LDR v2.0 SimMan 3G: General Information

Severe Preeclampsia and Eclampsia in LDR v2.0 SimMan3G

Part 1 – General Information

Authors: Mark Meyer MD, Darin Bowers MA – Southern California Permanente Medical Group

<table>
<thead>
<tr>
<th>Scenario</th>
<th>SimMan3G – LDR Severe Preeclampsia &amp; Eclampsia v2.0 (Labor/Delivery/Recovery)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario Time</td>
<td>15-20 minutes</td>
</tr>
<tr>
<td>Debriefing Time</td>
<td>20-45 minutes – longer if used as 1st scenario and requires more time to discuss non-technical skills (teamwork, communication, etc.) and CMQCC guidelines</td>
</tr>
<tr>
<td>Target Group</td>
<td>L&amp;D nurses, OB physicians, Anesthesiologists, CRNA’s, &amp; scrub techs.</td>
</tr>
</tbody>
</table>

Case Summary
This is a case of a patient on L&D who is being induced for mild preeclampsia. The patient develops severe preeclampsia and eclampsia that requires anti-hypertensive treatment as well as additional magnesium to control seizures. Despite maximal magnesium therapy, the patient continues to seize and the patient will require additional medications to control her seizures. In addition, the patient’s SpO2 will fall due to airway occlusion during/after the seizure. Simple repositioning of the head and opening the airway will restore SpO2. No intubation is required, but this could be required, if desired. This case is designed to ensure staff are following ACOG & CMQCC guidelines for appropriate treatment of preeclampsia and eclampsia. Therefore, there is a great emphasis on appropriate medication dosing and timing per these guidelines.

It is critical that the participants recognize the patient is seizing. Unfortunately, the effectiveness of the SimMan3G seizure feature is limited, so confederate may be required to point out the seizure if the team does not recognize this. Fetal monitoring simulators can also be used, however, a non-reassuring fetal heart tracing may prompt the treatment team to move the patient to the OR before the patient has received appropriate treatment for eclampsia and is stable for urgent c-section.

Teaching Personnel
1. GUI operator
2. Observer to note team communication and medical management skills – will serve as lead debriefer
3. Family member to voice observation of seizure signs if staff doesn’t recognize seizure (essential if using SimMan Classic and SimMan3G)
4. OB physician for clinical expertise if the lead debriefer is not OB
5. Voice of patient – could be GUI operator

Participants
1. 1-2 OB Physicians
2. 2-4 L&D nurses – varies depending on usual staffing on your unit
3. 1 CNM
4. Anesthesiologist and/or CRNA

Learning Objectives
1. Demonstrate effective teamwork and communication skills with a focus on adequate shared mental model and role clarity. This includes clear identification of all team members and SBAR to new team members as they arrive.
2. Diagnose severe preeclampsia
3. Treat hypertension per CMQCC Preeclampsia/Eclampsia guidelines
4. Provide appropriate initial management of eclamptic seizures with magnesium
5. Manage eclamptic seizures when magnesium is ineffective
6. Maintain airway and oxygenation in seizing and post-ictal patient

References

Used with permission, Kaiser Permanente and Mark Meyer, MD and Darin Bowers, MA 2013.
Appendix N: Simulation Scenario: Hypertension in Pregnancy, HELLP with Seizure

Simulation: HELLP with Seizure

Leslie Cragin, CNM, California Nurse Midwives Association
Ana Delgado, CNM, California Nurse Midwives Association
Ocean Berg, RN, MSN, IBCLC, Nurse Family Partnership Program, San Francisco

Topic: Hypertension in Pregnancy Scenario: HELLP with seizure Duration of Scenario: 6 - 13 min

General Description of the Scenario:
Jackie is a 17 yo G1P0 @ 36 weeks by sure normal LMP. She came to triage accompanied by her sister after beginning uterine contractions 8 hours ago, that have been increasing in intensity and frequency.

The contractions are every 3-4 minutes, lasting a minute. Jackie complains of a strong headache beginning 2 days ago. The baby is moving less than before labor began. She was admitted for labor 4 hours ago with V/E 4cm, 70%, -2 station.

Brief Medical/OB History:
- Regular visits, no chart available
- Fundal height = 34
- Admit labs: hgb 9.2, hct 30, platelets 90,000

Objectives:

Cognitive:
1. Accurately identify risk factors for severe pre eclampsia/HELLP
2. Identify the differential diagnosis for eclampsia
3. Identify medications to be used in managing an eclamptic seizure
4. Know the steps in management eclampsia

Technical:
1. Provide protection from injury and patent airway during seizure
2. Evaluate for interval to delivery
3. Evaluate fetal status
4. Prepare for fetal resuscitation and potentially postpartum hemorrhage

Behavioral:
1. Calls for help in a timely manner
2. Communication with team
3. Maintains a calm demeanor during the emergency
4. Clear communication with the frightened family members

