

CMQCC

California Maternal
Quality Care Collaborative



Improving Health Care Response to Hypertensive Disorders of Pregnancy

A CMQCC Quality Improvement Toolkit

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Improving Health Care Response to Hypertensive Disorders of Pregnancy

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Disclaimers around terminology

Throughout the toolkit, the terms “mother” or “maternal” or “she” or “her” are used in reference to a person who is pregnant or has given birth. We recognize not all people who become pregnant and give birth identify as mothers or women. We believe all persons are equally deserving of patient-centered care that helps them attain their full potential and live authentic, healthy lives.

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

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

Conflict of Interest

The contributing authors do not have any affiliations or financial involvement that conflict with the material or recommendations presented in this toolkit.

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Executive Summary

The California Department of Public Health (CDPH), Maternal, Child and Adolescent Health (MCAH) Division, the California Maternal Quality Care Collaborative (CMQCC), and the volunteer CMQCC Task Force on Hypertensive Disorders of Pregnancy (HDP) collaborated to develop this resource to address significant causes of maternal morbidity and mortality: maternal hypertension and preeclampsia.

In the United States, the rate of preeclampsia **increased by 25%** between 1987 and 2004.¹ HDP were the second leading cause of pregnancy-related mortality in California from 2002 to 2007, and over 60% of those deaths were deemed preventable.² Data from the California Pregnancy-Associated Mortality Review (CA-PAMR) and other state and national reports have emphasized the high rate of HDP preventability of morbidity and mortality in 50-70% of cases.²⁻⁴ HDP are also one of the primary contributors to preterm birth, leading to significant neonatal morbidity and mortality² and billions of dollars in health care costs.⁵ Preeclampsia with severe features was associated with a higher risk of maternal and infant adverse outcomes compared to preeclampsia without severe features in a study of over 2 million linked maternal-infant births in California.⁶

The Improving Health Care for Hypertensive Disorders of Pregnancy Toolkit is an update to the Toolkit on Improving Health Care for Preeclampsia/Eclampsia published in 2014. The Task Force was charged with updating the previous toolkit⁷ and expanding its scope to address all hypertensive disorders of pregnancy (HDP), a spectrum of diseases that overlap with

preeclampsia including chronic hypertension, preeclampsia with severe features, eclampsia and HELLP syndrome (**H**emolysis, **E**levated **L**iver enzymes, **L**ow **P**latelet count), and other related diagnoses. (See Figure 1 on page 9)

Addressing the clinical spectrum of these serious disorders and developing systematic approaches to recognize and respond to HDP remains a priority quality improvement issue for hospitals in California and the United States.

This revised Toolkit introduces guidelines on best practices for hypertensive disorders that reflect recent changes in the American College of Obstetricians and Gynecologists practice bulletins.⁸⁻⁹ It is organized using the 4R Quality Improvement Framework of Readiness, Recognition, Response, and Reporting to align with national maternal safety bundles from the Alliance for Innovation in Maternal Health (AIM).¹⁰ In addition, effective nationwide on January 1, 2021, The Joint Commission (TJC) requires all birth facilities to demonstrate how they are achieving the six Elements of Performance (EPs) for PC.06.03.01 to reduce the likelihood of harm related to maternal severe hypertension/preeclampsia.¹¹

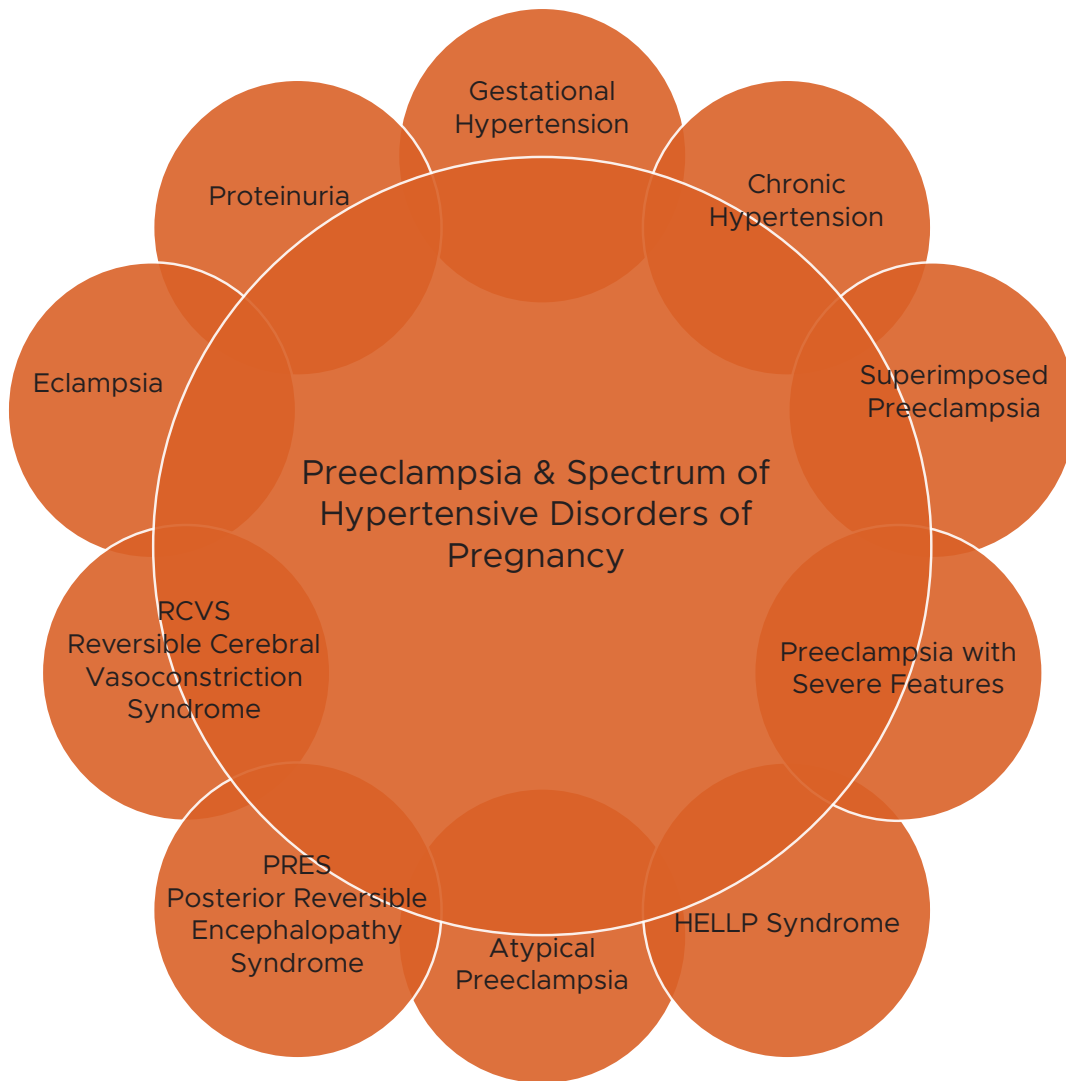
Hypertensive disorders of pregnancy (HDP) are transformative events that occur at a vulnerable time in a woman's life trajectory: pregnancy, birth, and postpartum. The Toolkit is a guide

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to support obstetric providers, clinical staff, hospitals, and healthcare organizations develop policies and processes within their facilities for timely recognition, and organized, evidence-based, rapid, and respectful responses to HDP.

The ultimate goal is to implement successful quality improvement programs for HDP that will decrease short- and long-term severe maternal morbidity, and maternal death.

Figure 1. The spectrum of hypertensive disorders of pregnancy



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



References

1. Wallis, A. B., Saftlas, A. F., Hsia, J. & Atrash, H. K. Secular trends in the rates of preeclampsia, eclampsia, and gestational hypertension, United States, 1987-2004. *American Journal of Hypertension B*, 521-526, doi:10.1038/ajh.2008.20 (2008).
2. California Department of Public Health. The California pregnancy-associated mortality review. Report from 2002 – 2007 maternal death reviews. (2018).
3. Thompson, J., Walsh, L. & Merkatz, I. R. The history of prenatal care: Cultural, social and medical contexts. (Elsevier, 1990).
4. Creanga, A. A., Syverson, C., Seed, K. & Callaghan, W. M. Pregnancy-related mortality in the United States, 2011-2013. *Obstetrics and Gynecology* 130, 366-373, doi:10.1097/AOG.0000000000002114 (2017).
5. Stevens, W. et al. Short-term costs of preeclampsia to the United States health care system. *American Journal of Obstetrics and Gynecology* 217, 237-248 e216, doi:10.1016/j.ajog.2017.04.032 (2017).
6. Ton, T. G. N. et al. Maternal and infant adverse outcomes associated with mild and severe preeclampsia during the first year after delivery in the United States. *American Journal of Perinatology* 37, 398-408, doi:10.1055/s-0039-1679916 (2020).
7. Druzin, M., Shields, L. E., Peterson, N. L. & Cape, V. Improving health care response to preeclampsia. (California Maternal Quality Care Collaborative Toolkit to Transform Maternity Care). (Developed under contract #11-10006 with the California Department of Public Health MCAH Division, Palo Alto, CA, 2013).
8. ACOG. Chronic hypertension in pregnancy: Practice Bulletin No. 203 of the College of Obstetricians and Gynecologists. *Obstetrics and Gynecology* 133, e26-e50, doi:10.1097/AOG.0000000000003020 (2019).
9. ACOG. Gestational hypertension and preeclampsia: Practice Bulletin No. 222 of the American College of Obstetricians and Gynecologists. *Obstetrics and Gynecology* 135, 1492-1495, doi:10.1097/AOG.0000000000003892 (2020).
10. Bernstein, P. S. et al. National Partnership for Maternal Safety: Consensus bundle on severe hypertension during pregnancy and the postpartum period. *Obstetrics and Gynecology* 130, 347-357, doi:10.1097/AOG.0000000000002115 (2017).
11. The Joint Commission. New standards for perinatal safety. https://www.jointcommission.org/-/media/tjc/documents/standards/prepublications/new_perinatal_standards_prepub_report_.pdf (2019)

Introduction

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Key Principles

1. The Joint Commission has published standards for hospital care of hypertensive disorders of pregnancy, effective January 1, 2021 for all birthing facilities.
2. Hypertensive disorders of pregnancy are among the most common medical disorders of pregnancy, occurring in 8-10% of pregnancies and contributing to maternal and neonatal morbidity and mortality.
3. Preeclampsia disproportionately affects African American women.

Background

In August 2019, The Joint Commission (TJC) published “Standards for Maternal Safety” to reduce the likelihood of harm related to maternal severe hypertension/preeclampsia.¹ (Implementing and Sustaining Maternal Quality, Safety, and Performance Improvement on page 15) These standards are effective as of January 2021. This updated toolkit on Improving Healthcare Response to Hypertensive Disorders of Pregnancy will serve as a valuable resource when addressing TJC requirements and provide assistance and guidance to hospital leaders who must ensure their implementation. The Toolkit has also been expanded to cover all hypertensive disorders of pregnancy (HDP).

The revised Toolkit introduces guidelines on best practices for hypertensive disorders that reflect recent changes in practice bulletin No. 222 by the American College of Obstetricians and Gynecologists,² and is organized using the 4R principles of Readiness, Recognition, Response, and Reporting, to align with national maternal safety bundles from the Alliance for Innovation in Maternal Health (AIM).³

The contribution of HDP to maternal and neonatal morbidity and mortality

Hypertensive disorders of pregnancy are one of the most common medical disorders of pregnancy, occurring in 8-10% of pregnancies.⁴ In the United States, the rate of preeclampsia increased by 25% between 1987 and 2004.⁵ Of note, in 2003, patients were at a 6.7-fold increased risk of preeclampsia with severe features, compared to patients in 1980.⁶ In addition, these disorders are one of the primary contributors to preterm birth, leading to significant neonatal morbidity and mortality.⁷ Preeclampsia with severe features was associated with a higher risk of maternal and infant adverse outcomes compared to preeclampsia without severe features in a study of over 2 million linked maternal-infant births in California.⁹ In addition, complications from HDP result in major costs to the health care system. In 2012, the estimated cost of preeclampsia within the first year of delivery was estimated to be \$2.18 billion, of which \$1.03 billion was for maternal care, and

\$1.15 billion for neonatal and infant care in the United States.¹⁰ The major contributor to the neonatal and infant cost of care was preterm birth, necessitated by medically-indicated delivery for the diagnosis of preeclampsia.⁹

Hypertensive disorders of pregnancy are leading contributors to premature birth, leading to significant neonatal morbidity and mortality.¹⁰ Induced delivery, although placing the preterm newborn at significant risk, is often necessary to preserve the pregnant woman's health and life. The cost of preserving maternal health is a potential increase in the incidence of preterm birth (PTB). Preeclampsia disproportionately affects African American women.¹¹ A study to investigate the role that gestational and chronic hypertension play in rates of preterm birth found that, **among African American women, chronic hypertension progressing to preeclampsia increased the risk for spontaneous and medically-indicated preterm birth, especially less than 32 weeks of gestation.**¹²

Is delivery the cure?

It is well accepted that delivery of the fetus and placenta is an essential component of the management HDP. The aphorism that “delivery is the cure” is widely believed in the obstetric world, but it is clear that in many cases the multi-system pathology of HDP continues for a variable amount of time following delivery and after hospital discharge.

For some women, delivery is not the cure.

It is critical to continue evaluating, asking, and listening to women about their health throughout the postpartum period, as serious clinical consequences may persist for days, and even weeks, after the birth. These clinical issues include severe hypertension, onset of eclamptic seizures, and renal dysfunction. Posterior reversible encephalopathy syndrome (PRES) is often diagnosed in the postpartum period. Clinicians should share information with women and their families about the complications.

Control of blood pressure to prevent stroke is a major goal in treatment practices in women with hypertensive disorders of pregnancy.

In the past, obstetric professional societies have placed emphasis on preventing eclamptic seizures, which are associated with a significant increase in both maternal and neonatal morbidity and mortality. The use of magnesium sulfate to prevent and treat seizures in patients with preeclampsia with severe features has been well accepted as the standard of care.¹³⁻¹⁶ Seizure prophylaxis for treatment of preeclampsia without severe features remains controversial. While ACOG does not recommend universal use of magnesium sulfate in patients without severe features, it also does not preclude universal use, which is important to note for women who have borderline severe-range blood pressures. (See Section: Borderline Severe-Range Blood Pressures: A Clinical Conundrum on page 35)

Historically, obstetric practice has placed less emphasis on acute control of blood pressure to prevent stroke, yet this aspect of management has recently been identified as a major gap in knowledge and application of proven therapeutic interventions. In addition to preventing cerebrovascular accidents, control of severe hypertension is associated with reduced severe maternal morbidity associated with preeclampsia.

This toolkit has been designed to be applicable at all levels of birth facilities that provide care to pregnant women and newborn infants. The toolkit algorithms are straightforward and focus on critical, respectful action. They are flexible for use by a wide variety of health care workers who are likely to encounter women with HDP including family medicine providers, emergency department personnel, intensivists, midwives, obstetricians, perinatologists, and nursing staff.

The focus of the toolkit is on the continuum of care from the prenatal period through birth and postpartum.

The authors of this toolkit adopted the Classification of Evidence Grading in alignment

with the American College of Obstetricians and Gynecologists (ACOG) to assess the type of study or evidence on which the recommendations were made. (See Appendix A: Classification of Evidence Grading on page 177)

References

1. The Joint Commission. New standards for perinatal safety. https://www.jointcommission.org/-/media/tjc/documents/standards/prepublications/new_perinatal_standards_prepub_report_.pdf (2019)
2. ACOG. Gestational hypertension and preeclampsia: Practice Bulletin No. 222 of the American College of Obstetricians and Gynecologists. *Obstetrics and Gynecology* 135, 1492-1495, doi:10.1097/AOG.0000000000003892 (2020).
3. Bernstein, P. S. et al. National Partnership for Maternal Safety: Consensus bundle on severe hypertension during pregnancy and the postpartum period. *Obstetrics and Gynecology* 130, 347-357, doi:10.1097/AOG.0000000000002115 (2017).
4. Mogos, M. F., Salemi, J. L., Spooner, K. K., McFarlin, B. L. & Salihu, H. H. Hypertensive disorders of pregnancy and postpartum readmission in the United States: National surveillance of the revolving door. *Journal of Hypertension* 36, 608-618, doi:10.1097/HJH.0000000000001594 (2018).
5. Wallis, A. B., Saftlas, A. F., Hsia, J. & Atrash, H. K. Secular trends in the rates of preeclampsia, eclampsia, and gestational hypertension, United States, 1987-2004. *American Journal of Hypertension* 21, 521-526, doi:10.1038/ajh.2008.20 (2008).
6. Ananth, C. V., Keyes, K. M. & Wapner, R. J. Pre-eclampsia rates in the United States, 1980-2010: Age-period-cohort analysis. *British Medical Journal* 347, f6564, doi:10.1136/bmj.f6564 (2013).
7. California Department of Public Health. The California pregnancy-associated mortality review. Report from 2002 - 2007 Maternal Death Reviews. (2018).
8. Kilpatrick, S. J., Abreo, A., Gould, J., Greene, N. & Main, E. K. Confirmed severe maternal morbidity is associated with high rate of preterm delivery. *American Journal of Obstetrics and Gynecology* 215, 233 e231-237, doi:10.1016/j.ajog.2016.02.026 (2016).
9. Ton, T. G. N. et al. Maternal and infant adverse outcomes associated with mild and severe preeclampsia during the first year after delivery in the United States. *American Journal of Perinatology* 37, 398-408, doi:10.1055/s-0039-1679916 (2020).
10. Stevens, W. et al. Short-term costs of preeclampsia to the United States health care system. *American Journal of Obstetrics and Gynecology* 217, 237-248 e216, doi:10.1016/j.ajog.2017.04.032 (2017).
11. Levine, L. D. et al. Persistent cardiac dysfunction on echocardiography in African American women with severe preeclampsia. *Pregnancy Hypertension* 17, 127-132, doi:10.1016/j.preghy.2019.05.021 (2019).
12. Premkumar, A., Baer, R. J., Jelliffe-Pawlowski, L. L. & Norton, M. E. Hypertensive disorders of pregnancy and preterm birth rates among black women. *American Journal of Perinatology* 36, 148-154, doi:10.1055/s-0038-1660461 (2019).
13. Clark, S. L. et al. Maternal death in the 21st century: Causes, prevention, and relationship to cesarean delivery. *American Journal of Obstetrics and Gynecology* 199, 36 e31-35; discussion 91-32 e37-11, doi:10.1016/j.ajog.2008.03.007 (2008).
14. Sibai, B. M. Magnesium sulfate prophylaxis in preeclampsia: Lessons learned from recent trials. *American Journal of Obstetrics and Gynecology* 190, 1520-1526, doi:10.1016/j.ajog.2003.12.057 (2004).
15. Duley, L., Gulmezoglu, A. M., Henderson-Smith, D. J. & Chou, D. Magnesium sulphate and other anticonvulsants for women with pre-eclampsia. *Cochrane Database Systematic Reviews*, CD000025, doi:10.1002/14651858.CD000025.pub2 (2010).
16. Altman, D. et al. Do women with pre-eclampsia, and their babies, benefit from magnesium sulphate? The Magpie Trial: A randomised placebo-controlled trial. *Lancet* 359, 1877-1890, doi:10.1016/s0140-6736(02)08778-0 (2002).



Readiness

This domain contains critical information all birthing facilities need to plan for managing patients with HDP. This section contains information and tools to ensure all clinicians are trained on how to best manage HDP, proposes treatment algorithms, and patient education materials.

In this section you will find the following:

- ▶ Bundle Implementation Guidance
- ▶ Recent changes in diagnosis and classification of HDP
- ▶ Perspectives on treating borderline severe range blood pressures, and other historical shifts in HDP treatment goals
- ▶ The suspected preeclampsia algorithm
- ▶ Warning signs (triggers) for when obstetricians should consult with specialists to treat seriously ill women
- ▶ Simulations and drills to help clinical staff learn to work as a team and use good communication skills when responding to acute hypertensive emergencies

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Implementing and Sustaining Maternal Quality, Safety, and Performance Improvement

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Key Principles

1. The Joint Commission’s Standards for Maternal Safety is comprised of 6 Elements of Performance (EP) that can function as a bundle checklist for perinatal leaders to guide this Toolkit’s implementation and help birth facilities meet accreditation requirements.
2. Bundle and toolkit implementation is not a ‘one size fits all’ endeavor and each hospital will need to address unique challenges dependent upon their local resources and organizational priorities.
3. Perinatal quality, safety, and performance improvement is a continuous and adaptive process that requires multidisciplinary teamwork.
4. It is important to identify and optimize existing data resources such as internal/external databases or dashboards, data reports, patient safety incident reporting systems, and department review workflows that can be used to monitor key clinical criteria and interventions for severe hypertension/preeclampsia.
5. Development of a data monitoring and communication plan that clarifies what measures to track, trend, and monitor; and where they need to be reported to align with regulatory and system goals is key.

Background

An effective way to achieve continuous perinatal quality, safety, and performance improvement is to fully implement safety bundles and integrate perinatal improvement metrics into your existing hospital quality and safety strategic plan for ongoing monitoring. This will ensure that perinatal quality improvement becomes an organizational priority and guides ongoing decision-making and resource allocation.

Clinical toolkit implementation is best facilitated

by aligning with a clinical patient safety bundle that incorporates key Toolkit practices into one succinct package of interventions. Patient safety bundles list specific actions that can be taken to improve care delivery, such as setting up a medication cart. Bundles are a way to organize interventions into a coordinated and standardized clinical care pathway that will improve the quality and safety of perinatal care for women and their newborns. When these interventions are followed consistently, they can be powerful agents of change for reducing preventable harm.

READINESS

Sustainability of perinatal quality care is a data-driven process achieved through monitoring data metrics that track and trend cases and the interventions and treatment provided. The value-add to integrating reporting and systems-learning from severe maternal events into organizational workflows ensures timely, meaningful, and sustainable improvements that directly contribute to high quality outcomes.

The Joint Commission's Standards for Maternal Safety

Reporting and Systems Learning content highlighted in the AIM and CMQCC severe hypertension/preeclampsia toolkits and maternal safety bundles informed The Joint Commission (TJC) in the development of Standards for Maternal Safety (PC.06.03.01) to reduce the likelihood of harm related to maternal severe hypertension/preeclampsia. This organizational alignment of the '4Rs' ensures that wherever birth facilities are in the bundle implementation journey, they have a shared understanding and common purpose in their efforts to reduce severe maternal events

related to hypertensive disorders of pregnancy (HDP).

TJC Standards for Maternal Safety, effective January 1, 2021, go beyond metric benchmarks and require leaders of hospitals, health systems, and birth facilities to look at the processes and procedures surrounding the care of women experiencing maternal hemorrhage and hypertension/preeclampsia. While the intention of these standards is to improve the quality and safety of perinatal care in TJC-accredited hospitals, standards such as these are useful for **all** birth facilities to review and adopt, regardless of their accreditation body, to ensure quality care for women and their newborns.

TJC's standards dedicated to severe hypertension/preeclampsia are organized around 6 Elements of Performance (EP), which are closely aligned with the 4R Framework. (See Box 1 on page 17) We recommend the 6 EPs to guide the implementation of this Toolkit. This approach will organize and focus your implementation efforts and ensure that your birth facility is ready for the TJC accreditation process.

The CMQCC Maternal Data Center (MDC) Joint Commission Maternal Standards Tool

Within the MDC, CMQCC member hospitals have access to an integrative tool that assists in tracking standards that have been met and provides resources for completing standards that have not been met. Actionable sustainability guidance is also included within the tool. The tool lists out each of the EPs using the identical language provided within TJC Standards for Maternal Safety. CMQCC provides rationales for each EP to ensure staff understanding and adoption. Examples of how to achieve compliance with each EP, links to resource documents that provide samples of various components from this toolkit, and template documents utilized during past CMQCC Collaboratives are included. A PDF feature allows obstetric and nursing leaders to easily share institutional progress with the C-suite and staff.

Box 1: Standards of Maternal Safety Elements of Performance to reduce the likelihood of harm related to maternal severe hypertension/preeclampsia (PC.06.03.01)

1. Develop written evidence-based procedures for measuring and remeasuring blood pressure. These procedures include criteria that identify patients with severely elevated blood pressure.

Resource documents from this Toolkit:

- ▶ Section: Accurate Blood Pressure Measurement on page 45

2. Develop written evidenced-based procedures for managing pregnant and postpartum patients with severe hypertension/preeclampsia that includes the following:

- ▶ The use of an evidence-based set of emergency response medications that are stocked and immediately available on the obstetric unit
- ▶ The use of seizure prophylaxis
- ▶ Guidance on when to consult additional experts and consider transfer to a higher level of care
- ▶ Guidance on when to use continuous fetal monitoring
- ▶ Guidance on when to consider emergent delivery
- ▶ Criteria for when a team debrief is required

Note: The written procedures should be developed by a multidisciplinary team that includes representation from obstetrics, emergency department, anesthesiology, nursing, laboratory, and pharmacy.

Relevant resources from Toolkit:

- ▶ Section: Consultation Prompts for all Obstetric Units on page 38
- ▶ Section: Nursing Management and Assessment of Preeclampsia on page 83
- ▶ Section: Antihypertensive Agents in Preeclampsia on page 121
- ▶ Section: Preventing and Managing Eclamptic Seizures on page 126
- ▶ Section: Learning From Cases: Debriefs and Multidisciplinary Case Reviews on page 163
- ▶ Appendix B: Suspected Preeclampsia Algorithm on page 178
- ▶ Appendix E: Acute Treatment Algorithm on page 195
- ▶ Appendix F: Sample Acute-Onset, Severe Hypertension and Eclampsia Medication Kit on page 198
- ▶ Appendix K: Sample Nursing Management Policy and Procedure on page 216
- ▶ Appendix M: Sample Order Set for Acute Control of Hypertensive Emergencies page 226
- ▶ Appendix P: Sample Management of Eclampsia and Acute-Onset, Severe Hypertension on page 233
- ▶ Appendix Q: Guidance for Rapid Debrief and Sample Form on page 234
- ▶ Appendix R: Sample Perinatal Safety Debrief Form on page 237

Other: AHRQ Rapid Response for Perinatal Safety

Continued on next page...

3. Provide role-specific education to all staff and providers who treat pregnant/postpartum patients about the hospital's evidence-based HDP procedure. At a minimum, education occurs at orientation, whenever changes to the procedure occur, or every two years. *Note: The emergency department is often where patients with symptoms or signs of severe hypertension present for care after delivery. For this reason, education should be provided to staff and providers in emergency departments regardless of the hospital's ability to provide labor and delivery services.*

Relevant resources from Toolkit:

- ▶ Section: Focus on Delayed Postpartum Preeclampsia and Eclampsia in the Emergency Department on page 60
- ▶ Appendix B: Suspected Preeclampsia Algorithm on page 178
- ▶ Appendix D: Preeclampsia Screening Tools on page 192
- ▶ Appendix E: Acute Treatment Algorithm on page 195
- ▶ Appendix L: FAQs for Timely Treatment for Acute-Onset Severe Hypertension during Pregnancy and the Postpartum Period on page 223
- ▶ HDP Toolkit Education Slide Set

4. Conduct drills at least annually to determine system issues as part of ongoing quality improvement efforts. Severe hypertension/preeclampsia drills include a team debrief.

Relevant resources from Toolkit:

- ▶ Section: The Role of Medical Simulation on page 41
- ▶ Appendix C: Simulation Scenarios on page 179

5. Review severe hypertension/preeclampsia cases that meet criteria established by the hospital to evaluate the effectiveness of the care, treatment, and services provided to the patient during the event.

Relevant resources from Toolkit:

- ▶ Section: Learning From Cases: Debriefs and Multidisciplinary Case Reviews on page 163
- Other: AIM Reduction of Peripartum Racial/Ethnic Disparities*

6. Provide printed education to patients and their families, including the designated support person whenever possible. At a minimum, education includes:

- ▶ Signs and symptoms of severe hypertension/preeclampsia during hospitalization that alert the patient to seek immediate care
- ▶ Signs and symptoms of severe hypertension/preeclampsia after discharge that alert the patient to seek immediate care
- ▶ When and why to schedule a post-discharge follow-up appointment

Relevant resources from Toolkit:

- ▶ Section: Patient Education on page 65
- ▶ Appendix G: Stop Sign for Patient Information on page 199
- ▶ Appendix H: Patient Clinical Summary: Severe Maternal Event on page 200
- ▶ Appendix I: Patient Education Checklists on page 201
- ▶ Appendix J: Sample Script: Physician Explanation of Hypertensive Disease Process and Management Plan on page 212

*Other: AIM Support after Severe Maternal Event Bundle
AIM Reduction of Peripartum Racial/Ethnic Disparities*

Alliance for Innovation on Maternal Health (AIM) Program

A coordinated national effort focused on reducing maternal mortality and severe maternal morbidity (SMM) in partnership with state-based Perinatal Quality Collaboratives (PQCs) and Maternal Child Health departments has been underway for over a decade. In 2015, the U.S. Department of Health and Human Services (HHS) Health Resources and Services Administration’s Maternal and Child Health Bureau (HRSA-MCHB) awarded funding to the American College of Obstetricians and Gynecologists (ACOG) to develop the AIM Program, which is a national data-driven maternal safety and quality improvement initiative based on proven implementation approaches to improve maternal safety and eliminate preventable severe maternal morbidity and maternal mortality across the U.S. AIM works through state teams and health systems to align national, state, and hospital level quality improvement efforts to improve overall maternal health outcomes. AIM also coordinates the development and endorsement of maternal safety bundles and resources through ACOG’s Council on Patient Safety in Women’s Health Care.

Implementation planning steps for nurse leaders at birth facilities

Step 1: Gap Analysis

It is critical to compare your facility’s current state to its ideal future state. Using the 6 Elements of Performance (EPs) as a checklist, conduct a full examination of the status of each required element. Determine where your facility is with each element and assess what you need to introduce or revise in order to fulfill the element. Next, determine whether there is a current workflow or existing process related to each EP. Some EPs may have never been addressed, while others may just need workflows or processes updated.

Questions to ask when examining each EP:

Is there a workflow/process/policy/education already in place that meets this requirement?

If yes, are revisions or updates needed? Do we need to look at data or perform audits to assess compliance with the current practice?

If not, what can be adopted from the toolkit to inform our efforts to meet the standard?

In addition to the facility-wide gap analysis, consider conducting a patient safety culture survey within your unit. This information can help leaders identify safety gaps in areas of teamwork, communication, and hierarchy that, if left unaddressed, can undermine even the most solid workflow or process.

Examples of patient safety culture surveys

[AHRQ Survey on Patient Safety Culture \(SOPS\) Hospital Survey](#)

[UT Health Center for Healthcare Safety & Quality: Safety Attitudes Questionnaire](#)

Step 2: Identify Resources and Collaborators

- ▶ Identify the quality, safety, and performance improvement experts in your facility that monitor and review TJC Perinatal Care (PC) data, organizational maternity care data and perinatal safety risk incidents.
- ▶ Reach out to quality and safety experts at your hospital and regional tertiary centers to build relationships for mentoring, developing peer-to-peer connections and sharing resources.
- ▶ Assess for opportunities to integrate perinatal patient safety into existing organizational quality and safety workplans. Examples include:
 - Connect with the facility-wide committee meeting and/or workgroup dedicated to perinatal safety and quality that reports its findings and systems-learning to senior leadership.
 - Generate and share data on priority quality metrics and key clinical criteria related to severe hypertension/preeclampsia.
 - Involve educators and simulation experts in safety work and team-based communication training.
 - Utilize your electronic health record (EHR) when possible to reinforce guidelines and develop interactive treatment pathways. An example design diagram for incorporating care pathways into the EHR is in Appendix N: Sample EMR Integration Care Pathway for Preeclampsia on page 228.
- ▶ Assemble a Perinatal Patient Safety Team

Types of Perinatal Patient Safety Team Members:

 - Physician Leader(s): OB, NICU, Anesthesia
 - Nurse Leader(s): CNM, Director, Manager, Educator
 - Peer Leaders: Physician, Nursing
 - Quality Staff
 - Patient Safety-Risk Management Staff
 - Pharmacist
 - Data Analyst/Consultant
 - Health Information Management/Clinical Informatics Staff
 - Patient Representative



Step 3: Implementation

Implementation is not a ‘one size fits all’ endeavor as each facility will need to address unique challenges dependent upon their local resources and organizational priorities. Bundle implementation—whether it occurs all at once or incrementally over time—is critical to achieve meaningful, sustainable, and systems-level improvements that will improve hospital based outcomes. We encourage a rapid-cycle Plan-Do-Study-Act (PDSA) approach to implementation. Learn about PDSA cycles here: [Institute of Healthcare Improvement \(IHI\)](#). A systems-minded approach can be achieved by creating teams with as few as two people, or as a larger committee, depending on local resources. It is important to remember that quality improvement work should never be dependent on a single person, but rather an integrated unit-level process that can be easily replicated to ensure ongoing success!

Implementing the toolkit and associated maternal safety bundles requires developing structure, process, and outcomes measures.

Structure measures

The first place for any birth facility to start when developing a data collection plan is to create a checklist of action steps and define the data metrics for each. The AIM program and CMQCC collaborated to develop the structure measures and align with the TJC Standards for Perinatal Safety. (See Box 1 on page 17)

Process measures

The single most important action to reduce severe maternal mortality and morbidity from hypertensive disorders of pregnancy is the rapid, timely, treatment of severe hypertension. (See Appendix E: Acute Treatment Algorithm on page 195) Many units start with a baseline of less than 40% of patients with severe hypertension treated within an hour. This baseline leaves significant opportunity for improvement, and once rates of timely treatment occur in greater than 80-90% of patients, continuous monitoring is needed to stay on target. Given the disparities observed in outcomes of HDP, we recommend that units look at their data by race/ethnicity and identify areas in need of additional work.

Base population: All pregnant women with HDP: chronic hypertension, gestational hypertension, preeclampsia, preeclampsia with severe features, and chronic hypertension with super-imposed preeclampsia.

Recommended process measures include:

Timely treatment of severe hypertension (strongly recommended)

Numerator: Women with severe hypertension who were treated within 1 hour of BP confirmation with IV labetalol, IV hydralazine, or PO nifedipine.

Denominator: Women with confirmed severe hypertension (systolic ≥ 160 mm Hg or diastolic ≥ 110 mm Hg) (no matter which underlying HDP)

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Utilization of magnesium sulfate in women who have preeclampsia with severe features

Numerator: Women treated with magnesium sulfate

Denominator: Women who meet criteria for preeclampsia with severe features

Timely follow-up care for women diagnosed with HDP

Numerator: Women receiving follow-up care within 3-7 days post-discharge

Denominator: Women who received antihypertensive medication during their admission

Provision of social and emotional support after a severe maternal morbidity:

Numerator: Women provided with social and emotional support and a written summary of the maternal event (See Section: Patient Education on page 65)

Denominator: Women with HDP who experienced severe maternal morbidity

Appendix L: FAQs for Timely Treatment for Acute-Onset Severe Hypertension during Pregnancy and the Postpartum Period on page 223 for more information about these data elements.

Outcome measures

TJC recommends that every birth facility carefully review all cases of HDP with Severe Maternal Morbidity (SMM) for improvement opportunities. At a minimum, it serves as an indicator for multidisciplinary case review. Many initiatives, including the AIM Program and CMQCC are using the CDC metric to track the rate of SMM complications in women with HDP (with and without transfusions). (See Section: Documenting Maternal Hypertensive Diagnoses with Accurate ICD-10 Coding on page 171)

Severe Maternal Morbidity among patients with HDP codes

Numerator: There are two sub-measures:

- (a) women with any CDC SMM ICD-10 codes, and
- (b) those with any CDC SMM non-transfusion codes

Denominator: Women with HDP codes

The CMQCC Maternal Data Center (MDC) is an online web tool that generates near real-time data and performance/process metrics on maternity care services for participating hospitals. Registered users have access to:

- ▶ Track timely treatment of hypertension,
- ▶ Data for most of the outcome measures and the framework for the process measures are built into the MDC.

Working solutions for Reporting and Systems Learning

To improve the implementation of the '4th R', Reporting and Systems Learning, we have outlined steps to address implementation that a facility may experience.

Identify data sources and resources

- ▶ How do you access the data?
- ▶ What existing data reports (i.e. from your EHR) exist that could be used or modified to enhance data tracking and trending?

Identify leadership support and assess level of engagement

- ▶ Organizational Leadership
- ▶ Department Leadership
- ▶ Unit Leadership

Identify quality, safety, and performance improvement experts (the ideal candidate(s) have passion for the project!)

- ▶ Quality Department: Who is assigned to, or manages, the review of TJC Perinatal Care (PC) core measures and other perinatal quality and safety metrics?
- ▶ Patient Safety-Risk Management Department: Who is assigned to or manages the review of the perinatal event reporting incidents?
- ▶ Data Department: Who manages the data report you want to use? Who is the Data Analyst or Consultant to assist you with writing a data query?
- ▶ Health Information Systems Department: Who is assigned to, or is a subject matter expert for, perinatal documentation in the EMR?

Monitor outcomes and process metrics of severe hypertension/preeclampsia cases. Examples of potential activities:

- ▶ At a minimum, review, severe maternal morbidity cases related to HDP on a monthly or quarterly basis.¹ Sample queries for such reviews include:
 - Was hypertension recognized appropriately and timely reported?
 - Was severe hypertension treated in a timely fashion with antihypertensive medications?
 - Did the patient appropriately receive magnesium sulfate?
 - Was the woman delivered at the appropriate time relative to her hypertensive disease?

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- Were any complications related to hypertensive disease managed appropriately?
 - Was patient discharge education given and timely follow-up visits scheduled?
- ▶ Review, align and/or develop a report query for tracking cases of severe hypertension and preeclampsia with severe features based on the [AIM Data Collection Plan](#) (See AIM worksheet tab: Severe Hypertension). This provides the denominator cases for some of the process measures noted above.
 - ▶ Collaborate with your facility-based Data Analyst or Consultant to develop a local data report query that identifies readmissions within 30 days to the emergency department and postpartum units with diagnosis codes for postpartum HDP.
 - Obtain retrospective data for the year prior to implementation start date to establish a baseline, then track and trend monthly
 - Consider additional data such as utilization reports of telehealth appointments
 - It is important to remember that readmissions related to HDP are not necessarily a sign of poor quality if the appropriate standard of care was initiated. Readmissions may be an indicator to assess the postpartum education and care. Indeed, the patient may have returned because they learned how to identify serious symptoms after self-monitoring and when to seek medical care.
 - ▶ Collaborate with the Patient Safety-Risk Management Dept to review reported perinatal safety incidents related to HDP.

Monitor compliance of documentation of patient education provided by nurses to patients about symptoms of preeclampsia.

- ▶ Coordinate staff education and patient education materials. Implement EMR documentation of patient education.
- ▶ Monitor compliance on a regular basis by reviewing staff competencies, auditing completion rates, and conducting chart reviews to validate patient education documentation.

Diagnosis and Classification

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Laurence E. Shields, MD, Marian Regional Medical Center, CommonSpirit Health

Key Principles

1. The current accepted terminology of preeclampsia (with and without severe features) replaces the prior definitions of “mild” and “severe” preeclampsia.¹
2. If the patient has been diagnosed with gestational hypertension or preeclampsia, and meets the BLOOD PRESSURE diagnostic criteria for severe hypertension ($\geq 160/110$ mm Hg confirmed) she immediately meets the criteria for preeclampsia with severe features. **Do not wait to treat the hypertensive emergency!**
3. As many as one quarter of women with gestational hypertension will develop preeclampsia.

The current diagnosis and classification of hypertensive disorders of pregnancy is primarily based on ACOG Practice Bulletin No. 222, Gestational Hypertension and Preeclampsia, June 2020.¹ The current accepted terminology of preeclampsia (with and without severe features) replaces the prior definitions of “mild” and “severe” preeclampsia. In addition, the ACOG Practice Bulletin No. 203, Chronic Hypertension in Pregnancy, published January 2019, defined chronic hypertension as hypertension diagnosed or present before pregnancy or before 20 weeks of gestation; or hypertension that is diagnosed for the first time during pregnancy and that does not resolve in the postpartum period. Chronic hypertension with superimposed preeclampsia is defined as preeclampsia in a woman with a history of hypertension before pregnancy or before 20 weeks of gestation.²

The expanded list of risk factors for preeclampsia as noted in Box 1 of ACOG Practice Bulletin #222 (See right) is important to heighten clinician awareness about the patients who are at greatest risk for developing preeclampsia. Greater clinical awareness

should aid in the earlier detection of this condition, allowing for earlier implementation of appropriate management.