Roles of the participants:
RN, CNM, extra RN, obstetrician,
- Facilitator taps out fetal heart rate
- MD is slow to come in after being called– doesn’t intervene or direct but does ask what is happening

Roles of the Confederates:
- Patient in PartoPants©, Significant other
Equipment: Partopants, bed, sheets, footstool, baby, IV pole/set/fluid, Doppler or fetoscope, delivery set, Simulator: Actress as Patient with PartoPants

Opening scene: Mother is laboring with ______

Progression of Scenario

<table>
<thead>
<tr>
<th>Time</th>
<th>Events for Actress and Confederates</th>
<th>Appropriate Actions</th>
<th>Symptoms/Results of inappropriate action</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5 min</td>
<td>Patient (IV in place); midwife/OB RN and significant other in room</td>
<td>Clean hands</td>
<td>Initial vitals 138/89 P=110</td>
</tr>
<tr>
<td></td>
<td>Patient in labor with ctx q3 min</td>
<td>Begins assessment: talks with patient</td>
<td>No pain meds given yet</td>
</tr>
<tr>
<td></td>
<td>FHR 120’s</td>
<td>Requests vital signs</td>
<td>No proteinuria</td>
</tr>
<tr>
<td></td>
<td>Pt begins to seize at about 5 minutes into scenario - seizure lasts 90</td>
<td>Asks about urine and proteinuria</td>
<td>Vaginal exam if done 8 cm, 100 % 0</td>
</tr>
<tr>
<td></td>
<td>seconds</td>
<td>May ask for additional labs</td>
<td>station</td>
</tr>
<tr>
<td></td>
<td>Fetal bradycardia to 80 BPM for 3 min begins with seizure and lasts 3 min</td>
<td>May turn mom into side-lying</td>
<td>BP stays in this range - never severely</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Notes FHR</td>
<td>elevated</td>
</tr>
<tr>
<td>4/5-10 min</td>
<td>Seizure resolves</td>
<td>Pt turned to L side, O2 on Mag. sulfate ordered: 4-6 gm IV over 15 minutes or 5 gm IM in each buttock if no IV</td>
<td>If no Mag. ordered by 2 min postictal,</td>
</tr>
<tr>
<td></td>
<td>Sister asks what is happening</td>
<td>No BP meds since BP is not elevated</td>
<td>another seizure begins - this should be</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Calls for help</td>
<td>treated with MgSO4, diazepam ok, but</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Evaluates FHR</td>
<td>NOT optimal</td>
</tr>
<tr>
<td></td>
<td>FHR 160’s then back to normal</td>
<td>Gives accurate concise report to attending</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pt is postictal/sleepy</td>
<td>Vaginal exam</td>
<td>STOP SCENARIO</td>
</tr>
<tr>
<td></td>
<td>Pt involuntarily pushes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Guide for review of simulation:

(Remember to focus on cues from the video; these are only triggers for discussion.)

General:
1. How did that feel?
2. Would someone give an overview of the scenario?
3. What did you see?
4. What went well?
5. What didn’t?
6. Was there anything in the **10 commandments** that would’ve helped you? (Translated and modified with permission from CAPE, Center for Advanced Pediatric and Perinatal Education (CAPE) 2007; Anderson et al., 2006. Ten Commandments of Simulation: 1) know your environment; 2) anticipate and plan for crises; 3) assume a leadership role; 4) communicate effectively; 5) distribute workload optimally; 6) allocate attention wisely; 7) utilize all available information; 8) utilize all available resources; 9) call for help early enough; 10) maintain professional behavior.)

Cognitive:
1. What were you thinking when you heard about the report?
2. What are the risk factors for pre-eclampsia/severe and HELLP?
3. What are the signs and symptoms of HELLP?
4. What labs would help to evaluate this pt?
5. What other emergencies/complications follow eclampsia (PPH, neonatal compromise)?

Technical:
1. What should be done to protect the patient?
2. What are the components of intrauterine resuscitation?
3. What are the medications to be used in eclampsia with severe HTN?

Behavioral: Focus on 2-3 points
1. Know your environment and team
2. Plan and anticipate
3. Assume the role of leader
   a. Who was the leader?
   b. How did that go? (ask leader and participants)
4. Communicate in an effective manner with the team, the patient and her family
   a. How was the interaction between the midwife/OB and nurse?
   b. How was the communication with the patient?
5. Delegate appropriately
6. Allocate attention wisely
7. Use all your available resources
8. Use all your available information
9. Call for help in a timely manner
   a. What made you call for help?
10. Maintain professional conduct/attitude at all times.

*Used with permission of Leslie Cragin, CNM, Ana Delgado, CNM, Ocean Berg, RN, MSN, IBCLC.*
OUTPATIENT MANAGEMENT OF PREECLAMPSIA

Sarah Kilpatrick, MD, PhD, Cedars Sinai Medical Center

BACKGROUND
Once a diagnosis of preeclampsia has been made based on new onset systolic blood pressure ≥ 140 mm Hg and or diastolic blood pressure ≥ 90 mm Hg, and new onset significant proteinuria, or signs and symptoms of preeclampsia as seen in the Chapter: Classification and Diagnosis or Hypertensive Disorders of Pregnancy, (Table 1, pg. 20), the provider must decide if the woman has preeclampsia without severe features (mild) or severe preeclampsia. Outpatient treatment should only be considered for women with preeclampsia without severe features (mild) at less than 37 weeks and only after confirming fetal wellbeing and maternal stability. It is imperative in the initial evaluation to document the severity of preeclampsia and the following evaluation is recommended: blood pressure, proteinuria assessment, CBC (complete blood count) with platelet count, AST (Aspartate Aminotransferase), ALT (Alanine Aminotransferase), Cr (Creatinine), bilirubin, and LDH (Lactate dehydrogenase). The symptoms that should be assessed and documented as present or absent include headache, abdominal pain, and significant visual disturbances.

Fetal assessment should include NST (Non-stress Test) or BPP (Biophysical Profile), which includes NST plus fetal movement, tone, breathing, and heart rate and amniotic fluid volume, and ultrasound assessment of fetal growth. The goal of outpatient management in women with preeclampsia without severe features (mild) is early identification of the development of severe preeclampsia so that the woman is hospitalized and delivered if necessary, before significant maternal or fetal morbidity ensues.

If any abnormalities in either maternal or fetal assessments are consistent with severe preeclampsia, further management should occur in the hospital (see Chapter: Special Circumstances: Severe Preeclampsia At < 34 weeks, pg. 76). If preeclampsia without severe features (mild) is documented and outpatient management is considered then there should be a clear documented follow-up plan that is understood by the patient. Heightened surveillance is recommended to diagnose signs of worsening disease, which would prompt hospitalization and/or delivery. This generally includes twice-weekly maternal and fetal assessment. Maternal blood pressure, urine protein assessment and a verbal review of signs and symptoms should be performed twice per week. The fetus should have an NST and AFI (Amniotic Fluid Index) or BPP twice per week during outpatient observation. Additional maternal laboratory tests should be done as indicated if there is a suspicion of worsening disease. Once the patient develops any sign of severe preeclampsia she should be admitted to the hospital and her plan should change accordingly. If the patient continues to have only preeclampsia without severe features (mild) but reaches 37 weeks, the plan of treatment should include delivery. If the patient is diagnosed with severe preeclampsia, she should be admitted to the hospital and—if gestational age is 34 weeks or greater—delivered. If she is less than 34 weeks with severe preeclampsia, she should be admitted and managed at a tertiary care facility with close observation for worsening disease or complications that necessitate delivery.

EVIDENCE GRADING
Level of Evidence: C REFERENCES


Part 2 of 2: Treatment - Evaluation and Treatment of Antepartum and Postpartum Preeclampsia and Eclampsia in the Emergency Department

Errata v 5/13/14

Evaluation and Treatment of Antepartum and Postpartum Preeclampsia and Eclampsia in the Emergency Department

<table>
<thead>
<tr>
<th>1st Line Anti-Hypertensive Treatment: Labetalol &amp; Hydralazine*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target BP: 140-160/90-100 (BP&lt;140/90 = decreased fetal perfusion)</td>
</tr>
<tr>
<td>See CMQCC Preeclampsia Toolkit for &quot;Anti-Hypertensives in Preeclampsia&quot; for 2nd line therapy</td>
</tr>
</tbody>
</table>

### Magensium

<table>
<thead>
<tr>
<th>Initial Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Loading Dose: 4-6 gm over 15-20 min</td>
</tr>
<tr>
<td>2. Maintenance 1-2 gm/hr</td>
</tr>
<tr>
<td>3. Close observation for signs of toxicity</td>
</tr>
<tr>
<td>• Disappearance of deep tendon reflexes</td>
</tr>
<tr>
<td>• Decreased RR, shallow respirations, shortness of breath</td>
</tr>
<tr>
<td>• Heart block, chest pain</td>
</tr>
<tr>
<td>• Pulmonary edema</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>If Patient Seizes While on Magnesium:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Secure airway and maintain oxygenation</td>
</tr>
<tr>
<td>2. Give 2nd loading dose of 2 gm Magnesium over 5 min</td>
</tr>
<tr>
<td>3. If patient seizures after 2nd magnesium bolus, consider the following:</td>
</tr>
<tr>
<td>• Midazolam 1-2 mg IV; may repeat in 5-10 min OR</td>
</tr>
<tr>
<td>• Lorazepam 2 mg IV—may repeat OR</td>
</tr>
<tr>
<td>• Diazepam 5-10 mg IV. May repeat q15 min to max of 30 mg</td>
</tr>
<tr>
<td>• Phenytoin 1 g IV over 20 min</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Seizures Resolve</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Maintain airway and oxygenation</td>
</tr>
<tr>
<td>2. Monitor VS, cardiac rhythm/ECG for signs of medication toxicity</td>
</tr>
<tr>
<td>3. Consider brain imaging for:</td>
</tr>
<tr>
<td>• Head trauma</td>
</tr>
<tr>
<td>• Focal seizure</td>
</tr>
<tr>
<td>• Focal neurologic findings</td>
</tr>
<tr>
<td>• Other neurologic diagnosis is suspected</td>
</tr>
</tbody>
</table>