Box 1: Risk Factors for Preeclampsia

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

Gestational hypertension and preeclampsia. ACOG Practice Bulletin No. 222. American College of Obstetricians and Gynecologists. Obstetrics and Gynecology 2020;135:e237–60. Reprinted with permission from the American College of Obstetricians and Gynecologists.

Note from HDP Task Force about Box 2: Diagnostic Criteria for Preeclampsia

If the patient has been diagnosed with gestational hypertension or preeclampsia, and meets the BLOOD PRESSURE diagnostic criteria for severe hypertension ($\geq 160/110$ mm Hg confirmed) she immediately meets the treatment criteria for preeclampsia with severe features.

Do not wait to treat the hypertensive emergency!

Continue to assess for and confirm additional criteria for preeclampsia diagnosis after or concurrent with antihypertensive administration.

Box 2: Diagnostic Criteria for Preeclampsia (ACOG)

Blood pressure

- ▶ Systolic blood pressure of 140 mm Hg or more or diastolic blood pressure of 90 mm Hg or more on two occasions at least 4 hours apart after 20 weeks of gestation in a woman with a previously normal blood pressure.
- ▶ Systolic blood pressure of 160 mm Hg or more or diastolic blood pressure of 110 mm Hg or more (Severe hypertension can be confirmed within a short interval (minutes) to facilitate timely antihypertensive therapy).

AND

Proteinuria

- ▶ 300 mg or more per 24-hour urine collection (or this amount extrapolated from a timed collection) or
- ▶ Protein/creatinine ratio of 0.3 or more or
- ▶ Dipstick reading of 2+ (used only if other quantitative methods not available).

In the absence of proteinuria, new-onset hypertension with the new-onset of any of the following:

- ▶ Thrombocytopenia: Platelet count less than $100 \times 10^9/L$
- ▶ Renal insufficiency: Serum creatinine concentrations greater than > 1.1 mg/dL or a doubling of the serum creatinine concentration in the absence of other renal disease
- ▶ Impaired liver function: Elevated blood concentrations of liver transaminases to twice normal concentration
- ▶ Pulmonary edema
- ▶ New onset headache unresponsive to medication and not accounted for by alternative diagnoses or visual symptoms.

Gestational hypertension and preeclampsia. ACOG Practice Bulletin No. 222. American College of Obstetricians and Gynecologists. Obstetrics and Gynecology 2020;135:e237–60. Reprinted with permission from the American College of Obstetricians and Gynecologists.

Box 3: Preeclampsia with Severe Features

Systolic blood pressure of 160 mm Hg or more, or diastolic blood pressure of 110 mm Hg or more on two occasions at least 4 hours apart (unless antihypertensive therapy is initiated before this time)

Thrombocytopenia (platelet count less than $100 \times 10^9/L$)

Impaired liver function that is not accounted for by alternative diagnoses and as indicated by abnormally elevated blood concentrations of liver enzymes (to more than twice the upper limit normal concentrations), or by severe persistent right upper quadrant or epigastric pain unresponsive to medications

Renal insufficiency (serum creatinine concentration more than > 1.1 mg/dL or a doubling of the serum creatinine concentration in the absence of other renal disease)

Pulmonary edema

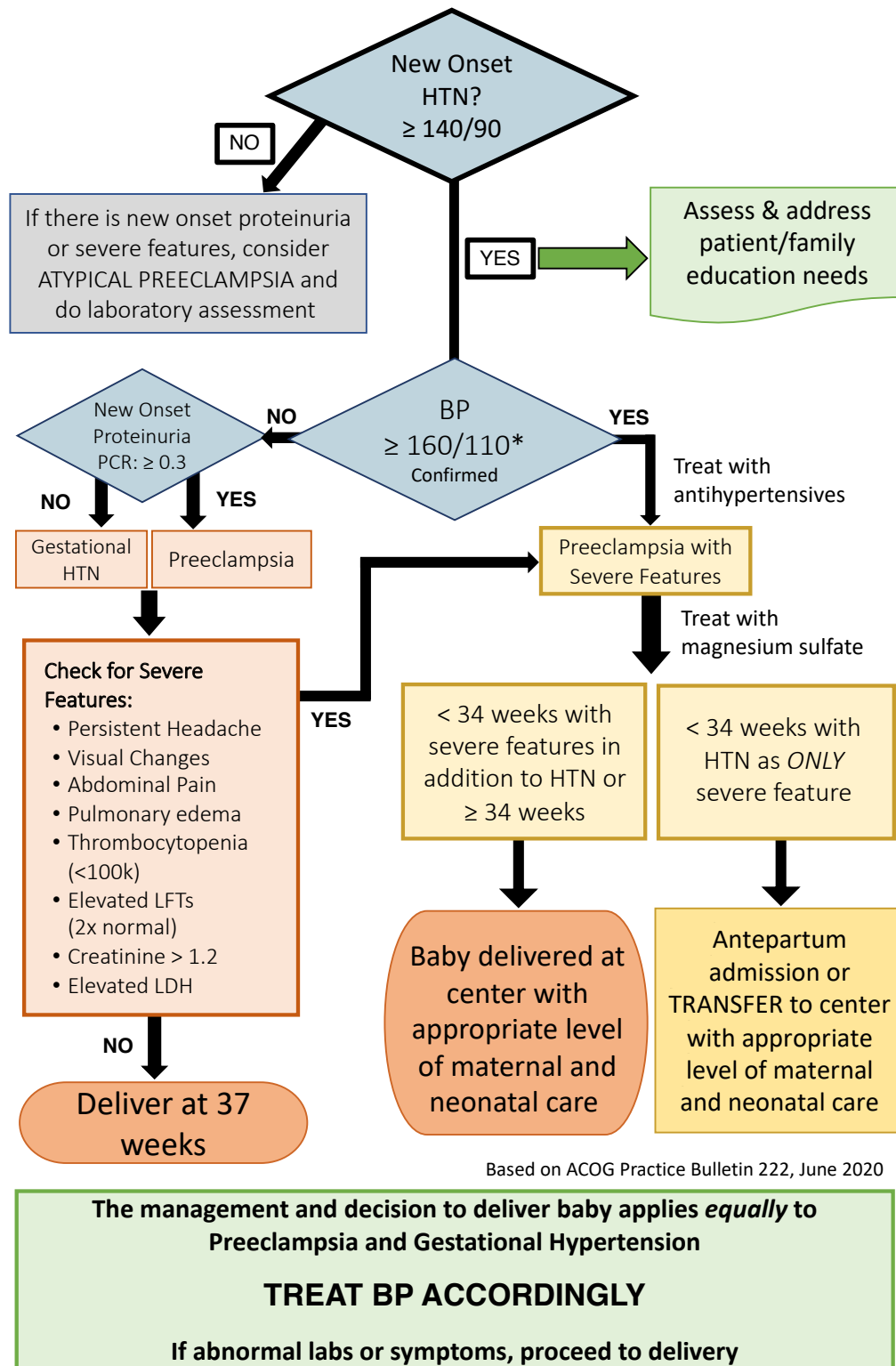
New-onset headache unresponsive to medication and not accounted for by alternative diagnoses

Visual disturbances

Gestational hypertension and preeclampsia. ACOG Practice Bulletin No. 222. American College of Obstetricians and Gynecologists. Obstetrics and Gynecology 2020;135:e237–60. Reprinted with permission from the American College of Obstetricians and Gynecologists.



Figure 1: Suspected preeclampsia algorithm



*Clinicians may consider antihypertensive therapy at 155/105 mm Hg given the association with increased maternal morbidities at this threshold in several studies as discussed in Toolkit Section: Borderline Severe-Range Blood Pressures: A Clinical Conundrum on page 35.

See Appendix B: Suspected Preeclampsia Algorithm on page 178

Additional considerations for diagnosis

Preexisting hypertension prior to 20 weeks of gestation would be considered chronic hypertension. Preexisting proteinuria prior to 20 weeks of gestation would be suggestive of chronic renal disease, often associated with longstanding hypertension and/or diabetes, or autoimmune disease.

The term gestational hypertension is used to describe cases occurring in women with elevated blood pressure, ≥ 140 mm Hg systolic or ≥ 90 mm Hg diastolic, without proteinuria, and without major organ involvement developing in a woman after 20 weeks of gestation with blood pressure levels returning to normal postpartum.³ As many as one quarter of women with gestational hypertension will develop proteinuria, i.e. preeclampsia.⁴

“White Coat Hypertension” is defined as elevated blood pressure, ≥ 140 mm Hg systolic or ≥ 90 mm Hg diastolic, primarily in the presence of health care providers. White coat hypertension may account for up to 15% of individuals with office hypertension, although the exact prevalence in pregnancy is not known.⁵ It must be emphasized that white coat hypertension should not be considered entirely benign; between 8% and 40% of such cases will progress to preeclampsia and gestational hypertension, respectively, later in pregnancy.⁶ For women with suspected white coat hypertension, the use of ambulatory blood pressure monitoring may be beneficial to confirm the diagnosis and to assist with decisions for initiation of antihypertensive therapy.²

There is clearly potential for overlap of all these conditions, as a patient may present with gestational hypertension or “white coat hypertension” and rapidly progress to the preeclampsia/eclampsia. It is important to share the diagnosis and prognosis with the patient and her family, and engage in shared decision-making about the plan of care.

Common associations with preeclampsia

HELLP Syndrome (Hemolysis, Elevated Liver enzymes, Low Platelets) is suggested when women with preeclampsia with severe features develop hepatic and hematologic manifestations as the predominant clinical picture, and is associated with a marked increased risk of adverse outcomes; HELLP syndrome can occur without hypertension or proteinuria.^{4,7,8}

Chronic hypertension complicating pregnancy is diagnosed by high blood pressure, BP $\geq 140/90$ mm Hg or greater, known to predate conception. When preconception blood pressures are not known, elevated blood pressure detected before

20 weeks of gestation is often due to chronic hypertension. Hypertension that is diagnosed for the first time during pregnancy and that does not resolve in the typical postpartum period also is classified as chronic hypertension. The most common etiology of chronic hypertension is most likely essential hypertension, although secondary hypertension as a result of renal disease, autoimmune disease, or vascular disease should be considered depending on the clinical presentation of the patient.

Superimposed preeclampsia/eclampsia in women with chronic or gestational hypertension is a common finding. Patients with underlying renal or vascular disease have a high risk of

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developing superimposed preeclampsia, as do those with essential hypertension.

It is important to note that recent data suggests that patients with stage 1 hypertension (130-139/80-89 mm Hg), based on American College of Cardiology/American Heart Association (ACC/AHA) guidelines, were at 2 to 3-fold increased risk for development of an HDP.⁹

Gestational age may be used to predict the severity of preeclampsia. Several recommendations divide preeclampsia according to the gestational age of presentation into the following categories:

- ▶ Less than 34 weeks of gestation – early preeclampsia. Development of preeclampsia at this early gestational age is often in the severe category, with significant risk for adverse maternal and fetal outcomes.¹⁰
- ▶ Greater than 34 weeks of gestation – late preeclampsia

The terms “mild” and “severe preeclampsia” should no longer be used. The new recommendation (since 2013) is to use the terms “preeclampsia without severe features” or “preeclampsia with severe features.”¹¹ The prior rigid assignment of patients with this disease into a category of “mild preeclampsia” was often detrimental to the appropriate management of a patient, because it suggested a form of the disease with minimal clinical sequelae. This disease is often not stable or static, and may evolve from “preeclampsia without severe features” to “preeclampsia with severe features,” HELLP Syndrome, and/or eclampsia within a matter of hours. Rapid progression is typically seen in preeclampsia with onset prior to 34 weeks.¹¹

Blood pressure levels and risk of stroke

There has been some controversy concerning

the blood pressure levels at which the risk of stroke is increased, as the evidence in support of the 160/110 mm Hg blood pressure threshold was primarily based on an article by Dr. James S. Martin and colleagues.¹² The recent publication from CA-PAMR¹³ supports the initial conclusions by Martin et al. Although these studies are retrospective, blood pressure levels of $\geq 160/110$ mm Hg or greater have been universally adopted as not only diagnostic for severe hypertension, but also as a clinical trigger requiring emergent antihypertensive therapy in pregnancy and the postpartum period.¹⁴ Many of the tools and best practices outlined in this revised Toolkit have been developed and recommended by national and international organizations including the American College of Obstetricians and Gynecologists (ACOG), National Institute for Health and Clinical Excellence (NICE) in the United Kingdom, and the Society for Obstetricians and Gynaecologists of Canada (SOGC).

The International Society for the Study of Hypertension in Pregnancy (ISSHP), a multidisciplinary international organization of clinicians and investigators, published a summary of the key points in diagnosis and management of hypertensive disorders of pregnancy.¹⁵ The ISSHP set of recommendations is designed to assist clinicians throughout the world in better recognizing and managing hypertensive disorders of pregnancy. The document includes sections written by those working in low- and middle-income countries so as to ensure global applicability. Some key points include:

- ▶ Resist classifying preeclampsia as “mild” or “severe” because the condition may progress rapidly and unpredictably.
- ▶ Proteinuria is not mandatory for a diagnosis of preeclampsia.
- ▶ HELLP Syndrome (Hemolysis, Elevated Liver enzymes, Low platelets) is one (serious)

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manifestation of preeclampsia and not a separate disorder.

- ▶ ISSHP supports women being screened during the first trimester for risk of preeclampsia when this can be integrated into the local health system; however, the cost effectiveness of this approach remains to be established.
- ▶ Women with established strong clinical risk factors for preeclampsia (i.e., prior preeclampsia, chronic hypertension, pre-gestational diabetes, maternal BMI > 30 kg/m², antiphospholipid syndrome and use of assisted reproduction) should be treated, ideally before 16 weeks, but definitely before 20 weeks of gestation, with low-dose aspirin (defined as 75–162 mg/day, as studied in randomized control trials).
- ▶ At this stage, ISSHP recommends against the routine clinical use of ‘rule-in’ or ‘rule-out’ tests for preeclampsia, looking at Placental Growth Factor (PIGF) and soluble fms-like tyrosine kinase-1 (sFLT-1), specifically PIGF or sFLT-1/PIGF ratio.
- ▶ Regardless of the type of hypertensive disorder of pregnancy, blood pressure requires urgent treatment in a monitored setting when severe ($\geq 160/110$ mm Hg).
- ▶ For preeclampsia, target diastolic blood pressure is 85 mm Hg in the office/clinic, and systolic blood pressure of 130–140 mm Hg in the office/clinic.
- ▶ Women with preeclampsia who have severe hypertension, ≥ 160 mm Hg systolic or ≥ 110 mm Hg diastolic with or without proteinuria, or hypertension with neurological signs or symptoms, should receive magnesium sulfate for convulsion prophylaxis.
- ▶ Annual medical review is advised throughout life, and all women who were diagnosed with

HDP should be counseled and supported to adopt a healthy lifestyle that includes exercise, eating well and aiming for ideal body weight.

The ISSHP Hypertension in Pregnancy document represents an international consensus on the key elements of improving healthcare in this group of patients.¹⁵ It validates the findings and recommendations presented in this Toolkit. It is important to note that ISSHP recommends against the routine clinical use of “rule-in” or “rule-out” tests, specifically PLGF or sFLT – 1/PLGF ratio for preeclampsia.¹⁵ This recommendation is in agreement with both ACOG and SMFM positions on this topic. These expensive tests are widely used in Europe and the United Kingdom. The cost/benefit ratio has not been established, and the widespread commercial promotion of these tests is not supported by the evidence.

The emerging evidence of adverse long-term consequences of hypertensive disorders of pregnancies, as noted in the ISSHP document, is of critical importance for promoting women’s health across their lifespan.^{15,16,18-22} Since the release of the first version of this toolkit, new information has emerged further supporting these recommendations. The American College of Cardiology (ACC) published updated guidelines concerning the definition of hypertension in the non-pregnant population.⁹ These guidelines endorse lower hypertensive thresholds for institution of antihypertensive therapy. At this point, it is unclear whether these lower thresholds should be considered in pregnancy. Recently, a retrospective study of singleton pregnancies in Australia reviewed maternal characteristics and blood pressure measurements at varying gestational ages. Blood pressures were categorized as normal, elevated, Stage 1 and Stage 2 hypertensive as per the ACC new guidelines. This study demonstrated that preeclampsia and the associated adverse outcomes were not exclusive to those with

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systolic blood pressures of greater than 140 mm Hg, the accepted definition for gestational hypertension. This study further suggests that those pregnant patients with pre-hypertensive blood pressures as defined by the ACC may

also benefit from closer monitoring. Further research is essential to confirm these findings, and whether lowering the blood pressure threshold in pregnancy could improve detection and outcomes.²³

EVIDENCE GRADING

LEVEL OF EVIDENCE: B

References

1. ACOG. Gestational hypertension and preeclampsia: Practice Bulletin No. 222 of the American College of Obstetricians and Gynecologists. *Obstetrics and Gynecology* 135, 1492-1495, doi:10.1097/AOG.0000000000003892 (2020).
2. ACOG. Chronic hypertension in pregnancy: Practice Bulletin No. 203 of the American College of Obstetricians and Gynecologists. *Obstetrics and Gynecology* 133, e26-e50, doi:10.1097/AOG.0000000000003020 (2019).
3. ACOG. Hypertension in pregnancy. Report of the American College of Obstetricians and Gynecologists' Task Force on Hypertension in Pregnancy. *Obstetrics and Gynecology* 122, 1122-1131, doi:10.1097/01.AOG.0000437382.03963.88 (2013).
4. Sibai, B. M., Ramadan, M. K., Chari, R. S. & Friedman, S. A. Pregnancies complicated by HELLP syndrome (hemolysis, elevated liver enzymes, and low platelets): Subsequent pregnancy outcome and long-term prognosis. *American Journal of Obstetrics and Gynecology* 172, 125-129 (1995).
5. Johnson, S., Liu, B., Kalafat, E., Thilaganathan, B. & Khalil, A. Maternal and perinatal outcomes of white coat hypertension during pregnancy: A systematic review and meta-analysis. *Hypertension* 76, 157-166, doi:10.1161/HYPERTENSIONAHA.119.14627 (2020).
6. Brown, M. A., Mangos, G., Davis, G. & Homer, C. The natural history of white coat hypertension during pregnancy. *British Journal of Obstetrics and Gynecology* 112, 601-606, doi:10.1111/j.1471-0528.2004.00516.x (2005).
7. Sibai, B. M. et al. Maternal morbidity and mortality in 442 pregnancies with hemolysis, elevated liver enzymes, and low platelets (HELLP syndrome). *American Journal of Obstetrics and Gynecology* 169, 1000-1006, doi:10.1016/0002-9378(93)90043-i (1993).
8. Barton, J. R. & Sibai, B. M. Hepatic imaging in HELLP syndrome (hemolysis, elevated liver enzymes, and low platelet count). *American Journal of Obstetrics and Gynecology* 174, 1820-1825; discussion 1825-1827, doi:10.1016/s0002-9378(96)70216-8 (1996).
9. Hauspurg, A., Countouris, M. E. & Catov, J. M. Hypertensive disorders of pregnancy and future maternal health: How can the evidence guide postpartum management? *Current Hypertension Reports* 21, 96, doi:10.1007/s11906-019-0999-7 (2019).
10. Ton, T. G. N. et al. Maternal and Infant Adverse Outcomes Associated with Mild and Severe Preeclampsia during the First Year after Delivery in the United States. *American Journal of Perinatology* 37, 398-408, doi:10.1055/s-0039-1679916 (2020).
11. Sibai, B. M. Evaluation and management of severe preeclampsia before 34 weeks of gestation. *American Journal of Obstetrics and Gynecology* 205, 191-198, doi:10.1016/j.ajog.2011.07.017 (2011).
12. Martin, J. N., Jr. et al. Stroke and severe preeclampsia and eclampsia: A paradigm shift focusing on systolic blood pressure. *Obstetrics and Gynecology* 105, 246-254, doi:10.1097/01.AOG.0000151116.84113.56 (2005).
13. Judy, A. E. et al. Systolic hypertension, preeclampsia-related mortality, and stroke in California. *Obstetrics and Gynecology* 133, 1151-1159, doi:10.1097/AOG.0000000000003290 (2019).
14. ACOG. ACOG Practice Bulletin No 222: Gestational Hypertension and Preeclampsia. *Obstetrics and Gynecology* 135 (2020).
15. Brown, M. A. et al. Hypertensive disorders of pregnancy: ISSHP classification, diagnosis, and management recommendations for international practice. *Hypertension* 72, 24-43, doi:10.1161/HYPERTENSIONAHA.117.10803 (2018).
16. Behrens, I. et al. Risk of post-pregnancy hypertension in women with a history of hypertensive disorders of pregnancy: Nationwide cohort study. *British Medical Journal* 358, j3078, doi:10.1136/bmj.j3078 (2017).

17. Stuart, J. J. et al. Hypertensive disorders of pregnancy and maternal cardiovascular disease risk factor development: An observational cohort study. *Annals of Internal Medicine* 169, 224-232, doi:10.7326/M17-2740 (2018).
18. Grandi, S. M. et al. Hypertensive disorders in pregnancy and the risk of subsequent cardiovascular disease. *Paediatric and Perinatal Epidemiology* 31, 412-421, doi:10.1111/ppe.12388 (2017).
19. Powe, C. E., Levine, R. J. & Karumanchi, S. A. Preeclampsia, a disease of the maternal endothelium: The role of antiangiogenic factors and implications for later cardiovascular disease. *Circulation* 123, 2856-2869, doi:10.1161/CIRCULATIONAHA.109.853127 (2011).
20. Romundstad, P. R., Magnussen, E. B., Smith, G. D. & Vatten, L. J. Hypertension in pregnancy and later cardiovascular risk: Common antecedents? *Circulation* 122, 579-584, doi:10.1161/CIRCULATIONAHA.110.943407 (2010).
21. Leslie, M. S. & Briggs, L. A. Preeclampsia Foundation position paper: Preeclampsia and future cardiovascular disease. (Preeclampsia Foundation, www.preeclampsia.org, 2020).
22. Leslie, M. S., Briggs, L., Dowling, M. & Park, J. The PEACH Project: Preeclampsia Survivor Awareness of Cardiovascular Health Risk. (Melbourne, FL, 2020).
23. Ahmed, R., Dunford, J., Mehran, R., Robson, S. & Kunadian, V. Pre-eclampsia and future cardiovascular risk among women: A review. *Journal of the American College of Cardiology* 63, 1815-1822, doi:10.1016/j.jacc.2014.02.529 (2014).
24. Reddy, M. et al. Challenging the definition of hypertension in pregnancy: A retrospective cohort study. *American Journal of Obstetrics and Gynecology*, doi:10.1016/j.ajog.2019.12.272 (2020).

Borderline Severe-Range Blood Pressures: A Clinical Conundrum

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Key Principles

1. Borderline severe elevated blood pressures of 155-159 mm Hg systolic and/or 105-109 mm Hg diastolic are clinically significant and may pose significant increased risk for patients.
2. An individualized approach and close observation of patients with borderline severe blood pressures is recommended.
3. Although borderline severe blood pressures of 155-159 mm Hg systolic and/or 105-109 mm Hg do not meet the strict criteria outlined by ACOG for the diagnosis of severe gestational hypertension or preeclampsia with severe features and immediate treatment with antihypertensive therapy, women in this category may experience significant risk of disease if not treated.^{1,2}
4. This level of hypertension is defined as moderate hypertension by National Institute for Health and Care Experience (NICE), and their recommendation is for hospitalization and treatment with antihypertensive medication. Target blood pressures are less than 150 mm Hg systolic and 80-100 mm Hg diastolic which are consistent with the blood pressure recommendations in this toolkit of 130-150/80-100 mm Hg.³

Borderline severe elevated blood pressures are clinically significant and may pose increased risk for patients. Patients experiencing borderline severe elevated blood pressures are at high risk of progressing to severe-range blood pressures and end organ involvement within a relatively short period of time. Several studies suggest that patients with blood pressures in this borderline severe-range may experience severe morbidity and possibly death at similar rates to patients with severe features.^{2,4}

Due to these concerns, CMQCC previously recommended considering treatment of blood pressures of 155/105 mm Hg or greater.⁵ Unfortunately, the discrepancy between these recommended treatment values and accepted diagnostic values for severe hypertension resulted in confusion among clinicians and implementation challenges. It is important to again draw attention to this subcategory of borderline severe blood pressures as an indicator that should be considered as having similar clinical implications as those related to severe-range blood pressures. A high index of suspicion and discretion is suggested for clinicians as to when monitoring and treatment should be implemented.

READINESS

The studies by Martin et al. and Judy et al. regarding the association of blood pressures of equal to or greater than 160 mm Hg systolic and/or equal to or greater than 110 mm Hg diastolic with hemorrhagic stroke, have confirmed the importance of these levels as indications for emergent antihypertensive therapy.^{2,4} The combined total of these two series comprised of 54 patients who suffered preeclampsia related stroke, with Judy's paper including maternal mortality. There were two patients with systolic blood pressures between 155 and 160 and an additional four patients who had diastolic blood pressures between 105 and 110.^{2,4} These six patients (11%) would not have been considered for antihypertensive therapy under the universally accepted treatment guidelines of equal to or greater than 160 systolic and/or equal to or greater than 110 diastolic. It is possible that treatment of these patients may have prevented them from suffering a devastating hemorrhagic stroke. There is very little risk associated with antihypertensive treatment at these levels of blood pressure. The theoretical risk of inducing severe hypotension has not been reported to any great extent. This data emphasizes the fact that severe-range blood pressures will often fluctuate and that stroke can occur at borderline severe-ranges of 155 systolic and/or 105 diastolic, meriting consideration of antihypertensive treatment in these cases.⁶

Clinicians may be reluctant to diagnose preeclampsia with severe features utilizing borderline severe pressures in a woman < 34 weeks of gestation because guidelines recommend either immediate delivery or hospitalization with close observation and delivery at 34 weeks of gestation. Preterm delivery has major implications for the neonate and the woman, and therefore should be avoided, unless clearly indicated. Frequent maternal and fetal evaluation and individualized treatment of this group of patients is recommended as outlined below. At gestational ages > 34 weeks, the diagnosis of preeclampsia with severe features and the decision to administer antihypertensive therapy is critically important, as this intervention will mandate administration of magnesium sulfate.

At a minimum, for any patient with new-onset blood pressures values 155-159 mm Hg/105-109 mm Hg, the following is recommended:

- ▶ Immediate notification of physician of borderline severe blood pressures values.
- ▶ Consideration of the administration of antihypertensive therapy and magnesium sulfate at 155/105 mm Hg or greater given the association with increased maternal morbidities at this threshold in several studies.
- ▶ Physician evaluation of the patient, with particular emphasis on overt manifestations of severe disease, such as headache, visual disturbance and right upper quadrant or epigastric pain, or change since admission or last assessment.
- ▶ Continuous electronic fetal monitoring, as fetal deterioration and abruptio placentae often follows episodes of marked elevations in maternal blood pressures.
- ▶ Inpatient observation for a prolonged period (minimum of 24-48 hours).
- ▶ Frequent assessment of vital signs and symptoms (every 2 hours for a minimum of 24 hours).
- ▶ Serial assessment of serum labs (at least daily for 2 days).

Should the patient progress to severe blood pressure elevation (160/110 mm Hg or greater), antihypertensives should be administered as outlined in the antihypertensive treatment algorithm, (See Section: Antihypertensive Agents in Preeclampsia on page 121) and the patient should be diagnosed with severe hypertension or preeclampsia with severe features and managed according to recommended guidelines. It is important to keep women and their families informed and apprised of the changing clinical situation, and provide reassurances that she will be cared for.

Clinicians may choose to discharge the patient with very close outpatient surveillance. However, for patients who continue to demonstrate recurrent blood pressures in the 150-159/100-109 mm Hg range, *even in the absence of severe-range elevations* as defined by ACOG (160/110 mm Hg or greater), ongoing inpatient observation as outlined above is advised, along with careful consideration of the potential benefits of antihypertensive therapy to decrease maternal morbidity.¹

When considering outpatient management, close surveillance during the antepartum period for this unique group is recommended. A patient may be discharged home with or without antihypertensive medications if they:

- ▶ Do not manifest any severe-range blood pressures of 160/110 mm Hg or greater over the period of intensive inpatient observation (minimum 24-48 hours).
- ▶ Maintain blood pressures of less than 150/100 mm Hg for a minimum of 24-48 hours.
- ▶ Remain free of symptoms or laboratory abnormalities consistent with severe features for the duration of hospitalization.
- ▶ Demonstrate reassuring fetal status.
- ▶ Receive and understand information about the signs and symptoms that warrant medical attention.

EVIDENCE GRADING
LEVEL OF EVIDENCE: C

References

1. ACOG. Gestational hypertension and preeclampsia: Practice Bulletin No. 222 of the American College of Obstetricians and Gynecologists. *Obstetrics and Gynecology* 135, 1492-1495, doi:10.1097/AOG.0000000000003892 (2020).
2. Martin, J. N., Jr. et al. Stroke and severe preeclampsia and eclampsia: A paradigm shift focusing on systolic blood pressure. *Obstetrics and Gynecology* 105, 246-254, doi:10.1097/01.AOG.0000151116.84113.56 (2005).
3. Webster, K. et al. Diagnosis and management of hypertension in pregnancy: Summary of updated NICE guidance. *British Medical Journal* 366, l5119, doi:10.1136/bmj.l5119 (2019).
4. Judy, A. E. et al. Systolic hypertension, preeclampsia-related mortality, and stroke in California. *Obstetrics and Gynecology* 133, 1151-1159, doi:10.1097/AOG.0000000000003290 (2019).
5. Druzin, M., Shields, L. E., Peterson, N. L. & Cape, V. Improving health care response to preeclampsia. (California Maternal Quality Care Collaborative Toolkit to Transform Maternity Care). (Developed under contract #11-10006 with the California Department of Public Health MCAH Division, Palo Alto, CA, 2013).
6. Sharma, K. J., Rodriguez, M., Kilpatrick, S. J., Greene, N. & Aghajanian, P. Risks of parenteral antihypertensive therapy for the treatment of severe maternal hypertension are low. *Hypertension in Pregnancy* 35, 123-128, doi:10.3109/10641955.2015.1117098 (2016).

Consultation Prompts for all Obstetric Units

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Key Principles

1. When the obstetric (OB) team feels uncomfortable with the medical situation, or if any hematologic, cardiac, pulmonary, or persistent neurologic symptoms are present, strongly consider consultation with maternal-fetal medicine (MFM), anesthesia, cardiology, hematology, neurology or any other sub-specialties.
2. Request consultations when the patient needs a higher level of care than usually provided by regular birth center staff, or when the staff feel uncomfortable with the medical situation. Often the first consults are with the MFM and/or anesthesiologist covering the Obstetrics Department.^{1,2}
3. Consultations should also be considered in the following situations:
 - ▶ There is clinical disagreement among team members about the severity and complexity of the patient's condition (See Section: Teamwork and Communication on page 89)
 - ▶ The hypertension is resistant to standard treatment and severe hypertension (systolic BP ≥ 160 mm Hg, or diastolic BP ≥ 110 mm Hg, persists. (See Appendix E: Acute Treatment Algorithm on page 195) This situation requires a 3rd line medication.
 - ▶ There is persistent low BP (e.g., systolic BP < 90 mm Hg) unresponsive to fluid bolus(es) of 500 ml
 - ▶ Persistent oliguria (e.g., < 30 cc per hour) after fluid challenge (See Section: Fluid Management in Preeclampsia on page 143)
 - ▶ Suspected amniotic fluid or pulmonary embolism
 - ▶ Hemorrhage with disseminated intravascular coagulation (DIC)

Background

Patients with preeclampsia are at risk for numerous adverse outcomes. The maternity team of obstetricians, nurses and anesthesiologists are the first responders, and will require consultation with other specialties in a number of clinical circumstances.³ The guidelines in Table 1 specify the type of specialist who should be engaged when warning criteria (triggers) are present.⁴ Maternity providers are encouraged to consult with specialists appropriate for the clinical situation when patients become critically ill. There should be no hesitation in calling for assistance, as patient safety is the primary concern.⁵

Table 1: Warning criteria (triggers) in preeclampsia with severe features for seeking multidisciplinary team approaches

Consultation from other specialties	Warning criteria (triggers)
Pulmonology or Critical care	<ul style="list-style-type: none"> • Pulmonary edema • Not improving with the use of diuretic • Shortness of breath–DDx: Rule out pulmonary embolism (spiral CT scan preferred)
Cardiology or Critical care	<ul style="list-style-type: none"> • Cardiac pump failure–DDx: Peripartum cardiomyopathy, preeclampsia-induced heart failure– need echo • Arrhythmia (e.g. SVT, atrial fibrillation) • Difficulty breathing, evaluation for intubation–DDx: pulmonary edema, stridor from swelling fluids/allergic reaction, asthmatic not responsive to initial medications, magnesium toxicity, occult valvular disorders • Hypoxia, any cause (e.g. oxygen saturation < 95% on oxygen) • Vasopressors management
Neurology	<ul style="list-style-type: none"> • Repeated seizures, unresponsive to initial therapy–DDx: SAH/ intracranial hemorrhage–CT required • Altered mental status–DDx: Magnesium toxicity, metabolic disorders, medication or drug (Rx or illicit) overdose, (e.g. local anesthetic systemic toxicity) • Acute stroke/neurologic changes–DDx: Rule out intracranial bleed • Cortical vein thrombosis
Hematology	<ul style="list-style-type: none"> • Disseminated Intravascular Coagulopathy (DIC) • HELLP syndrome (e.g. platelets < 50,000) • Coagulopathy, any cause • Massive transfusion and OB hemorrhage • On anticoagulants (e.g., LMWH)–Timing, dosing, when to hold, when to restart

DDx: Differential Diagnosis; CT: computed tomography; SVT: Supraventricular Tachycardia; SAH: subarachnoid hemorrhage; HELLP: Hemolysis, Elevated Liver Enzymes, Low Platelet; LMWH: low molecular weight heparin

Improving Health Care Response to Hypertensive Disorders of Pregnancy, a CMQCC Quality Improvement Toolkit, 2021.

References

1. Isono, S. Mallampati classification, an estimate of upper airway anatomical balance, can change rapidly during labor. *Anesthesiology* 108, 347-349, doi:10.1097/ALN.0b013e318164cb0b (2008).
2. Kodali, B. S., Chandrasekhar, S., Bulich, L. N., Topulos, G. P. & Datta, S. Airway changes during labor and delivery. *Anesthesiology* 108, 357-362, doi:10.1097/ALN.0b013e31816452d3 (2008).
3. Morton, C. H., Seacrist, M. J., VanOtterloo, L. R. & Main, E. K. quality improvement opportunities identified through case review of pregnancy-related deaths from preeclampsia/eclampsia. *Journal of Obstetric, Gynecologic and Neonatal Nursing* 48, 275-287, doi:10.1016/j.jogn.2019.02.008 (2019).
4. Judy, A. E. et al. Systolic hypertension, preeclampsia-related mortality, and stroke in California. *Obstetrics and Gynecology* 133, 1151-1159, doi:10.1097/AOG.0000000000003290 (2019).
5. Arnolds, D. E., Smith, A., Banayan, J. M., Holt, R. & Scavone, B. M. National Partnership for Maternal Safety recommended maternal early warning criteria are associated with maternal morbidity. *Anesthesia and Analgesia* 129, 1621-1626, doi:10.1213/ ANE.0000000000003889 (2019).

The Role of Medical Simulation

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Key Principles

1. Medical simulation in obstetrics includes a spectrum of tools and does not require extensive resources to be effective.
2. The greatest value of simulation and drills lies in their potential to improve team dynamics and communication so that teams can successfully “execute” during critical situations.
3. Effective January 2021, The Joint Commission requires hospitals to perform annual drills related to severe hypertension/preeclampsia to identify system issues and inform local quality improvement efforts.

Background

The use and recognition of the value of medical simulation continues to grow. An expanding body of literature demonstrates the efficacy of medical simulation to improve recognition of, and response to, obstetric emergencies,¹⁻³ though review of this data is beyond the scope of this discussion.

Medical simulation includes a spectrum of tools, from low fidelity drills to high fidelity, inter-professional, interdisciplinary team simulations. Effective simulation programs must be designed with clear learning objectives and tailored to available resources and instructor expertise. Simulations do not require extensive resources to be effective.⁴

Simulation can be used to address knowledge gaps in the identification and treatment of hypertensive disorders of pregnancy (HDP), as well as communication gaps with each other and with the patient. It is also exceedingly effective at helping teams execute existing skills and knowledge. Using simulation to address system and communication issues is a powerful quality and process improvement tool that goes far beyond traditional education. Whether conducted in a dedicated simulation lab, or in real patient care areas (in-situ simulation), inter-professional team training provides opportunities to:

- ▶ Develop and test new policies and procedures
- ▶ Practice and demonstrate skills under realistic conditions that recreate the stressors and distractions of real clinical practice. Simulation is an excellent method to facilitate team learning and execution of key skills that have been learned in other venues.
- ▶ Incorporate communication and teamwork skills, including effectively communicating with patients and families about the critical situation. (See Sections: Patient Education on page 65; Teamwork and Communication on page 89)

READINESS

- ▶ Identify systems issues and provide the opportunity to test new systems and improve existing ones.
- ▶ Educate and practice techniques to improve communication and coordination of treatment teams, e.g. TeamSTEPPS, etc. (See Section: Teamwork and Communication on page 89)

Effective January 2021, The Joint Commission will require annual interdisciplinary drills of severe hypertension/preeclampsia. In addition to improving teamwork and communication, these drills should focus on system issues and must include team debriefing with a focus on quality improvement.⁵ (See Implementing and Sustaining Maternal Quality, Safety, and Performance Improvement on page 15)



Educational materials

When constructing simulations for team response to HDP, particularly preeclampsia and eclampsia, it is important to consider possible locations of events and the specific diagnoses:

- ▶ Patient locations: Labor and delivery, emergency department, operating room, recovery, postpartum
 - ▶ Diagnoses: Preeclampsia without severe features, preeclampsia with severe features, eclampsia
- Requirements for successful treatment:
- Will one (1) dose of antihypertensive medication be sufficient
 - Will the team be required to proceed with multiple doses/drugs to be successful?
- ▶ Simulation expertise and resources of the participating medical center

This toolkit provides one sample scenario of preeclampsia with severe features and eclampsia in the postpartum unit. (See Appendix C: Simulation Scenarios on page 179) This scenario requires the management of preeclampsia with severe features and eclamptic seizures that are refractory to magnesium. The scenario materials provide detailed information essential for an effective simulation experience, including debriefing guides specific to the scenario, and a more generic debriefing guide for teamwork and communication skills. The scenario can easily be modified to account for different clinical environments, different levels of clinical complexity, and different levels of simulation expertise and resources. Simulations can be done with or without dedicated simulation equipment.

The “Preeclampsia with severe features and eclampsia in the postpartum unit” scenario is comprised of the following components listed below and can be found in the Appendices of this toolkit:

Part 1: General directions for use	Part 5: Equipment/materials list
Part 2: Scenario overview	Part 6: Program algorithm & GUI (Graphic User Interface) Notes
Part 3: Detailed learning objectives	Part 7: Debriefing objectives
Part 4: Patient background information	

EVIDENCE GRADING

LEVEL OF EVIDENCE: B

References

1. Yucel, C., Hawley, G., Terzioglu, F. & Bogossian, F. The effectiveness of simulation-based team training in obstetrics emergencies for improving technical skills: A systematic review. *Simulation in Healthcare* 15, doi:10.1097/SIH.0000000000000416 (2020).
2. Le Lous, M., Simon, O., Lassel, L., Lavoue, V. & Jannin, P. Hybrid simulation for obstetrics training: A systematic review. *European Journal of Obstetrics and Gynecology Reproductive Biology* 246, 23-28, doi:10.1016/j.ejogrb.2019.12.024 (2020).
3. Merien, A. E., van de Ven, J., Mol, B. W., Houterman, S. & Oei, S. G. Multidisciplinary team training in a simulation setting for acute obstetric emergencies: A systematic review. *Obstetrics and Gynecology* 115, 1021-1031, doi:10.1097/AOG.0b013e3181d9f4cd (2010).
4. Magee, S. R., Shields, R. & Nothnagle, M. Low cost, high yield: Simulation of obstetric emergencies for family medicine training. *Teaching and Learning in Medicine* 25, 207-210, doi:10.1080/10401334.2013.797353 (2013).
5. The Joint Commission. New standards for perinatal safety. https://www.jointcommission.org/-/media/tjc/documents/standards/prepublications/new_perinatal_standards_prepub_report_.pdf (2019)



Recognition

This domain includes resources to ensure HDP can be recognized at the first signs of disease progression. Explanation of symptoms and assessments are described and specific risk factors at each point in pregnancy and the postpartum period are also presented.

In this section you will find the following:

- ▶ Best practices for accurate blood pressure measurement
- ▶ Diagnostic criteria for proteinuria as an indicator has changed with new ACOG guidelines
- ▶ Recognizing signs and symptoms of preeclampsia in the early stages
- ▶ Preeclampsia Screening Tools
- ▶ Tools to help prepare Emergency Department (ED) staff who frequently care for pregnant women or women who have recently given birth

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Accurate Blood Pressure Measurement

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Key Principles

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

Background

Blood pressure (BP) measurement is one of the most important clinical assessments that clinicians perform, yet it is often done inaccurately. For patients with hypertensive disorders of pregnancy (HDP), false BP measurement may lead to delays in diagnosis and treatment. Obtaining accurate BP measurement is critical to guide management decisions in HDP. The oscillatory, or automated BP machine, is the method most used in hospital settings, and it tends to underestimate both systolic and diastolic readings by as much as 10 mm Hg.^{1,2} In clinic settings and clinician offices, BP measurement is often performed with the aneroid sphygmomanometer (mechanical type with a dial). For most patients, automated devices are acceptable for clinical practice. However, if there is a potential for deterioration in the patient's condition, a manual cuff should be used when management decisions need to be made.³

A severe-range BP obtained with an automated BP device should be validated with a manual measurement for accuracy. The International Standards Organization (ISO) is used by manufacturers of noninvasive BP devices to test against a aneroid sphygmomanometer. The standard allows for a difference of ± 5 mm Hg with a standard deviation of no more than 8mm Hg. Ideally, when severe-range BP values are obtained using an automatic device, the BP should be retaken with a manual device. If the difference is > 8 mm Hg, a manual cuff should be used from this point.⁴

Refer to Table 1 on page 46 for steps in obtaining accurate BP measurement⁵ and Figure 1 on page 48 for recommended cuff sizes.

Table 1: Steps for obtaining accurate blood pressure measurements

Steps	Key points for accurate measurement
<p>1. Prepare equipment</p>	<ul style="list-style-type: none"> a. Aneroid sphygmomanometer is the gold standard for measuring BP; however, in many settings automatic cuffs are used routinely. b. Validated equivalent automated equipment can be used. c. When using automated BP equipment ensure that it has a rigid calibration verification schedule every 6 months. d. Check cuff for any defaults. e. Obtain correct size cuff: width of bladder 40% of circumference and encircle 80% of arm (See Figure 1 on page 48).
<p>2. Prepare the patient</p>	<ul style="list-style-type: none"> a. Ensure the patient is sitting or in a semi-recumbent position with the back supported and arm at heart level. <i>If BP must be taken in a recumbent position, place the patient in a left lateral decubitus position with cuff at the level of the right atrium.</i> b. Patient needs to sit quietly for 5 minutes prior to measurement. c. Free the bare upper arm of any restrictive clothing. d. Patient’s feet should be flat, not dangling from examination table or bed, and legs uncrossed. e. Assess recent (within previous 30 minutes) consumption of caffeine or nicotine. If BP is at the level that requires treatment, the patient should be treated. Recent use of nicotine or caffeine should not lead to delays in initiating appropriate antihypertensive therapies.

Continued on next page...

Steps	Key points for accurate measurement
3. Take measurement	<ul style="list-style-type: none"> • At time of admission, BP should be taken in both arms; continue BP measurements in arm with higher pressure. • Support patient's arm at heart level. • For auscultatory measurement: use first audible sound (Kortokoff I) as systolic pressure and use disappearance of sound (Kortokoff V) as diastolic pressure. • Read BP level to the nearest 2 mm Hg. • Instruct the patient not to talk. Background noise and talking can affect BP accuracy. • Use the highest reading obtained to determine next steps. • If BP is $\geq 140/90$ mm Hg, repeat within 15 minutes and if still elevated, further evaluation for preeclampsia is warranted. • Do not reposition patient to either side to obtain a lower BP. Repositioning will give you a false reading.
4. Record Measurement	<p>Document:</p> <ul style="list-style-type: none"> • Blood pressure measurement. • Patient position (sitting, semi-recumbent). • Location taken (arm, forearm, right or left). • Cuff size used.

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

Figure 1: Recommended cuff sizes

Arm circumference (cm)	Cuff size
22–26	Small Adult: 12x22cm
27–34	Adult: 16x30cm
25–44	Large Adult: 16x36cm
45–52	Adult Thigh: 16x42cm



This figure is original content from the Improving Health Care Response to Preeclampsia: A California Quality Improvement Toolkit, funded by the California Department of Public Health, 2014; supported by Title V funds. © 2014 California Department of Public Health.

Photo used with permission by Kristi Gabel, RNC-OB, C-EFM, MSN, CNS, Sutter Roseville Medical Center, 2020.

Factors that decrease the accuracy of BP measurements and should be avoided:

- ▶ Using cuffs that are too small, too loose, applied over clothing, or with the arm positioned below heart level and unsupported.
- ▶ Presence of air in the cuff before it is placed on the arm.
- ▶ Kinks or loose connections among the tubing.
- ▶ Any patient arm movement during measurement (passive or active).
- ▶ Improper positioning such as an unsupported back, crossed legs, as well as the patient talking during the measurement.⁶

Accurate BP measurements in obese women can be quite challenging due to the tronco-conical shape of the upper arm (when circumference near the shoulder is greater than the circumference near the elbow) resulting in a poor cuff fit and an inaccurate reading. Using a too-small cuff can overestimate BP by up to 30 mm Hg, and this practice accounts for 84% of the miscuffing in

this patient population. Using a too-large cuff can underestimate BP by 10-30 mm Hg.⁷ There have been numerous studies to date comparing traditional cylindrical cuffs with conical-shaped cuffs that provide a better fit and have shown improved accuracy of BP measurements in the obese population.^{7,8} In women with an upper-arm circumference of more than 34 cm, large adult cuffs or thigh cuffs can be used to improve BP accuracy. In these potentially sensitive situations, it is important to use nonjudgmental communication. For upper-arm measurements greater than 50 cm, the American Heart Association recommends using a cuff on the forearm and feeling for the appearance of the radial pulse at the wrist to estimate systolic BP. However, the accuracy of forearm measurement is not reliable,⁶ because systolic BP and diastolic BP differ in more distal arteries with systolic BP increasing and diastolic BP decreasing due to resistance as the vessels narrow.

Health care practitioners need to be consistent in measuring BP using same arm, same position and cuff size.

Accurate BP measurement is essential to guide management decisions in order to avoid over- or under- treatment. It is therefore imperative that health care providers are consistent in measuring BP using the **same arm, same position**, and correct cuff size for patients. Blood pressure readings can vary by > 10 mm Hg depending on which arm is used, so BP should be measured in both arms initially and the arm with the highest pressure should be used for subsequent

readings. If using automated BP monitors, it is extremely important to be present with the patient to confirm that appropriate BP technique and criteria have been met especially if a patient has preeclampsia. Automated BP measurements that are programmed on “auto-cycle” will cycle irrespective of maternal position, contractions, visitor distractions, etc., and the accuracy of BP measurement cannot be relied on unless the clinician is present.

Accuracy of the automated device may be limited if patients are hypertensive, hypotensive, and/or have cardiac dysrhythmias.⁶ In these situations, if there is a risk of deterioration in the patient’s condition, a manual cuff is recommended to inform management decisions.³

Implementing accurate BP measurements

- ✓ Inventory equipment and make sure it is regularly inspected, calibrated and validated.
- ✓ Ensure that proper size cuffs are readily available.
- ✓ Ensure that all staff are trained in standardized BP measurement technique.
- ✓ Update protocol to reflect current recommendations and guidelines.

EVIDENCE GRADING
LEVEL OF EVIDENCE: B

References

- 1 Natarajan, P. et al. Comparison of auscultatory and oscillometric automated blood pressure monitors in the setting of preeclampsia. *American Journal of Obstetrics and Gynecology* 181, 1203-1210, doi:10.1016/s0002-9378(99)70109-2 (1999).
- 2 Ogedegbe, G. & Pickering, T. Principles and techniques of blood pressure measurement. *Cardiology Clinics* 28, 571-586, doi:10.1016/j.ccl.2010.07.006 (2010).
- 3 Skirton, H., Chamberlain, W., Lawson, C., Ryan, H. & Young, E. A systematic review of variability and reliability of manual and automated blood pressure readings. *Journal of Clinical Nursing* 20, 602-614, doi:10.1111/j.1365-2702.2010.03528.x (2011).
- 4 McFarlane, J. Blood pressure measurement in obese patients. *Critical Care Nurse* 32, 70-73, doi:10.4037/ccn2012489 (2012).
- 5 Peters, R. M. High blood pressure in pregnancy. *Nursing for Womens Health* 12, 410-421; quiz 422, doi:10.1111/j.1751-486X.2008.00365.x (2008).
- 6 Pickering, T. G. et al. Recommendations for blood pressure measurement in humans: an AHA scientific statement from the Council on High Blood Pressure Research Professional and Public Education Subcommittee. *Journal of Clinical Hypertension (Greenwich)* 7, 102-109, doi:10.1111/j.1524-6175.2005.04377.x (2005).
- 7 Palatini, P. & Parati, G. Blood pressure measurement in very obese patients: a challenging problem. *Journal of Hypertension* 29, 425-429, doi:10.1097/HJH.0b013e3283435b65 (2011).
- 8 Bonso, E. et al. Accuracy of a single rigid conical cuff with standard-size bladder coupled to an automatic oscillometric device over a wide range of arm circumferences. *Hypertension in Research* 33, 1186-1191, doi:10.1038/hr.2010.146 (2010).

Proteinuria

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Key Principles

1. The level of proteinuria should not be used to classify preeclampsia with or without severe features, and should not be otherwise used to predict severity of disease or guide management.¹ (See Section: Severe Hypertension or Preeclampsia with Severe Features at < 34 Weeks of Gestation on page 111)
2. Urine dipstick is an acceptable initial screen. If positive (1+ or more), further evaluation is warranted through use of a protein/creatinine or albumin/creatinine ratio.
3. A urine sample collected after rupture of membranes may result in an elevated protein/creatinine ratio.² Obtain a urine sample from a urinary catheter if a value is needed for diagnostic confirmation of the presence of proteinuria.
4. Obtain baseline 24-hour urine protein or validated equivalent from patients with proteinuria noted pre-pregnancy or in early pregnancy. Use heightened surveillance, carefully evaluate for symptoms of preeclampsia with severe features, and monitor for an increase in proteinuria to abnormal levels.
5. Preeclampsia, eclampsia, severe gestational hypertension, and/or HELLP syndrome, may occur without proteinuria.^{3,4}
6. Patients with blood pressures, ≥ 140 mm Hg systolic and/or ≥ 90 mm Hg diastolic without proteinuria (gestational hypertension) or with normal blood pressure and development of new-onset proteinuria are at increased risk of development of preeclampsia.

Background

Proteinuria may be identified and quantified by a urine test strip “dip,” timed urine collection, protein/creatinine ratio, or albumin/creatinine ratio. The ACOG Practice Bulletin #222 recommends the use of a spot urine protein/creatinine ratio or a 24-hour urine collection to quantify the protein present.¹ The National Institute for Health and Care Excellence (NICE) guidelines, used to inform care in England and Wales, recommend the use of either the spot

urine protein/creatinine, or albumin/creatinine ratio, to quantify urine protein for the diagnosis of preeclampsia.⁵ The urine protein/creatinine and albumin/creatinine ratios are measurements designed to compensate for the variation in protein and albumin concentration in urine by comparing the amounts of protein to the concentration of creatinine present. (See Boxes 1 and 2 on page 51)

Box 1: Online calculator for urine protein/creatinine ratio

[Online Calculator for urine protein/creatinine ratio](#)

Box 2: Online calculator for urine albumin/creatinine ratio

[Online Calculator for urine albumin/creatinine ratio](#)

While a urine test strip “dip” has both high false positive and false negative values, it may be used to identify the need for further screening.^{1,5} NICE guidelines recommend the use of an automated reagent reading device for testing the urine “dip”, and do not recommend the use of a 24-hour urine in screening for preeclampsia collection.^{5,6}

The ACOG Practice Bulletin #203 recommends the use of a 24-hour urine collection, if needed, in the setting of chronic hypertension, and if protein/creatinine ratios are borderline or abnormal.^{1,7} Timed urine collections at 2 hours, 4 hours, or 12 hours, correlate well with 24-hour urine results, and may be an acceptable alternative when there is not enough time to collect a 24-hour urine.⁸⁻¹⁰

Clinicians need to be aware of testing methods used by the laboratories in their practice settings and the time frame for receiving results. It is important to know the turnaround times for protein/creatinine ratio or a sample for urinalysis assessment of protein. Dipstick testing of urine, while approved as an FDA Clinical Laboratory Improvement Amendments (CLIA) waived test, nevertheless requires considerable resources to meet the College of American Pathologists (CAP) accreditation standards.²

A clean catch urine specimen collected after rupture of membranes may result in higher protein values than one obtained from urinary catheterization.¹¹

Obtain a baseline 24-hour urine protein or validated equivalent from those patients with proteinuria present in early or pre-pregnancy. Use heightened surveillance, carefully evaluate for symptoms of preeclampsia with severe features, and monitor for an increase in excreted protein in this population. The presence of new-onset proteinuria in the absence of elevated blood pressure requires careful and more frequent patient surveillance (weekly to twice weekly) for the possible development of preeclampsia. Information needs to be given to, and understood by, women and their families so they can recognize and respond appropriately to signs and symptoms of worsening.¹² (See Section: Patient Education on page 65)

Table 1. Proteinuria values in preeclampsia

Dipstick ^A	24-hour urine	Protein/ Creatinine ratio ^D	Albumin: Creatinine ratio
2+ for diagnosis ^A	≥ 300 mg/24 hours ^C	≥ 0.3	≥ 8mg/mmol ^B
1+ for further screening ^B			

^A For diagnosis: Urine dipstick samples should be obtained twice, four hours apart and in absence of infection ^{1,5,18}

^B National Institute for Health and Care Excellence (NICE) guidelines; For 1+ dipstick screen with protein: creatinine or albumin: creatinine ratio ^{5,18}

^C Society of Obstetricians and Gynaecologists of Canada (SOGC) ¹⁹

^D See Boxes 1 and 2 on page 51 for how to calculate

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

Isolated new-onset proteinuria, in the absence of urinary tract infection (UTI), is associated with a significantly increased risk for development of preeclampsia/atypical preeclampsia.¹³⁻¹⁷

EVIDENCE GRADING
LEVEL OF EVIDENCE: B

References

1. ACOG. Gestational hypertension and preeclampsia: Practice Bulletin No. 222 of the American College of Obstetricians and Gynecologists. *Obstetrics and Gynecology* 135, 1492-1495, doi:10.1097/AOG.0000000000003892 (2020).
2. Dyhdalo, K. S., Howanitz, P. J., Wilkinson, D. S., Souers, R. J. & Jones, B. A. Documentation of quality control and operator training at point-of-care testing: A College of American Pathologists Q-Probes study of 106 institutions. *Archives in Pathology and Laboratory Medicine* 138, 1444-1448, doi:10.5858/arpa.2013-0552-CP (2014).
3. Homer CS, Brown MA, Mangos G, Davis GK. Non-proteinuric pre-eclampsia: A novel risk indicator in women with gestational hypertension. *Journal of Hypertension* 26, 295-302. doi: 10.1097/HJH.0b013e3282f1a953 (2008).
4. Thornton CE, Makris A, Ogle RF, Tooher JM, Hennessy A. Role of proteinuria in defining pre-eclampsia: Clinical outcomes for women and babies. *Clinical and Experimental Pharmacology and Physiology* 37, 466-70. doi: 10.1111/j.1440-1681.2009.05334.x (2010).
5. Webster, K. et al. Diagnosis and management of hypertension in pregnancy: Summary of updated NICE guidance. *British Medical Journal* 366, l5119, doi:10.1136/bmj.l5119 (2019).
6. Waugh, J. et al. Spot protein-creatinine ratio and spot albumin-creatinine ratio in the assessment of pre-eclampsia: A diagnostic accuracy study with decision-analytic model-based economic evaluation and acceptability analysis. *Health Technology Assessment* 21, 1-90, doi:10.3310/hta21610 (2017).
7. ACOG. Chronic hypertension in pregnancy: Practice Bulletin No. 203 of the American College of Obstetricians and Gynecologists. *Obstetrics and Gynecology* 133, e26-e50, doi:10.1097/AOG.0000000000003020 (2019).
8. Airoidi, J. & Weinstein, L. Clinical significance of proteinuria in pregnancy. *Obstetrics and Gynecology Survey* 62, 117-124, doi:10.1097/01.ogx.0000253301.55009.ac (2007).
9. Abebe, J. et al. Accuracy of urine dipsticks, 2-h and 12-h urine collections for protein measurement as compared with the 24-h collection. *Journal of Obstetrics and Gynecology* 28, 496-500, doi:10.1080/01443610802196880 (2008).
10. Soni, S., Aggarwal, N., Dhaliwal, L., Wangkheimayum, S. & Menon, M. C. Absent circadian rhythm of proteinuria in hospitalized patients with preeclampsia. *Hypertension in Pregnancy* 31, 300-306, doi:10.3109/10641955.2010.507846 (2012).
11. Herrera Gonzalez, A. et al. The effect of amniotomy on urine protein creatinine ratio test accuracy. *International Journal of Women's Health* 11, 371-375, doi:10.2147/IJWH.S201210 (2019).
12. Morton, C. H. et al. National Partnership for Maternal Safety: Consensus bundle on support after a severe maternal event. *Journal of Obstetric, Gynecologic and Neonatal Nursing* 50, 88-101, DOI: <https://doi.org/10.1016/j.jogn.2020.09.160> (2021).
13. Chung, W. H. & To, W. W. K. Outcome of pregnancy with new onset proteinuria and progression to pre-eclampsia: A retrospective analysis. *Pregnancy Hypertension* 12, 174-177, doi:10.1016/j.preghy.2017.11.007 (2018).
14. Morikawa, M. et al. Pregnancy outcome of women who developed proteinuria in the absence of hypertension after mid-gestation. *Journal of Perinatal Medicine* 36, 419-424, doi:10.1515/JPM.2008.062 (2008).
15. Morikawa, M., Yamada, T. & Minakami, H. Outcome of pregnancy in patients with isolated proteinuria. *Current Opinions in Obstetrics and Gynecology* 21, 491-495, doi:10.1097/GCO.0b013e32833040bf (2009).
16. Ekiz, A. et al. The outcome of pregnancy with new onset proteinuria without hypertension: Retrospective observational study. *Journal of Maternal Fetal and Neonatal Medicine* 29, 1765-1769, doi:10.3109/14767058.2015.1061497 (2016).
17. Shinar, S. et al. Isolated proteinuria is a risk factor for pre-eclampsia: A retrospective analysis of the maternal and neonatal outcomes in women presenting with isolated gestational proteinuria. *Journal of Perinatology* 36, 25-29, doi:10.1038/jp.2015.138 (2016).
18. ACOG. Gestational hypertension and preeclampsia. Practice Bulletin No. 202 of the American College of Obstetricians and Gynecologists. *Obstetrics and Gynecology* 133, e1-25, DOI: 10.1097/AOG.0000000000003018 (2019).
19. Butalia, S. et al. Hypertension Canada's 2018 guidelines for the management of hypertension in pregnancy. *Canadian Journal of Cardiology* 34, 526-531, doi:10.1016/j.cjca.2018.02.021 (2018).

Early Recognition and Treatment of Preeclampsia

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Key Principles

1. Regardless of specific diagnoses, all women who have severe-range blood pressures (BP) need to be treated with antihypertensive medication.
2. Patients with gestational hypertension who present with severe-range BPs should be considered as preeclampsia with severe features and treated accordingly.
3. All medical facilities are recommended to:
 - ▶ Develop a process for both recognizing and appropriately responding in the event of a patient's deteriorating condition, including sharing information and decision-making with the patient and family.
 - ▶ Adopt written criteria describing early warning signs and intervention strategies that, whenever possible, are built into the electronic medical record system. (See Appendix D: Preeclampsia Screening Tools on page 192).
 - ▶ Establish regular drills for recognizing, responding to, and treating preeclampsia and severe gestational hypertension.

Background

Hypertensive disorders of pregnancy are second only to hemorrhage as leading causes of severe maternal morbidity in the U.S.¹ Early recognition and treatment of worsening signs and symptoms of preeclampsia was identified as a critical factor in reducing maternal morbidity and mortality in data from the California Pregnancy-Associated Mortality Review.² Of the 53 deaths due to preeclampsia, 62% had a good-to-strong chance to alter the outcome. A major theme that emerged from the quality improvement data analysis was that despite clear triggers indicating a serious deterioration in the patient's condition,

healthcare providers failed to recognize, acknowledge, and respond to these clinical signs in a timely manner. Delayed response to vital sign "triggers" occurred in over 90% of the preeclampsia deaths.² Many of these cases documented elevated BP values in the medical record that should have alerted the health care team to implement an immediate clinical action to treat the women with antihypertensive medication.³ In addition, there were other critical warning signs such as: proteinuria, headache, epigastric pain, deteriorating fetal status and altered mental status that were not recognized or acknowledged as evidence of a severe disease

process.³ These cases demonstrated an overall lack of critical thinking or ‘putting the pieces of the puzzle together’ to form a diagnosis by the health care team.³ Data has demonstrated that use of standardized approaches to critical BP values improves time to attain BP normalization and reduces maternal morbidity.^{4,5}

Delays in early recognition, diagnosis and management of preeclampsia can result when clinicians attribute patient signs and symptoms to physiological changes of pregnancy, without further evaluation. These physiological changes include vasodilatation that leads to a reduction in BP during the second trimester. Thus, vasodilation may mask underlying chronic hypertension in some patients. Concerning symptoms, such as headache, abdominal discomfort, and edema are common in normal pregnancy. When patients presenting with these symptoms are informed these are “normal” physiological changes of pregnancy, any future signs of preeclampsia or deterioration in their condition may not be recognized by the patient, her family, or the provider. When signs and symptoms of preeclampsia are dismissed, and not thoroughly evaluated, their clinical significance will be missed, including timely interventions that may decrease the risk of adverse outcomes and/or death.

The importance of maternal early warning signs

The National Health System of the United Kingdom has used a “Modified Early Obstetric Warning System” (MEOWS) chart since the 2003-2005 Confidential Enquiry into Maternal and Child Health (CEMACH) Report recommended its use.⁶ This MEOWS chart is designed to aid early recognition of severity of illness in order to facilitate prompt treatment of patients who are at risk for life-threatening complications.

In 2010, The Joint Commission (TJC) issued a

Sentinel Alert, “Preventing Maternal Death,” recommending that all U.S. birth facilities have processes in place to recognize and respond to patients’ deteriorating condition. The Joint Commission specifies that these processes must include written criteria describing early warning signs and indicating when to seek further assistance.⁷

Since the release of Version 1.0 of this Toolkit, the National Partnership for Maternal Safety published the Maternal Early Warning Criteria (Mhyre, D’Oria et al. 2014) and Shields and colleagues (2016) published the Maternal Early Warning Trigger (MEWT) tool.^{8,9} Both of these tools, like the MEOWS, are designed to ensure that critical maternal triggers are not missed, and to enhance provider intervention when those triggers are noted. Ideally, these types of tools should be part of every pregnant and postpartum patient’s working medical record, and providers should discuss risks with women and their families ahead of time, where relevant. Prospective use of the MEWT tool, as well as implementing antihypertensive treatments that utilize the guidelines in this Toolkit, has demonstrated reduced maternal morbidity in a large patient population.⁴ Early warning tools are designed to assist providers to detect maternal disease deterioration as quickly as possible, with the goal of reducing severe maternal morbidity (SMM).

The nursing role in early recognition

Nurses have a critical role to play in identifying early signs of deterioration in patients’ clinical status. An early warning tool provides clinical trigger parameters to assist nurses in identifying changes in vital signs, lab values, alterations in mental status, and concerning fetal heart rate patterns. It is important to listen and take seriously women’s or family member concerns about their health. Early detection of worsening health can prompt timely interventions and/or transfers to a higher level of care, when needed.



When nurses utilize clinical judgment and clear management guidelines to alert providers and escalate a rapid response, these actions may prevent further morbidity.

Two or more yellow triggers on the Preeclampsia Screening Tools (See Figure 1 on page 56) should prompt notification of provider and charge nurse. Interventions should include increasing the frequency of assessments, ordering appropriate labs/tests, considering the use of magnesium sulfate, and consulting with anesthesia.

For one or more red triggers, an immediate bedside evaluation by a provider should be requested. If severe-range BP is persistent for 15 minutes or more, this is considered an acute hypertensive crisis and needs to be treated within 30–60 minutes with antihypertensive medications. In addition, treatment with magnesium sulfate should follow promptly, per protocol. (See Appendix E: Acute Treatment Algorithm on page 195)

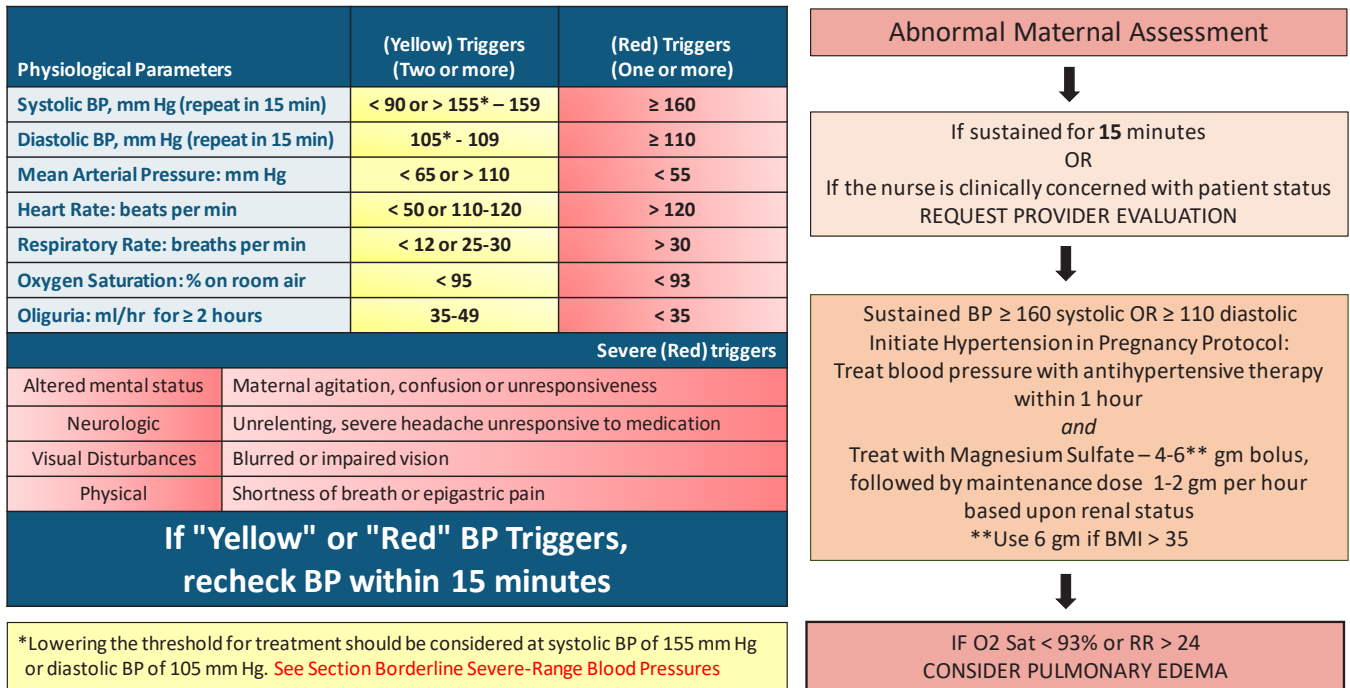
For any signs of altered mental status, consider a neurology consult. A severe headache unresponsive to medication or reports of visual changes should prompt a CT scan to rule out subarachnoid intracranial hemorrhage. For respiratory triggers (shortness of breath, decreased oxygen saturation) initiate O₂ @ 10L per non-rebreather mask, evaluate for pulmonary edema and order a chest x-ray.

Keep in mind that an evolving deterioration of the fetal heart rate can be an early sign of maternal decompensation and hypoxia, which requires further assessment.

All sites are strongly recommended to use a maternal early warning system or tool. For this Toolkit, we have included a comprehensive preeclampsia early warning tool (PERT) that can be used for nursing and physician education as well as preeclampsia-related drills. We have also included a shortened version that has been developed for this toolkit specifically designed for preeclampsia. This tool can also be used for nursing and provider education and can be minimized and laminated to use as a badge card or placed in each patient room for reference.

Figure 1. Preeclampsia Screening Tools

A: Preeclampsia Early Recognition Tool integrated within a Maternal Early Warning System



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

B: Preeclampsia Early Recognition Tool (PERT), page 1 of 2

ASSESS	NORMAL (GREEN)	WORRISOME (YELLOW)	SEVERE (RED)
Awareness	Alert/oriented	<ul style="list-style-type: none"> ▶ Agitated/confused ▶ Drowsy ▶ Difficulty speaking 	Unresponsive
Headache	None	<ul style="list-style-type: none"> ▶ Mild headache ▶ Nausea, vomiting 	Unrelieved headache
Vision	None	Blurred or impaired	Temporary blindness
Systolic BP (mm Hg)	100-139	≥ 155-159	≥ 160
Diastolic BP (mm Hg)	50-89	90-109	≥ 110
HR	61-110	110-120	> 120
Respiration	11-24	< 12 or 25-30	< 10 or > 30
SOB	Absent	Present	Present
O2 Sat (%)	≥ 95	< 95	< 93
Pain: Abdomen or Chest	None	<ul style="list-style-type: none"> ▶ Nausea, vomiting ▶ Chest pain ▶ Abdominal pain 	<ul style="list-style-type: none"> ▶ Nausea, vomiting ▶ Chest pain ▶ Abdominal pain
Fetal Signs	<ul style="list-style-type: none"> ▶ Category I ▶ Reactive NS 	<ul style="list-style-type: none"> ▶ Category II ▶ IUGR ▶ Non-reactive NST 	Category III
Urine Output (ml/hr)	≥50	35-49	≤ 35 (in 2 hrs)
Proteinuria*	Trace	<ul style="list-style-type: none"> ▶ ≥ +1** ▶ ≥ 300mg/24 hours 	Protein/Creatinine Ratio (PCR) > 0.3 Dipstick ≥ 2+
Platelets	> 100	50-100	< 50
AST/ALT	< 70	> 70	> 70
Creatinine	≤ 0.8	0.9-1.1	≥ 1.1
Magnesium Sulfate Toxicity	<ul style="list-style-type: none"> ▶ DTR +1 ▶ Respiration 16-20 	Depression of patellar reflexes	Respiration < 12

B: Preeclampsia Early Recognition Tool, page 2 of 2

*Level of proteinuria is not an accurate predictor of pregnancy outcome

GREEN=NORMAL: proceed with caution

YELLOW=WORRISOME: Increase assessment frequency

1 Trigger, TO DO:

Notify provider

≥ 2 Triggers, TO DO:

- ▶ Notify charge RN
- ▶ In-person evaluation
- ▶ Order labs/test
- ▶ Anesthesia consult
- ▶ Consider magnesium sulfate
- ▶ Supplemental oxygen

**Provider should be made aware of worsening or new-onset proteinuria

RED=SEVERE: Trigger, 1 of any type listed below

1 of any type:

- ▶ Immediate evaluation
- ▶ Transfer to higher acuity level
- ▶ 1:1 staff ratio

Awareness, Headache, Visual

- ▶ Consider Neurology consult
- ▶ CT Scan
- ▶ R/O SAH/intracranial hemorrhage

BP

- ▶ Labetalol/Hydralazine/nifedipine within 30-60 min
- ▶ In-person evaluation
- ▶ Magnesium sulfate loading or maintenance infusion

Chest Pain

- ▶ Consider CT angiogram

Respiration SOB

- ▶ O2 at 10L per non-rebreather mask

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

References

1. Creanga, A. A., Syverson, C., Seed, K. & Callaghan, W. M. Pregnancy-related mortality in the United States, 2011-2013. *Obstetrics and Gynecology* 130, 366-373, doi:10.1097/AOG.0000000000002114 (2017).
2. California Department of Public Health. The California pregnancy-associated mortality review. Report from 2002 - 2007 Maternal Death Reviews. (2018).
3. Morton, C. H., Seacrist, M. J., VanOtterloo, L. R. & Main, E. K. Quality improvement opportunities identified through case review of pregnancy-related deaths from preeclampsia/eclampsia. *Journal of Obstetric, Gynecologic & Neonatal Nursing* 48, 275-287, doi:10.1016/j.jogn.2019.02.008 (2019).
4. Shields, L. E., Wiesner, S., Klein, C., Pelletreau, B. & Hedriana, H. L. Early standardized treatment of critical blood pressure elevations is associated with a reduction in eclampsia and severe maternal morbidity. *American Journal of Obstetrics and Gynecology* 216, e1-5, doi:10.1016/j.ajog.2017.01.008 (2017).
5. Froehlich, R. J., Maggio, L., Has, P., Vrees, R. & Hughes, B. L. Improving obstetric hypertensive emergency treatment in a tertiary care women's emergency department. *Obstetrics and Gynecology* 132, 850-858, doi:10.1097/AOG.0000000000002809 (2018).
6. Lewis G. Saving mothers' lives: Reviewing maternal deaths to make motherhood safer: 2003-2005. London: Confidential Enquiry into Maternal and Child Health (2007).
7. The Joint Commission. Preventing Maternal Death. Sentinel Event Alert. Issue 44, <https://www.jointcommission.org/resources/patient-safety-topics/sentinel-event/sentinel-event-alert-newsletters/sentinel-event-alert-issue-44-preventing-maternal-death/> (2010).
8. Mhyre, J. M. et al. The maternal early warning criteria: A proposal from the national partnership for maternal safety. *Journal of Obstetric, Gynecologic & Neonatal Nursing* 43, 771-779, doi:10.1111/1552-6909.12504 (2014).
9. Shields, L. E., Wiesner, S., Klein, C., Pelletreau, B. & Hedriana, H. L. Use of Maternal Early Warning Trigger tool reduces maternal morbidity. *American Journal of Obstetrics and Gynecology* 214, 527 e521-526, doi:10.1016/j.ajog.2016.01.154 (2016).

Focus on Delayed Postpartum Preeclampsia and Eclampsia in the Emergency Department

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Key Principles

1. The most important first step when women present to the emergency department (ED) is to **identify whether they are or have been pregnant in the last 6 weeks**. If yes, assess immediately. Emergency department personnel should be familiar with the risk factors and signs and symptoms of postpartum preeclampsia and eclampsia. Delayed or new-onset disease can occur in women with seemingly normal BP on arrival. Identify significant symptoms which indicate preeclampsia for early intervention and treatment, and to prevent eclampsia.
2. The critical or “trigger” blood pressure (BP) in pregnancy and postpartum is ≥ 160 mm Hg systolic or ≥ 110 mm Hg diastolic. These values are typically lower than values used for hypertensive emergencies in non-obstetric patients.
3. Pregnant or recently postpartum women with elevated BP, neurologic symptoms, or other signs/symptoms of preeclampsia can deteriorate rapidly. When they present to the ED, the emergency physician and OB clinicians should be notified immediately to expedite appropriate evaluation and treatment.
4. Do not overlook other neurologic causes of seizure, particularly if the seizure occurs more than 48 hours after delivery.
5. Neuroimaging during pregnancy and postpartum must be performed if clinically indicated.
6. Implement the protocol for diagnosis and treatment of severe hypertensive emergencies. (See Appendix E: Acute Treatment Algorithm on page 195) Protocol recommendations can be reinforced through the use of educational tools, drills and simulations. (See Appendix C: Simulation Scenarios on page 179)
7. Since each hospital has different resources and workflows, an interdepartmental team of ED and OB clinicians should discuss practices that would work best for their hospital. Ideally, the interdepartmental team should use mutually developed workflows to create a policy that is available to all clinicians caring for pregnant and postpartum birthing people.

Background

Hypertensive disorders of pregnancy (HDP) are one of the leading causes of maternal morbidity and mortality. While there has been an overall decrease in the frequency of eclampsia, the frequency of postpartum and delayed eclampsia has increased,¹ making it more common for patients to present to the ED with symptoms. Although obstetric consultation is warranted in every case of preeclampsia, all clinicians working in the ED should be knowledgeable of, and comfortable with, the initial management. Since many pregnant or postpartum patients will present to an ED without a history of preeclampsia, emergency physicians should have a high index of suspicion for HDP, in order to treat appropriately. Educating ED personnel on the varying presentations, diagnoses, and treatments of HDP is necessary. To reduce preventable morbidity and mortality due to HDP, it is vital that pregnant and recently postpartum patients are rapidly identified and triaged in the ED.

The critical or “trigger” blood pressure in pregnancy and postpartum is ≥ 160 mm Hg systolic or ≥ 110 mm Hg diastolic. These values are typically lower than values used for hypertensive emergencies in non-obstetric patients.

Opportunities for improvement

The ED was the site of several quality improvement opportunities identified in a review of maternal deaths in California from 2002 to 2007.² Among women who died from pregnancy-related causes, two-thirds received care in an ED at some time in the prenatal or postpartum period, with nearly 40% presenting to the ED more than two times. Improvement opportunities were noted in one third of the cases where women received care in an ED.²

ED triage protocols must identify patients who are currently pregnant or have delivered in the previous 6 weeks. If the patient’s medical records are not available, then ED personnel should directly question the patient, family, Emergency Medical Services (EMS), etc., who may be able to provide the medical history. This information must then be clearly communicated to the treatment team.

Prenatal education for pregnant persons should cover the importance of alerting the ED team at triage of any recent pregnancy or childbirth (within the last 6 weeks) and postpartum medical concerns.

Women’s concerns should be evaluated carefully, especially if she presents to the ED in the postpartum period, when they are often taken less seriously.

Among women who died from pregnancy-related causes, two-thirds received care in an ED at some time in the prenatal or postpartum period, with nearly 40% having more than two visits to the ED.²

RECOGNITION

The Toolkit includes an important algorithm for acute treatment, which is comprised of three parts: Diagnostic Algorithm; Antihypertensive Treatment Algorithm for Hypertensive Emergencies; and Magnesium Dosing and Treatment Algorithm for Refractory Seizures. (See Appendix E: Acute Treatment Algorithm on page 195) ED and OB providers should consider partnering to provide staff education on protocols for treatment and transfer to labor and delivery. Joint training, including practicing drills should be designed to assist ED clinicians in improving their recognition and response to HDP when women present with signs and symptoms of these serious diseases.

Post a striking graphic to inform women or their families to alert the triage nurse if they are pregnant or recently postpartum, have a headache, visual complaints, confusion, chest pain, shortness of breath, weakness, severe abdominal pain, seizure, history of hypertension or preeclampsia during pregnancy. A graphic may help to ensure timely diagnosis and treatment. Appendix G: Stop Sign for Patient Information on page 199 contains an example of a stop sign graphic.