### TREATMENT

<table>
<thead>
<tr>
<th>LABETALOL as Primary Anti-Hypertensive</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Administer Labetalol 20 mg IV</td>
</tr>
<tr>
<td>2. Repeat BP in 10 min</td>
</tr>
<tr>
<td>• If BP threshold is still exceeded, administer Labetalol 40 mg IV</td>
</tr>
<tr>
<td>• If SBP&lt;160 and DBP&lt;100, continue to monitor closely</td>
</tr>
<tr>
<td>3. Repeat BP in 10 min</td>
</tr>
<tr>
<td>• If BP threshold is still exceeded, administer Labetalol 80 mg IV</td>
</tr>
<tr>
<td>• If SBP&lt;160 and DBP&lt;100, continue to monitor closely</td>
</tr>
<tr>
<td>4. Repeat BP in 10 min</td>
</tr>
<tr>
<td>• If BP threshold is still exceeded, administer Hydralazine 10 mg IV</td>
</tr>
<tr>
<td>• If SBP&lt;160 and DBP&lt;100, continue to monitor closely</td>
</tr>
<tr>
<td>5. Repeat BP in 20 min; if BP threshold is still exceeded, obtain emergent consultation from maternal-fetal medicine, internal medicine, anesthesiology, or critical care</td>
</tr>
<tr>
<td>6. Once target BP achieved, monitor BP q10 min for 1 hour, q 15 min for 2nd hour</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HYDRAZINE as Primary Anti-Hypertensive</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Administer Hydralazine 5 or 10 mg IV</td>
</tr>
<tr>
<td>2. Repeat BP in 20 min</td>
</tr>
<tr>
<td>• If BP threshold is still exceeded, administer Hydralazine 10 mg IV</td>
</tr>
<tr>
<td>• If SBP&lt;160 and DBP&lt;100, continue to monitor closely</td>
</tr>
<tr>
<td>3. Repeat BP in 20 min</td>
</tr>
<tr>
<td>• If BP threshold is still exceeded, administer Labetalol 20 mg IV</td>
</tr>
<tr>
<td>• If SBP&lt;160 and DBP&lt;100, continue to monitor closely</td>
</tr>
<tr>
<td>4. Repeat BP in 10 min</td>
</tr>
<tr>
<td>• If BP threshold is still exceeded, administer Labetalol 40 mg IV and obtain emergent consultation from maternal-fetal medicine, internal medicine, anesthesiology, or critical care</td>
</tr>
<tr>
<td>• If SBP&lt;160 and DBP&lt;100, continue to monitor closely</td>
</tr>
<tr>
<td>5. Once target BP achieved, monitor BP q10 min for 1 hour, q 15 min for 2nd hour</td>
</tr>
</tbody>
</table>

* Labetalol and Hydralazine recommendations based on 2011 ACOG Committee Opinion #514 and Practice Bulletin #33, Reaffirmed 2012