Important considerations

- ▶ Up to 26% of eclamptic seizures occur beyond 48 hours, and as late as four to six (4-6) weeks after delivery.^{1,3} However, most eclamptic seizures occur in the first 7 days after delivery.^{4,5} As many as 78% of postpartum patients have no previous diagnosis of hypertensive disease with the antecedent pregnancy.^{3,4}
- ▶ 50% of women with gestational hypertension will develop preeclampsia.⁶
- ▶ If medical records are not immediately available, treating personnel may have no knowledge that the patient has recently given birth, resulting in a decreased index of suspicion.⁷ Triage assessments should always include the question of current or recent pregnancy. Elevated BP or neurologic symptoms should trigger rapid evaluation by the ED team and call for OB consult.
- ▶ While the clinical presentation of delayed postpartum preeclampsia may be atypical, the most common complaint (69%) is headache.⁴ Headache in a recently pregnant patient will likely be isolated but should prompt an investigation into the possibility of delayed postpartum preeclampsia.
- ▶ Management by ED personnel should focus on maternal resuscitation, BP management with first line agents such as labetalol, hydralazine or nifedipine, and seizure prophylaxis with magnesium sulfate. "Treatment with first-line agents should be expeditious and occur as soon as possible within 30-60 minutes of confirmed severe hypertension to reduce the risk of maternal stroke."^{6,8}
- ▶ Obstetric consultation is necessary for patients who may require transfer to another unit or facility for higher level of care. Stroke is one of the most feared complications and management in the acute setting should involve a neurologic/stroke team when possible. Most maternal deaths (60-80%) resulting from preeclampsia are a result of hemorrhagic stroke.⁹⁻¹¹ Select patients presenting with acute ischemic strokes may be eligible for tissue plasminogen activator (tPA) and mechanical thrombectomy. Stroke should be considered part of the differential diagnosis when evaluating a pregnant or postpartum woman with recent-onset neurologic deficits, particularly in the setting of severe-range BP values, the presence of severe features of preeclampsia, or following an eclamptic seizure. Similarly, an assessment for preeclampsia should be performed for a woman who presents with symptoms of stroke while pregnant or after recently giving birth. For a woman with a peripartum stroke, optimal coordination of care includes consulting with an anesthesiologist, both for stroke recognition and planning for anesthesia.¹² Neurologic deficits suggestive of preeclampsia with severe

features (headache, visual disturbances or altered level of consciousness) may be associated with cerebral vasoconstrictive syndrome, also known as postpartum angiopathy or with Posterior reversible encephalopathy syndrome (PRES).

- ▶ Seizures in the first and early second trimester, (< 20 weeks) or well into the postpartum period, are likely due to central nervous system (CNS) pathology and warrant full evaluation, including cerebral imaging, lumbar puncture (if clinical evidence of meningitis or concern for hemorrhage exists), determination of electrolyte levels and urine or serum toxicologic screening. Do not overlook other neurologic causes of seizure, particularly if the seizure occurs more than 24-48 hours after childbirth. Focal neurologic seizures are more concerning for acute intracranial pathology and advanced imaging is warranted.
- ▶ Magnesium sulfate is the drug of choice for eclamptic seizures. If cardiac arrest occurs in a preeclamptic or eclamptic patient receiving magnesium sulfate, remember to give calcium chloride or gluconate in addition to standard Advanced Cardiac Life Support (ACLS) protocols. (See Section: Preventing and Managing Eclamptic Seizures on page 126)
- ▶ Patients with a history of HDP during pregnancy or that developed HDP postpartum are at increased risk for pulmonary edema and cardiomyopathy. Patients with low oxygen saturation, shortness of breath or dyspnea should be evaluated (BNP, EKG, CXR, cardiac echo) and treated with appropriate diuresis with cardiology consultation if cardiomyopathy is suspected or confirmed.

EVIDENCE GRADING

LEVEL OF EVIDENCE: C

References

1. Chames, M. C., Livingston, J. C., Ivester, T. S., Barton, J. R. & Sibai, B. M. Late postpartum eclampsia: A preventable disease? *American Journal of Obstetrics and Gynecology* 186, 1174-1177, doi:10.1067/mob.2002.123824 (2002).
2. California Department of Public Health. The California pregnancy-associated mortality review. Report from 2002 - 2007 Maternal Death Reviews. (2018).
3. Matthys, L. A., Coppage, K. H., Lambers, D. S., Barton, J. R. & Sibai, B. M. Delayed postpartum preeclampsia: An experience of 151 cases. *American Journal of Obstetrics and Gynecology* 190, 1464-1466, doi:10.1016/j.ajog.2004.02.037 (2004).
4. Al-Safi, Z. et al. Delayed postpartum preeclampsia and eclampsia: Demographics, clinical course, and complications. *Obstetrics and Gynecology* 118, 1102-1107, doi:10.1097/AOG.0b013e318231934c (2011).
5. Filetti, L. C. et al. New onset delayed postpartum preeclampsia: Different disorders? *Journal of Maternal, Fetal and Neonatal Medicine* 25, 957-960, doi:10.3109/14767058.2011.601365 (2012).
6. ACOG. Gestational hypertension and preeclampsia. Practice Bulletin No. 222 of the American College of Obstetricians and Gynecologists. *Obstetrics and Gynecology* 133, e1-25, DOI: 10.1097/AOG.0000000000003018 (2019).
7. Joint Commission. Preventing Maternal Death. Sentinel Event Alert. Issue 44: January 26, 2010 <https://www.jointcommission.org/resources/patient-safety-topics/sentinel-event/sentinel-event-alert-newsletters/sentinel-event-alert-issue-44-preventing-maternal-death/> (2010).
8. Kerrigan, K. & Smith, L. in *CorePendium* (eds A. Mattu & S. Swadron) (CorePendium, LLC, 2019).
9. Centre for Maternal and Child Enquiries (CMACE). Saving mothers' lives: Reviewing maternal deaths to make motherhood safer: 2006-08. The Eighth Report on Confidential Enquiries into Maternal Deaths in the United Kingdom. *British Journal of Obstetrics and Gynecology* 118, 1-203 (2011).
10. Judy, A. E. et al. Systolic hypertension, preeclampsia-related mortality, and stroke in California. *Obstetrics and Gynecology* 133, 1151-1159, doi:10.1097/AOG.0000000000003290 (2019).
11. Martin, J. N., Jr. et al. Stroke and severe preeclampsia and eclampsia: A paradigm shift focusing on systolic blood pressure. *Obstetrics and Gynecology* 105, 246-254, doi:10.1097/01.AOG.0000151116.84113.56 (2005).
12. Miller, E. C. & Leffert, L. Stroke in pregnancy: A focused update. *Anesthesia and Analgesia* 130, 1085-1096, doi:10.1213/ ANE.0000000000004203 (2020).



Response

This domain covers best practices and protocols for HDP treatment. Care algorithms, medication recommendations, and the importance of a high-functioning team are presented in this section

In this section you will find the following:

- ▶ The importance of patient education
- ▶ Low-dose aspirin for prevention
- ▶ Outpatient management of preeclampsia without severe features
- ▶ Nursing management and assessment of preeclampsia
- ▶ Teamwork and communication
- ▶ Chronic hypertension in pregnancy
- ▶ Gestational hypertension
- ▶ Acute treatment algorithm
- ▶ Severe hypertension or preeclampsia at < 34 weeks of gestation
- ▶ Antihypertensive agents in preeclampsia
- ▶ Magnesium sulfate
- ▶ Neurologic complications of hypertension
- ▶ Fluid management in preeclampsia
- ▶ Airway management in pregnant or postpartum women having seizures
- ▶ Severe hypertension and hypotension in women with amphetamine or cocaine use
- ▶ Postpartum management of new-onset hypertension and preeclampsia
- ▶ Long-term follow-up after hypertensive disorders of pregnancy

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Patient Education

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Key Principles

1. Educating women and their families throughout all stages about the clinical spectrum of hypertensive disorders of pregnancy (HDP) is critical for identifying early warning signs and preventing adverse outcomes.
2. Clinicians' understanding and acknowledgment of the impact of HDP diagnoses on women's lives and mental health promotes effective communication and education.
3. By talking with women and their family members/support persons in a way that is mindful of emotional states, education levels, health literacy, cultural practices and languages spoken, clinicians can better identify and address their unique challenges and circumstances after HDP diagnosis.
4. Clinicians can rely on evidence-based communication protocols when sharing information about HDP to ensure patient-centered care, promote shared decision-making and embrace the diversity of family structures and cultural practices.¹
5. Debriefing with the woman and her family before or shortly after discharge is critical to her short- and long- term well-being. Hypertensive disorders of pregnancy are transformative events that occur at a vulnerable time in a woman's life trajectory: pregnancy, birth, and postpartum.

Background

Patient education is crucial to the early identification of HDP, as women are more likely to seek timely care if they and their families understand the signs and symptoms of this complex condition. However, most expecting parents do not attend prenatal education classes offered by certified instructors where this information is typically provided,² and the internet contains many sources of information and misinformation for expecting parents to sort through. Throughout prenatal care, the goal should be for providers to ensure that women

know how to identify early warning signs and symptoms of HDP and why it is important to seek medical care. When women understand the importance of warning signs, they are more likely to contact a provider and present earlier for evaluation, thereby decreasing the risk of adverse outcomes.³

The need to educate women and families

Many people have a poor understanding of preeclampsia and its dangers during pregnancy and postpartum.⁴ According to the Preeclampsia Foundation, less than half of well-educated

women know the signs and symptoms of preeclampsia, and others, who do know, may not share their symptoms for fear of being labeled as overreacting.^{5,6} Women with low literacy levels have an even more pronounced lack of knowledge and understanding of prodromal symptoms.⁷

Women with first-time pregnancies or births may believe, or be told by their maternity provider, that the signs and symptoms they are experiencing are a normal part of pregnancy or childbirth, and they may ignore or downplay concerning symptoms as a result.

Delays in seeking care and “lack of knowledge” (of preeclampsia signs and symptoms) were the most frequently identified patient-related contributory factors in a study of maternal deaths from 2002-2007 in California.⁸ Other patient factors contributing to poor outcomes included women’s seeming lack of knowledge about the seriousness of warning signs. When women and their families do not understand the severity of preeclampsia or are slow to report symptoms that could represent severe illness, they are at greater risk for worse outcomes.⁴ These patient factors have been shown to contribute to preventable maternal deaths from preeclampsia during pregnancy and the first 42 days postpartum.^{9,10}

On a positive note, knowledge deficits associated with preeclampsia are potentially modifiable, particularly when prenatal care providers include referrals to certified childbirth educators or share and review up-to-date, evidenced based information during medical visits. Women who report receiving information about the disease prenatally demonstrate improved knowledge and understanding of this condition.^{7,11} Since

the severe forms of preeclampsia are often associated with maternal symptoms, the most serious outcomes of preeclampsia may be prevented when women and their families understand what to watch for.¹²

Best practices for prenatal and postpartum education

Optimal tools for sharing health information contain verbal and written communication about the disease or condition. A graphics-based education tool, such as the one provided by the Preeclampsia Foundation, is an evidence-based, effective means of informing women and families about HDP.^{7,13}

Prenatal care providers should offer ongoing information and engage in discussions about what to expect in the antepartum, and especially the postpartum, periods. The birth of the baby is the most important therapeutic intervention towards a cure, but the underlying pathologic process of HDP – and psychological impacts of HDP – often continues postpartum.

At time of discharge, nursing needs to ensure women and families understand signs and symptoms of postpartum preeclampsia and what to do should they arise.

Many clinicians and women are unaware that preeclampsia can persist or develop for the first time postpartum, whether or not there was hypertension in pregnancy.¹⁴

In cases where postpartum eclampsia develops late, researchers found that nearly all of the patients had at least one prodromal symptom, and half had more than one symptom that preceded their eclamptic seizure. Only 33% of women sought care for their symptoms, suggesting a need for adequate patient education to improve outcomes.¹⁵

Long-term health impacts for women with HDP

Few women who experience HDP are informed about the long-term consequences of preeclampsia.¹⁶ Women who survive preeclampsia or other HDP are at significantly increased risk for future cardiovascular disease including heart attack, coronary artery disease, thrombosis and stroke.¹⁷ (See Section: Long-Term Follow-Up after Hypertensive Disorders of Pregnancy on page 159) Maternity providers should inform women about this risk and refer them to primary care provider for follow-up. The AIM safety tool, “Support after a Severe Event” includes a clinical summary for the patient that can be given to her so she has necessary information to share with her subsequent care providers. (See Appendix H: Patient Clinical Summary: Severe Maternal Event on page 200)

When women know how to recognize the signs and symptoms of HDP, and they understand the explanations offered, they are more likely to report symptoms and follow prescribed treatment plans. Educating women and their families has a direct impact on reducing adverse outcomes.¹⁸

Patient Perspective: The Impact of a Preeclampsia Diagnosis

A diagnosis of HDP may have a profound and life-changing impact on a woman’s experience of current and future pregnancies, and on their long-term health. Women prefer clinicians who take a patient-centered approach, who listen to their concerns and answer their questions, with patience and compassion.¹⁹⁻²¹ HDP have short- and long-term consequences on women’s physical and mental health. Relevant and understandable information about their medical and psychological condition will allow patients to participate in and play an active role in their health care and prepare them for a possible challenging postpartum recovery. Prenatal care providers can advise women to plan for additional support to care for the infant and other children, along with social support in the form of meals, mental health care, and other



Preeclampsia is enormously humbling. No one could ever explain to me why I had it—twice. Before, I was a runner, a yoga enthusiast: I was an athlete. Being confined to a hospital bed, attached to a catheter and blood pressure cuffs, and unable to focus my eyes, made me feel frail. It made me dependent on my doctors, husband, mom, on my boss’s kindness in understanding why I needed to stay on [maternity] leave for a bit longer. What I realized is that this experience is one I will live with long after discharge.

Varina Winder

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preparations to help the postpartum recovery process.

At the time of diagnosis, providers should assess a woman's emotional state, education level, health literacy, cultural understanding and language barriers prior to communicating information. Women may be in shock, in denial of their diagnosis, holding onto pre-conceived desires or expectations of the birth they were hoping for, and/or concerned for their own and their babies' health. Even women with higher levels of education and health literacy may have difficulty comprehending information and instructions due to the emotional impact of the illness and its treatment. Education should be tailored to their needs.

Women diagnosed with HDP, including preeclampsia, during their pregnancies may encounter physical, mental and emotional challenges that necessitate increased support from a care team, including clinicians and family members.²⁴

- ▶ Women and families require ongoing education on
 - warning signs of serious hypertensive events
 - appropriate management of high blood pressure
 - complications of severe hypertension
 - short-and long-term risks associated with a preeclampsia diagnosis.
- ▶ Partners and families should be included in discussions as much as possible. They are key partners in identifying a woman's complaints of shortness of breath, relentless headache and other concerning symptoms.²⁵
- ▶ Communication should be timely and contextualized to the woman's health literacy, family structure, cultural practices, medical history and experiences, and the maternal-infant dyad.²⁶ Clinicians should be sensitive to systemic historic discrimination and/or marginalization impacting pregnancy outcomes of Black women, Indigenous women, and women of color, and work to establish rapport and trust during the course of care.

Black women, Indigenous women, and people of color are disproportionately impacted by systemic historic discrimination and/or marginalization, which affects all aspects of their sexual, reproductive and maternal health.²² Increased anxiety may emerge for these women stemming from awareness of widely publicized data that pregnancy outcomes for Black women are significantly worse than outcomes for white women.²³ Dr. Adjoa Boateng, anesthesiologist and critical care fellow at Stanford Hospital, poignantly expressed her concerns on KQED Forum with host, Michael Krasny:

...when I give birth in a few months, because of Black female mortality risks [which are] five times higher than our white counterparts, I will be preparing a document to give to my husband and my mother [which says] 'here are the labs you need to know about, here is what you need to observe on my body if I am groggy or unable to pay attention to those things myself. I cannot die, my baby cannot die...I refuse to be a statistic.

Dr. Adjoa Boateng

[Used with permission, 2020]

- ▶ Women and their families benefit from caring words and actions by clinicians who recognize the potential for posttraumatic or acute stress disorder.^{24,27}
- ▶ Special attention should be given to a woman’s mental health following a preeclampsia diagnosis and throughout postpartum.²⁸

Hospitalization for postpartum preeclampsia becomes compounded by the presence of the newborn in the patient’s life, in addition to the typical postpartum conditions such as pain, disordered sleep, fatigue and challenges to psychosocial well-being and emotional health.²⁵ Sleep deprivation, postpartum depression and anxiety, prioritizing the newborn’s health, and a lack of familiarity with normal postpartum experiences contribute to women and families more easily ignoring or missing indicators of a problem.⁵ New mothers may often disregard symptoms since they may not know how they “should” be feeling postpartum.

Communication Practices: Debriefing and Offering COMFORT

Patient Debrief

After experiencing a severe maternal event, women seek information and explanations about their particular condition(s), and the long-term health effects of preeclampsia. A debrief can be a short explanation of preeclampsia, its long-term physical and mental health consequences, and a discussion about how the patient experienced care. A written clinical summary should be provided for women to share with future health care providers.²⁹ This summary can also include resources for women and families.

When debriefing a woman about her preeclampsia diagnosis, providers should:

- ▶ Consider the context of the debrief and the woman’s state of mind.
- ▶ Explain the pathophysiology of preeclampsia using simple and descriptive language.
- ▶ Ensure a family member or support person

It was only when I got home from the hospital that I realized how scary this preeclampsia diagnosis was. The birth experience was pretty foggy for me due to the mag drip [magnesium sulfate infusion]. Now, when things are clearer, most of what I read online told me that I might have died or was now at serious risk of dying in the future—or at least that’s how I interpreted it. After I got home, I had blood pressure that kept spiking, even though I was taking my medication as indicated. Sleep was hard to come by, with a new baby at home, and my toddler adjusting to life with a new sibling. I was trying to nurse with engorged and chapped nipples. I was super emotional, exhausted, and afraid to be at home with my newborn son because I thought I might die. Although they tried, my partner and family didn’t seem to understand my fears—they thought I was being hysterical. I’ve never felt so isolated and afraid.

Emily M. Cramer

[Used with permission 2020]

is included in the conversation. Family members are key partners in preventing maternal morbidity and potential mortality by intervening when a woman complains of shortness of breath, relentless headache, and other concerning symptoms.

- ▶ Focus on what the clinical team is doing/will do to ensure the woman's safety and the safety of her child.
- ▶ Use positive and hopeful language to the extent possible.
- ▶ Pause for patient or family member questions.

See Appendix J on page 212 for a sample script a provider may use when explaining a preeclampsia diagnosis. This script, in addition to the use of an evidence-based communication protocol (See Section: Teamwork and Communication on page 89), may offer guidance for effective, comprehensive and patient-focused education.

Offering COMFORT

Clinicians can rely on evidence-based communication protocols in sharing information about a preeclampsia diagnosis, to ensure woman-centered care that promotes respectful care, encourages shared decision-making and embraces the diversity of family structures and cultural practices. An evidence-based communication protocol such as COMFORT¹ is vital to ensuring information is shared effectively between clinicians, women and their families.

Communication: Communication with women about preeclampsia should be dyadic and adaptive, characterized by unambiguous, familiar verbal messages as well as nonverbal immediacy (e.g. maintaining eye contact, standing close to the patient, using touch appropriately/with consent).

Orientation: Using language appropriate to age and health literacy, clinicians can orient women to the reality of the diagnosis and prognosis of preeclampsia. Preeclampsia and related conditions may pose challenges for women of all literacy levels to understand. Clinicians can demonstrate transparency and attentiveness by sharing what is known and not known about the condition.

Mindfulness: Clinicians should strive to be present—physically, psychologically, and emotionally—in interactions related to the preeclampsia diagnosis. Scripts of stereotypically re-enacted encounters should be disregarded.

Family: A woman's family should be welcomed, included, and listened to as part of the unit of care. The clinician can continually check in regarding infant care, care of other children in the family, as well as the woman's social support system.

Ongoing: Ongoing dialogue about preeclampsia diagnosis and care correlates positively with a sense of non-abandonment. Clinicians should strive to blend task/treatment messages (e.g. "We'll start the magnesium sulfate drip now.") and relational queries (e.g. "What questions do you have? How can I help?").

Reiterative: Repetition boosts patient understanding and becomes an important aspect in understanding/explaining a diagnosis. Having a mother and/or her family repeat back what they've learned can help clinicians gauge their woman and family's levels of understanding about the preeclampsia and disease prognosis.

Team: Women in the context of a preeclampsia diagnosis can be alerted to the team of coordinated care providers—her OBGYN, primary care physician, nurses, medical technicians, social worker, and other healthcare providers—who are available for support and assistance. Accordingly, the team should receive training on the COMFORT (or another evidence-based communication) model.

Administrative Staff Education and Training

When women experience symptoms or signs of preeclampsia and do call their providers immediately, the administrative staff at a doctor’s office, clinic, or hospital must be educated to understand the signs and symptoms of preeclampsia and its potential for serious negative impacts on the outcome of pregnancy. Staff need to be able to provide appropriate and timely instructions. Because of the complexity and wide range of presentations of HDP, a simple instruction is often the best choice; for example: “Please go immediately to labor and delivery (or the emergency room and let them know you are pregnant or recently gave birth) and I will phone to alert them you are coming.” (See Appendix G: Stop Sign for Patient Information on page 199)

The following checklists have been developed to assist clinicians as they provide women and their families with education about hypertensive disorders of pregnancy (HDP) throughout pregnancy and postpartum period. The checklists emphasize important warning signs and provide timely responses to reports of preeclampsia-related symptoms. They also contain customized care plans to safeguard maternal health and safety, especially during the postpartum period. (See Appendix I: Patient Education Checklists on page 201)

The OB clinic receptionist told me that a headache was a primary care problem and I needed to call my primary care physician (PCP). I reiterated that I was 32 weeks pregnant, with a diagnosis of preeclampsia and a headache can be a sign of worsening disease. I told her I needed to speak to my OB or the OB on-call. She continued to argue with me and instructed me to call my PCP. Luckily, I am a perinatal professional and I knew I needed to be evaluated. I called L&D. Unfortunately, the nurse who answered the phone at the L&D was no more helpful. Despite explaining that I was 32 weeks pregnant, with known preeclampsia and a severe headache, she kept insisting that I call my OB clinic, even when I explained that they were trying to refer me to primary care.

Kelly Brennan-Lee

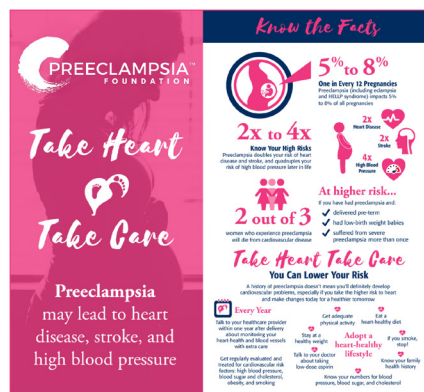
[Used with permission, 2020]

Educational checklists for clinicians to use with women and families

Checklist 1: Prenatal HDP Education for All Pregnant Women
Checklist 2: Discharge HDP Education for All Postpartum Women
Checklist 3: Education for Outpatient Management of Preeclampsia
Checklist 4: Education for Women Diagnosed with Preeclampsia with Severe Features
Checklist 5: Education at Discharge for Postpartum Women with Preeclampsia
Checklist 6: Immediate and Long-term Follow-up Counseling for Women after a HDP Diagnosis
Checklist 7: HDP Education for Administrative Staff

Together, the checklists represent the various points during the prenatal and postpartum period where clinicians need to check in with women and their families about their information needs. (See Appendix I: Patient Education Checklists on page 201)

The following materials and more patient information resources are available from the Preeclampsia Foundation: www.preeclampsia.org



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**EVIDENCE GRADING
LEVEL OF EVIDENCE: C**

References

- Villagran, M., Goldsmith, J., Wittenberg-Lyles, E. & Baldwin, P. Creating COMFORT: A communication-based model for breaking bad news. *Communication Education* 59, 220-234 (2010).
- Declercq, E. R., Sakala, C., Corry, M. P. & Applebaum, S. *Listening to Mothers*. Childbirth Connection, New York, (2006).
- Menzies, J. et al. Instituting surveillance guidelines and adverse outcomes in preeclampsia. *Obstetrics and Gynecology* 110, 121-127, doi:10.1097/01.AOG.0000266977.26311.f0 (2007).
- You, W. B. et al. Factors associated with patient understanding of preeclampsia. *Hypertension in Pregnancy* 31, 341-349, doi:10.3109/10641955.2010.507851 (2012).
- Preeclampsia Foundation. Postpartum preeclampsia: Moms are still at risk after delivery <https://www.preeclampsia.org/postpartum-preeclampsia> (2018).
- Wallis, A. B., Tsigas, E. Z., Saftlas, A. F. & Sibai, B. M. Prenatal education is an opportunity for improved outcomes in hypertensive disorders of pregnancy: Results from an Internet-based survey. *Journal of Maternal, Fetal and Neonatal Medicine* 26, 1565-1567, doi:10.3109/14767058.2013.797403 (2013).

7. You, W. B., Wolf, M. S., Bailey, S. C. & Grobman, W. A. Improving patient understanding of preeclampsia: A randomized controlled trial. *American Journal of Obstetrics and Gynecology* 206, 431 e431-435, doi:10.1016/j.ajog.2012.03.006 (2012).
8. Judy, A. E. et al. Systolic hypertension, preeclampsia-related mortality, and stroke in California. *Obstetrics and Gynecology* 133, 1151-1159, doi:10.1097/AOG.0000000000003290 (2019).
9. Main, E. K., McCain, C. L., Morton, C. H., Holtby, S. & Lawton, E. S. Pregnancy-related mortality in California: Causes, characteristics, and improvement opportunities. *Obstetrics and Gynecology* 125, 938-947, doi:10.1097/AOG.0000000000000746 (2015).
10. Morton, C. H., Seacrist, M. J., VanOtterloo, L. R. & Main, E. K. Quality improvement opportunities identified through case review of pregnancy-related deaths from preeclampsia/eclampsia. *Journal of Obstetric, Gynecologic & Neonatal Nursing* 48, 275-287, doi:10.1016/j.jogn.2019.02.008 (2019).
11. Goldenberg, R. L., McClure, E. M., Bhattacharya, A., Groat, T. D. & Stahl, P. J. Women's perceptions regarding the safety of births at various gestational ages. *Obstetrics and Gynecology* 114, 1254-1258, doi:10.1097/AOG.0b013e3181c2d6a0 (2009).
12. Ogunyemi, D., Benaie, J. L. & Ukatu, C. Is eclampsia preventable? A case control review of consecutive cases from an urban underserved region. *Southern Medicine Journal* 97, 440-445, doi:10.1097/00007611-200405000-00005 (2004).
13. Strassberg, E. R., Fisher, S., Mackeen, A. D., Sun, H. & Paglia, M. J. Comparison of different methods of patient education on preeclampsia: A randomized controlled trial. *Journal of Maternal, Fetal and Neonatal Medicine*, 1-5, doi:10.1080/1476 7058.2020.1786524 (2020).
14. Association of Women's Health Obstetric and Neonatal Nurses. POST-BIRTH Warning Signs Education Program, <https://awhonn.org/education/hospital-products/post-birth-warning-signs-education-program/> (2020).
15. Chames, M. C., Livingston, J. C., Ivester, T. S., Barton, J. R. & Sibai, B. M. Late postpartum eclampsia: A preventable disease? *American Journal of Obstetrics and Gynecology* 186, 1174-1177, doi:10.1067/mob.2002.123824 (2002).
16. Skurnik, G. et al. Improving the postpartum care of women with a recent history of preeclampsia: A focus group study. *Hypertension in Pregnancy* 35, 371-381, doi:10.3109/10641955.2016.1154967 (2016).
17. Leslie, M. S., Briggs, L., Dowling, M. & Park, J. The PEACH project: Preeclampsia survivor awareness of cardiovascular health risk. (Melbourne, FL, 2020).
18. Preeclampsia Foundation. Healthcare Providers: Educating Patients, <https://www.preeclampsia.org/public/educating-patients> (2020).
19. Dekker, R., Morton, C. H., Singleton, P. & Lyndon, A. Women's experiences being diagnosed with peripartum cardiomyopathy: A qualitative study. *Journal of Midwifery and Women's Health* 61, 467-473, doi:10.1111/jmwh.12448 (2016).
20. Morton, C. H. & Simkin, P. Can respectful maternity care save and improve lives? *Birth* 46, 391-395, doi:10.1111/birt.12444 (2019).
21. Oparah, J. C., Arega, H., Hudson, D., Jones, L. & Osequera, T. *Battling over birth: Black women and the maternal health crisis in California.* (Black Women Birthing Justice, Oakland, CA. (2016).
22. Ross, L. J. Reproductive Justice as Intersectional Feminist Activism. *Souls* 19, 286-314, doi:10.1080/10999949.2017.1389634 (2017).
23. Mengesha, B., Arora, K. S. & Levy, B. S. Physician leadership: Racial disparities and racism. Where do we go from here? *OBG Management Vol. 32* (2020).
24. Council on Patient Safety in Women's Health Care. Patient safety bundle: Support after a severe maternal event, <https://safehealthcareforeverywoman.org/aim/patient-safety-bundles/support-after-a-severe-maternal-event-patient-safety-bundle-aim/> (2016).
25. Cheng, C. Y., Fowles, E. R. & Walker, L. O. Postpartum maternal health care in the United States: A critical review. *Journal of Perinatal Education* 15, 34-42, doi:10.1624/105812406X119002 (2006).
26. Council on Patient Safety in Women's Health Care. Patient safety bundle: Postpartum care basics for maternal safety, <https://safehealthcareforeverywoman.org/wp-content/uploads/2017/11/Postpartum-Care-Basics-Bundle.pdf> (2017).
27. Bernstein, P. S. et al. National Partnership for Maternal Safety: Consensus bundle on severe hypertension during pregnancy and the postpartum period. *Obstetrics and Gynecology* 130, 347-357, doi:10.1097/AOG.0000000000002115 (2017).
28. Caropreso, L., de Azevedo Cardoso, T., Eltayebani, M. & Frey, B. N. Preeclampsia as a risk factor for postpartum depression and psychosis: A systematic review and meta-analysis. *Archives in Women's Mental Health* 23, 493-505, doi:10.1007/s00737-019-01010-1 (2020).
29. Council on Patient Safety in Women's Health Care. Patient clinical summary after a severe maternal event, <https://safehealthcareforeverywoman.org/council/patient-safety-tools/support-after-a-severe-maternal-event-patient-safety-bundle-aim/> (2020).

Low-Dose Aspirin for Prevention

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Key Principles

1. Low-dose aspirin can be safely used in pregnancy to help prevent preeclampsia in all settings.
2. Identify women at high risk for preeclampsia to evaluate the appropriateness of using low-dose aspirin.
3. In 2021, the United States Preventative Services Task Force (USPSTF) reviewed evidence and issued a recommendation on aspirin use to prevent preeclampsia and related morbidity and mortality.

Background

The etiology of, or reasons behind, preeclampsia remain elusive and are likely multi-factorial. Ideally, prevention and treatment of preeclampsia would improve maternal and neonatal outcomes. Preventing poor neonatal outcomes may also reduce post-traumatic stress disorder and postpartum depression due to the association of preeclampsia with poor maternal mental health outcomes.¹

One of the promising preventive tools is low-dose aspirin (LDA). The beneficial effects of LDA include prevention of early-onset disease (preeclampsia before 34 weeks of gestation), and associated maternal and fetal complications. Utilization of low-dose aspirin has been shown to be an effective mechanism for prevention of preeclampsia in high-risk patients, mainly those with a history of preeclampsia.²

Aspirin is theorized to be protective against preeclampsia due to its well-known anti-inflammatory, anti-angiogenesis, and antiplatelet properties. The active ingredient of aspirin is 'acetylsalicylic acid.'

An imbalance in the prostacyclin and thromboxane A2 (TXA2) metabolism is one of the underlying mechanisms in the development of preeclampsia. Prostacyclin is a potent vasodilator that inhibits platelet aggregation, while TXA2 is a vasoconstrictor that promotes platelet synthesis and platelet aggregation.³ At lower doses (60-150 mg) aspirin increases the prostacyclin/TXA2 ratio and thus reduces platelet aggregation.

In 2021, the United States Preventative Services Task Force (USPSTF) reviewed evidence and issued a recommendation on aspirin use to prevent preeclampsia and related morbidity and mortality. The USPSTF found adequate evidence that the use of LDA (60-150 mg) in women at increased risk for preeclampsia reduced their risk for preeclampsia, preterm birth, and intrauterine fetal growth restriction (IUGR), thus showing substantial benefit (Grade B recommendation).² In clinical trials, LDA (60-150 mg) reduced the risk for preeclampsia by 15%, for preterm birth by 20%, and IUGR by 18%.⁷ International guidelines for aspirin dosing may vary.

For asymptomatic pregnant women who are at increased risk for preeclampsia (See Table 1 on page 76), the potential benefits of LDA greatly outweigh any potential risks of aspirin use in pregnancy. However, LDA should be avoided in patients with aspirin allergies or prior adverse effects of its use, those with aspirin-sensitive asthma, or gastrointestinal bleeding.

Provider guidelines for prescribing low-dose aspirin (LDA)

- ▶ Low-dose aspirin (81 mg/day) prophylaxis is recommended for women at high risk of preeclampsia and should be initiated between 12 weeks and 28 weeks of gestation (optimally before 16 weeks) and continued daily until delivery.⁴
- ▶ Recommended LDA doses range from 60-150mg daily but in the United States the current ACOG recommended dose is 81 mg daily.⁴ The Combined Multimarker Screening and Randomized Patient Treatment with Aspirin for Evidence-Based Preeclampsia Prevention (ASPRE) trial results showed the effectiveness of LDA in prevention of preterm preeclampsia with a dose closer to 160mg than 80mg.⁵ There has been no head-to-head comparison of these two dosage regimens. Both the USPSTF and ACOG have continued to recommend 81 mg pending further studies.
- ▶ International Society of Hypertension in Pregnancy (ISSHP) includes reproductive technologies as a risk factor for preeclampsia and recommends LDA.^{2,8,9}



Table 1: USPSTF clinical risk assessment for preeclampsia and low-dose aspirin administration

Risk level	Risk factors	Recommendation to initiate LDA
High	<ul style="list-style-type: none"> a. History of preeclampsia b. Multifetal gestation c. Chronic hypertension d. Type 1 or 2 diabetes e. Renal disease f. Autoimmune disease (systemic lupus erythematosus, antiphospholipid syndrome) g. Combinations of multiple moderate risk factors 	<p>If one or more risk factors exist, recommend low-dose aspirin.</p>
Moderate	<ul style="list-style-type: none"> a. Nulliparity (never having given birth) b. Obesity (body mass index > 30 kg/m²) at first appointment c. Family history of preeclampsia (mother or sister) d. Black persons (due to social rather than biological factors) e. Lower income f. Age ≥ 35 years g. Personal history factors (e.g., low birth weight or small for gestational age, previous adverse pregnancy outcome, > 10-year pregnancy interval) h. In vitro conception 	<p>If two or more risk factors exist, recommend low-dose aspirin. If one risk factor exists, consider low-dose aspirin.</p>
Low	<p>Previous uncomplicated full-term delivery</p>	<p>Do not recommend low-dose aspirin.</p>

US Preventive Services Task Force. Aspirin Use to Prevent Preeclampsia and Related Morbidity and Mortality: US Preventive Services Task Force Recommendation Statement. *JAMA*. 2021;326(12):1186–1191.

Patient education resources

The March of Dimes has created resources for health care practitioners to share with patients at risk of preterm birth.⁶

Low-dose aspirin: Clinical talking points for women

- ▶ For some women, taking low-dose aspirin during pregnancy may help reduce the risk for serious problems for you and your baby, like preeclampsia and premature birth.
- ▶ Preeclampsia is when you have high blood pressure and signs that some of your organs, like your kidneys and liver, may not be working right. Preeclampsia can happen after the 20th week of pregnancy or right after pregnancy.
- ▶ If not treated, preeclampsia can cause serious problems for you and your baby, including premature birth (before 37 weeks of pregnancy). Babies born early may have more health problems than babies born on time.
- ▶ There are several factors which increase your risk for developing preeclampsia.
- ▶ One way to reduce the chance that you get preeclampsia is for you to take a low-dose aspirin every day starting at 12 weeks of gestation.
- ▶ Low-dose aspirin also is called prenatal aspirin, baby aspirin, or 81 mg (milligrams) aspirin.
- ▶ You can buy low-dose aspirin over-the-counter, or your provider can write a prescription for aspirin for you so that you can get it at low cost or no cost, depending on your health insurance.
- ▶ Low-dose aspirin is safe during pregnancy and won't harm you or your baby.
- ▶ Setting a calendar alert on your cell phone can be an easy way to remember to take your pill each day before bedtime.
- ▶ Go to all your prenatal care checkups, even if you're feeling fine. You can have preeclampsia and not know it.
- ▶ What questions or concerns do you have about taking low-dose aspirin during your pregnancy?

Used with permission from March of Dimes

The Preeclampsia Foundation has educational resources (print, online, and video) for clinicians to help them communicate with women and families who encounter this complication in pregnancy. Information about the safety and rationale for low-dose aspirin can be found on the “Ask About Aspirin” card, and can be used alongside the “Common Questions & Answers” and video resources.

Ask About Aspirin
It may delay or prevent the onset of preeclampsia

If
you have any of
these risk factors

- History of preeclampsia
- Pregnant with more than one baby
- High blood pressure
- Diabetes
- Kidney disease
- Autoimmune disorders

Talk
to your
care provider
about taking
prenatal
aspirin

**Start taking
81 mg aspirin**

between
12-16 weeks
of your pregnancy
daily at bedtime

Treatment with low-dose aspirin should not decrease regular monitoring and response by a certified care provider. If you experience signs or symptoms of preeclampsia, notify your care provider.

PREECLAMPSIA
FOUNDATION

To learn more, visit
preeclampsia.org/aspirin

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To order materials, visit Preeclampsia Foundation at preeclampsia.org

Frequently asked questions about Low-Dose Aspirin

Where can I get low-dose aspirin (LDA)?

Low-dose, 81 mg tablet aspirin is available over the counter at pharmacies and grocery stores. Your doctor also may write you a prescription for low-dose aspirin for you to have filled at your pharmacy so that you can get it at no cost or very low cost. Your health insurance may pay for all or some of your aspirin prescription.

Does low-dose aspirin increase risk of miscarriage?

Research suggests the use of aspirin during pregnancy does not increase the risk of miscarriage.

Do I continue LDA if I have had bleeding in the pregnancy prior to starting the LDA or if I develop bleeding while on the daily LDA treatment?

Low-dose aspirin does not cause or increase bleeding during pregnancy. If you are bleeding, however, it is best to discontinue the LDA, and consult your provider on further recommendations. In a majority of cases, LDA can be restarted after one week of no bleeding.

Will taking LDA when I'm pregnant hurt the baby?

Taking LDA is safe for mom and safe for baby. Aspirin does not increase the chance of birth defects.

What time of day should I take my dose?

Research shows that aspirin is most effective when taken at bedtime, as compared to morning, afternoon, and evening dose times.

When should I stop taking low-dose aspirin?

It is very important that you ask your doctor when you should stop taking aspirin, as recommendations may differ depending on your medical history.

Used with permission from the Preeclampsia Foundation and March of Dimes

**EVIDENCE GRADING
LEVEL OF EVIDENCE: A**

References

1. Zhang, S. et al. Association between mental stress and gestational hypertension/preeclampsia: A meta-analysis. *Obstetrics and Gynecology Surveys* 68, 825-834, doi:10.1097/OGX.0000000000000001 (2013).
2. US Preventive Services Task Force. Aspirin Use to Prevent Preeclampsia and Related Morbidity and Mortality: US Preventive Services Task Force Recommendation Statement. *JAMA*. 2021;326(12):1186–1191.
3. Smith, J. B., Araki, H. & Lefer, A. M. Thromboxane A₂, prostacyclin and aspirin: Effects on vascular tone and platelet aggregation. *Circulation* 62, V19-25 (1980).
4. ACOG. Low-dose aspirin use during pregnancy. Committee Opinion No. 743 of the American College of Obstetricians and Gynecologists. *Obstetrics and Gynecology* 132, e44-e52, doi:10.1097/AOG.0000000000002708 (2018).
5. O’Gorman, N., Wright, D., Rolnik, D. L., Nicolaides, K. H. & Poon, L. C. Study protocol for the randomised controlled trial: Combined multimarker screening and randomised patient treatment with Aspirin for evidence-based Preeclampsia prevention (ASPREE). *British Medical Journal Open* 6, e011801, doi:10.1136/bmjopen-2016-011801 (2016).
6. Ladella S, Kremer ME, et al. Optimizing use of low-dose aspirin and progesterone (17P) for preterm birth prevention: A toolkit for prenatal care providers in California. *March of Dimes California*.
7. Henderson JT, Vesco KK, Senger CA, Thomas RG, Redmond N. Aspirin Use to Prevent Preeclampsia and Related Morbidity and Mortality: An Evidence Update for the U.S. Preventive Services Task Force. Evidence Synthesis No. 205. Agency for Healthcare Research and Quality; 2021. AHRQ publication 21-05274-EF-1.
8. Watanabe, N., Fujiwara, T., Suzuki, T., Jwa, S. C., Taniguchi, K., Yamanobe, Y., Kozuka, K., & Sago, H. (2014). Is in vitro fertilization associated with preeclampsia? A propensity score matched study. *BMC pregnancy and childbirth*, 14, 69.
9. Luke, B., Brown, M., Eisenberg, M., Callan, C., Botting, B., Pacey, A., Sutcliffe, A., & Baker, V. (2019). In vitro fertilization and gestational hypertension/preeclampsia risk: effect of diagnosis versus treatment parameters. *Fertility and Sterility*, 112(3), e299.