Resources: Additional Links

References


## Appendix C – Section 2 Recognition

### Resources: Tools and Tables

### Classification of hypertension in pregnancy table

<table>
<thead>
<tr>
<th>Classification</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic hypertension</td>
<td>• Persistent stage 1 hypertension (BP of 130-139 mmHg systolic or 80-89 mmHg diastolic)</td>
</tr>
<tr>
<td></td>
<td>• Identified prior to 20 weeks gestation and diagnosed first time during pregnancy</td>
</tr>
<tr>
<td></td>
<td>• Diagnosed for the first time during pregnancy and doesn’t resolve postpartum</td>
</tr>
<tr>
<td>Superimposed preeclampsia or eclampsia</td>
<td>• New onset preeclampsia after 20 weeks in a woman with chronic hypertension</td>
</tr>
<tr>
<td>on chronic hypertension</td>
<td>• Sudden increase in proteinuria if already present in early gestation</td>
</tr>
<tr>
<td></td>
<td>• Development of HELLP syndrome</td>
</tr>
<tr>
<td>Gestational hypertension</td>
<td>• ≥140 mm Hg systolic or ≥ 90 mm Hg diastolic, or both, on two occasions at least 4 hours apart occurring after 20 weeks gestation</td>
</tr>
<tr>
<td></td>
<td>• Transient diagnosis with normalization of BP by 12 weeks postpartum</td>
</tr>
<tr>
<td></td>
<td>• May represent pre-proteinuric phase of preeclampsia or recurrence of chronic hypertension abated in mid-pregnancy</td>
</tr>
<tr>
<td>Preeclampsia</td>
<td>• BP ≥ 140 mm Hg systolic or ≥ 90 mm Hg diastolic or higher (after 20 weeks gestation)</td>
</tr>
<tr>
<td></td>
<td>• Proteinuria – protein/creatinine ratio of 0.3 mg/dL or more or 300 mg or more in a 24-hour urine specimen</td>
</tr>
<tr>
<td></td>
<td>• In the absence of proteinuria, new-onset hypertension with new-onset of any severe features (see below)</td>
</tr>
<tr>
<td>Eclampsia</td>
<td>• Presence of new onset tonic-clonic, focal, or multifocal seizures in the absence of other causative conditions</td>
</tr>
<tr>
<td></td>
<td>• New onset seizures 48-72 hours postpartum (other central nervous system pathology is the likely reason for the seizure after 7 days)</td>
</tr>
<tr>
<td>Preeclampsia with severe features</td>
<td>If one or more of the following criteria are present:</td>
</tr>
<tr>
<td></td>
<td>1. Blood pressure of 160 mm Hg systolic or 110 mm Hg diastolic or higher on two occasions at least 4 hours apart (unless antihypertensive therapy is initiated before this time)</td>
</tr>
<tr>
<td></td>
<td>2. New-onset headache unresponsive to medication and not accounted for by alternative diagnoses</td>
</tr>
<tr>
<td></td>
<td>3. Cerebral or visual disturbances</td>
</tr>
<tr>
<td></td>
<td>4. Pulmonary edema or cyanosis</td>
</tr>
<tr>
<td></td>
<td>5. Impaired liver function as indicated by abnormally elevated blood concentrations of liver enzymes (twice normal concentration or higher), severe persistent right upper quadrant or epigastric pain unresponsive to medication and not accounted for by alternative diagnoses, or both</td>
</tr>
<tr>
<td></td>
<td>6. Thrombocytopenia (platelet count&lt; 100,000 x 10⁹/L)</td>
</tr>
<tr>
<td></td>
<td>7. Renal insufficiency (serum creatinine concentration &gt; 1.1 mg/dL or a doubling of the serum creatinine concentration in the absence of other renal disease)</td>
</tr>
<tr>
<td>HELLP Syndrome</td>
<td>Presence of all 3 criteria concurrently</td>
</tr>
<tr>
<td></td>
<td>• Hemolysis (serum LDH &gt; 600 U/L or total bilirubin &gt; 1.1 mg/dL)</td>
</tr>
<tr>
<td></td>
<td>• Elevated Liver enzymes (twice the upper limit of normal concentration)</td>
</tr>
<tr>
<td></td>
<td>• Low Platelets (platelet count &lt; 100,000 x 10⁹/L)</td>
</tr>
</tbody>
</table>
Suspected Preeclampsia Algorithm

The Suspected Preeclampsia Algorithm flowchart may be used to inform potential care and delivery decisions for patients determined to be experiencing severe gestational hypertension and preeclampsia.

New Onset HTN? (>140/90)
- No
  - No
    - No
      - New Onset Proteinuria?
        - No
          - Gestational HTN
        - Yes
          - Preeclampsia
    - Yes
      - Check for Persistent: Headache, Visual Changes Abdominal Pain
        OR Thrombocytopenia, Elevated LFTs Creatinine >1.2 Elevated LDH
  - Yes
    - New Onset HTN? (>160/110)
      - No
        - Gestational HTN
      - Yes
        - New Onset Proteinuria?
          - No
            - Severe Gestational HTN
          - Yes
            - Severe Preeclampsia
              - ≥ 34 weeks gestation?
                - Yes
                  - Transfer to Level 3 Center
                - No
                  - Deliver Now
            - Deliver between 34-37 weeks for severely elevated blood pressure
Resources: Additional Links

Provider and Patient education

Healthcare team

1.) Alliance for Innovation on Maternal Health (AIM) eModules: Severe Hypertension (HTN) in Pregnancy
   a. https://safehealthcareforeverywoman.org/aim-emodules/#link_acc-1-5-d

2.) American College of Obstetricians and Gynecologists Safe Motherhood Initiative: Severe Hypertension

3.) Preeclampsia Foundation: Healthcare Providers
   a. https://www.preeclampsia.org/healthcare-providers

Patient Education

1.) Preeclampsia Foundation: Educating Patients

2.) American College of Obstetricians and Gynecologists Preeclampsia and High Blood Pressure During Pregnancy: Frequently Asked Questions

3.) Alliance for Innovation on Maternal Health (AIM): Urgent Maternal Warning Signs
   a. https://safehealthcareforeverywoman.org/urgentmaternalwarningsigns/

Blood Pressure Cuffs and Measurement

AAMI – Association for the Advancement of Medical Instrumentation
BHS – British Hypertension Society
EHS – European Hypertension Society