Outpatient Management of Preeclampsia Without Severe Features

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Key Principles

1. Outpatient management of preeclampsia should only be considered for patients without severe features, with stable disease and reassuring fetal assessment, and who are able to follow the recommended outpatient management plan.
2. Hospital admission is necessary for any patient who develops preeclampsia with severe features.
3. Women with preeclampsia without severe features should be admitted and delivered at 37 weeks of gestation.

Background

Once providers diagnose preeclampsia based on new-onset systolic BP ≥ 140 mm Hg and/or diastolic blood pressure ≥ 90 mm Hg, and new-onset proteinuria, or signs and symptoms of preeclampsia, they must decide if the woman has preeclampsia with or without severe features. The criteria for preeclampsia with severe features are listed in Appendix B: Suspected Preeclampsia Algorithm on page 178. Outpatient treatment should only be considered for women who have preeclampsia without severe features, who are less than 37 weeks of gestation, and only after providers confirm fetal wellbeing and maternal stability.¹⁻³

A complete initial evaluation is required in order to document the severity of preeclampsia. This evaluation should include the following: serial BP values, proteinuria assessment (protein/creatinine ratio or 24-hour urine for protein), complete blood count (CBC) with platelet count, aspartate aminotransferase (AST), alanine aminotransferase (ALT), Creatinine (Cr) and lactate dehydrogenase (LDH).¹⁻² The patient should be questioned thoroughly regarding possible associated symptoms of epigastric or right

upper quadrant abdominal pain, headache, and significant visual disturbances. Fetal assessment should include non-stress test (NST) or biophysical profile (BPP), ultrasound assessment of fetal growth and amniotic fluid volume.

There are currently no national guidelines on the length of observation period necessary to determine whether a woman can be managed on an outpatient basis. The consensus among the CMQCC Task Force on Hypertensive Disorders of Pregnancy was for a minimum of 4-6 hours observation, and many felt that up to 24 hours observation may be needed. After observation, providers must determine whether a patient has a diagnosis of preeclampsia without severe features, and is therefore a candidate for outpatient management. During this time, providers should obtain several BP values, and review laboratory results, perform fetal assessment (NST/ultrasound), question the patient, and monitor for possible associated symptoms. If concerning results are obtained, this period of observation may be extended. This extended observation would allow time to administer betamethasone and collect a formal 24-hour urine protein (if clinically

appropriate) while continuing to monitor BP values, symptoms and laboratory values.

As noted in the section on gestational hypertension in this Toolkit, ACOG recently recognized the diagnosis of white coat hypertension.⁴ Defined as elevated blood pressure primarily during medical appointments, white coat hypertension may represent approximately 15% of patients with hypertension noted during an office visit. Importantly, patients with white coat hypertension should be followed closely, as 8% will progress to preeclampsia and 40% will develop gestational hypertension. For women with suspected white coat hypertension, ambulatory, or at-home, blood pressure monitoring is suggested to help in the diagnosis and management of these conditions.^{5,6} (See Section: Accurate Blood Pressure Measurement on page 45)

Outpatient management

The goal of outpatient management for women who have preeclampsia without severe features is to ensure early identification of severe features. Should preeclampsia with severe features develop, we recommend maternal hospitalization, and timely delivery before significant maternal or fetal morbidity occurs.

If any abnormalities in either maternal or fetal assessments are consistent with severe features of preeclampsia, further management should occur in the hospital. If the patient is > 34 weeks of gestation and has preeclampsia with severe features, delivery is always indicated. In cases where gestational age is < 34 weeks of gestation, **inpatient** observation may be considered. (See Section: Severe Hypertension or Preeclampsia with Severe Features at < 34 Weeks of Gestation on page 111)

If preeclampsia without severe features is diagnosed and the patient is considered to be a candidate for outpatient management, the following criteria must be met:

- A clearly documented follow-up plan that is understood and agreed to by the woman and the partner/family. They should be able to articulate the signs and symptoms that would be consistent with severe features and understand that if these signs are present, the woman needs to return to the hospital immediately—regardless of the day of the week or time of the day.
- The follow-up plan should include twice-weekly maternal and fetal assessment with BP checks, a review for new signs and symptoms of preeclampsia, NST and amniotic fluid index (AFI) or BPP, and repeat labs at least weekly (Of note, the amount of proteinuria over the diagnostic threshold is no longer a criterion for diagnosis of preeclampsia with severe features, so this test does not need to be repeated). Continue performing growth ultrasounds every 3 weeks.
- Patients demonstrating borderline severe BP of 155/105 mm Hg range should be observed in the hospital for a minimum of 24-48 hours for evaluation of severity of disease.
- The seriousness of a diagnosis of preeclampsia and the possibility of long-term maternal or fetal morbidities or mortality should be described in terms the patient and family can understand. Signs and symptoms which should prompt urgent in-hospital evaluation or a 911 call for emergency assistance should be reviewed in detail. Again, the family should be aware of these and provided with an information sheet. (See Appendix H: Patient Clinical Summary: Severe Maternal Event on page 200) It is helpful to have the patient/family member verbally repeat these details back to the care provider to ensure understanding. (See Section: Patient Education on page 65)

- Confirm that the woman's living situation, distance from hospital and available transportation methods allow for frequent trips for evaluation or urgent transport to the hospital. Confirm that she will not have additional responsibilities, such as primary care of children or the expectation to continue working, etc. Specific questions such as "Who will care for your small children during the day if you need to come in for an evaluation? How will you come in for appointments and will you be able to have someone with you?" may better clarify constraints to timely assessment when indicated. (See Section: Patient Education on page 65)
- It is important the woman agrees and consents to outpatient management as this approach may be associated with a higher risk for adverse outcomes compared to inpatient management.
- There is no evidence that strict bedrest, sometimes ordered as "bedrest with bathroom privileges", is beneficial in HDP. In fact, this level of immobilization has been demonstrated to increase the risk of VTE after as little as 48 hours. In addition, deconditioning and loss of muscle mass is another harmful effect of this approach.

Patients should be encouraged to engage in normal daily activities, without strenuous exercise. Home BP monitoring should be encouraged.

The goal of outpatient management for women who have preeclampsia without severe features is to ensure early identification of severe features if and when they occur. (See Preeclampsia with severe features at < 34 weeks on page 111) If a woman develops any sign of preeclampsia with severe features she should be admitted to the hospital and the plan of care modified appropriately:

At < 34 weeks of gestation, a woman diagnosed with preeclampsia with severe features should be managed at a facility with capability to manage both maternal and neonatal care.

At > 34 weeks, a woman diagnosed with preeclampsia with severe features should be admitted to the hospital and delivery should be expedited.³

If the patient's diagnosis continues to be preeclampsia without severe features, delivery should be scheduled at 37 weeks.

EVIDENCE GRADING
LEVEL OF EVIDENCE: B

References

1. ACOG. Gestational hypertension and preeclampsia: Practice Bulletin No. 222 of the American College of Obstetricians and Gynecologists. *Obstetrics and Gynecology* 135, 1492-1495, doi:10.1097/AOG.0000000000003892 (2020).
2. Sibai, B. M. Diagnosis and management of gestational hypertension and preeclampsia. *Obstetrics and Gynecology* 102, 181-192 (2003).
3. Sibai, B. M. Evaluation and management of severe preeclampsia before 34 weeks of gestation. *American Journal of Obstetrics and Gynecology* 205, 191-198, doi:10.1016/j.ajog.2011.07.017 (2011).
4. ACOG. Chronic hypertension in pregnancy: Practice Bulletin No. 203 of the American College of Obstetricians and Gynecologists. *Obstetrics and Gynecology* 133, e26-e50, doi:10.1097/AOG.0000000000003020 (2019).
5. Brown, M. A., Mangos, G., Davis, G. & Homer, C. The natural history of white coat hypertension during pregnancy. *British Journal of Obstetrics and Gynecology* 112, 601-606, doi:10.1111/j.1471-0528.2004.00516.x (2005).
6. Johnson, S., Liu, B., Kalafat, E., Thilaganathan, B. & Khalil, A. Maternal and perinatal outcomes of white coat hypertension during pregnancy: A systematic review and meta-analysis. *Hypertension* 76, 157-166, doi:10.1161/HYPERTENSIONAHA.119.(2020).

Nursing Management and Assessment of Preeclampsia

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Key Principles

1. Women who have preeclampsia should be cared for by a nurse with experience caring for high-risk patients, who has the expertise to recognize worsening signs of preeclampsia and who is empowered to advocate on the patient's behalf.
2. Early onset preeclampsia (< 34 weeks of gestation) is associated with severe maternal and perinatal morbidity and mortality.
3. In the early postpartum period, risk factors for persistent hypertension includes the severity of preeclampsia and headache.
4. Postpartum preeclampsia/eclampsia can develop up to four to six (4-6) weeks after birth among women who had no evidence of preeclampsia during their pregnancy or at the time of delivery.

Background

Nursing care and management for women who have hypertensive disorders of pregnancy (HDP) requires hypervigilance and frequent monitoring of blood pressure (BP), urinary output, and cardiac, respiratory, and central nervous system status.¹ Early recognition and management of such changes in maternal-fetal status is imperative for optimal treatment and recovery. Women who have HDP should be cared for by a nurse with experience caring for high-risk patients and who has the expertise to recognize worsening signs of preeclampsia. Specific preventable errors contributing to maternal deaths include failure to control BP for hypertensive women, and failure to adequately diagnose and treat pulmonary edema in preeclampsia.²⁻⁴

Early-onset preeclampsia (< 34 weeks of gestation) is associated with severe maternal and

perinatal mortality and morbidities such as HELLP syndrome, eclampsia, and fetal growth restriction (IUGR).⁵ Delivery by 34 weeks of gestation is required if the woman has preeclampsia with severe features. Expectant management can be considered on a case by case basis for women without severe features.

Nurses must know the risk factors associated with developing postpartum complications of HDP. This is critical for early recognition and treatment, and also for mitigating practices that will reduce the risk of readmissions. Blood pressure generally decreases 48 hours after delivery, then increases, and peaks 3-6 days postpartum, usually after discharge. It is challenging to predict which women may need to be treated with antihypertensive medication. A recent retrospective study of 358 women found that in the early postpartum period, risk factors for persistent hypertension included the severity of

preeclampsia, and headache. In addition, the need for antihypertensive treatment is related to early onset of preeclampsia or gestational hypertension, higher mean BP values, induced preterm labor, the need for prophylactic magnesium sulfate and cesarean delivery.^{6,7} Women with these risk factors require increased surveillance and early initiation of medications when indicated to decrease postpartum complications and shorten the length of hospital stay.

Maintaining a quiet, calm atmosphere and controlling environmental stressors are important for the patient and family. Women on magnesium sulfate have cognitive challenges and may need to be given information more than once. Families can and should be engaged in information sharing, and clinicians may use their clinical judgment as specified in the HIPAA Privacy Rule when sharing information.⁸

For early recognition of severe hypertension, members of the clinical team should maintain a high index of suspicion and embrace non-hierarchical communication. All team members should feel empowered to speak up about a concern and know that their input is valued by the care team. Effective team communication enables members to relay relevant information in a way that is clear and understood. (See Section: Teamwork and Communication on page 89)

Postpartum preeclampsia/eclampsia can develop up to 4-6 weeks after birth among women who had no evidence of preeclampsia during their pregnancy or at the time of delivery.⁹ Women and their family members should be given specific instructions prior to discharge on signs and symptoms that warrant immediate follow-up. (See Section: Patient Education on page 65)

Key action points for nursing management

Assess women for worsening signs and symptoms of preeclampsia without severe features evolving to preeclampsia with severe features and notify provider if any of the following are present:

- ▶ Systolic BP \geq 160 mm Hg or diastolic BP \geq 110 mm Hg*
- ▶ Headache unrelieved by over-the-counter medications
- ▶ Altered level of consciousness – agitation, restless, lethargy, hallucinations, confusion
- ▶ Visual disturbances – blurred vision, floaters, spots, blind spot
- ▶ Upper abdominal pain
- ▶ Urine output $<$ 30 ml/hour
- ▶ Shortness of breath
- ▶ Complaints of chest pain
- ▶ Oxygen saturation (SpO₂) $<$ 95%
- ▶ Cough
- ▶ Tachypnea $>$ 26 breaths per minute
- ▶ Tachycardia $>$ 100 beats per minute
- ▶ Adventitious breath sounds
- ▶ Eclamptic seizure
- ▶ Magnesium toxicity (See Section: Preventing and Managing Eclamptic Seizures on page 126)

*Clinicians may consider antihypertensive therapy at 155/105 mm Hg given the association with increased maternal morbidities at this threshold in several studies as discussed in the Section: Borderline Severe-Range Blood Pressures: A Clinical Conundrum on page 35.

Other considerations for nurse assessment

Patient care assignments should take into account the level and expertise of the clinician or nurse assigned to patients with HDP, as well as patient acuity and phase of care (ante, intra, post). According to AWHONN staffing guidelines, patients with severe features should be staffed with a 1:1 nurse-to-patient ratio, with the most experienced nurse available.

Women with preeclampsia with severe features should receive care from a multi-disciplinary team.¹⁰ The team should consist of an obstetric

provider credentialed to perform cesareans, nurses, an anesthesiologist, pediatrician, mental health professional, laboratory and blood bank personnel, and other sub-specialties as needed.

Guidelines for the frequency of nursing assessment vary depending on diagnosis, institutional protocols, policies and procedures, the patient's condition and stage of labor, and provider preferences. The recommended frequency of assessments listed in Table 1 are considered as minimum.¹¹ (See Appendix K: Sample Nursing Management Policy and Procedure on page 216)

Table 1. Nursing assessment and frequency by diagnosis

A. Nursing assessments for preeclampsia <u>without</u> severe features				
Assessment Type	Assessment frequency Antepartum*	Assessment frequency Intrapartum*	Assessment frequency Recovery (first 2 hours)	Assessment frequency Postpartum*
<ul style="list-style-type: none"> ▶ BP ▶ Pulse ▶ Respiration ▶ SpO2 	Every 4 hours (awake) to 8 hours (sleeping)	Every 1 hour	Every 15 minutes x 4 and every 30 minutes x 2	Every 4–8 hours
Lung auscultation	Every 4-8 hours	Every 4-8 hours	N/A	Every 4-8 hours
<ul style="list-style-type: none"> ▶ Deep tendon reflexes and clonus, level of consciousness ▶ Edema ▶ Assessment for headache, visual disturbances, epigastric pain 	Every 4-8 hours depending on patient condition	Every 4-8 hours depending on patient condition	N/A	Every 4-8 hours depending on patient condition
Fetal status and uterine activity	Every shift minimum	Continuous	N/A	N/A
Temperature	Per facility policy			
Intake and output	Every 4 hours during labor or every 8 or 12 hours (depending on shift length) and total every 24 hours.			

**This is the minimum recommended frequency for patients NOT on magnesium sulfate.*

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

B. Nursing assessments for preeclampsia with severe features on magnesium sulfate

Assessment Type	Assessment frequency and action plan
<ul style="list-style-type: none"> ▶ BP ▶ Pulse ▶ Respiration ▶ SpO2 	<ul style="list-style-type: none"> ▶ Every 5-15 minutes during magnesium sulfate loading dose <ul style="list-style-type: none"> • Maintenance of magnesium sulfate infusion: Every 30 minutes for a minimum of one hour • Hourly for remainder of infusion ▶ Notify provider for: <ul style="list-style-type: none"> • Severe-range BP • Respiratory rate < 12 (discontinue magnesium infusion) • Oxygen saturation < 95 %
Lung auscultation	<ul style="list-style-type: none"> ▶ Every 2 hours ▶ Assess for signs and symptoms of pulmonary edema <ul style="list-style-type: none"> • Shortness of breath/orthopnea • Fine crackles, wheezing or gasping for breath • Cold, clammy skin • Extreme agitation • Cough with frothy sputum and/or blood tinged • Decreased oxygen saturation • Rapid, irregular heartbeat (palpitations)
<ul style="list-style-type: none"> ▶ Deep tendon reflexes & clonus ▶ Edema ▶ Level of consciousness 	Every four hours or more frequently depending on patient condition
Assessment for headache, visual disturbances, epigastric pain	<ul style="list-style-type: none"> • At minimum, every shift or more, often based on the clinical situation • Advise patient of importance of reporting headache to nurse • Notify provider for headache unrelieved by medication, visual disturbance, or epigastric pain
Temperature	Per facility protocol

Continued on next page...

Assessment Type	Assessment frequency and action plan
Intake and output	<p>Intake</p> <ul style="list-style-type: none"> • Use infusion pumps for all IV solutions and medication drips • Ensure total hourly intake should be < 125 ml/hour • NPO with ice chips or as permitted by provider <p>Output</p> <ul style="list-style-type: none"> • Insert Foley with urimeter (closed urine measuring system) • Calculate hourly, with totals every 8 – 12 hours and 24-hour totals • Notify provider of urine output < 30 ml/hr
Fetal status and uterine activity	Perform continuous fetal monitoring to check for evolving abnormal fetal heart rate patterns and recurrent decelerations with decreasing variability
Staffing Recommendations ¹⁰	Women in labor who are receiving magnesium sulfate should have 1 nurse in continuous bedside attendance for the first hour of administration and 1 nurse: 1 patient thereafter

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

C. Nursing assessment for post eclamptic seizure and magnesium sulfate toxicity

Assessment Type	Assessment frequency
<ul style="list-style-type: none"> ▶ BP ▶ Pulse ▶ Respiration 	Every 5 minutes until stable
SpO2	Continuous
Level of consciousness	Every 15 minutes for a minimum of 1 hour
Fetal status and uterine activity	Continuous

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

D. Nursing assessments for acute BP treatment with IV medication

Assessment Type	Assessment frequency
<ul style="list-style-type: none"> ▶ BP ▶ Pulse ▶ Respiration 	Every 10-20 minutes based on medication administered until stable, then BP every 10 minutes x 1 hour, every 15 minutes x 1 hour, every 30 minutes x 1 hour and every one hour x 4 hours.
SpO2	Continuous
Level of consciousness	Every 5-15 minutes for a minimum of 1 hour
Fetal status and uterine activity	Continuous until delivery

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

EVIDENCE GRADING

LEVEL OF EVIDENCE: B

References

- Sibai, B. M. Diagnosis and management of gestational hypertension and preeclampsia. *Obstetrics and Gynecology* 102, 181-192 (2003).
- Turner, J. A. Diagnosis and management of pre-eclampsia: An update. *International Journal of Women's Health* 2, 327-337, doi:10.2147/IJWH.S8550 (2010).
- The Joint Commission. Preventing Maternal Death. Sentinel Event Alert. Issue 44, <https://www.jointcommission.org/resources/patient-safety-topics/sentinel-event/sentinel-event-alert-newsletters/sentinel-event-alert-issue-44-preventingmaternal-death/> (2010).
- Morton, C. H., Seacrist, M. J., VanOtterloo, L. R. & Main, E. K. Quality improvement opportunities identified through case review of pregnancy-related deaths from preeclampsia/eclampsia. *Journal of Obstetric, Gynecologic and Neonatal Nursing* 48, 275-287, doi:10.1016/j.jogn.2019.02.008 (2019).
- Kucukgoz Gulec, U. et al. Comparison of clinical and laboratory findings in early- and late-onset preeclampsia. *Journal of Maternal Fetal and Neonatal Medicine* 26, 1228-1233, doi:10.3109/14767058.2013.776533 (2013).
- ACOG. Gestational hypertension and preeclampsia: Practice Bulletin No. 222 of the American College of Obstetricians and Gynecologists. *Obstetrics and Gynecology* 135, 1492-1495, doi:10.1097/AOG.0000000000003892 (2020).
- Asali, A. et al. Can we predict the need for antihypertensive treatment during the early postpartum period for women with preeclampsia or gestational hypertension? *Pregnancy Hypertension* 17, 133-137 (2019).
- U.S. Department of Health and Human Services. (2017). HIPAA and marriage: Understanding spouse, family member, marriage, and personal representatives in the privacy rule. (HHS-0945--F-8117).
- Yancey, L. M., Withers, E., Bakes, K. & Abbott, J. Postpartum preeclampsia: Emergency department presentation and management. *Journal of Emergency Medicine* 40, 380-384, doi:10.1016/j.jemermed.2008.02.056 (2011).
- Association of Women's Health Obstetric and Neonatal Nurses (AWHONN). Guidelines for professional registered nurse staffing for perinatal units. (Association of Women's Health, Obstetric and Neonatal Nurses (AWHONN), Washington, D.C., 2010).
- Council on Patient Safety in Women's Health Care. Patient safety bundle: Support after a severe maternal event, <https://safehealthcareforeverywoman.org/aim/patient-safety-bundles/support-after-a-severe-maternal-event-patient-safetybundle-aim/> (2016).
- Troiano, N. H., Witcher, P. M. & McMurtry Baird, S. in *High Risk & Critical Care Obstetrics*, 4th ed. 371-375 (Wolters Kluwer, 2019).

Teamwork and Communication

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Key principles

1. All units should adopt the principles outlined in “Quality Patient Care in Labor and Delivery: A Call to Action.”¹
2. A strong organizational culture of professionalism, respect and accountability is necessary to address inequities in quality of care and to establish and continually model and reinforce values that center patient agency, dignity, and respectful interaction at all levels.
3. Adoption of standardized protocols supports effective teamwork. Units should use standardized protocols for risk assessment, medication selection and administration, and parameters for patient monitoring and primary provider notification.
4. Policy, procedure, and unit culture should outline clear lines of communication and facilitate avenues for escalation when appropriate.
5. Administrators must support clinicians and patients who raise safety concerns.
6. Clinicians should conduct routine briefings and debriefings for patients with preeclampsia.

Background

Communication breakdowns and failures of organizational culture and teamwork have consistently ranked among the leading contributors to reported maternal and newborn sentinel events.^{2,3} Preeclampsia/eclampsia was identified as the second leading cause of maternal deaths in the 2002-2007 California Pregnancy-Associated Mortality Review.⁴ For women whose deaths were reviewed, clinician factors were identified as contributory to the death in 78% of cases, and facility or system level factors were identified as contributory to the deaths in 57% of cases. Overall, 62% of preeclampsia/eclampsia deaths were determined to have a strong or good chance to alter outcomes. Delays or failures in treatment, misdiagnosis, and denial of the severity of women’s illness were key factors contributing

to fatal outcomes.⁵ Failures in communication, including silence in the face of clinical concerns, and lack of listening skills or responsiveness to concerns, likely contributed to delays, misdiagnosis, and treatment failures. Therefore, creating an environment where all staff, regardless of formal or informal status within the medical and organizational hierarchy, can and will speak up about their clinical concerns is critical to implementing clinical practice changes to improve preeclampsia outcomes and clinical safety.

According to Lyndon et al. (2019), “The fact that more than half of severe maternal morbidity and maternal deaths are classified as preventable, and Black women have 2 to 3 times the adjusted risk for severe morbidity and maternal mortality suggest there is a problem with failure to rescue in U.S. maternity care. Failure to rescue refers to the inability to prevent death from health care

complications”.⁶ Another study found that birth facility location was the most important factor in the progression from severe morbidity to death, even after adjusting for patient characteristics and comorbidities.⁷

Effective communication and teamwork are essential components of obstetric safety and quality.¹ While it is difficult to link specific, discrete communication strategies to changes in patient outcomes, there is evidence that sustained attention to communication, teamwork, and safety can indeed improve perinatal outcomes.⁸⁻¹¹ Furthermore, empowering staff to speak up when they witness problems, or noncompliance with protocols, has been a central component of initiatives to reduce or eliminate complications such as central line infections that were previously deemed unpreventable. Teamwork training substantially reduced surgical mortality.¹²⁻¹⁴ However, multiple studies suggest that clinicians may remain silent about their clinical concerns even when they know or believe that harm to the woman or fetus might result from continuing with the planned care.¹⁵⁻¹⁹ Patients or their family members may also identify clinical deterioration and lack of protocol compliance, but often feel ignored if and when they raise concerns.^{6,20-22}

Communication breakdowns and failures of organizational culture and teamwork have consistently ranked among the leading contributors to maternal and newborn sentinel events.

Seven U.S. professional organizations for clinicians who care for childbearing women asserted that shared decision-making, effective communication, and effective teamwork are fundamental tenets of quality patient care.¹

These principles are especially important in the setting of complications such as preeclampsia/eclampsia, where the potential for catastrophic problems is elevated and early identification and communication of disease progression is essential for effective management.²² However, multiple reports suggest that poor provider communication and instances of disrespect and abuse toward patients is a problem in U.S. maternity care, and improvement is needed.²³⁻²⁶ Black women and women of color experience higher levels of disrespect and abuse from health care practitioners, which may lead to a lack of trust or not feeling safe in health care settings.²⁷ Past disrespectful experiences may cause women to be reluctant to return to the facility even when signs and symptoms warrant medical attention.²⁸ It is essential for all U.S. birthing facilities to educate all healthcare personnel on implicit bias, interpersonal and structural racism in healthcare, and improved ways to communicate in a respectful and supportive manner.²⁹

Effective, highly reliable teams are intensely aware of the potential for failure and therefore collectively monitor and crosscheck each other and clinical processes to proactively identify potential problems. It is essential that perinatal units create an environment where all staff are empowered to “stop the line,” or formally interrupt planned care and procedures to check safety when they observe potential for harm.^{30,31} The primary goal is for all staff, patients, and family members to feel comfortable stating their concerns, with persistence, until a mutually agreeable resolution is established. Key skills for health care professions includes the ability to listen to one other and respond in a supportive manner regardless of whether or not they agree with their peers.^{1,32} These listening and responding skills should extend to the respectful care given to patients. Established strategies for improving communication and teamwork are well delineated nationally and internationally, and are outlined in Table 1 on page 91.^{6,22}

RESPONSE

Perspectives on the best course of action for a patient with preeclampsia in specific clinical situations may vary between physicians, midwives, nurses, the woman, and her family members. (See Table 2 on page 95) Managing conflict has long been difficult for clinicians. Key skills for effectively handling conflict include: a) addressing the issue rather than letting concerns fester; b) taking the time to listen carefully to the concerns of others; c) setting aside assumptions, especially regarding what motivates others' behavior; and d) being willing to own part of the problem. When clinical disagreements are approached with a spirit of inquiry, good will, active listening, and dedication to shared decision-making, they can often be resolved quickly and in a manner that builds continued trust between team members.³²

In the event that concerns cannot be resolved using these or other communication strategies, all clinicians, including registered nurses, have an affirmative duty to pursue their concerns about patient safety through the institutional chain of authority.³³

Changing culture, including communication and behavior change around conflict, requires commitment from all staff across all disciplines. Numerous training models are available to assist in the assessment, development, implementation and evaluation of communication and collaboration in complex settings. Findings of interdisciplinary team training have suggested that focused training contributes to optimizing human performance and reducing human error.^{22,34}

Table 1. Communication strategies to foster mutual respect and shared decision-making

Communication Strategy	Rationale and Utility
Briefings	<ul style="list-style-type: none"> ▶ Set the tone for team interaction ▶ Can be a routine part of board rounds, huddles, handouts and bedside rounds
Debriefings	<ul style="list-style-type: none"> ▶ Used to identify what happened, what was learned, and what can be done better next time ▶ Can be team-building in real patient situations as well as during simulation learning
Assertive language	<ul style="list-style-type: none"> ▶ Effective assertion is persistent, polite, timely, clear and solution-focused. ▶ Use "CUS" as a guideline: "I'm Concerned," "I'm Uncomfortable," "This is a Safety Issue"
Critical language	Ensures that specific, relevant, critical information is communicated, using SBAR-R-R as a guide: S ituation, B ackground, A ssessment, R ecommendation, R easoning, R atification

Continued on next page...

Communication Strategy	Rationale and Utility
Closed communication loop	<ul style="list-style-type: none"> ▶ Receiver of information restates what was said to the sender to ensure correct understanding. ▶ Reinforces the importance of effective listening
Call outs	Used to confirm the phase of a process

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Example Dialogue—Closed Communication Loop

Nurse: Hi CNM Jones, this is Nurse Smith, calling about Ms. Green in room 27 at XYZ birth center.

She is 39-3/7 weeks G1P0 admitted for nausea and vomiting this morning. Her blood pressure is 150/92, no proteinuria on dip UA, but she has a sudden severe headache. I am concerned and would like you to come over now to evaluate her.

CNM: Thanks Nurse Smith, I'm going to be over later to rupture her membranes and get this labor going. She must be miserable from all that vomiting and probably has the flu.

Nurse: Hmm. I understand the vomiting could be a GI bug. But I'm concerned that the signs and symptoms Ms. Green is demonstrating could also be atypical preeclampsia, and if so, the headache would make it preeclampsia with severe features. I really think she needs a workup now and you should come evaluate her. When can I expect to see you?

CNM: Oh, I see. Please draw xyz labs right away. I'll be right over, and I'm calling the OB back-up now. Thanks for clarifying your concerns.

Nurse: Ok great. I'll draw xyz labs right away. I'll let Ms. Green know you'll be in to see her in about 15 minutes.

CNM: Agreed, thank you.

Miscommunication or conflict in the maternity setting has many sources, including differing expectations regarding style and content of communication and differing opinions on the proposed treatment plan.⁶ Another source of conflict includes disruptive, disrespectful or rude behavior that is incongruent with providing effective, compassionate care. Such behavior includes talking negatively or gossiping about women or their families outside patient rooms, in break rooms or while on duty. Staff should avoid “talking over” women when they are lying in bed, and especially in the operating room. Women describe this as feeling like they don’t matter, or as if they are not there.³⁵

There are negative biases against women whose characteristics, behaviors or past experiences are not in accordance with a social ideal of “good” or “deserving” motherhood. These may include such ideas, for example, that “good” mothers are not unmarried, substance-using teens, but are married, planned their pregnancies, and have private health insurance. Healthcare settings are not immune from the effects of social biases. Racism is embedded throughout society, and maternity providers may hold stereotypes or implicit biases that negatively affect their ability to listen and care for Black women and women of color.

To improve communications in maternity care settings, it is important to have individual, organizational and professional accountability, and educate all staff on strategies for improving communication by minimizing and resolving conflict.⁶ There should be strong institutional support for and investment in team training, a clear escalation policy and standardized behavioral expectations. Hospital leaders should ensure staffing is adequate, and demonstrate an openness to feedback and reporting of concerning situations.⁶

Many institutions have well-developed approaches for addressing potential sources of conflict,

including structured communication tools, such as SBAR-R-R and others outlined in Table 1 on page 91, and intensive team training that covers specific teamwork skills such role identification and cross-monitoring. Adopting standardized approaches to hypertensive disorders of pregnancy and fetal monitoring are important, particularly in emergent situations where a prompt, effective team approach is essential to prevent maternal morbidity. Most critically, hospital leaders need to make equity and targeting racial disparities their top priorities for quality improvement, and ensure that clinicians are trained on implicit bias and interpersonal, institutional and systemic racism.⁶

SBAR-R-R Communication Technique

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 (See Box 1 on page 94 and Table 2 on page 95), 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. Further, no matter how well formulated, an SBAR must be listened to in order to be effective.⁶

Box 1: SBAR-R-R communication technique

Prepare for an SBAR-R-R by:

- 1 Assessing the patient
- 2 Reviewing recent notes and laboratory results
- 3 Having the medical record available during the conversation

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 including 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.

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Table 2: Sample SBAR-R-R scenarios applied to preeclampsia

Scenarios	Ambulatory Care or Emergency Department	Inpatient Antepartum or Intrapartum	Postpartum
Situation	<p>I am calling about Ms. __, who</p> <ul style="list-style-type: none"> ▣ is pregnant ▣ recently had a baby <p>and is here in the ED with stomach pain. I am concerned about:</p> <ul style="list-style-type: none"> ▶ High BP ▶ Headache ▶ Visual disturbances ▶ Decreased fetal movement ▶ Nausea and vomiting 	<p>I am calling about Ms. __, who is an antepartum patient being monitored for preeclampsia. I am concerned about:</p> <ul style="list-style-type: none"> ▶ New-onset headache ▶ Increasing BP ▶ Headache that has not resolved ▶ Visual disturbances ▶ Abdominal pain ▶ Abnormal or indeterminate fetal status ▶ Altered or worsening lab values 	<p>I'm calling about Ms. __ who had her second baby yesterday at 3 pm. I am concerned about:</p> <ul style="list-style-type: none"> ▶ New-onset headache ▶ Increasing BP ▶ Headache that has not resolved ▶ Visual disturbances ▶ Stomach pain ▶ Altered/worsening lab values
Background	<ul style="list-style-type: none"> ▶ G_P_ @__weeks or G_P_ #days post birth ▶ Significant OB and medical history ▶ Current problems ▶ Patient complaints ▶ Vital signs ▶ Interventions and response 	<ul style="list-style-type: none"> ▶ G_P_ @__weeks ▶ Significant OB and medical history ▶ Current problems ▶ Patient complaints ▶ Vital signs ▶ Fetal heart rate (FHR) tracing baseline, variability, accelerations, decelerations ▶ Uterine activity ▶ Interventions already completed 	<ul style="list-style-type: none"> ▶ G_P_ ▶ Mode of birth (vaginal/cesarean) ▶ Significant OB and medical history ▶ Current problems ▶ Patient complaints ▶ Vital signs ▶ Interventions already completed

Scenarios	Ambulatory Care or Emergency Department	Inpatient Antepartum or Intrapartum	Postpartum
Assessment	<ul style="list-style-type: none"> ▶ I'm thinking she may have preeclampsia and needs an OB evaluation before we can clear her ▶ I'm concerned she may have preeclampsia with severe features and needs medication to control her blood pressure now 	<ul style="list-style-type: none"> ▶ Her preeclampsia seems to be progressing and her BP values indicate hypertension or preeclampsia with severe features ▶ The FHR tracing is indeterminate and the decelerations do not resolve with position change 	<p>I'm thinking that her increasing BP values and new-onset headache may represent preeclampsia and that she would benefit from an initial preeclampsia workup</p>
Recommendation	<ul style="list-style-type: none"> ▶ Could you please come and evaluate her within___? <ul style="list-style-type: none"> • Now • Within 30 min • Before___, etc. ▶ Could I have orders for:___ <ul style="list-style-type: none"> • CBC, liver function, kidney function • Antihypertensive ▶ Magnesium sulfate 	<ul style="list-style-type: none"> ▶ I need you to come and evaluate her now. ▶ May I please have an order for antihypertensive medication? ▶ Are there any labs we need to repeat? ▶ When can I expect you? 	<ul style="list-style-type: none"> ▶ May I have an order for a preeclampsia lab panel? ▶ When can I expect you in to evaluate Ms. ___?
Reasoning	<ul style="list-style-type: none"> ▶ I don't think it is safe to send her home without evaluating the possibility of preeclampsia ▶ If we don't lower her BP to a safer range, she could have a stroke 	<ul style="list-style-type: none"> ▶ It is really important to control her BP while we make preparations to proceed to delivery ▶ If we don't lower her BP to a safer range, she could have a stroke 	<p>It's important for us to get baseline data before considering discharge in the morning</p>

Scenarios	Ambulatory Care or Emergency Department	Inpatient Antepartum or Intrapartum	Postpartum
Ratification	Ok, I'll do ___, and you'll evaluate her in ___ or call ___ for ___	Ok, I'll do ___, and you'll be here to evaluate her in ___	OK, I'll do ___ and you'll be in to evaluate her in ___

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Building collaborative culture and problem-solving skills

Nurse-led multidisciplinary obstetric patient summaries (MOPS) are one strategy for improving communications around patient care.³⁶ As a regular practice, every patient should be discussed by the multidisciplinary team each shift. This might occur at board rounds with the entire labor and delivery team, or might be a two-person process, involving the attending physician or midwife and bedside nurse, with additional consultation from anesthesia, maternal-fetal-medicine, charge nurse, or others as needed for patient complexity. The exact make-up and logistics for each team will depend on local conditions and needs.

All care providers are encouraged to consider elements of concern or potential risks by pondering questions such as:

- ▶ What potential risks exist for this patient? (e.g., risk of stroke, eclampsia, hemorrhage, or fetal injury)
- ▶ Are there trends that indicate concern? (e.g., vital signs, fetal trends, lab trends, headache, malaise, nausea, abdominal pain, or scotomata)
- ▶ Is there any information or task that I don't understand or know how to perform?
- ▶ What is the plan of care based on the given information?
- ▶ Do I feel uncomfortable or I am concerned about the plan of care?
- ▶ Do I feel qualified or do I feel inexperienced in caring for a patient like this?
- ▶ Are there concerns I would like to have addressed?

EVIDENCE GRADING
LEVEL OF EVIDENCE: B

References

1. Association of Women's Health Obstetric and Neonatal Nurses. Quality patient care in labor and delivery: A call to action. *Journal of Obstetric, Gynecologic & Neonatal Nursing* 41, 151-153, doi:10.1111/j.1552-6909.2011.01317.x (2012).
2. The Joint Commission. Preventing infant death and injury during delivery. Sentinel Event Alert Issue 30, <https://www.jointcommission.org/resources/patient-safety-topics/sentinel-event/sentinel-event-alert-newsletters/sentinel-event-alert-issue-30-preventing-infant-death-and-injury-during-delivery/> (2004).
3. The Joint Commission. Preventing Maternal Death. Sentinel Event Alert. Issue 44, <https://www.jointcommission.org/resources/patient-safety-topics/sentinel-event/sentinel-event-alert-newsletters/sentinel-event-alert-issue-44-preventing-maternal-death/> (2010).
4. California Department of Public Health. The California pregnancy-associated mortality review. Report from 2002 - 2007 Maternal Death Reviews. (2018).
5. Morton, C. H., Seacrist, M. J., VanOtterloo, L. R. & Main, E. K. Quality improvement opportunities identified through case review of pregnancy-related deaths from preeclampsia/eclampsia. *Journal of Obstetric, Gynecologic & Neonatal Nursing* 48, 275-287, doi:10.1016/j.jogn.2019.02.008 (2019).
6. Lyndon, A. Failure to rescue, communication, and safety culture. *Clinical Obstetrics and Gynecology* 62, 507-517, doi:10.1097/GRF.0000000000000461 (2019).
7. Friedman, A. M., Ananth, C. V., Huang, Y., D'Alton, M. E. & Wright, J. D. Hospital delivery volume, severe obstetrical morbidity, and failure to rescue. *American Journal of Obstetrics and Gynecology* 215, 795 e791-795 e714, doi:10.1016/j.ajog.2016.07.039 (2016).
8. Mehlhaff, K. M. & Pettker, C. M. Establishing and maintaining a quality and safety program on labor and delivery. *Clinical Obstetrics and Gynecology* 62, 572-579, doi:10.1097/GRF.0000000000000468 (2019).
9. Pettker, C. M. et al. Impact of a comprehensive patient safety strategy on obstetric adverse events. *American Journal of Obstetrics and Gynecology*, doi:S0002-9378(09)00092-1 [pii] 10.1016/j.ajog.2009.01.022 (2009).
10. Pettker, C. M. et al. A comprehensive obstetrics patient safety program improves safety climate and culture. *American Journal of Obstetrics and Gynecology* 204, 216 e211-216, doi:10.1016/j.ajog.2010.11.004 (2011).
11. Simpson, K. R., Knox, G. E., Martin, M., George, C. & Watson, S. R. Michigan Health & Hospital Association Keystone Obstetrics: A statewide collaborative for perinatal patient safety in Michigan. *Joint Commission Journal of Quality and Patient Safety* 37, 544-552, doi:10.1016/s1553-7250(11)37070-5 (2011).
12. Miller, M. R. et al. Reducing PICU central line-associated bloodstream infections: 3-year results. *Pediatrics* 128, e1077-1083, doi:10.1542/peds.2010-3675 (2011).
13. Pronovost, P. J., Watson, S. R., Goeschel, C. A., Hyzy, R. C. & Berenholtz, S. M. Sustaining reductions in central line-associated bloodstream infections in Michigan intensive care units: A 10-year analysis. *American Journal of Medical Quality* 31, 197-202, doi:10.1177/1062860614568647 (2016).
14. Wilder, K. A., Wall, B., Haggard, D. & Epperson, T. CLABSI reduction strategy: A systematic central line quality improvement initiative integrating line-rounding principles and a team approach. *Advances in Neonatal Care* 16, 170-177, doi:10.1097/ANC.0000000000000259 (2016).
15. Blatt, R., Christianson, M. K., Sutcliffe, K. M. & Rosenthal, M. M. A sensemaking lens on reliability. *Journal of Organizational Behavior* 27, 897-917 (2006).
16. Gardezi, F. et al. Silence, power and communication in the operating room. *Journal of Advanced Nursing* 65, 1390-1399, doi:10.1111/j.1365-2648.2009.04994. (2009).
17. Lyndon, A. Social and environmental conditions creating fluctuating agency for safety in two urban academic birth centers. *Journal of Obstetric and Neonatal Nurses* 37, 13-23 (2008).
18. Lyndon, A. et al. Predictors of likelihood of speaking up about safety concerns in labour and delivery. *British Medical Journal Quality and Safety*, doi:10.1136/bmjqs.2010.050211 (2012).
19. Smetzer, J. L. & Cohen, M. R. Intimidation: Practitioners speak up about this unresolved problem. *Joint Commission Journal of Quality and Patient Safety* 31, 594-599, doi:10.1016/s1553-7250(05)31077-4 (2005).
20. Hurst, I. Vigilant watching over: Mothers' actions to safeguard their premature babies in the newborn intensive care nursery. *Journal of Perinatal and Neonatal Nursing* 15, 39-57, doi:10.1097/00005237-200112000-00005 (2001).
21. Schwappach, D. L. Engaging patients as vigilant partners in safety: A systematic review. *Medical Care Research Review* 67, 119-148, doi:10.1177/1077558709342254 (2010).
22. Teamwork and communication working group. Improving patient safety with effective teamwork and communication: Literature review needs assessment, evaluation of training tools and expert consultations. (Canadian Patient Safety Institute,, Edmonton (AB), 2011).

23. Altman, M. R. et al. Information and power: Women of color's experiences interacting with health care providers in pregnancy and birth. *Social Science and Medicine* 238, 112491, doi:10.1016/j.socscimed.2019.112491 (2019).
24. Diaz-Tello, F. Invisible wounds: Obstetric violence in the United States. *Reproductive Health Matters* 24, 56-64, doi:10.1016/j.rhm.2016.04.004 (2016).
25. McLemore, M. R. et al. Health care experiences of pregnant, birthing and postnatal women of color at risk for preterm birth. *Social Science and Medicine* 201, 127-135, doi:10.1016/j.socscimed.2018.02.013 (2018).
26. Morton, C. H., Henley, M. M., Seacrist, M. & Roth, L. M. Bearing witness: United States and Canadian maternity support workers' observations of disrespectful care in childbirth. *Birth* 45, 263-274, doi:10.1111/birt.12373 (2018).
27. Vedam, S. et al. The Giving Voice to Mothers study: Inequity and mistreatment during pregnancy and childbirth in the United States. *Reproductive Health* 16, 77, doi:10.1186/s12978-019-0729-2 (2019).
28. Morton, C. H. & Simkin, P. Can respectful maternity care save and improve lives? *Birth* 46, 391-395, doi:10.1111/birt.12444 (2019).
29. Rubashkin, N. & Minckas, N. How should trainees respond in situations of obstetric violence? *AMA Journal of Ethics* 20, 238-246, doi:10.1001/journalofethics.2018.20.3.ecas2-1803 (2018).
30. Leonard, M., Graham, S. & Bonacum, D. The human factor: The critical importance of effective teamwork and communication in providing safe care. *Quality and Safety in Health Care*, 13 Suppl 1, i85-90, doi:10.1136/qhc.13.suppl_1.i85 (2004).
31. Knox, G. E. & Simpson, K. R. Perinatal high reliability. *American Journal of Obstetrics and Gynecology* 204, 373-377, doi:10.1016/j.ajog.2010.10.900 (2011).
32. Lyndon, A., Zlatnik, M. G. & Wachter, R. M. Effective physician-nurse communication: A patient safety essential for labor and delivery. *American Journal of Obstetrics and Gynecology* 205, 91-96, doi:10.1016/j.ajog.2011.04.021 (2011).
33. American Nurses Association. Code of ethics for nurses with interpretive statements, <https://www.nursingworld.org/coe-view-only> (2015).
34. Hughes, A. M. et al. Saving lives: A meta-analysis of team training in healthcare. *Journal of Applied Psychology* 101, 1266- 1304, doi:10.1037/apl0000120 (2016).
35. Lyndon, A., Malana, J., Hedli, L. C., Sherman, J. & Lee, H. C. Thematic analysis of women's perspectives on the meaning of safety during hospital-based birth. *Journal of Obstetric, Gynecologic and Neonatal Nursing* 47, 324-332, doi:10.1016/j.jogn.2018.02.008 (2018).
36. Bozeman, L. Nurse-led multidisciplinary obstetric patient summaries: Improving collaboration, collegiality and patient safety. *Nursing for Women's Health* 15, 382-391, doi:10.1111/j.1751-486X.2011.01662. (2011).

Chronic Hypertension in Pregnancy

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Key Principles

1. Women with chronic hypertension are at significant risk of developing superimposed preeclampsia.
2. Patients with long-standing chronic hypertension should be evaluated for cardiovascular comorbidities.
3. Patients with chronic hypertension should be treated with low-dose aspirin (LDA) initiated between 12-16 weeks.
4. Patients with American Heart Association Stage I hypertension are at increased risk of hypertensive disorders of pregnancy.

Background

Women with chronic hypertension should receive more frequent prenatal assessments during the late second and early third trimester due to the increased rate of maternal and fetal complications. The frequency of assessment should be weekly for those with stable blood pressure (BP) control, and every 3-4 days for those who require increasing dosages of antihypertensive medication. Women who require frequent increasing dosages of medication should also be considered for inpatient stabilization.

- ▶ Women with chronic hypertension should receive antihypertensive treatment if their BP is in the range of 140-150/90-100 mm Hg. If they have other comorbid conditions such as pre-gestational diabetes, collagen vascular disease, or chronic renal disease, lower treatment target goals (130-140/80-90 mm Hg) should be considered.
- ▶ Women presenting for their first prenatal visit in the mid-second trimester with BP values that are not quite high enough for a diagnosis of chronic hypertension (e.g., 130-139/80-89 mm Hg) may in fact have chronic hypertension

and should be observed more frequently for BP exacerbation.^{1,2}

- ▶ Patients with stage 1 hypertension based on American College of Cardiology (ACC) and the American Heart Association (AHA) revised criteria are at increased risk for progression to classic gestational hypertension and preeclampsia and should be monitored more closely.² Consideration for use of low-dose aspirin in this group would seem reasonable as their risk of progression to preeclampsia appears higher than many of the other groups included in the ACOG and USPSTF recommendations. (See Section: Low-Dose Aspirin for Prevention on page 74) Cardiomyopathy should be part of the differential diagnosis and assessment for women presenting with symptoms of shortness of breath and chronic hypertension, particularly if they are in a high-risk category (preexisting diabetes, collagen vascular disease, obesity, advanced maternal age, or long-standing chronic hypertension). In some instances, multiple medications may be needed to control BP values.

- ▶ Evaluation of cardiac function using echocardiography, electrocardiogram (EKG), and laboratory assessment of brain natriuretic peptides (BNP) should be part of the assessment of women with longstanding chronic hypertension.

The prevalence of chronic hypertension in women of childbearing age has been reported to vary from 0.6% to greater than 22% depending on the age, BMI, and ethnicity of the patient, with about 1-5% of pregnant women having chronic hypertension.^{3,4} The rate of chronic hypertension in the pregnant population has increased significantly since 1999.⁴ This increased incidence of chronic hypertension has been attributed to increasing maternal age, along with increased rates of obesity and diabetes. Pregnancies complicated by chronic hypertension are at increased risk for a variety of maternal complications⁵ including superimposed preeclampsia,⁶⁻⁸ pulmonary edema, placental abruption, acute renal failure, cerebral vascular accidents, stroke, and maternal death.^{4,9} About 20% (17-25%) of patients with chronic hypertension will go on to develop superimposed preeclampsia and experience complications similar to those with preeclampsia with severe features.¹⁰

Among women who died from a pregnancy-related cause in California between 2002-2007,

16% (N=54/333) died from preeclampsia. Among this cohort of pregnancy-related deaths, the true burden of hypertension was significantly higher.¹¹ Nearly 40% of the California women were noted to have hypertension during the prenatal period, at labor and delivery, or postpartum. This is 5-6 times higher than in the general obstetric population in California, suggesting hypertension is a significant comorbidity for pregnancy-related deaths. Women with a history of chronic hypertension also represented a significant percentage of those who died from cardiomyopathy.

Chronic hypertension during pregnancy is defined as BP (mm Hg) ≥ 140 systolic or ≥ 90 diastolic, prior to the 20th week of pregnancy.^{3,12} It is preferable to identify chronic hypertension prior to 12 weeks of gestation, in part because the normal nadir of maternal BP during pregnancy occurs at approximately 16-18 weeks. As a result, it is possible that women presenting with second trimester BP values that are below the 140/90 mm Hg cut-off for the diagnosis of chronic hypertension (e.g. 130/80 mm Hg) may in fact have mild to moderate chronic hypertension.

In 2017 the American College of Cardiology (ACC) and the American Heart Association (AHA) changed the criteria for hypertension.² (See Table 1 below) Despite these changes, ACOG and others have not recommended changing the criteria for diagnosis of hypertension in pregnancy.

TABLE 1: Updated American College of Cardiology (ACC) and the American Heart Association (AHA) blood pressure categories²

Definition	Range
Normal	< 120/80 mm Hg
Elevated	120-129/< 80 mm Hg
Stage 1	130-139/80-89 mm Hg
Stage 2	$\geq 140/ \geq 90$ mm Hg

It is important to note that recent data evaluating the effect of the ACC/AHA categorization found pregnant patients who presented to care with stage 1 hypertension (130-139/80-89 mm Hg) were at a 2-3 fold increased risk for development of a hypertensive disorder of pregnancy suggesting that these patients are at increased risk for hypertensive related complications of pregnancy (HDP).¹³

Most national committees divide the severity of hypertension into mild or severe categories. The majority (90%) of women diagnosed with chronic hypertension will have essential hypertension. (See Table 2 on page 103) The remaining 10% will have a secondary cause of hypertension and women presenting with severe hypertension first diagnosed in early pregnancy should be evaluated for secondary causes (e.g., pheochromocytoma, primary aldosteronism, Cushing Syndrome, sleep apnea, methamphetamine use, renal artery stenosis).³ As a result, it is possible that a woman's chronic hypertension increases the risk for developing superimposed preeclampsia and the presence of proteinuria at the initial evaluation, and also increases the risk of adverse pregnancy outcomes.⁶ The most severe adverse outcomes of pregnancy related to hypertension (i.e., stroke and cerebral vascular accidents) are most closely associated with systolic BP above 155-160 mm Hg.¹⁴

The most effective therapeutic approach to women with chronic hypertension during pregnancy is controversial. Treatment trials have been limited in size and yielded mixed results. Many experts argue that treatment of hypertension outside of pregnancy is directed towards reducing the longer-term risk of cerebral vascular and cardiac events, and the duration of pregnancy is unlikely to influence these outcomes in patients with mild chronic hypertension.¹⁵ Well-

controlled randomized trials are limited in assisting clinicians in choosing a medical therapy and the degree of BP control. The largest randomized clinical trial of the degree of BP control¹⁶ showed that tighter control was associated with a reduction in progression to severe disease. Two Cochrane reviews are available detailing the results of treatment of mild and moderate chronic hypertension during pregnancy.^{10,17} In these reports, the use of beta-blockers and methyldopa were both associated with reductions in progression to severe hypertension, and beta-blockers were also associated with reductions in proteinuric preeclampsia, eclampsia, and neonatal respiratory distress syndrome (RDS). Other widely accepted antihypertensive agents in pregnancy include labetalol, hydralazine, and nifedipine; however, there are some concerns that nifedipine may be associated with a modest increased risk for the development of superimposed preeclampsia.^{3,10} Neither of these reviews addresses the issue of the level of BP control, and concerns have been raised that aggressive treatment may decrease placental perfusion and negatively impact fetal growth.¹⁷

With limited well-conducted clinical trials, recommendations related to treatment of chronic hypertension have been primarily in the form of expert opinion and consensus recommendations from groups like ACOG, Hypertension Canada/Society of Obstetricians and Gynaecologists of Canada (SOGC), and the National Institute for Health and Clinical Excellence (NICE).^{3,18,19} (Tables 2 and 3 on page 103) Based on these recommendations and the universal recommendation for acute treatment when a pregnant or postpartum patient has a systolic BP > 160 mm Hg or diastolic BP > 110 mm Hg, it seems prudent to initiate maintenance medication prior to that point and once the BP enters the range of > 140-150/90-100 mm Hg.²⁰

Women with chronic hypertension who are treated with medication should be closely supervised for both maternal and fetal status by a physician experienced in treating and monitoring hypertension in pregnancy.

Table 2. Diagnostic criteria for patients with chronic hypertension in pregnancy among national obstetrics organizations

Organization	Blood Pressure	Mild (mm Hg)	Moderate (mm Hg)	Severe (mm Hg)
ACOG*	systolic	140-159	-	≥ 160
	diastolic	90-109	-	≥ 110
SOGC**	systolic	≥ 140	-	≥ 160
	diastolic	≥ 90	-	≥ 110
NICE***	systolic	140-149	150-159	≥ 160
	diastolic	90-99	100-109	≥ 110

*American College of Obstetrics and Gynecology

**Society of Obstetricians and Gynaecologists of Canada

***National Institute for Health and Clinical Excellence (NICE)

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Table 3. Treatment recommendations from national obstetrics organizations for patients with chronic hypertension

Organization	BP values (mm Hg) to initiate treatment	Goal BP values (mm Hg)	Patients with comorbid conditions****
ACOG*	160/110	120-160/80-105	Lower value may be needed
SOGC**	140-159/90-109	130-155/90-109	130-139/80-90 mm Hg
NICE***	150/100	< 150/100	< 140/90 mm Hg

* American College of Obstetrics and Gynecology

** Society of Obstetricians and Gynaecologists of Canada

*** National Institute for Health and Clinical Excellence

****Comorbid conditions (i.e., special circumstances) are defined as the presence of impaired renal function, pre-gestational diabetes, cardiovascular disease

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References

1. Wu, D. D. et al. increased adverse pregnancy outcomes associated with stage 1 hypertension in a low-risk cohort: Evidence From 47 874 cases. *Hypertension* 75, 772-780, doi:10.1161/HYPERTENSIONAHA.119.14252 (2020).
2. Whelton PK, Carey RM, Aronow WS, Casey DE, Collins KJ, Dennison Himmelfarb C, DePalma SM, Gidding S, Jamerson KA, Jones DW, MacLaughlin EJ, Muntner P, Ovbigele B, Smith SC, Spencer CC, Stafford RS, Taler SJ, Thomas RJ, Williams KA, Williamson JD, Wright JT. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APHA/ASH/ASPC/NMA/PCNA guideline for the prevention, detection, evaluation, and management of high blood pressure in adults: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *J Am Coll Cardiol*. 2018; 71:e127–e248.
3. ACOG. Chronic hypertension in pregnancy: Practice Bulletin No. 203 of the American College of Obstetricians and Gynecologists. *Obstetrics and Gynecology* 133, e26-e50, doi:10.1097/AOG.0000000000003020 (2019).
4. Bateman, B. T. et al. Prevalence, trends, and outcomes of chronic hypertension: A nationwide sample of delivery admissions. *American Journal of Obstetrics and Gynecology* 206, 134 e131-138, doi:10.1016/j.ajog.2011.10.878 (2012).
5. Rey, E. & Couturier, A. The prognosis of pregnancy in women with chronic hypertension. *American Journal of Obstetrics and Gynecology* 171, 410-416, doi:10.1016/0002-9378(94)90276-3 (1994).
6. Sibai, B. M. et al. Risk factors for preeclampsia, abruptio placentae, and adverse neonatal outcomes among women with chronic hypertension. National Institute of Child Health and Human Development Network of Maternal-Fetal Medicine Units. *New England Journal of Medicine* 339, 667-671, doi:10.1056/NEJM199809033391004 (1998).
7. Sibai, B. M. Chronic hypertension in pregnancy. *Obstetrics and Gynecology* 100, 369-377, doi:10.1016/s0029-7844(02)02128-2 (2002).
8. Ankumah, N. E. & Sibai, B. M. Chronic hypertension in pregnancy: Diagnosis, management, and outcomes. *Clinical Obstetrics and Gynecology* 60, 206-214, doi:10.1097/GRF.0000000000000255 (2017).
9. Kuklina, E. et al. Severe Obstetric Morbidity in the United States: 1998-2005. *Obstetrics and Gynecology* 113, 293-299 (2009).
10. Abalos, E., Duley, L., Steyn, D. W. & Gialdini, C. Antihypertensive drug therapy for mild to moderate hypertension during pregnancy. *Cochrane Database Systematic Reviews* 10, CD002252, doi:10.1002/14651858.CD002252.pub4 (2018).
11. California Department of Public Health. The California pregnancy-associated mortality review. Report from 2002 - 2007 maternal death reviews. (2018).
12. Barton, J. R. & Sibai, B. M. Prediction and prevention of recurrent preeclampsia. *Obstetrics and Gynecology* 112, 359-372 (2008).
13. Hauspurg, A. et al. Blood pressure trajectory and category and risk of hypertensive disorders of pregnancy in nulliparous women. *American Journal of Obstetrics and Gynecology* 221, 277 e271-277 e278, doi:10.1016/j.ajog.2019.06.031 (2019).
14. Sibai, B. M. Diagnosis, prevention, and management of eclampsia. *Obstetrics and Gynecology* 105, 402-410, doi:10.1097/01.AOG.0000152351.13671.99 (2005).
15. Seely, E. W. & Ecker, J. Chronic hypertension in pregnancy. *Circulation* 129, 1254-1261, doi:10.1161/CIRCULATIONAHA.113.003904 (2014).
16. Magee, L. A. et al. Less-tight versus tight control of hypertension in pregnancy. *New England Journal of Medicine* 372, 407-417, doi:10.1056/NEJMoa1404595 (2015).
17. Magee, L. A. & Duley, L. Oral beta-blockers for mild to moderate hypertension during pregnancy. *Cochrane Database Systematic Reviews*, CD002863, doi:10.1002/14651858.CD002863 (2003).
18. Butalia, S. et al. Hypertension Canada's 2018 Guidelines for the management of hypertension in pregnancy. *Canadian Journal of Cardiology* 34, 526-531, doi:10.1016/j.cjca.2018.02.021 (2018).
19. National Institute for Health and Care Excellence (NICE). Hypertension in pregnancy: Diagnosis and management. <https://www.nice.org.uk/guidance/ng133/resources/hypertension-in-pregnancy-diagnosis-and-management-pdf-66141717671365> (2019).
20. Easterling, T. R. Post-Control of Hypertension in Pregnancy Study (CHIPS): What is the optimal strategy to manage hypertension during pregnancy? *Hypertension* 68, 36-38, doi:10.1161/HYPERTENSIONAHA.116.07190 (2016).

Gestational Hypertension

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Key Principles

1. Women with gestational hypertension and severe-range blood pressures (BP) values should be diagnosed with preeclampsia with severe features¹ and treated appropriately with antihypertensives, magnesium sulfate and delivery at 34 weeks of gestation.
2. Although outcomes in women with gestational hypertension are usually favorable, this diagnosis is often associated with adverse pregnancy outcomes, and in fact, may not represent a separate entity from preeclampsia.
3. Gestational hypertension and preeclampsia may be indistinguishable in terms of long-term cardiovascular risk.

Background

There continues to be confusion about the clinical management of patients who are diagnosed with gestational hypertension because the term, 'gestational hypertension,' historically was considered as less severe than preeclampsia and thus not warranting treatment. Severe-range BP values, systolic of 160 mm Hg or greater or diastolic of 110 mm Hg or greater, need to be treated immediately. Clinicians may consider antihypertensive therapy at BP 155/105 mm Hg given the documented association with increased maternal morbidities at this threshold in several studies as discussed in the Section: Borderline Severe-Range Blood Pressures: A Clinical Conundrum on page 35.

There is a pervasive impression that patients who are diagnosed with gestational hypertension without proteinuria or major organ involvement have better pregnancy outcomes compared to those who develop preeclampsia/eclampsia. This impression is inaccurate and often leads to inappropriate management of patients.

Gestational hypertension is defined as a systolic BP ≥ 140 mm Hg, or a diastolic BP ≥ 90 mm Hg or both, on two occasions at least 4 hours apart after 20 weeks of gestation, in a woman with a previously normal BP. Gestational hypertension is considered severe when the systolic BP reaches 160 mm Hg or the diastolic reaches 110 mm Hg or both. In this situation, the diagnosis needs to be confirmed within a shorter interval (15 minutes) rather than waiting 4 hours to facilitate timely intervention therapy.¹ In other words, severe levels of hypertension, BP 160/110 mm Hg or greater, need to be treated immediately, regardless of the diagnosis.

The classification of gestational hypertension requires the presence of hypertension without proteinuria or severe features after 20 weeks of gestation, with BP values returning to normal in the postpartum period. This diagnosis has been described as “more of an exercise in the nomenclature than a pragmatic one, because the management of gestational hypertension, and that of preeclampsia without severe features, is similar in many aspects and both require enhanced surveillance”.¹ Furthermore, although outcomes in women with gestational hypertension are usually good, this diagnosis is often associated with adverse pregnancy outcomes and in fact may not represent an entity separate from preeclampsia.¹ Up to 50% of women with gestational hypertension will eventually develop proteinuria or other end-organ dysfunction consistent with a diagnosis of preeclampsia. This progression of disease is more likely when gestational hypertension is diagnosed prior to 32 weeks of gestation.¹

Women with gestational hypertension require continued monitoring, including serial ultrasonography for fetal growth, weekly antepartum testing and preeclampsia labs, and close monitoring of BP.¹ Women should be instructed to notify their provider if they have any “persistent, concerning, or unusual symptoms.”¹ Providers should provide women with clear, written instructions about these symptoms and encourage sharing this information with families. (See Section: Patient Education on page 65) For women with gestational hypertension, the progression to preeclampsia with severe features usually takes 1-3 weeks after diagnosis in cases where preeclampsia develops.¹

Women with gestational hypertension who present with severe-range BP values should be managed with the same approach as for women with preeclampsia with severe features, including the administration of antihypertensive medications, the use of magnesium sulfate for the prevention and treatment of seizures and delivery at 34 weeks of gestation.¹ Treatment within this paradigm has reduced maternal

morbidity.² Further, gestational hypertension and preeclampsia may be indistinguishable in terms of long-term cardiovascular risk.¹

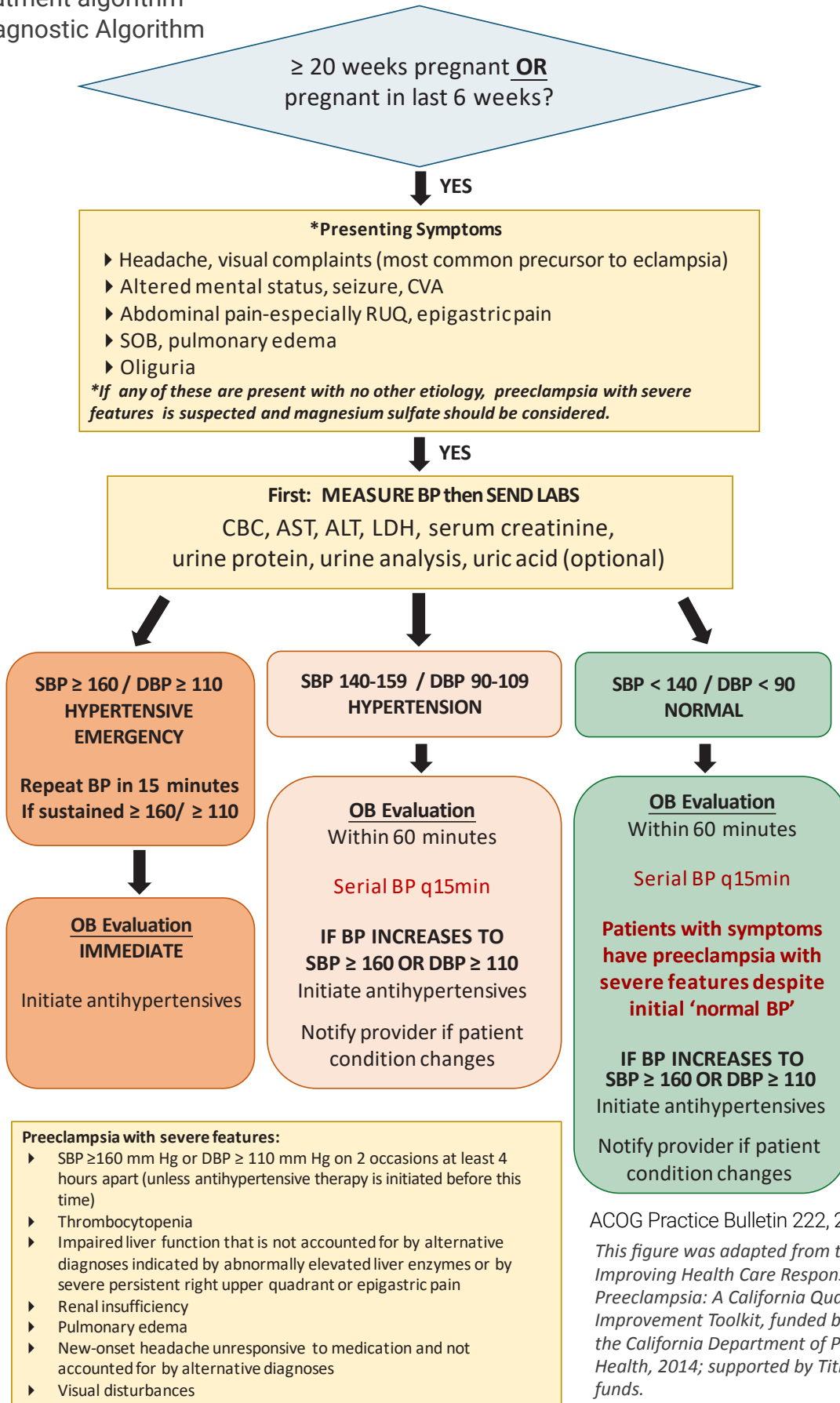
Treatment of gestational hypertension in the United States is controversial.³ However, in one of the largest treatment trials to date, CHIPS, that included both women with chronic hypertension and gestational hypertension, tighter BP control (diastolic BP < 85 v. < 100 mm Hg) was associated with less frequent progression to severe hypertension.⁴ There were also reductions in thrombocytopenia and elevated liver function tests ($p < 0.05$) but these did not reach a prespecified p value of < 0.01 . There was, however, no change in neonatal outcomes. Based on this trial, many centers in the U.S. have initiated treatment with patients with gestational hypertension for maternal benefit. Regardless of whether treatment intervention is initiated or not, this group of patients are at high risk of worsening disease and close monitoring/surveillance is warranted (bi-weekly or weekly).^{4,5}

White Coat Hypertension

White coat hypertension, a common condition, is defined as elevated blood pressure primarily in the presence of healthcare providers. **Both ACOG and the International Society of Hypertension in Pregnancy (ISSHP) have recognized white coat hypertension as a valid diagnostic category in pregnancy.**^{3,6} Many providers think, incorrectly, that white coat hypertension is a benign condition requiring minimal monitoring and intervention. However, there is evidence that 8% of patients with white coat hypertension will progress to preeclampsia, and 40% of those cases will progress to gestational hypertension later in pregnancy.³ Patients with suspected white coat hypertension should therefore use ambulatory blood pressure monitoring to confirm the diagnosis.⁷ **Appropriately validated devices and patient training should be emphasized. Clear and concise instructions about when to contact the healthcare provider should be given to the patient and her family.**

RESPONSE

Acute treatment algorithm
Part 1: Diagnostic Algorithm



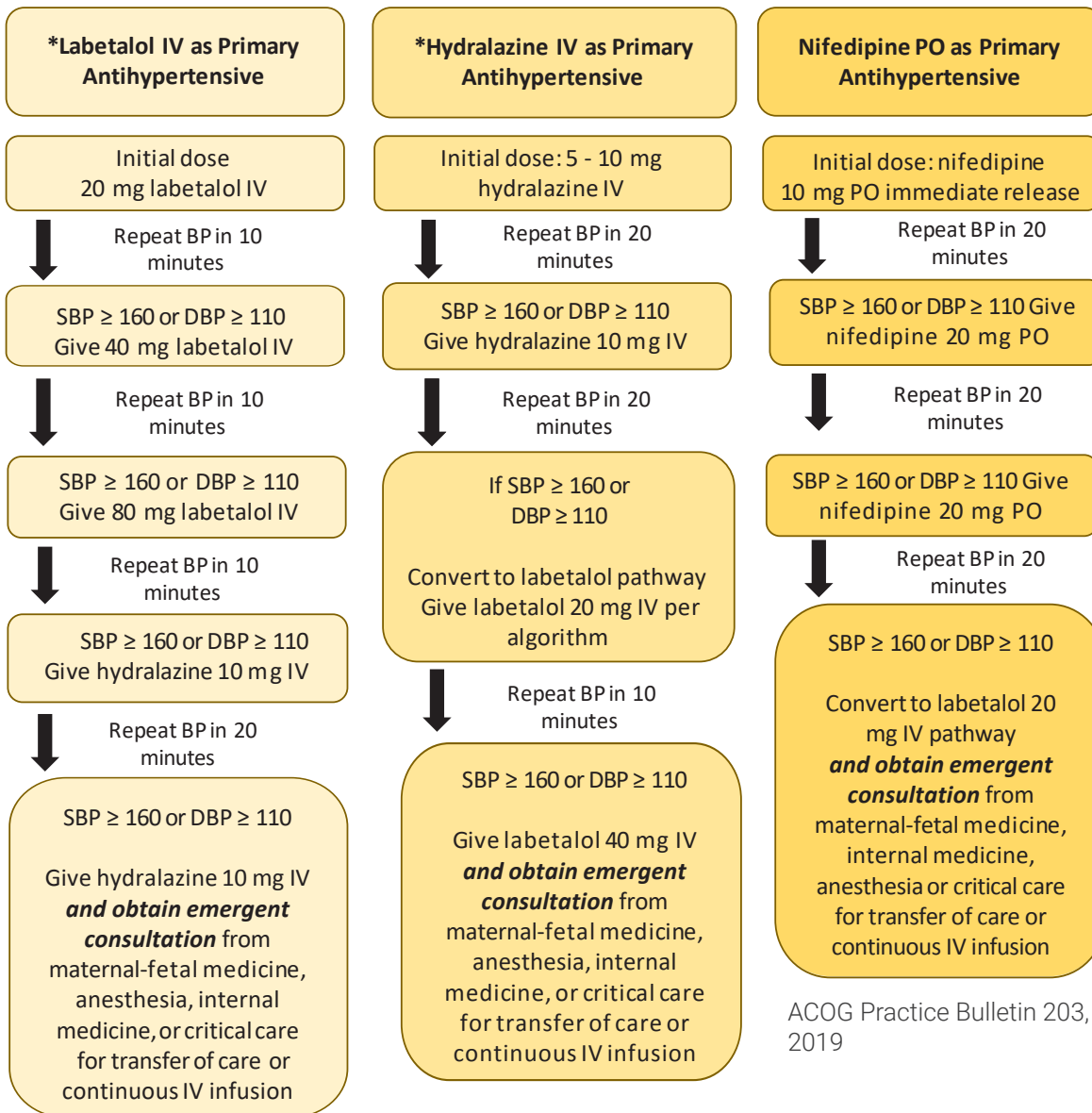
ACOG Practice Bulletin 222, 2020
This figure was adapted from the Improving Health Care Response to Preeclampsia: A California Quality Improvement Toolkit, funded by the California Department of Public Health, 2014; supported by Title V funds.

RESPONSE

Part 2: Antihypertensive Treatment Algorithm for Hypertensive Emergencies

Treatment Recommendations for Sustained Systolic BP ≥ 160 mm Hg or Diastolic BP ≥ 110 mm Hg

*Antihypertensive treatment and magnesium sulfate should be administered simultaneously. If concurrent administration is not possible, antihypertensive treatment should be 1st priority.



ACOG Practice Bulletin 203, 2019

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

Once BP threshold is achieved:

- ▶ Q10 min for 1 hr
- ▶ Q15 min for 1 hr
- ▶ Q30 min for 1 hr
- ▶ Q1hr for 4 hrs

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

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

Part 3: Magnesium Dosing and Treatment Algorithm for Refractory Seizures

Magnesium: Initial Treatment

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

For recurrent seizures while on magnesium

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

Seizures Resolve

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

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

References

1. ACOG. Gestational hypertension and preeclampsia: Practice Bulletin No. 222 of the American College of Obstetricians and Gynecologists. *Obstetrics and Gynecology* 135, 1492-1495, doi:10.1097/AOG.0000000000003892 (2020).
2. Shields, L. E., Wiesner, S., Klein, C., Pelletreau, B. & Hedriana, H. L. Early standardized treatment of critical blood pressure elevations is associated with a reduction in eclampsia and severe maternal morbidity. *American Journal of Obstetrics and Gynecology* 216, e1-5, doi:10.1016/j.ajog.2017.01.008 (2017).
3. ACOG. Chronic hypertension in pregnancy: Practice Bulletin No. 203 of the College of Obstetricians and Gynecologists. *Obstetrics and Gynecology* 133, e26-e50, doi:10.1097/AOG.0000000000003020 (2019).
4. Magee, L. A. et al. The CHIPS Randomized Controlled Trial (Control of Hypertension in Pregnancy Study): Is severe hypertension just an elevated blood pressure? *Hypertension* 68, 1153-1159, doi:10.1161/HYPERTENSIONAHA.116.07862 (2016).
5. Abalos, E., Duley, L., Steyn, D. W. & Gialdini, C. Antihypertensive drug therapy for mild to moderate hypertension during pregnancy. *Cochrane Database Systematic Reviews* 10, CD002252, doi:10.1002/14651858.CD002252.pub4 (2018).
6. Brown, M. A., Mangos, G., Davis, G. & Homer, C. The natural history of white coat hypertension during pregnancy. *British Journal of Obstetrics and Gynecology* 112, 601-606, doi:10.1111/j.1471-0528.2004.00516. (2005).
7. Johnson, S., Liu, B., Kalafat, E., Thilaganathan, B. & Khalil, A. Maternal and perinatal outcomes of white coat hypertension during pregnancy: A systematic review and meta-analysis. *Hypertension* 76, 157-166, doi:10.1161/HYPERTENSIONAHA.119.14627 (2020).

Severe Hypertension or Preeclampsia with Severe Features at < 34 Weeks of Gestation

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Key Principles

1. Patients with preeclampsia with severe features or severe gestational hypertension should be delivered no later than 34 weeks of gestation.
2. Patients with diagnostic criteria for preeclampsia without severe features at ≥ 37 weeks of gestation should be delivered.
3. In select cases, postponing delivery to 34 weeks of gestation may be reasonable. Patients with preeclampsia with severe features remote from term (< 34 weeks) should be treated at or transported to a center with a full team that has experience and expertise in managing the disease and its potential complications.
4. Patients who develop preeclampsia with severe features or severe gestational hypertension are high risk for recurrence of preeclampsia or gestational hypertension in subsequent pregnancies.
5. Mode of delivery should be based on usual obstetrical indications.

Background

Preeclampsia presenting < 37 weeks of gestation

The criteria for diagnosing preeclampsia with and without severe features are the same regardless of gestational age.¹ Preeclampsia is generally part of a spectrum of hypertensive disorders of pregnancy (HDP) that manifests near term with an overall incidence of 5-10% of all pregnancies.¹ Preeclampsia may present at earlier gestational ages, often when in association with other co-morbidities such as chronic hypertension, renal disease, autoimmune disease, and diabetes.^{2,3} Preeclampsia in women who are < 37 weeks of gestation is seen in approximately 1.5% of

pregnancies, and approximately 50% of these cases represent severe disease.^{2,4,5} About 0.3% of pregnant women will develop preeclampsia at < 34 weeks of gestation.² For California, with an estimated 500,000 births annually, this equates to approximately 1,500 women per year who will develop preeclampsia with severe features prior to 34 weeks of gestation.

Delivery is indicated at ≥ 37 weeks for patients who develop preeclampsia without severe features. Immediate delivery is indicated for patients who develop preeclampsia with severe features at gestational age of ≥ 34 weeks of gestation. These recommendations are based on balancing maternal risk and potential neonatal benefit.⁶⁻⁸

Table 1. Preeclampsia with severe features and management options for delayed delivery

Criteria	Definition/Significance	Attempt to Delay Delivery
Persistent headache, blurred vision or scotomata ¹ /mental status changes ²	Suggests central nervous system dysfunction	No
Persistent epigastric pain or right upper quadrant pain	Suggests liver capsule distension or rupture	No
Eclampsia	Generalized tonic-clonic seizure	No
Pulmonary edema and/or hypoxia (Oxygen saturation < 95%)	Excessive fluid accumulation in the lungs	No
Oliguria/Renal failure	Urine output of < 500/24 hours or Creatinine > 1.1 (unless chronic renal disease)	No
Hepatocellular injury	Serum transaminases > 2x normal	No
Blood pressure	≥ 160mm Hg or ≥ 110mm Hg BP criteria for preeclampsia with severe features	Yes, if responds to treatment

¹ Patients with eclampsia and visual disturbances should be evaluated in consultation with critical care medicine/ neurology for the presence of posterior reversible encephalopathy syndrome (PRES).

² Mental status changes in the presence of severe thrombocytopenia should be evaluated in consultation with hematology for thrombotic thrombocytopenic purpura (TTP) and consideration given for treatment or transfer to a center with treatment capacity.

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Preeclampsia with severe features presenting at < 34 weeks of gestation

Delivery has traditionally been recommended for patients with preeclampsia with severe features presenting at any gestational age. However, a number of observational studies and a limited number of randomized clinical trials suggest that, under appropriate conditions, patients

with severe disease at < 34 weeks of gestation may be managed conservatively. Conservative management, also referred to as expectant management, consists of delaying immediate delivery following maternal admission.^{4,6,9} Patients eligible for this approach will primarily be those in whom blood pressure can be controlled in a relatively short period of time and **without** manifestations of end-organ disease.

The only exception would be significant proteinuria, > 5 gram/24 hours, which is no longer an indication for immediate delivery and expectant management can be implemented. Normal fetal testing is a prerequisite for conservative management.⁶⁻⁸ Severe intrauterine growth restriction (IUGR) with reassuring fetal monitoring is a clinical scenario where conservative management is a reasonable option. Patients who meet the criteria for conservative management should be hospitalized and their status continuously assessed for disease progression. Delivery is indicated if there is evidence of either fetal or maternal deterioration.^{1,10}

Treatment of maternal blood pressure should be maintained at a level that reduces the risk of maternal cerebral vascular accidents (BP < 160 mm Hg systolic and < 110 mm Hg diastolic).^{1,11}

The goal should be 130-150 mm Hg systolic and 80-100 mm Hg diastolic. In addition to maternal blood pressure control, seizure prophylaxis with magnesium sulfate should be instituted. An initial bolus of 4-6 grams over 15-20 minutes followed by 1-2 gm per hour as maintenance is recommended. (See Section: Preventing and Managing Eclamptic Seizures on page 126) Betamethasone should be administered at time of admission, for induction of fetal lung maturity and to decrease complications such as respiratory distress syndrome (RDS), intraventricular hemorrhage (IVH), and necrotizing enterocolitis (NEC).