List of validated home blood pressure monitors
https://www.validatebp.org/

How to use your blood pressure monitor at home
https://www.youtube.com/watch?v=K9HU2F3TOal&feature=youtu.be

Self-Measured Blood Pressure Monitoring (Tools and Protocols)
https://millionhearts.hhs.gov/tools-protocols/smbp.html#refs

References


**Appendix D – Section 3 Response**  
**Resources: Tools and Tables**

<table>
<thead>
<tr>
<th>L&amp;D Severe Preeclampsia &amp; Eclampsia Box – Content and Dose Guideline</th>
</tr>
</thead>
</table>
| **Magnesium 20 grams/500 ml bag** | **IV (Use Magnesium Sulfate Continuous Infusion under L&D protocol in Alaris Pump Library):**  
*Initial (Loading Dose)*: 4-6 g (100 ml – 150 ml) over 20-30 minutes  
*Maintenance Dose*: 1-2 g/hour (25 ml/hr – 50 ml/hr) continuous infusion  
**Intramuscular Injection (in case of difficulty establishing venous access):**  
*Initial (Loading Dose)*: 10 g (250ml)  
*Maintenance Dose*: 5 g (125 ml) q 4 hours |
| **Labetalol 100 mg/20 ml vial** | **Initial**: Draw 4 ml from the vial.  
10–20 mg (2 ml - 4ml) IV, then 20–80 mg (4ml - 16ml) every 10–30 minutes to a maximum cumulative dosage of 300 mg (60 ml); or constant infusion 1-2 mg/min IV |
| **Hydralazine 20 mg/ml vial** | **Initial**: Draw 0.25 ml from the vial.  
5 mg IV or IM, then 5–10 mg IV every 20–40 minutes to a maximum cumulative dosage of 20 mg; or constant infusion of 0.5–10 mg/hr |
| **Nifedipine 10 mg PO** | 10–20 mg orally, repeat in 20 minutes if needed; then 10–20 mg every 2–6 hours; maximum daily dose is 180 mg |
| **Calcium gluconate 1000 mg/10 ml vial** | 10% solution, 10 ml IV over 3 minutes |
| **Supply contents** | 3 ml, 10 ml, and 20 ml syringes, appropriate needles and appropriate tubing sets |
| **Esmolol 100 mg/10 ml vial (By Anesthesiologists ONLY)** | Requires coordination with Anesthesiologist |
| **Propofol 10 mg/ml, 20 ml vial (By Anesthesiologists ONLY)** | Requires coordination with Anesthesiologist |

**Resources: Additional Sources**

<table>
<thead>
<tr>
<th>Onset and Duration of magnesium sulfate therapy</th>
<th>CMQCC “Magnesium Sulfate” pages 51-57</th>
</tr>
</thead>
<tbody>
<tr>
<td>Postpartum patient education</td>
<td>Urgent Maternal Warning Signs</td>
</tr>
<tr>
<td>Labetalol</td>
<td>ACOG Labetalol Algorithm</td>
</tr>
<tr>
<td>Hydralazine</td>
<td>ACOG Hydralazine Algorithm</td>
</tr>
<tr>
<td>Oral Nifedipine</td>
<td>ACOG Immediate-Release Oral Nifedipine Algorithm</td>
</tr>
</tbody>
</table>
References


A specific strategy for structured communication that many health care providers are familiar with is “SBAR.” This format, developed by Kaiser Permanente, was adapted from military and aviation crew resource management practices. It is recommended and taught in most healthcare teamwork improvement programs. The SBAR format, which stands for Situation-Background-Assessment-Recommendation, provides a brief, organized, predictable flow of information that facilitates critical thinking and communication skills between healthcare providers, and may be especially helpful in leveling communication styles between disciplines. However SBAR alone does not explicitly incorporate essential teamwork principles of assertive communication of concern and closed loop communication. These two principles can be built into SBAR with a simple expansion to SBAR-R-R (Table 3), which includes the steps “Reasoning,” to ensure team members understand each other’s interpretation of the present situation if immediate agreement is not reached, and “Ratification,” to ensure the team members have an agreed upon plan for moving forward.

Table 3: SBAR-R-R Communication Technique Applied to Preeclampsia

<table>
<thead>
<tr>
<th>Prepare for an SBAR-R-R by:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Assessing the patient</td>
</tr>
<tr>
<td>2. Reviewing recent notes and laboratory results</td>
</tr>
<tr>
<td>3. Having the medical record available during the conversation</td>
</tr>
</tbody>
</table>

**Situation:** Always identify yourself, where you are calling from, the name of the woman you are calling about, quickly state the main reason and the level of urgency for the call.

**Background:** Give brief pertinent background information – medical history, complaints, vital signs, and interventions that have already occurred.

**Assessment:** Say what you think is going on.

**Recommendation:** Say what you think should happen or ask for specific orders.

**Reasoning:** If the response is not what you expect and requested, state why what you think should happen is important. What could happen if we don’t do this?