Conservative (expectant) management should *only* be implemented in a facility that has the resources to care for both the pregnant patient and the newborn. The Neonatal Intensive Care Unit should be capable of caring for neonates at gestational ages of less than 34 weeks. Pregnancy complications in these patients may include seizure, stroke, posterior reversible encephalopathy syndrome (PRES), pulmonary edema, adult respiratory distress syndrome (ARDS), placental abruption, liver rupture,

obstetric hemorrhage, disseminated intravascular coagulation (DIC), and acute renal failure.²

Assessment of maternal symptoms related to the central nervous system (headache, visual changes or change in mental status) and gastrointestinal system (epigastric, right upper quadrant (RUQ) pain, or nausea and vomiting), should be included in each vital sign assessment. Continuous or intermittent electronic fetal monitoring (every shift) should be performed according to the clinical situation. (See Table 1 on page 112)

Most expert opinion^{6,7} and other international organizations^{12,13} do not recommend expectant management (delaying delivery) if any of the following conditions are present. (See Table 2 on page 114)

1. Eclampsia
2. Hemolysis, Elevated Liver Enzymes, Low Platelet Syndrome (HELLP)
3. Pulmonary edema
4. Severe thrombocytopenia
5. Coagulopathy

Any patient who does not meet the criteria for continuation of pregnancy should be delivered by either induction of labor or cesarean section.

Determining the mode of delivery (vaginal or cesarean) should take into consideration the likelihood of success based on cervical status, gestational age, fetal status, and the severity of disease and rapidity of any changes in maternal or fetal status. For women with HELLP syndrome who are between the gestational age of fetal viability and 33 6/7 weeks of gestation, there is consideration for delayed delivery to complete a course of corticosteroids for fetal benefit. This delay can only be justified if maternal and fetal condition remain stable.¹⁴

Each obstetric unit should develop a policy that delineates the conditions under which mothers and neonates can be effectively treated at that institution. A decision checklist, specific to the level of care that can be provided, should be used to assist physicians with decisions related to transfer. If the pregnant patient or the neonate cannot be adequately cared for at the current center, strong consideration should be given to transport to a center that can provide a higher level of care.

Table 2: Daily assessment for delivery versus continuing pregnancy at < 34 weeks of gestation

Clinical Criteria	Present?	
	Yes	No
Persistent maternal headache	Yes	No
Visual changes (blurred vision or scotomata)	Yes	No
Hypoxia (O ₂ saturation < 95%) or pulmonary edema on clinical exam	Yes	No
Persistent BP ≥ 160 mm Hg systolic or ≥ 110 mm Hg despite medical management	Yes	No
Oliguria (< 500 ml/24 hours)	Yes	No
Evidence of renal failure (serum creatinine > 1.1 mg/dL)	Yes	No
HELLP syndrome	Yes	No
Thrombocytopenia (platelet count < 100 x 10 ⁹ L in the absence of alternative diagnosis)	Yes	No
Elevated AST or ALT > 2 times upper normal limit	Yes	No
Evidence of hemolysis (LDH > 600, bilirubin > 1.2 mg/dL or abnormal peripheral blood smear)	Yes	No
Abnormal coagulation (elevated PT/PTT or fibrinogen < 300)	Yes	No
Suspected placental abruption or unexplained vaginal bleeding	Yes	No
Abnormal fetal testing (NST, BPP, absent or reversed end-diastolic flow)	Yes	No
	Yes to ANY of above CONSIDER DELIVERY	No to ALL of above CONTINUE PREGNANCY

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

A multidisciplinary working group that includes obstetricians, obstetric nursing, anesthesia, maternal-fetal medicine (if available), pediatricians/neonatologists, intensivists and intensive care unit nursing (as needed) should coordinate patient care. The care plan should address the problems related to the unique manifestations of preeclampsia, including potential multi-organ dysfunctions. It is likely that the obstetrician, obstetric nurse or maternal-fetal medicine specialist will need to lead the coordination of care. The pediatric/neonatal team should be involved to provide consultation, education, and anticipatory neonatal outcome guidance based on gestational age. The parents should be counseled that continuation of the pregnancy is being attempted with the goal of improving neonatal outcome. In addition, patients should be counseled about the risks, even if minimal, of fetal demise and/or significant maternal morbidity if expectant management is instituted. Everyone involved in a severe maternal event needs support during and after the acute crisis.¹⁵ (See Section: Patient Education on page 65)

Blood draws for laboratory evaluations should occur approximately every 6 hours for the first 24 hours, and if normal, daily for two consecutive days. If the laboratory values remain normal after 48 hours, blood pressures remain stable, (not requiring additional medications), and the clinical condition is stable, then less frequent laboratory monitoring should be instituted (every second or third day).

Hemolysis, Elevated Liver Enzymes, Low Platelets (HELLP) Syndrome

HELLP syndrome is a variant of preeclampsia with severe features characterized by red blood hemolysis, thrombocytopenia, and abnormal elevations in liver transaminases.¹⁶ The diagnostic criteria and classes of HELLP syndrome are listed in Tables 3 and 4 on page 116. Three classes of HELLP syndrome are characterized by severity of laboratory abnormalities and risk for significant adverse perinatal outcome based on the patient's platelet count.¹⁷ The most severe manifestation (Class I) has platelet counts $\leq 50,000$ cells/ μL , Class II has platelet counts of $> 50,000$ and $\leq 100,000$ cells/ μL , and in Class III, there is mild thrombocytopenia with a platelet nadir between $> 100,000$ and $\leq 150,000$ cells/ μL . The severity of maternal, fetal and neonatal morbidity is correlated with the severity of the disease.¹⁷ Approximately 10-15% of patients with classic HELLP syndrome will not have elevated blood pressures (BP $\geq 140/90$ mm Hg)¹⁸ and like other forms of preeclampsia with severe features, proteinuria is absent in 15-25% of patients.¹⁷ The presence of subjective symptoms is seen in 64-84% of patients with Class III and Class I HELLP syndrome respectively.¹⁷ Thus, the presence of proteinuria or elevated blood pressure is not essential for the diagnosis of HELLP syndrome and in those patients without classic features, the presence of subjective symptoms (i.e., headache, epigastric pain, nausea and vomiting, or visual disturbances) should prompt further evaluation to rule out progression of disease requiring delivery.

Table 3. Diagnostic criteria for HELLP syndrome

HELLP complication	Diagnostic Criteria
Hemolysis	<ul style="list-style-type: none"> ▶ Elevated LDH (> 600 IU/L)¹, or ▶ Microangiopathic hemolytic anemia on peripheral blood smear <i>or</i> ▶ Low haptoglobin (< 25 mg/dL) ▶ Elevated indirect bilirubin
Thrombocytopenia	Platelet count ≤ 100,000 cells/μL
Elevated Transaminases	Serum AST ² ≥ 70 IU/L or twice baseline values

¹ Elevated lactic dehydrogenase (LDH) > 600IU/L is currently the most readily available and accurate laboratory indicator of hemolysis.

² Aspartate Aminotransferase (AST)

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The majority of patients with HELLP syndrome will have elevated blood pressure spanning the range from mild to severe-range. The combination of severely elevated blood pressure with thrombocytopenia and abnormal coagulation parameters place the patient at increased risk for cerebral vascular accidents or other hemorrhagic complications. The frequency of seizures/eclampsia ranges from 5-12% in preeclampsia with severe features and HELLP syndrome of any degree (Class I, II, and III).¹⁷

Maternal and neonatal morbidity is significantly

increased in pregnancies complicated by HELLP syndrome. The rate of preterm birth is high (70%) with 15% of deliveries occurring prior to 28 weeks of gestation.¹⁸ The risk of maternal death has been estimated at 1%, and the frequency of other severe morbidities is also high, including Disseminated Intravascular Coagulation (DIC): 15-30%; pulmonary edema: 8%; acute renal failure: 3% and; adult respiratory distress syndrome (ARDS) and stroke: both 1%. Initiation of corticosteroid therapy to decrease maternal morbidity for Class I and II HELLP syndrome should be considered.¹⁹ This is controversial as there is limited high quality data.

Table 4: Classes of HELLP syndrome

Class	Description
I	Platelet counts < 50,000 cells/μL
II	Platelet counts ≥ 50,000 and < 100,000 cells/μL
III	Mild thrombocytopenia Platelet nadir between ≥ 100,000 and < 150,000 cells/μL

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RESPONSE

Diagnosis of HELLP Syndrome can be challenging, as the differential diagnosis includes thrombotic thrombocytopenic purpura (TTP), hemolytic uremic syndrome (HUS), and acute fatty liver disease of pregnancy (AFLP). (See Table 5 below) TTP and HUS should be considered in all pregnant women with severe thrombocytopenia, severe anemia, and elevated lactic dehydrogenase (LDH) levels with minimal elevation of AST.²⁰ A history of proteinuria and hypertension prior to onset of hemolysis, liver abnormalities, and thrombocytopenia favor the diagnosis of preeclampsia, while high LDH levels with only modest elevation of AST favors

TTP.²¹ (See Table 3 on page 116) The distinction between TTP or HUS and preeclampsia with severe features or HELLP syndrome is important for therapeutic and prognostic reasons, as TTP would generally be treated with plasmapheresis.

Systemic lupus erythematosus (SLE) nephritis flares may present with similar features, and should be considered in the differential diagnosis. Antinuclear antibody (ANA), is an accurate screening tool for SLE, if using the updated EULAR classification for SLE. If ANA is negative, the diagnosis of SLE is unlikely).

Table 5. Differentiation between preeclampsia, HELLP syndrome, acute fatty liver disease of pregnancy (AFLP), thrombotic thrombocytopenia purpura (TTP), hemolytic uremic syndrome (HUS)

	Plts	LFT	Bili	Cr	LDH	Glu	DIC	CNS
Preeclampsia	±	±	±	±	±	→	±	±
HELLP	↓↓↓	↑↑	↑	±	↑	→	±	±
AFLP	↓↓	↑↑	↑↑↑	↑	↑	↓↓↓	↑↑↑	±
TTP	↓↓↓	↑	↑	↑	↑↑	→	±	++
HUS	↓	↑↑	↑↑	↑↑↑	↑	→	±	±

Key

Plts: Platelet Count; LFT: Liver Function Test; Bili: Total Bilirubin Level; Cr: Creatinine; LDH: Lactate Dehydrogenase; Glu: Glucose; DIC: Disseminated Intravascular Coagulation; CNS: Central Nervous System symptoms (confusion, visual changes, headache)

Arrows (↓↑→) represent relative changes: one arrow equals small change; two arrows indicate moderate change; three arrows equal large change; ± may change or remain unchanged; ++ significant component of diagnosis.

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Hypertension

Professional guidelines and health systems have variously categorized the degree of hypertension associated with pregnancy as mild, moderate, and severe.^{22,23} (See Tables 6 and 7 below) The rationale for this expanded categorization is to recognize that many patients in the moderate hypertension category are at higher risk for poor obstetrical outcome and likely merit closer observation.

Table 6. Preeclampsia diagnostic criteria for three blood pressure categories

(mm Hg)

SOGC ¹ , NICE ²	Mild	Moderate	Severe
Systolic	140-149	150-159	≥ 160
Diastolic	90-99	100-109	≥ 110

¹SOGC (Society of Obstetricians and Gynaecologists of Canada)

²NICE (National Institute for Health and Clinical Excellence)

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Table 7: Preeclampsia diagnostic criteria for two blood pressure categories

(mm Hg)

ACOG ¹	Hypertension	Severe Hypertension
Systolic	140-159 mm Hg	≥ 160 mm Hg
Diastolic	90-109 mm Hg	≥ 110 mm Hg

¹ACOG (American College of Obstetrics and Gynecology)

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

Atypical preeclampsia

The recognition that the pathophysiology of preeclampsia is highly variable has led to the realization that the disease can present with single- or multi-organ dysfunction.²⁰ Cases that present as “atypical” are those that manifest at < 20 weeks of gestation, more than 48 hours after birth, or with any of the diagnostic criteria for severe disease in the absence of proteinuria or elevated blood pressure. Severe nausea and vomiting in the late 2nd or early 3rd trimester should raise the index of suspicion for preeclampsia. Development of preeclampsia in the presence of gestational hypertension is inversely

related to the time of diagnosis of gestational hypertension.²⁴ Furthermore, proteinuria, in the absence of hypertension, may be the first manifestation of disease in the sequence leading to preeclampsia.²⁵ These women merit close antenatal follow-up (1-2 times per week) with laboratory assessment.²⁰ Women who present after delivery with gestational hypertension or isolated proteinuria and who have laboratory or subjective symptoms of preeclampsia with severe features should be treated with magnesium sulfate.

Summary statements

- ▶ Patients with diagnostic criteria for preeclampsia without severe features (formerly mild) at ≥ 37 weeks or preeclampsia with severe features at < 34 weeks of gestation should be delivered.
- ▶ Patients with diagnostic criteria for preeclampsia with severe features at < 34 weeks of gestation should be delivered if criteria outlined in Table 1 are not met.
- ▶ Patients with preeclampsia with severe features remote from term (< 34 weeks) should be managed at or transported to a center with experience and expertise in management of these patients and their potential complications.
- ▶ Blood pressure should be controlled to a level that is between **130-150 mm Hg systolic and 80-100 mm Hg diastolic**.

Corticosteroids may be considered in cases of HELLP syndrome for decreasing maternal morbidity.²⁶ Corticosteroids have been used in randomized controlled trials to attempt to improve maternal and fetal condition. In these studies, there was no evidence of benefit to improve overall maternal and fetal

outcome (although this has been suggested in observational studies). There is evidence in the randomized trials of improvement of platelet counts with corticosteroid treatment.²⁷ In clinical settings in which an improvement in platelet count is considered useful, corticosteroids may be justified. Quality of evidence: Low; Strength of recommendation: Qualified.^{14,27}

- ▶ Patients with moderate hypertension (150-159 mm Hg systolic and 100-109 mm Hg diastolic) with and without proteinuria should be monitored with a heightened level of supervision, including the frequency of blood pressure measurements, laboratory studies and symptom assessment. Antihypertensive therapy should be considered in the group of patients who have blood pressures that are > 155 mm Hg systolic and 105 mm Hg diastolic.¹¹ (See Section: Borderline Severe-Range Blood Pressures: A Clinical Conundrum on page 35)
- ▶ Patients with elevated blood pressure without proteinuria, but who manifest other diagnostic criteria for preeclampsia with severe features, should be treated as if they have severe disease.

**EVIDENCE GRADING:
LEVEL OF EVIDENCE: A**

References

1. ACOG. Gestational hypertension and preeclampsia: Practice Bulletin No. 222 of the American College of Obstetricians and Gynecologists. *Obstetrics and Gynecology* 135, 1492-1495, doi:10.1097/AOG.0000000000003892 (2020).
2. Gupta, L. M., Gaston, L. & Chauhan, S. P. Detection of fetal growth restriction with preterm severe preeclampsia: Experience at two tertiary centers. *American Journal of Perinatology* 25, 247-249, doi:10.1055/s-2008-1075034 (2008).
3. Hutcheon, J. A., Lisonkova, S. & Joseph, K. S. Epidemiology of pre-eclampsia and the other hypertensive disorders of pregnancy. *Best Practices in Research and Clinical Obstetrics and Gynaecology* 25, 391-403, doi:10.1016/j.bpobgyn.2011.01.006 (2011).
4. Sibai, B. M. Evaluation and management of severe preeclampsia before 34 weeks' gestation. *American Journal of Obstetrics and Gynecology* 205, 191-198, doi:10.1016/j.ajog.2011.07.017 (2011).
5. Catov, J. M., Ness, R. B., Kip, K. E. & Olsen, J. Risk of early or severe pre-eclampsia related to pre-existing conditions. *International Journal of Epidemiology* 36, 412-419, doi:10.1093/ije/dyl271 (2007).
6. Norwitz, E. R. & Funai, E. F. Expectant management of severe preeclampsia remote from term: Hope for the best, but expect the worst. *American Journal of Obstetrics and Gynecology* 199, 209-212, doi:10.1016/j.ajog.2008.06.084 (2008).

7. Sibai, B. M. Management of late preterm and early-term pregnancies complicated by mild gestational hypertension/pre-eclampsia. *Seminars in Perinatology* 35, 292-296, doi:10.1053/j.semperi.2011.05.010 (2011).
8. Haddad, B. et al. Maternal and perinatal outcomes during expectant management of 239 severe preeclamptic women between 24 and 33 weeks' gestation. *American Journal of Obstetrics and Gynecology* 190, 1590-1595; discussion 1595-1597, doi:10.1016/j.ajog.2004.03.050 (2004).
9. Balogun, O. A. & Sibai, B. M. Counseling, management, and outcome in women with severe preeclampsia at 23 to 28 weeks' gestation. *Clinics in Obstetrics and Gynecology* 60, 183-189, doi:10.1097/GRF.0000000000000250 (2017).
10. Bernstein, P. S. et al. National Partnership for Maternal Safety: Consensus bundle on severe hypertension during pregnancy and the postpartum period. *Obstetrics and Gynecology* 130, 347-357, doi:10.1097/AOG.0000000000002115 (2017).
11. Martin, J. N., Jr. et al. Stroke and severe preeclampsia and eclampsia: A paradigm shift focusing on systolic blood pressure. *Obstetrics and Gynecology* 105, 246-254, doi:10.1097/01.AOG.0000151116.84113.56 (2005).
12. Visintin, C. et al. Management of hypertensive disorders during pregnancy: summary of NICE guidance. *British Medical Journal* 341, c2207, doi:10.1136/bmj.c2207 (2010).
13. Chaillet, N. et al. Identifying barriers and facilitators towards implementing guidelines to reduce caesarean section rates in Quebec. *Bulletin of the World Health Organization* 85, 791-797, doi:10.2471/blt.06.039289 (2007).
14. ACOG. Hypertension in pregnancy. Report of the American College of Obstetricians and Gynecologists' Task Force on Hypertension in Pregnancy. *Obstetrics and Gynecology* 122, 1122-1131, doi:10.1097/01.AOG.0000437382.03963.88 (2013).
15. Morton, C. H. et al. National Partnership for Maternal Safety: Consensus bundle on support after a severe maternal event. *Journal of Obstetric, Gynecologic and Neonatal Nursing* 50, 88-101, DOI: <https://doi.org/10.1016/j.jogn.2020.09.160> (2021).
16. Weinstein, L. Syndrome of hemolysis, elevated liver enzymes, and low platelet count: A severe consequence of hypertension in pregnancy. *American Journal of Obstetrics and Gynecology* 142, 159-167, doi:10.1016/s0002-9378(16)32330-4 (1982).
17. Martin, J. N., Jr. et al. The spectrum of severe preeclampsia: Comparative analysis by HELLP (hemolysis, elevated liver enzyme levels, and low platelet count) syndrome classification. *American Journal of Obstetrics and Gynecology* 180, 1373-1384, doi:10.1016/s0002-9378(99)70022-0 (1999).
18. Sibai, B. M. Diagnosis, controversies, and management of the syndrome of hemolysis, elevated liver enzymes, and low platelet count. *Obstetrics and Gynecology* 103, 981-991, doi:10.1097/01.AOG.0000126245.35811.2a (2004).
19. Martin, J. N., Jr. et al. Standardized Mississippi Protocol treatment of 190 patients with HELLP syndrome: Slowing disease progression and preventing new major maternal morbidity. *Hypertension in Pregnancy* 31, 79-90, doi:10.3109/10641955.2010.525277 (2012).
20. Sibai, B. M. & Stella, C. L. Diagnosis and management of atypical preeclampsia-eclampsia. *American Journal of Obstetrics and Gynecology* 200, 481 e481-487, doi:10.1016/j.ajog.2008.07.048 (2009).
21. Sibai, B. M. et al. Maternal morbidity and mortality in 442 pregnancies with hemolysis, elevated liver enzymes, and low platelets (HELLP syndrome). *American Journal of Obstetrics and Gynecology* 169, 1000-1006, doi:10.1016/0002-9378(93)90043-i (1993).
22. National Institute for Health and Care Excellence (NICE). Hypertension in pregnancy: Diagnosis and management. <https://www.nice.org.uk/guidance/ng133/resources/hypertension-in-pregnancy-diagnosis-and-management-pdf-66141717671365> (2019).
23. Butalia, S. et al. Hypertension Canada's 2018 Guidelines for the Management of Hypertension in Pregnancy. *Canadian Journal of Cardiology* 34, 526-531, doi:10.1016/j.cjca.2018.02.021 (2018).
24. Barton, J. R., O'Brien J, M., Bergauer, N. K., Jacques, D. L. & Sibai, B. M. Mild gestational hypertension remote from term: Progression and outcome. *American Journal of Obstetrics and Gynecology* 184, 979-983, doi:10.1067/mob.2001.112905 (2001).
25. Airoidi, J. & Weinstein, L. Clinical significance of proteinuria in pregnancy. *Obstetrics and Gynecology Survey* 62, 117-124, doi:10.1097/01.ogx.0000253301.55009.ac (2007).
26. Martin, J. N., Jr. et al. HELLP syndrome and composite major maternal morbidity: Importance of Mississippi classification system. *Journal of Maternal, Fetal and Neonatal Medicine* 26, 1201-1206, doi:10.3109/14767058.2013.773308 (2013).
27. Roberts, D., Brown, J., Medley, N. & Dalziel, S. R. Antenatal corticosteroids for accelerating fetal lung maturation for women at risk of preterm birth. *Cochrane Database Systematic Reviews* 3, CD004454, doi:10.1002/14651858.CD004454.pub3 (2017).

Antihypertensive Agents in Preeclampsia

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Key Principles

1. Antihypertensive treatment is extremely important to prevent serious maternal morbidity.
2. Women with severe hypertension requiring antihypertensive medications need to be observed carefully for signs of pulmonary congestion such as agitation, low oxygen saturation, cough, or rales on lung exam suggesting pulmonary edema or heart failure.

Background

Early treatment of hypertension has consistently been found to reduce the incidence of hypertensive crisis and severe maternal morbidity.¹ In addition, data from multiple case studies revealed increased rates of heart failure, pulmonary edema, stroke, cerebrovascular hemorrhage, myocardial ischemia and death when antihypertensive medications were not used in women with severe gestational hypertension or preeclampsia with severe features.^{2,3} Antihypertensive treatment is extremely important for the prevention of these serious maternal sequelae. According to ACOG, a hypertensive emergency is an acute-onset, severe hypertension that is persistent for 15 minutes or more.⁴

Treatment should be initiated for BP values that are ≥ 160 mm Hg systolic or ≥ 110 mm Hg diastolic.⁴ The goal of BP control is not to return it to “normal” but rather to lower it no more than 15 to 25% of the initial mean arterial pressure (MAP) or a target blood pressure range of **140-150/90-100 mm Hg**. At this level, the risk of intracranial hemorrhage is reduced. A lower target of 130-150/80-100 mm Hg has been suggested by other international guidelines.⁵ (See Section: Borderline Severe-Range Blood

Pressures: A Clinical Conundrum on page 35) Reaching these targets will frequently require the initiation of maintenance oral antihypertensive therapy. Theoretically, lowering the BP below this range may reduce placental perfusion and/or produce abnormal fetal heart rates. **However, no significant changes have been noted in fetal heart rate with either labetalol, hydralazine, or nifedipine, when used for treatment of severe-range BP values.**⁶

Treatment of hypertension in the patient with chronic cocaine/ amphetamine abuse may cause an exaggerated decrease in blood pressure. Hypotension may be difficult to treat due to altered vasopressor response and depleted endogenous catecholamine stores. Unexpected, severe hypotension may also occur after regional anesthesia or general anesthesia. (See Section: Severe Hypertension and Hypotension in Women with Amphetamine or Cocaine Use on page 149)

Antihypertensive therapy is indicated for women with systolic BP ≥ 160 mm Hg or diastolic BP ≥ 110 mm Hg.* Increasingly, risk of stroke is thought to be correlated with maximum systolic BP.^{3,4,7,8}

*Clinicians may consider antihypertensive therapy at 155/105 mm Hg given the association with increased maternal morbidities at this threshold in several studies as discussed in Section: Borderline severe-range blood pressures on page 35.

First line therapy recommendations for acute treatment of critically elevated BP in pregnant women (≥ 160 or ≥ 110 mm Hg*) are either IV labetalol or hydralazine, or oral Nifedipine.⁴ (See Tables 1 and 2; Appendix E: Acute Treatment Algorithm on page 195; Appendix L: FAQs for Timely Treatment for Acute-Onset Severe Hypertension during Pregnancy and the Postpartum Period on page 223; Appendix M: Sample Order Set for Acute Control of Hypertensive Emergencies on page 226) If acute treatment is needed in a patient without IV access, immediate release nifedipine may be used (10 mg) and may be repeated in 20 minutes.⁹ Nifedipine appears equally as efficacious as IV labetalol in correcting severe BP elevations.¹⁰ Oral labetalol would be expected to be less effective in acutely lowering the BP due to the slower onset to peak therapeutic effect, and thus should be used only if nifedipine is not available in a patient without IV access.¹⁰ If the patient is tachycardic, the initial IV therapy should be labetalol and not hydralazine.

For patients whose BP cannot be controlled using the sequence of two agents, (i.e., IV labetalol then IV hydralazine or nifedipine PO then IV labetalol) consult with anesthesiologists or intensivists who are accustomed to the titration of vasoactive medications for patients with uncontrolled blood pressure. IV esmolol (beta blocker) and IV nicardipine (calcium channel blocker) are second line drugs. Many patients who are not controlled will be persistently tachycardic needing more direct beta-effect. Esmolol is a very short-acting beta-blocking agent and can cause the baseline fetal heart rate to decrease, but this often resolves rapidly when esmolol is stopped.

Sodium nitroprusside is a very potent vasodilator that acts immediately and is rarely used. It must be used by experienced providers accompanied by invasive (e.g., an arterial line) BP monitoring.

Placement of an arterial line may be helpful in women whose BP is particularly difficult to control or difficult to get cuff measure (i.e. bariatric patients). There may also be cases where repeated blood studies will be necessary, and where repeated venipunctures may be difficult.

Birth people with severe hypertension requiring antihypertensive medications need to be observed carefully for signs of pulmonary congestion such as agitation, low oxygen saturation, cough, or rales on lung exam suggesting pulmonary edema or heart failure. Careful monitoring of both cardiac and pulmonary status should be implemented. Proper lateral positioning should be employed for these patients, since aortocaval compression can exacerbate uteroplacental insufficiency due to preeclampsia itself.

Table 1. First line agents for acute-onset severe hypertension in pregnancy and postpartum

In the presence of sinus bradycardia or a history of asthma, hydralazine or nifedipine are preferred as initial agents. If maternal HR >110, labetalol is preferred.

Medication Agents	Labetalol IV ^A	Hydralazine IV ^{B,C}	Nifedipine (Immediate release)
Route	IV	IV	PO
Initial therapy	20 mg	5-10 mg	10 mg
Onset ^{E,F,G}	2-5 minutes	5-20 minutes	5-20 minutes
Peak ^{E,F,G}	5 minutes	15-30 minutes	30-60 minutes
Max dose ^D (Before switching agents)	140 mg	20 mg	50 mg
Mechanism of action	<ul style="list-style-type: none"> • Combined α and β-blocking agent • Arteriolar dilator • Decreases heart rate 	Arteriolar dilator	<ul style="list-style-type: none"> • Calcium channel blocker • Arterial smooth muscle dilator
Side effects	<ul style="list-style-type: none"> • Use with caution in patients with known asthma • Flushing, light headedness, palpitations and scalp tingling • Safe for use after cocaine and amphetamine use (including methamphetamine)^A 	<ul style="list-style-type: none"> • Tachycardia, headache^E • Upper abdominal pain (rare) • Flushing • Nausea^B 	<ul style="list-style-type: none"> • Reflex tachycardia • Headache • Flushing • Nausea • Vomiting

A: (Richards, Hollander et al. 2017) B: (Raheem, Saaid et al. 2012) C: (Duley, Meher et al. 2013) D: (ACOG 222 2020) E: (Cohan and Checcio 1985) F: (Cheng, Cheng-Lai et al. 2005) G: (Raheem, Saaid et al. 2012)

Improving Health Care Response to Hypertensive Disorders of Pregnancy, a CMQCC Quality Improvement Toolkit, 2021.

Note regarding medication kit

Oral labetalol is not recommended for acute hypertensive emergencies and thus should be used only if nifedipine is not available in a patient without IV access.³ Appropriate dosing: PO, initial therapy 100 mg BID, onset 20 minutes – 2 hours, peak 1-4 hours.

Table 2. Sample medication kit: Acute-onset, severe hypertension

Each institution should prepare medication kits specific to local protocols	
Medication	Dosage
Labetalol IV 100 mg/20 mL vial	Initial: 20 mg (4 mL) IV bolus followed by 40 mg (8 mL) IV if not effective within 10 minutes; followed by 80 mg (16 mL) IV if not effective within 10 minutes
Hydralazine IV 20 mg/mL vial	Initial: 5-10 mg (0.25-0.5 mL) IV bolus followed by 10 mg (0.5 mL) IV if not effective within 20 minutes
Nifedipine 10 mg immediate release tablets	10 mg PO , followed by 20 mg PO if not effective within 20 minutes; followed by another 20 mg PO if not effective within 20 minutes
Magnesium 20 g/500 mL bag	Initial (Loading Dose): 4-6 gm (100 mL–150 mL) IV over 20 minutes (BMI > 35 requires a 6 gram loading dose and 2 gm per hour maintenance) Maintenance Dose: 1-2 g/hr (25 mL/hr–50 mL/hr) continuous IV infusion
	<i>See Appendix E: Acute Treatment Algorithm on page 195 for further detail</i>
Esmolol 100 mg/10 mL vial (Anesthesiologists or intensivists ONLY)	1-2 mg/kg (0.1-0.2 mL/kg) IV over 1 minute
Propofol 10 mg/mL, 20 mL vial (Anesthesiologists or intensivists ONLY)	30-40 mg (3-4 mL) IV bolus
Calcium Gluconate 1000 mg/10 mL vial	1000 mg/10 mL IV over 2-5 minutes

Adapted and used with written permission from Lucile Packard Children’s Hospital, Stanford, Gillian Abir, MBChB, and Shabnam Gaskari, PharmD, BCPPS, 2020

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EVIDENCE GRADING
LEVEL OF EVIDENCE: B

References

1. Shields, L. E., Wiesner, S., Klein, C., Pelletreau, B. & Hedriana, H. L. Early standardized treatment of critical blood pressure elevations is associated with a reduction in eclampsia and severe maternal morbidity. *American Journal of Obstetrics and Gynecology* 216, e1-5, doi:10.1016/j.ajog.2017.01.008 (2017).
2. Magee, L. A. et al. How to manage hypertension in pregnancy effectively. *British Journal of Clinical Pharmacology* 72, 394-401, doi:10.1111/j.1365-2125.2011.04002. (2011).
3. Judy, A. E. et al. Systolic hypertension, preeclampsia-related mortality, and stroke in California. *Obstetrics and Gynecology* 133, 1151-1159, doi:10.1097/AOG.0000000000003290 (2019).
4. ACOG. Gestational hypertension and preeclampsia: Practice Bulletin No. 222 of the American College of Obstetricians and Gynecologists. *Obstetrics and Gynecology* 135, 1492-1495, doi:10.1097/AOG.0000000000003892 (2020).
5. World Health Organization. WHO recommendations for prevention and treatment of pre-eclampsia and eclampsia. https://www.who.int/reproductivehealth/publications/maternal_perinatal_health/9789241548335/en/ (2011).
6. Duley, L., Meher, S. & Jones, L. Drugs for treatment of very high blood pressure during pregnancy. *Cochrane Database Systematic Reviews*, CD001449, doi:10.1002/14651858.CD001449.pub3 (2013).
7. Richards, J. R. et al. Beta-blockers, cocaine, and the unopposed alpha-stimulation phenomenon. *Journal of Cardiovascular Pharmacology Therapy* 22, 239-249, doi:10.1177/1074248416681644 (2017).
8. Chestnut, D., Polley, L., Tsen, L. & Wong, C. *Chestnut's obstetric anesthesia: Principles and practice*. 6th ed., (2020).
9. Raheem, I. A., Saaid, R., Omar, S. Z. & Tan, P. C. Oral nifedipine versus intravenous labetalol for acute blood pressure control in hypertensive emergencies of pregnancy: A randomised trial. *British Journal of Obstetrics and Gynaecology* 119, 78-85, doi:10.1111/j.1471-0528.2011.03151. (2012).
10. Tuffnell, D. J. et al. Outcomes of severe pre-eclampsia/eclampsia in Yorkshire 1999/2003. *British Journal of Obstetrics and Gynaecology* 112, 875-880, doi:10.1111/j.1471-0528.2005.00565.x (2005).

Preventing and Managing Eclamptic Seizures

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Key Principles

1. Controversy surrounds the use of magnesium in the setting of preeclampsia without severe features.
2. The editors of this Toolkit would like to emphasize that use of magnesium sulfate should be considered in cases without severe features, if the degree of blood pressure (BP) elevation approaches severe-range levels, or there are rapid changes in the patient's clinical picture.
3. The American College of Obstetrics and Gynecology (ACOG) supports the use of magnesium sulfate in preeclampsia with severe features, severe gestational hypertension, eclampsia, and chronic hypertension with acute elevation of BP ≥ 160 mm Hg systolic or ≥ 110 mm Hg diastolic.
4. Magnesium sulfate is a high-alert medication and nurse staffing guidelines should be followed.

Background

Magnesium sulfate is the primary medication used in the prevention and management of eclamptic seizures and exerts its effect by depressing the central nervous system.¹ In the setting of preeclampsia with severe features, magnesium sulfate has been shown to significantly reduce the rate of eclampsia compared to placebo, phenytoin, nimodipine, or diazepam. In the setting of eclampsia, magnesium sulfate has been demonstrated to be superior to diazepam, phenytoin, or lytic cocktails in reducing the risk of recurrent seizures as well as reducing the risk of maternal death.²⁻⁶ There is an increased risk of neonatal respiratory depression.⁷

However, controversy surrounds the use of sulfate in the setting of preeclampsia without severe features with some studies finding no difference and others alluding to a potential benefit.⁸⁻¹⁰ The Magpie Trial demonstrated the numbers of women who needed to be treated in order to prevent one seizure was 63 in subjects with preeclampsia with severe features and 109 in those with preeclampsia without severe features.² A similar rate of eclampsia (1.1%) was observed when magnesium sulfate was not used in women with less severe disease.¹¹ It should be noted that progression to preeclampsia with severe features can occur during labor or postpartum. Magnesium sulfate may need to be added to the plan of care if the patient's status changes.

Guidelines for magnesium sulfate therapy

The 2020 ACOG Practice Bulletin No. 222, “Gestational Hypertension and Preeclampsia” states that there is no consensus for the prophylactic use of magnesium sulfate to prevent seizures in women having gestational hypertension or preeclampsia without severe features.¹²

Two randomized trials compared outcomes of women with preeclampsia without severe features who were administered placebo or magnesium sulfate. There were no reported cases of eclampsia in the placebo group, and no significant differences in the proportion who developed preeclampsia with severe features. These two trials had small sample sizes and results may not be appropriate for use for clinical guidance. The limitation of seizure prophylaxis should be at the discretion of the clinical care team.

Additionally, the International Society for the Study of Hypertension in Pregnancy (ISSHP) recommends consideration of magnesium sulfate therapy in patients without severe features in low- and middle-income resource settings.¹³ There is higher maternal mortality from eclampsia in low or middle income countries (up to 15%) as compared to high-resource countries, (approximately 1%).¹⁶ ACOG recommendations regarding the use of magnesium sulfate **does not preclude its use in patients without severe features**. Both SOGC and WHO provide statements that support the use of magnesium sulfate in the setting of preeclampsia without severe features.^{14,15}

Currently, the use of magnesium sulfate in preeclampsia with severe features, severe gestational hypertension, eclampsia, and chronic hypertension with acute elevation of BP ≥ 160 mm Hg systolic or ≥ 110 mm Hg

diastolic is supported by the American College of Obstetricians and Gynecologists (ACOG),¹² World Health Organization (WHO),¹⁵ Hypertension Canada/Society of Obstetricians and Gynaecologists of Canada (SOGC),¹⁴ and the National Institute for Health and Clinical Excellence (NICE).^{17,18}

Magnesium sulfate is listed by the Institute of Safe Medication Practices (ISMP) as a high-alert medication.¹⁹ Magnesium sulfate was identified as the second most common source of medication errors in labor, delivery, recovery and postpartum units.¹⁹ As a safe medication practice, The Joint Commission recommends that magnesium sulfate be written out and not abbreviated as MgSO₄, as this designation can be misinterpreted as MS or MSO₄, which are abbreviations for morphine sulfate.²⁰

Magnesium sulfate and nursing care implications

The Task Force proposes that these nurse staffing ratios be considered in the setting of magnesium sulfate.

High-risk antepartum care: A woman who is receiving IV magnesium sulfate should have one nurse in continuous bedside attendance for the first hour of administration. Women receiving IV magnesium sulfate who are not in labor require a minimum of one nurse to every two women.

Labor and Delivery: A woman with medical or obstetric complications who is receiving magnesium sulfate in labor should have one nurse in continuous bedside assistance for the first hour of administration, and one nurse to one woman thereafter.

Mother-Baby Care: Nurses caring for women receiving magnesium sulfate during the postpartum period should not have more than one other mother-baby couplet.

Readiness Checklist for Nursing Leaders

- Label magnesium sulfate as a high-alert medication.
- Administer loading dose from a bolus bag and not from the maintenance solution.
- Clearly label IV solutions, tubing and connections.
- Use luer-lock connectors at all points.
- Require independent verification by two nurses of magnesium sulfate IV pump infusion settings for initial infusion, rate changes, or assumption of care.
- Standardize the ordering, storage, preparation, and administration of magnesium sulfate.
- Improve access to information concerning indications, risks and benefits, and treatment of toxicity.

The following Tables 1 and 2 outline the steps that should be taken to prepare, store, obtain order and administer magnesium sulfate according to protocol. They also indicate nursing interventions for specific side effects or toxicity with the use of magnesium sulfate.

Table 1: Steps for preparation, storage, ordering and administration of magnesium sulfate

Step	Action
Step 1: Preparation	<ul style="list-style-type: none"> a. Purchase commercially prepared standard concentrations of magnesium sulfate. b. Use standard premixed magnesium sulfate infusions in a volume different than oxytocin to prevent accidental toxicity. c. Pharmacy should prepare non-commercially prepared solutions. d. Use a piggy-back bag for magnesium sulfate loading doses and do not use the main infusion bag.
Step 2: Storage	<ul style="list-style-type: none"> a. Label dose bags of magnesium sulfate with a “high-alert” sticker or distinctive colored label. b. Loading dose bags should be stored in a separate pharmacy area to prevent inadvertent medication errors.
Step 3: Order/ Transcribe	<ul style="list-style-type: none"> a. When prescribing magnesium sulfate, use preprinted orders and order sets, with the words “magnesium sulfate” spelled out. b. Utilize a “high-alert” warning on the automated dispensing machine (ADM) when magnesium sulfate is withdrawn.

Continued on next page...

Step	Action
Step 4: Administration	<p>a. Label tubing used for infusing magnesium sulfate appropriately.</p> <p>b. An infusion pump should always be used. A 'smart' infusion pump with patient safety software activated should be used when available.</p> <p>Note: An independent double check should be performed by two nurses when magnesium sulfate is initiated, rate is changed, and at change of shift.</p> <p>Calcium gluconate should be readily available as a reversal agent in the event of magnesium toxicity.</p>
Step 5: Discontinuation	<p>a. Disconnect tubing from main line immediately when magnesium sulfate is discontinued.</p>

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

Table 2: Protocol for administering magnesium sulfate

A. Magnesium sulfate loading and maintenance dosage			
Hypertensive disorder of pregnancy	Loading (gm)	Infusion Rate (min)	Maintenance
Preeclampsia and eclampsia	4-6*	20-30	Infuse at 1-2 grams per hour via infusion pump
Recurrent eclampsia	2-4	5	
*If BMI > 35, loading dose should be 6 grams ^{21,22}			

B. Nursing interventions for magnesium sulfate side effects and toxicity	
Magnesium sulfate side effects and toxicity	Nursing intervention
Cutaneous flushing, sweating, malaise, weakness, drowsiness	Keep room and patient cool (provide fan), educate patient about potential side effects; monitor patient movement and assist with getting out of bed

Continued on next page...