**Ratification:** Close the loop by confirming actions to be taken. Assure mutual agreement on the plan.
### Table 4: Sample SBAR-R-R Scenarios

<table>
<thead>
<tr>
<th>Situation</th>
<th>Ambulatory Care or Emergency Department</th>
<th>Inpatient Antepartum or Intrapartum</th>
<th>Postpartum</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am calling about Ms. ___, who</td>
<td>I am calling about Ms. ___, who is an antepartum patient being monitored for preeclampsia. I am concerned about:</td>
<td>I’m calling about Ms. ___ who had her second baby yesterday at 3 pm. I am concerned about:</td>
<td></td>
</tr>
<tr>
<td>□ is pregnant</td>
<td>• New onset headache</td>
<td>• New onset headache</td>
<td></td>
</tr>
<tr>
<td>□ recently had a baby and is here in the ED with stomach pain. I am concerned about:</td>
<td>• Increasing blood pressures</td>
<td>• Increasing blood pressures</td>
<td></td>
</tr>
<tr>
<td>• High blood pressure</td>
<td>• Headache that has not resolved</td>
<td>• Headache that has not resolved</td>
<td></td>
</tr>
<tr>
<td>• Headache</td>
<td>• Visual disturbances</td>
<td>• Visual disturbances</td>
<td></td>
</tr>
<tr>
<td>• Visual disturbances</td>
<td>• Stomach pain</td>
<td>• Stomach pain</td>
<td></td>
</tr>
<tr>
<td>• Decreased fetal movement</td>
<td>• Abnormal or indeterminate fetal status</td>
<td>• Altered/worsening lab values</td>
<td></td>
</tr>
<tr>
<td>• Nausea and vomiting</td>
<td>• Altered/worsening lab values</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Background</th>
<th>GPTAL @_<em>weeks or G_P</em> #days post birth</th>
<th>GPTAL @__weeks</th>
<th>G_P__</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Significant OB and medical history</td>
<td>• Significant OB and medical history</td>
<td>• Mode of birth (vaginal/cesarean)</td>
</tr>
<tr>
<td></td>
<td>• Current problems</td>
<td>• Current problems</td>
<td>• Significant OB and medical history</td>
</tr>
<tr>
<td></td>
<td>• Patient complaints</td>
<td>• Patient complaints</td>
<td>• Current problems</td>
</tr>
<tr>
<td></td>
<td>• Vital Signs</td>
<td>• Vital Signs</td>
<td>• Patient complaints</td>
</tr>
<tr>
<td></td>
<td>• Interventions and response</td>
<td>• FHR tracing baseline, variability, accelerations, decelerations</td>
<td>• Vital Signs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Uterine activity</td>
<td>• Interventions already completed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Interventions already completed</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assessment</th>
<th>I’m thinking she may have preeclampsia and need an OB evaluation before we can clear her.</th>
<th>Her preeclampsia seems to be progressing and her blood pressures indicate severe hypertension and severe preeclampsia.</th>
<th>I’m thinking that her increasing BPs and new onset headache may represent preeclampsia and that she would benefit from an initial preeclampsia workup.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• I’m concerned she may have severe preeclampsia and needs medication to control her blood</td>
<td>• The FHR tracing is indeterminate and the</td>
<td></td>
</tr>
<tr>
<td>Recommendation</td>
<td>Decelerations do not resolve with position change.</td>
<td></td>
<td></td>
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<tr>
<td>----------------</td>
<td>--------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Could you please come and evaluate her within__?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Now</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>o Within 30 min</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Before___, etc.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>• Could I have orders for: ___</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o CBC, liver function, kidney function</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Antihypertensive</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Magnesium sulfate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• I need you to come and evaluate her now.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• May I please have an order for antihypertensive medication?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Are there any labs we need to repeat?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• When can I expect you?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• May I have an order for a preeclampsia lab panel?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• When can I expect you in to evaluate Ms. ____?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reasoning</th>
<th>I don’t think it is safe to send her home without evaluating the possibility of preeclampsia</th>
</tr>
</thead>
<tbody>
<tr>
<td>• If we don’t lower her blood pressure to a safer range she could have a stroke</td>
<td></td>
</tr>
<tr>
<td>• It is really important to control her blood pressure while we make preparations to proceed to birth.</td>
<td></td>
</tr>
<tr>
<td>• If we don’t lower her blood pressure to a safer range she could have a stroke.</td>
<td></td>
</tr>
<tr>
<td>• It’s important for us to get baseline data before considering discharge in the morning.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ratification</th>
<th>Ok, I’ll do___, and You’ll evaluate her in ___ or call ___ for ___.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Ratification</th>
<th>Ok, I’ll do___, and you’ll be here to evaluate her in ___.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratification</td>
<td>OK, I’ll do ___ and you’ll be in to evaluate her in ___.</td>
</tr>
</tbody>
</table>

Adapted from Kaiser Permanente SBAR Guidelines and SBAR Report to Physician about a Critical Situation, and Ascension Health Perinatal SBAR Report Template.
### Abstraction

- **SMM (recorded cause)** ______________________________
- **SMM Date** __________________
- **MR # or PATIENT ID** ________________
- **Zip code of patient residence** __________________
- **Abstraction Date** ____/_____/____
- **Abstractor** ______________________
- **Birth Facility** __________________

### Patient Characteristics

**Age** __

**Weight/Height** __/______

**Body mass index (BMI) at first prenatal visit** __

**Most recent BMI** __

**Race** (Indicate race patient identifies)
- Choose an item.

**Hispanic or Latina**
- No ☐
- Yes ☐
- Unknown ☐

### Obstetric History

- **Gravida** _______
- **Para** ___
- **Term** ___
- **Premature** __
- **Aborted** __
- **Living** __

**# Previous fetal deaths** _______

**# Previous infant deaths** _______

### Prenatal Care (PNC)

- **Yes** ☐ Week PNC began ______
- **Week unknown** ☐
- **No** ☐
- **Number of PNC visits** ______
- **Visit # unknown** ☐
- **No** ☐

- **Unknown PNC status** ☐

**Discipline of Primary PNC Provider** (choose one)
- Choose an item.

**Prenatal care source/location**
- Choose an item.

**Planned/intended place of delivery**
- Choose an item.

**Timing of maternal morbidity**
- Choose an item.

**Maternal Transport** (during peripartum period)
- **No** Choose an item.
- **Yes** ☐ From facility ________ to facility ________
- **Unknown** ☐

**Perinatologist consultation** (during peripartum period)
- **No** Choose an item.
- **Yes** ☐ Provider type: __________
- **Unknown** ☐

**Delivery Information**
- Gestational age at time of morbidity __________
- Singleton ☐ Multiple ☐ (If multiple fill out additional delivery information per fetus)

**Birth status**
- Choose an item.

**Labor**
- Yes ☐
- No ☐

**Delivery type**
- Choose an item.

**If C-Section**
- Type of C-section Choose an item.

**If C-Section**
- Primary reason for C-Section Choose an item.

**Type of anesthesia**
- Choose an item.

**Primary payer source**
- Choose an item.
Case Narrative
Should include brief synopsis focused on the specific severe maternal morbidity that occurred that allow you to address the disease specific questions. It should be concise and pertinent to the particular SMM and include appropriate time line, evaluation, and be in chronologic format. Try to identify key moments that impacted care.

Case Analysis
<table>
<thead>
<tr>
<th>1. Morbidity Category</th>
<th>□ ICU Admission □ Transfused 4 or more units □ Other ______</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Sequence of Morbidity</td>
<td>1.</td>
</tr>
<tr>
<td>Indicate the course of events:</td>
<td></td>
</tr>
<tr>
<td>Clinical Cause of Morbidity: 1 &amp; 2 reflect what initiated the final cause resulting in the severe morbidity. 3 is the final cause</td>
<td></td>
</tr>
<tr>
<td>For example: 1. Preeclampsia 2. uncontrolled hypertension 3 intracranial bleed, So that 1, caused 2, that resulted in 3 – the severe morbidity</td>
<td></td>
</tr>
<tr>
<td>3. Primary Cause of Morbidity</td>
<td>Choose an item.</td>
</tr>
<tr>
<td>If trauma indicated as primary cause of morbidity:</td>
<td>Choose an item.</td>
</tr>
<tr>
<td>Other cause:</td>
<td>________________________</td>
</tr>
</tbody>
</table>
Refer to the SMM Outcome Factors Guide (pg. 7) of the SMM Review Long Form to determine contributing factors and opportunities.

<table>
<thead>
<tr>
<th>Opportunity to Alter Outcome</th>
<th>[ ] Strong</th>
<th>[ ] Possible</th>
<th>[ ] None</th>
</tr>
</thead>
<tbody>
<tr>
<td>If opportunity to alter outcome present were opportunities largely: Circle all that apply</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provider</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>System</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

List up to 3 things that could be done to alter outcome:

Identify practices that were done well and should be reinforced:

Recommendations for system, practice, provider improvements:

This form was originally developed by the California Pregnancy-Associated Mortality Review (CA-PAMR) using Title V MCH funding and is adapted with permission from the California Department of Public Health, Maternal, Child and Adolescent Health Division. Sacramento, CA

Geller SE, Adams MG, Komiarek MA, Hibbard JU, Endres LK, Cox SM, Kilpatrick SJ. Reliability of a preventability model in maternal death and morbidity. AJOG 2007;196:57.e1

Geller SE, Cox SM, Kilpatrick SJ. A descriptive model of preventability in maternal morbidity and mortality. J Perinat 2006;26:79-84

Resources: Additional Links

| Alliance for Innovation on Maternal Health | AIM eModules |

References