Magnesium sulfate side effects and toxicity	Nursing intervention
Transient decreased amplitude and frequency of contractions at the time of loading dose	Monitor fetal heart rate and uterine activity continuously
Soreness at IV site	Apply warm soaks or ice to site, as needed
Decreased rate and depth of respiration, shortness of breath	Discontinue treatment if shortness of breath is not relieved with oxygen
Diuresis	Strictly monitor and document input & output per orders; magnesium sulfate is excreted exclusively in urine and an output of <30 ml/hr may lead to magnesium toxicity
Disappearance of deep tendon reflexes	Notify physician if absent or significant change in baseline assessment
Heart block (decreased PR interval, increased QRS), chest pain	Avoid use of magnesium sulfate in patients with cardiac conduction abnormalities
Pulmonary edema	Strict input and output monitoring, and fluid restrict as ordered (usually 60-125 ml/hour)

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

Other considerations regarding magnesium sulfate therapy

Magnesium sulfate can be given intramuscularly (IM) if IV access cannot be established. The recommended dosage is 10 gm (5 gm IM in each buttock) followed by 5 g every 4 hours. It can be mixed with 1 mL of xylocaine 2% solution to decrease discomfort during administration. Intramuscular administration is associated with an increased rate of adverse effects such as respiratory depression and cardiac arrest due to its action as a smooth muscle relaxant.^{2,12,23} If magnesium sulfate is unavailable, alternative anti-seizure medications such as a benzodiazepine (e.g., midazolam, lorazepam, or diazepam) or phenytoin should be used in the setting of eclampsia. Consultation with neurology is recommended to discuss continued

medical prophylaxis for seizures if magnesium sulfate is unavailable. If a patient has preeclampsia without severe features and there is no magnesium sulfate available, close observation is recommended.

Magnesium sulfate treatment

Magnesium sulfate dosage: Loading dose of 4-6 gm over 15-20 minutes. If BMI > 35, loading dose should be 6 grams.^{21,22}

- ▶ After the initial loading dose, administer a maintenance dose of 1-2 gm/hour. Magnesium sulfate is cleared by renal excretion and lower maintenance doses will be needed in patients with impaired renal function. The loading dose, however, should not change as toxicity is related to maintenance therapy. At the time of initiation

of magnesium sulfate therapy, if not already done, a serum creatinine should be obtained to assess renal function.

- ▶ Signs of magnesium toxicity: discontinue magnesium sulfate infusion and obtain a stat serum magnesium level in the following situations: hypotension, new-onset loss of DTRs, respiratory depression, respiratory arrest, oliguria, shortness of breath, chest pains, and electrocardiographic changes.^{1,24}
 - ▶ Magnesium levels: A specific therapeutic level is not known; however, serum magnesium levels may need to be monitored in certain circumstances (e.g., renal insufficiency, absent deep tendon reflexes). In such cases, magnesium levels between 4.8-8.4 mg/dL (4-7 mEq/L) are recommended.¹² Symptoms of magnesium sulfate toxicity are seen with the following maternal serum concentrations: loss of deep tendon reflexes (9.6-12 mg/dL) (> 7 mEq/L), respiratory depression (12-18 mg/dL) (> 10 mEq/L), and cardiac arrest (24-30 mg/dL) (> 25mEq/L).
 - ▶ Calcium gluconate: the antidote for magnesium toxicity is calcium gluconate 1 gm IV over 3 minutes. Repeat doses may be necessary. Calcium chloride can also be used in lieu of calcium gluconate. The suggested dose for calcium chloride for magnesium toxicity is 500 mg of 10% calcium chloride IV given over 5-10 minutes. Calcium gluconate or chloride should be readily available on all obstetric units.
 - ▶ In the setting of gestational or chronic hypertension with severe-range BP values, preeclampsia with severe features, and eclampsia, magnesium sulfate should be administered upon diagnosis, continued during labor **and intraoperatively** until 24 hours after delivery.^{12,25}
 - If the patient's preeclampsia symptoms do not improve, clinical judgment is advised
- to consider whether magnesium sulfate administration may need to be provided for an extended period of time.
- If the patient is stabilized, remote from term, and being expectantly managed, we advise continuing magnesium sulfate during the course of administering corticosteroids for fetal lung maturity for at least 24 hours. Magnesium sulfate should be resumed if there are escalating signs of worsening preeclampsia, eclampsia, or when plans are made to proceed with delivery.
- ▶ The ACOG Practice Bulletin #222 states that there is no consensus regarding the prophylactic use of magnesium sulfate in women with gestational hypertension or preeclampsia without severe features.¹² The clinical decision of whether to use magnesium sulfate for seizure prophylaxis in patients with preeclampsia without severe features should be determined by the physician or institutional policy, considering patient status, rapidity of clinical changes, and after a risk/benefit discussion with the patient.
 - ▶ In cases of severe gestational hypertension, magnesium sulfate is indicated.
 - ▶ If an eclamptic seizure occurs postpartum, and the patient is not being treated with magnesium sulfate, it should be administered for at least 24 hours after the last seizure. If a patient has recurrent seizures despite already being on magnesium sulfate, the first therapy we recommend is an additional loading dose of magnesium sulfate 2g IV over 5 minutes. If the patient continues to have seizures despite a repeat loading dose of magnesium sulfate, alternative anti-convulsant medications should be considered and anesthesia should be notified, and ideally present for, potential airway management. (See Table 3 on page 132)

Table 3. Management of eclamptic seizures

Seizure status	Nursing actions
Seizure occurs; no magnesium sulfate infusing	<p>Magnesium sulfate 4-6* grams IV loading dose over 20-30 minutes; followed by a 1-2 gram/hour maintenance dose if renal function is normal</p> <p>*BMI > 35 requires a 6 gram loading dose and 2 grams per hour maintenance dose</p> <p>If postpartum and magnesium sulfate discontinued, readminister treatment with magnesium sulfate for at least 24 hours after last seizure</p>
Recurrent seizures; magnesium sulfate infusing	Administer additional loading dose of magnesium sulfate 2-4 gm IV over 5 minutes ¹¹
Recurrent seizure after 2 nd loading dose of magnesium sulfate	<p>Consider alternative anti-convulsant medications</p> <p>Notify anesthesia</p> <p>Notify neurology and consider head imaging</p>

Improving Health Care Response to Hypertensive Disorders of Pregnancy, a CMQCC Quality Improvement Toolkit, 2021.



In cases refractory to magnesium sulfate (still seizing at 20 minutes after the bolus or more than two recurrences), suggested seizure treatment includes:²⁶

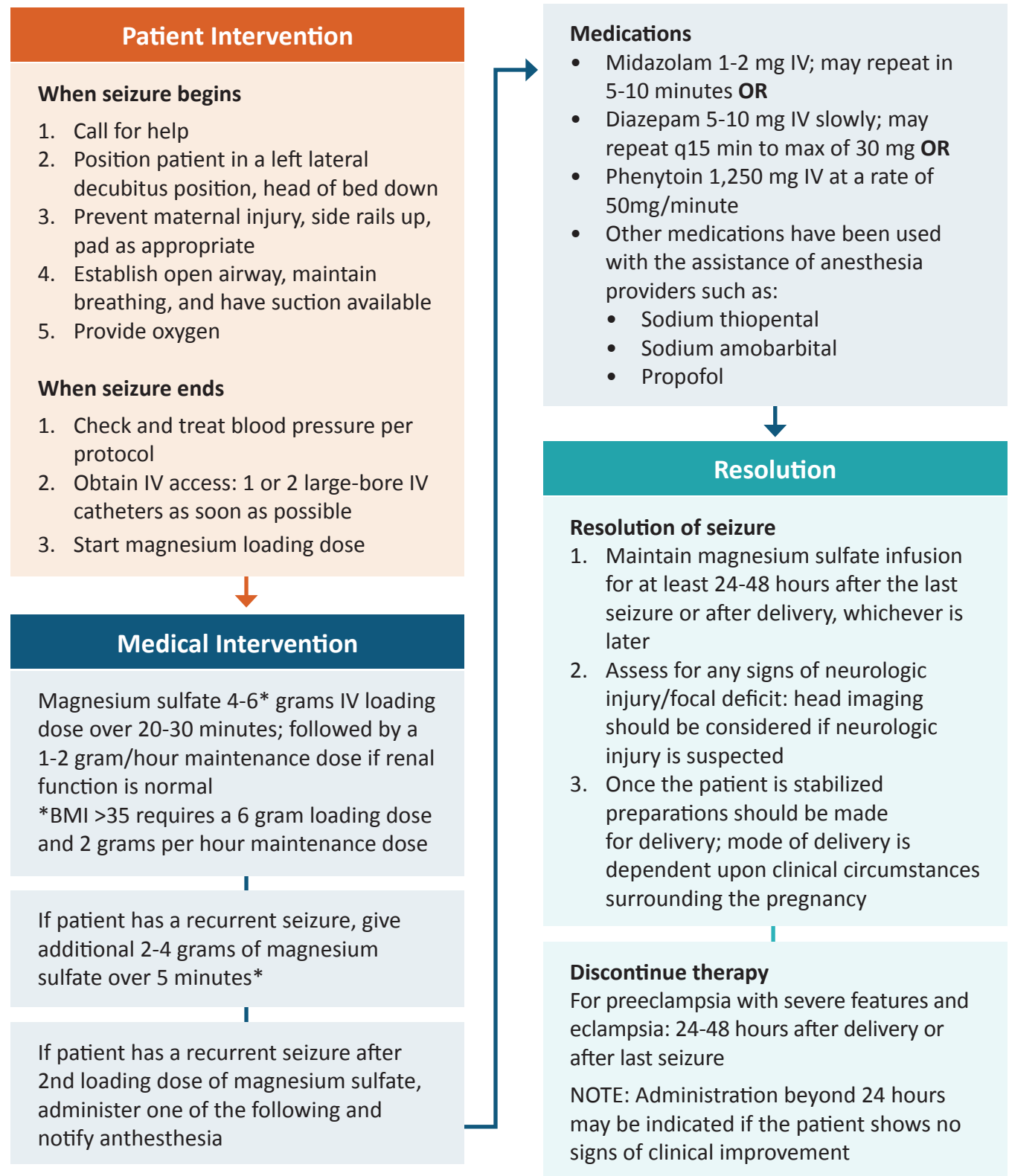
- ▶ Midazolam: 1-2 mg IV (may repeat in 5-10 minutes) **OR**
- ▶ Diazepam: 5-10 mg IV slowly (may repeat every 15 minutes for a maximum total of 30 mg) **OR**
- ▶ Phenytoin: 1,250 mg IV at a rate of 50 mg/minute¹¹
- ▶ Other medications have been used with the assistance of anesthesia providers such as:
 - Sodium thiopental¹¹
 - Sodium amobarbital^{11,26}
 - Propofol

Appendix O: Eclampsia Algorithm on page 232 clearly summarizes and outlines this management in a flow chart format that can be utilized for reference by staff when caring for patients. See Appendix P: Sample Management of Eclampsia

and Acute-Onset, Severe Hypertension on page 233 as an example of one unit's approach.

- ▶ Consider the possibility of other central nervous system pathology with recurrent or persistent seizures, perform neuroimaging and consult neurology.
- ▶ Consider metabolic disorders and substance abuse in your differential diagnosis.
- ▶ Renal insufficiency: Magnesium sulfate should be used with caution in women with renal insufficiency/failure (i.e., serum creatinine greater than 1.1 mg/dL). Most pregnant women have a serum creatinine of < 0.8 mg/dL and a creatinine of 1.2 suggests a 50% reduction in renal function. In these patients, if they are naive to magnesium therapy, a loading dose can be administered. A lower maintenance dose can be considered with serial serum magnesium levels to guide therapy (e.g., 1 gm per hour).
- ▶ Myasthenia Gravis: Magnesium sulfate is contraindicated in patients with myasthenia gravis.

Eclampsia Algorithm



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

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

EVIDENCE GRADING
LEVEL OF EVIDENCE: A

References

1. Drugs.com. Magnesium sulfate, <https://www.drugs.com/pro/magnesium-sulfate.html> (2020).
2. Altman, D. et al. Do women with pre-eclampsia, and their babies, benefit from magnesium sulphate? The Magpie Trial: A randomised placebo-controlled trial. *Lancet* 359, 1877-1890, doi:10.1016/s0140-6736(02)08778-0 (2002).
3. Duley, L., Gulmezoglu, A. M. & Chou, D. Magnesium sulphate versus lytic cocktail for eclampsia. *Cochrane Database Systematic Reviews*, CD002960, doi:10.1002/14651858.CD002960.pub2 (2010).
4. Duley, L. & Henderson-Smith, D. Magnesium sulphate versus phenytoin for eclampsia. *Cochrane Database Systematic Reviews*, CD000128, doi:10.1002/14651858.CD000128 (2003).
5. Duley, L., Matar, H. E., Almerie, M. Q. & Hall, D. R. Alternative magnesium sulphate regimens for women with pre-eclampsia and eclampsia. *Cochrane Database Systematic Reviews*, CD007388, doi:10.1002/14651858.CD007388.pub2 (2010).
6. Coetzee, E. J., Dommissie, J. & Anthony, J. A randomised controlled trial of intravenous magnesium sulphate versus placebo in the management of women with severe pre-eclampsia. *British Journal of Obstetrics and Gynaecology* 105, 300-303, doi:10.1111/j.1471-0528.1998.tb10090.x (1998).
7. Greenberg, M. B. et al. Effect of magnesium sulfate exposure on term neonates. *Journal of Perinatology* 33, 188-193, doi:10.1038/jp.2012.95 (2013).
8. Ehrenberg, H. M. & Mercer, B. M. Abbreviated postpartum magnesium sulfate therapy for women with mild preeclampsia: A randomized controlled trial. *Obstetrics and Gynecology* 108, 833-838, doi:10.1097/01.AOG.0000236493.35347.d8 (2006).
9. Livingston, J. C., Livingston, L. W., Ramsey, R., Mabie, B. C. & Sibai, B. M. Magnesium sulfate in women with mild preeclampsia: A randomized controlled trial. *Obstetrics and Gynecology* 101, 217-220, doi:10.1016/s0029-7844(02)03053-3 (2003).
10. Shields, L. E., Wiesner, S., Klein, C., Pelletreau, B. & Hedriana, H. L. Early standardized treatment of critical blood pressure elevations is associated with a reduction in eclampsia and severe maternal morbidity. *American Journal of Obstetrics and Gynecology* 216, e1-5, doi:10.1016/j.ajog.2017.01.008 (2017).
11. Alexander, J. M., McIntire, D. D., Leveno, K. J. & Cunningham, F. G. Selective magnesium sulfate prophylaxis for the prevention of eclampsia in women with gestational hypertension *Obstetrics and Gynecology* 108, 826-832, doi:10.1097/01.AOG.0000235721.88349.80 (2006).
12. ACOG. Gestational hypertension and preeclampsia: Practice Bulletin No. 222 of the American College of Obstetricians and Gynecologists. *Obstetrics and Gynecology* 135, 1492-1495, doi:10.1097/AOG.0000000000003892 (2020).
13. von Dadelszen, P. et al. Prediction of adverse maternal outcomes in pre-eclampsia: Development and validation of the fullPIERS model. *Lancet* 377, 219-227, doi:10.1016/S0140-6736(10)61351-7 (2011).
14. Butalia, S. et al. Hypertension Canada's 2018 Guidelines for the Management of Hypertension in Pregnancy. *Canadian Journal of Cardiology* 34, 526-531, doi:10.1016/j.cjca.2018.02.021 (2018).
15. World Health Organization. WHO recommendations for prevention and treatment of pre-eclampsia and eclampsia. https://www.who.int/reproductivehealth/publications/maternal_perinatal_health/9789241548335/en/ (2011).
16. Ghulmiyyah, L. & Sibai, B. Maternal mortality from preeclampsia/eclampsia. *Seminars in Perinatology* 36, 56-59, doi:10.1053/j.semperi.2011.09.011 (2012).
17. National Institute for Health and Care Excellence (NICE). Hypertension in pregnancy: Diagnosis and management. <https://www.nice.org.uk/guidance/ng133/resources/hypertension-in-pregnancy-diagnosis-and-management-pdf-66141717671365> (2019).
18. Visintin, C. et al. Management of hypertensive disorders during pregnancy: Summary of NICE guidance. *British Medical Journal* 341, c2207, doi:10.1136/bmj.c2207 (2010).
19. Institute for Safe Medication Practices. Failure to set a volume limit for a magnesium bolus dose leads to harm, <https://www.ismp.org/resources/failure-set-volume-limit-magnesium-bolus-dose-leads-harm> (2010).
20. The Joint Commission. Official "Do Not Use" List. https://www.jointcommission.org/-/media/tjc/documents/resources/patient-safety-topics/do_not_use_list_6_28_19.pdf (2019).
21. Brookfield, K. F., Elkomy, M., Su, F., Drover, D. R. & Carvalho, B. Optimization of maternal magnesium sulfate administration for fetal neuroprotection: Application of a prospectively constructed pharmacokinetic model to the BEAM cohort. *Journal of Clinical Pharmacology* 57, 1419-1424, doi:10.1002/jcph.941 (2017).

22. Dayicioglu, V., Sahinoglu, Z., Kol, E. & Kucukbas, M. The use of standard dose of magnesium sulphate in prophylaxis of eclamptic seizures: Do body mass index alterations have any effect on success? *Hypertension in Pregnancy* 22, 257-265, doi:10.1081/PRG-120024029 (2003).
23. Easterling, T. et al. Oral antihypertensive regimens (nifedipine retard, labetalol, and methyldopa) for management of severe hypertension in pregnancy: An open-label, randomised controlled trial. *Lancet* 394, 1011-1021, doi:10.1016/S0140-6736(19)31282-6 (2019).
24. Simpson, K. & Crehan, P. *Perinatal nursing*, 4th edition. Wolters/Kluwer/Lippincott Williams & Wilkins. (2014).
25. ACOG. Hypertension in pregnancy. Report of the American College of Obstetricians and Gynecologists' Task Force on Hypertension in Pregnancy. *Obstetrics and Gynecology* 122, 1122-1131, doi:10.1097/01.AOG.0000437382.03963.88 (2013).
26. Harsono, A. A. H., Achmadi, A., Aldika Akbar, M. I. & Joewono, H. T. Recurrent seizures in 2 patients with magnesium sulfate-treated eclampsia at a secondary hospital. *American Journal of Case Reports* 19, 1129-1134, doi:10.12659/AJCR.911004 (2018).

Neurologic Complications of Hypertension: Posterior Reversible Encephalopathy Syndrome (PRES) and Stroke

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Key Principles

1. The preeclamptic patient with neurologic findings and/or symptoms (headache and visual changes) should be considered to have severe features and delivery is indicated.
2. All patients with persistent neurological symptoms associated with hypertensive disorders of pregnancy (HDP) need to be evaluated for stroke or posterior reversible encephalopathy syndrome (PRES), and if present, should be considered an emergency, similar to any adult stroke code.
3. In these complex clinical cases, a multidisciplinary team of emergency medicine, obstetrics, anesthesia, and neurology and/or critical care is necessary and consultation with a neurologist and neuroradiologic imaging should be implemented for a pregnant/postpartum patient with a hypertensive disorder and non-transient focal symptoms to exclude other intracranial pathology.
4. MRI is considered the most appropriate tool as an adjunct in the clinical setting to diagnose PRES; however, do not delay treatment to perform neuroradiologic imaging.
5. Initiate established treatment algorithms for preeclampsia with severe features and eclampsia to control blood pressure (BP), decrease the risk for seizures and reduce possible sequelae of PRES.
6. Institutional stroke assessment tools should be incorporated into unit education and drills in order to facilitate early intervention to prevent maternal morbidity from stroke.

Recognizing neurologic complications

Neurologic symptoms commonly precede eclampsia. Headache and visual disturbance are the most common prodromal symptoms. These neurologic symptoms reflect the development of cerebral edema and vasospasm of cerebral and retinal vessels. Premonitory symptoms may provide an early warning of imminent eclampsia. Other common warning symptoms include nausea, vomiting, or epigastric/abdominal pain and need to be taken seriously.

Diagnosing neurologic complications

Magnetic Resonance Imaging (MRI) is considered the most appropriate tool as an adjunct in the clinical setting to demonstrating the characteristic brain lesions and diagnosing PRES. MRI imaging is superior to computerized tomography (CT) imaging in patients with PRES or eclamptic encephalopathy, however if urgent imaging is required, and MRI is not available, CT imaging should be utilized. The hallmark feature is bilateral or unilateral symmetrical vasogenic edema in the territories of the posterior cerebral circulation white matter (occipital and posterior parietal lobes). While bilateral lesions are the hallmark, unilateral or asymmetrical findings are also seen. The posterior cerebral white matter edema is most evident on T2-weighted MRI images with fluid-attenuated inversion recovery (FLAIR).¹ The predominance of occipital lesions corresponds well to the neurologic manifestation of temporary cortical blindness. Neuroradiologic imaging should be strongly considered in the postpartum period with a patient who presents with headache, hypertension, seizures, or atypical neurologic symptoms such as visual changes/blindness, in order to rule out other differential diagnoses such as a mass lesion or cerebral venous thrombosis.

Posterior reversible encephalopathy syndrome (PRES)

Posterior reversible encephalopathy syndrome (PRES) is a transient clinical neuroradiological entity characterized by clinical signs and symptoms including hypertension, generalized seizure activity, altered mental status, headache, and vision changes with characteristic findings on computed tomography (CT) or magnetic

resonance imaging (MRI) of the brain.² Many causes of PRES have been reported in the literature including hypertensive encephalopathy, preeclampsia, eclampsia, renal failure, immunosuppressants, thrombotic thrombocytopenic purpura, systemic lupus erythematosus (SLE), and acute intermittent porphyria.³ The nomenclature for this syndrome has undergone several changes, with one radiologic journal describing this entity as eclamptic encephalopathy.⁴ Preeclampsia and eclampsia are probably the most common causes of PRES. The true incidence of PRES complicating preeclampsia and eclampsia is unknown because neuroradiographic imaging is not routinely performed.

PRES pathophysiology

Posterior reversible encephalopathy syndrome has been attributed to failure of cerebral auto-regulation and endothelial dysfunction. This impairment of cerebral auto-regulation leads to disruption of the blood-brain barrier in the posterior circulation with resultant extravasation of fluids and protein across the altered blood-brain barrier.⁵ This process causes the characteristic lesions seen in the occipital and posterior parietal lobes on neuroradiologic imaging (Photos A-D). These radiographic cerebral abnormalities appear as intense signals on T2-weighted MRI scans and as low-density areas on CT scans.

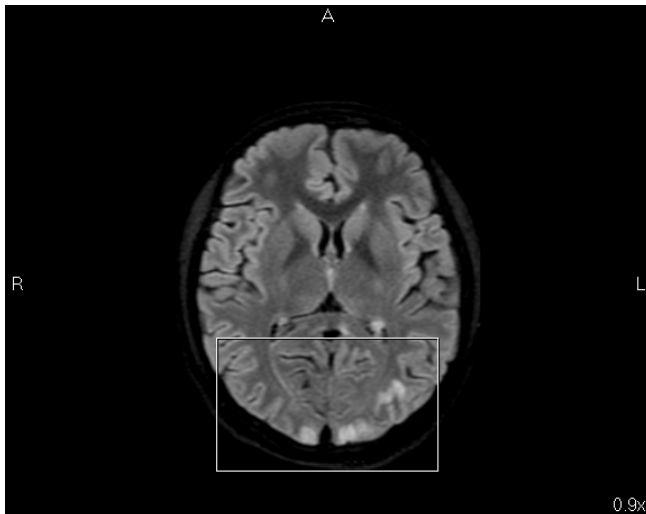


Photo A.

Fluid-attenuated inversion recovery (FLAIR) sequences show edema (bright white) in the occipital region.

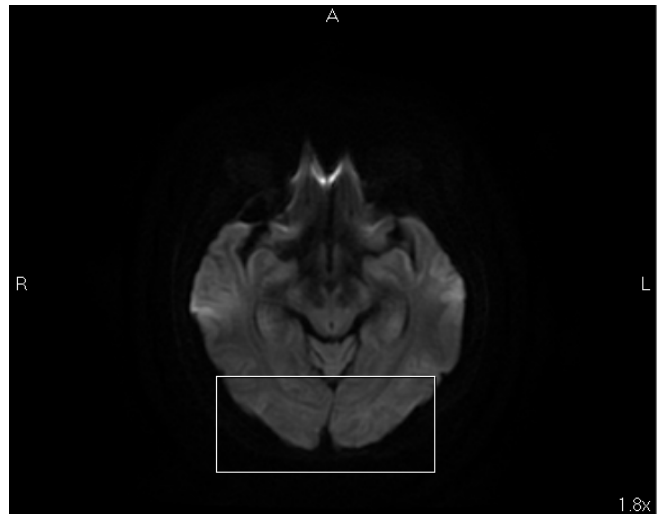


Photo C.

The same area on diffusion weighted images are normal. This rules out infarction.

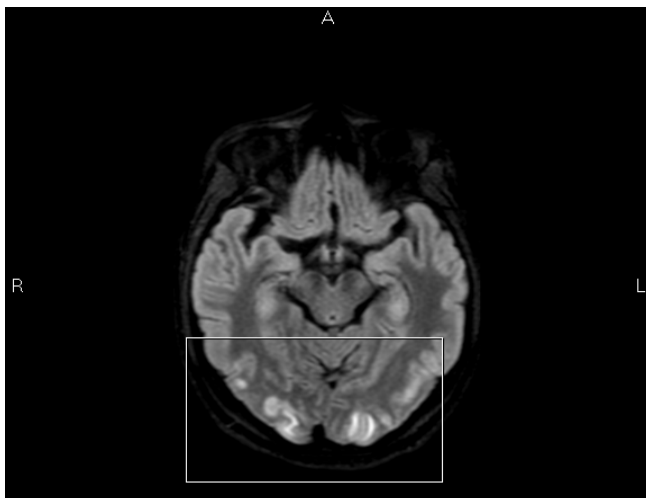


Photo B.

Fluid-attenuated inversion recovery (FLAIR) sequences show edema (bright white) in the occipital region.

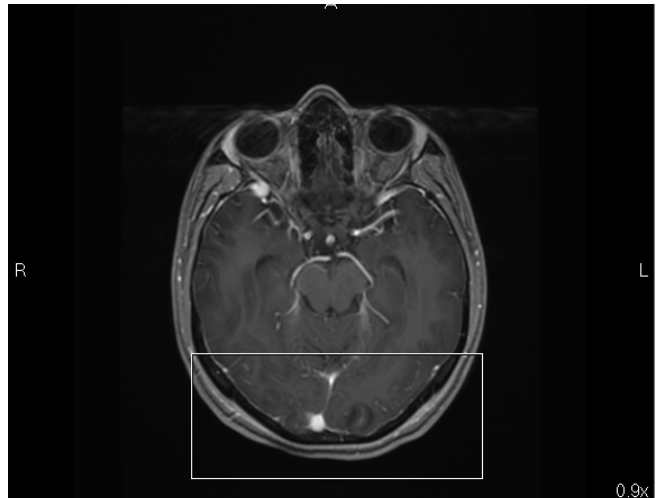


Photo D.

T1 diffusion-weighted images after contrast do not show any enhancement, which suggests the cause is not an infection or tumor.

Images provided and used by permission from Dr. Steve Holtzman, MD, Director of Diagnostic Imaging, Marian Regional Medical Center, CommonSpirit Health.

Reversible cerebral vasoconstriction syndrome (RCVS)

Reversible cerebral vasoconstriction syndrome (RCVS) is a distinct entity from PRES which can have a similar presentation in pregnancy. This syndrome classically presents with a thunderclap headache and may be associated with significant hypertension and neurologic deficits related to brain edema, stroke or seizure.⁶ Both MRI and CT imaging are often initially normal. Computed tomography angiography (CTA) and magnetic resonance angiography (MRA) are the preferred imaging modalities to document the reversible multifocal narrowing (“sausage on a string”) of the cerebral arteries. Supportive care is usually sufficient, although some have used calcium channel blockers in an attempt to relieve vasoconstriction. The clinical outcome is usually benign, although major strokes can result in severe disability and death in a minority of patients.

Treating neurologic complications

Posterior reversible encephalopathy syndrome is usually reversible with prompt diagnosis and treatment. Early recognition and effective treatment of BP in patients with PRES in the acute setting, along with seizure prophylaxis, decreases the long-term sequelae of this condition. However, in rare cases, the reversible vasogenic edema associated with PRES can progress to irreversible ischemic damage, cerebral infarction, or even death.⁷ In general, neurologic symptoms should prompt consultation with neurology. The diagnosis of PRES should prompt delivery in a pregnant patient.

Stroke

Stroke is a known complication of hypertension and eclampsia,⁸⁻¹⁰ and a major cause of pregnancy-related death.¹¹ It is therefore important that obstetrical clinicians have systems in place to perform a quick evaluation for stroke, and to expedite collaboration with stroke experts in order to optimize care during this time-sensitive event.

Symptoms of stroke and preeclampsia with severe features may be similar, and include elevated BP, visual disturbances, and severe headache. Neurological changes may be attributed to other conditions, or may result from an eclamptic seizure.¹² In a review of pregnancy-related deaths in California, a case recounted where the “patient’s symptoms of confusion were misdiagnosed as postpartum psychosis vs. intracranial hemorrhage.” Some cases of altered level of consciousness have been “attributed to women’s noncompliance or drug-seeking behavior.”¹³

A Cochrane Database Systematic Review¹⁴ of prehospital stroke scales identified the use of the recognition of stroke in the emergency department (ROSIER) scale¹⁵ as the test of choice in the emergency department. The American Heart Association promotes the use of the acronym FAST: Face, Arm, Speech, Time, to increase awareness of stroke symptoms and the need for timely evaluation. (See Table 1 on page 141)

Clinicians can easily be trained to use FAST for recognizing the onset of new symptoms and knowing when to activate the internal emergency response system. This FAST assessment should also be performed following eclamptic seizure, which has been associated with the onset of intracranial hemorrhage.⁹

Table 1: FAST algorithm from the American Heart Association

F	Assess	FACIAL droop (have patient show teeth and look for symmetry)
A	Assess	ARM drift (have patient extend both arms in front of her, looking for a drift)
S	Assess	SPEECH difficulties (e.g., have patient repeat a simple sentence, such as “The sky is blue”)
T	If any of the above are present	TIME to activate the inpatient emergency response team that will allow for a thorough neurological exam and escalation to a higher level of care if needed

Used with permission from the American Heart Association 2020

Table 2: Readiness, recognition, response and reporting of neurologic complications in pregnancy

Readiness	Training for staff and providers about HDP (preeclampsia with severe features, HELLP syndrome and eclampsia, and the full spectrum), should incorporate stroke assessment and the importance of a thorough evaluation of any neurological changes. This training includes when and how to identify appropriate clinical team members and/or consultants and how to activate the facility emergency response system. Training may be accomplished through presentations and on-unit drills. Develop interdisciplinary agreements with the facility’s emergency department and specialists responsible for stroke management. Use resources such as posters of diagnosis and treatment algorithms.
Recognition	Use standardized assessments, such as FAST, to perform an assessment for possible stroke symptoms.
Response	Use identified emergency response and escalation pathways.
Reporting	Perform facility review of severe events to identify systems issues and training needs.

Improving Health Care Response to Hypertensive Disorders of Pregnancy, a CMQCC Quality Improvement Toolkit, 2021.

EVIDENCE GRADING
LEVEL OF EVIDENCE: C

References

1. Long, T. R., Hein, B. D., Brown, M. J., Rydberg, C. H. & Wass, C. T. Posterior reversible encephalopathy syndrome during pregnancy: seizures in a previously healthy parturient. *Journal of Clinical Anesthesia* 19, 145-148, doi:10.1016/j.jclinane.2006.07.004 (2007).
2. Powell, E. S. & Goldman, M. J. Posterior reversible encephalopathy syndrome (PRES) in a thirty-six-week gestation eclamptic. *Journal of Emergency Medicine* 33, 377-379, doi:10.1016/j.jemermed.2007.02.025 (2007).
3. Cho, H. J. & Lee, H. J. Posterior reversible encephalopathy syndrome in early postpartum woman. *Hong Kong Journal of Emergency Medicine* 19, 58-61 (2012).
4. Zak, I. T., Dulai, H. S. & Kish, K. K. Imaging of neurologic disorders associated with pregnancy and the postpartum period. *Radiographics* 27, 95-108, doi:10.1148/rg.271065046 (2007).
5. Nuwer, J. & Eshaghian, S. Late postpartum eclampsia with posterior reversible encephalopathy syndrome. *Hospital Physician*, 45-49 (2007).
6. Ducros, A. et al. The clinical and radiological spectrum of reversible cerebral vasoconstriction syndrome. A prospective series of 67 patients. *Brain* 130, 3091-3101, doi:10.1093/brain/awm256 (2007).
7. Lee, V. H., Wijidicks, E. F., Manno, E. M. & Rabinstein, A. A. Clinical spectrum of reversible posterior leukoencephalopathy syndrome. *Archives of Neurology* 65, 205-210, doi:10.1001/archneuro.2007.46 (2008).
8. Bushnell, C. et al. Guidelines for the prevention of stroke in women: A statement for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke* 45, 1545-1588, doi:10.1161/01.str.0000442009.06663.48 (2014).
9. Hart, L. A. & Sibai, B. M. Seizures in pregnancy: Epilepsy, eclampsia, and stroke. *Seminars in Perinatology* 37, 207-224, doi:10.1053/j.semperi.2013.04.001 (2013).
10. Swartz, R. H. et al. The incidence of pregnancy-related stroke: A systematic review and meta-analysis. *International Journal of Stroke* 12, 687-697, doi:10.1177/1747493017723271 (2017).
11. Judy, A. E. et al. Systolic hypertension, preeclampsia-related mortality, and stroke in California. *Obstetrics and Gynecology* 133, 1151-1159, doi:10.1097/AOG.0000000000003290 (2019).
12. Morton, C. H., Seacrist, M. J., VanOtterloo, L. R. & Main, E. K. Quality improvement opportunities identified through case review of pregnancy-related deaths from preeclampsia/eclampsia. *Journal of Obstetric, Gynecologic and Neonatal Nursing* 48, 275-287, doi:10.1016/j.jogn.2019.02.008 (2019).
13. Morton, C. H., VanOtterloo, L. R., Seacrist, M. J. & Main, E. K. Translating maternal mortality review into quality improvement opportunities in response to pregnancy-related deaths in California. *Journal of Obstetric, Gynecologic and Neonatal Nursing* 48, 252-262, doi:10.1016/j.jogn.2019.03.003 (2019).
14. Zhelev, Z., Walker, G., Henschke, N., Fridhandler, J. & Yip, S. Prehospital stroke scales as screening tools for early identification of stroke and transient ischemic attack. *Cochrane Database Systematic Reviews* 4, CD011427, doi:10.1002/14651858.CD011427.pub2 (2019).
15. Nor, A. M. et al. The Recognition of Stroke in the Emergency Room (ROSIER) scale: Development and validation of a stroke recognition instrument. *Lancet Neurology* 4, 727-734, doi:10.1016/S1474-4422(05)70201-5 (2005).

Fluid Management in Preeclampsia

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Key Principles

1. Management of fluids in the preeclamptic patient requires nursing adherence to strict monitoring of input and output.
2. In the setting of oliguria and reduced oxygen saturation (i.e., below 95%), pulmonary edema should be strongly suspected and diuresis may be indicated, with close monitoring of fluids.

Background

One of the hallmarks of preeclampsia is the maternal systemic endothelial dysfunction, the exact mechanisms of which are not entirely known. There is a link between aberrant trophoblast invasion during early placentation and maternal endothelial dysfunction manifested after 20 weeks of gestation. This maternal endothelial dysfunction disrupts the tight junctions of endothelial cells in maternal end-organs and contributes to the challenge of fluid management in preeclampsia. This leakage can produce significant fluid shifts into the interstitial space, resulting in peripheral and/or central edema (pulmonary and central nervous system). As fluid shifts out of the intravascular space, there is also the potential for hypovolemia.

Fluid management requires close attention to perfusion of end organs without increasing the risk of fluid overload leading to cardiovascular compromise. Matching intake to output and accounting for insensible loss is a common starting point. As most women with preeclampsia have reduced intravascular volume, they can be very sensitive to vasodilation with epidural analgesia/anesthesia and can experience

hypotension or even shock with mild postpartum hemorrhage. Therefore, fluid administration must be assessed in the context of preserving organ perfusion, while limiting or preventing pulmonary edema. Renal endothelial damage appears to be particularly sensitive to these fluid changes, resulting in proteinuria and oliguria. Renal function (serum creatinine) should be assessed to determine the degree of renal dysfunction. One hallmark of intravascular depletion is hemoconcentration.¹⁻⁴ Management of fluids in preeclamptic patients requires adherence to strict monitoring of inputs and outputs. This monitoring is critical during the intrapartum and postpartum management of these patients, particularly those with severe features, which indicates increased end-organ dysfunction. Since pulmonary edema is more common, and permanent renal damage due to preeclampsia is rare, fluids are normally restricted.⁵⁻⁷

If oliguria (< 0.5 ml/kg per hour) occurs, a trial of intravenous (IV) fluid bolus of 250-500 ml isotonic fluid (plasmalyte or Lactated Ringer's) can be given, along with assessment of the last 24-hour evaluation of inputs and outputs. If, after a total infusion of 1000 ml of crystalloid IV fluids, urine output is not improved, consideration is



usually given to other modalities for enhancing urine output. If hypovolemia is still suspected, then a trial of colloid IV fluid administration or blood may be used. In these clinical settings, oxygen saturation monitoring is essential due to the risk of pulmonary edema with excessive fluid administration in preeclamptic patients. If the patient is adequately hydrated, a trial pharmacological diuresis (furosemide, 5-10 mg IV) may be attempted. Oliguria, particularly when combined with excessive IV fluid administration, significantly increases the risk for pulmonary edema. Oliguria will also reduce the renal clearance of magnesium sulfate, and the maintenance dose of magnesium sulfate will need to be adjusted to reduce the risk of magnesium toxicity. In the setting of oliguria and reduced oxygen saturation, (i.e. below 95%) diuresis is indicated. If it is not clear whether the patient is intravascularly depleted, the use of transthoracic echo may be employed to evaluate cardiac filling. Additionally, noninvasive ultrasound techniques may be employed to evaluate pulmonary edema.⁷ If the patient is experiencing increased oxygenation requirements and warrants more invasive respiratory and cardiac monitoring, she may require transfer to the intensive care unit. Pulmonary artery

catheters are not necessary but central venous pressure (CVP) monitoring may be helpful in directing therapy. Recent developments in non-invasive cardiac monitoring may be important to consider for fluid management in the future.⁸

Recommendations for monitoring and treatment

- ▶ Patients with preeclampsia with severe features should have strict fluid intake and output monitoring assessments.
- ▶ Total fluid intake (oral and intravenous) should be limited in both preeclampsia with and without severe features. Many recommend that the sum of oral and all IV fluid should be ≤ 125 mL/hour (range of 60 to ≤ 125 mL/hour) unless there are other clinical circumstances that dictate a different management plan.⁹
- ▶ Serum creatinine should be assessed in all patients with gestational hypertension, preeclampsia, or chronic hypertension with superimposed preeclampsia.
- ▶ A Foley catheter with urimeter is useful for monitoring hourly urine output and is essential in the setting of oliguria or pulmonary edema.

- ▶ A patient with oliguria (less than 30 mL per hour for two hours, or less than 500 mL in 24 hours), should be given a limited trial of IV fluid boluses (Lactated Ringer's or plasmalyte), usually starting with 250-500 mL.⁹
- ▶ If oliguria does not resolve after a total of 1000 mL of crystalloid IV fluid is administered and if hypovolemia is still suspected, consideration may be given to the administration of colloid (e.g., albumin) or blood to enhance renal perfusion and urine output.⁹
- ▶ After adequate hydration, and particularly postpartum, consideration should be given to the use of pharmacological diuresis (furosemide).
- ▶ In the setting of oliguria and reduced oxygen saturation (i.e., below 95%), pulmonary edema should be strongly suspected and diuresis may be indicated, with close monitoring of fluids.
- ▶ Cardiac dysfunction should be strongly considered in the presence of persistently low oxygen saturations, the development of respiratory distress, persistent pulmonary edema, or unanticipated low blood pressure values. In this setting, measurement of maternal B-type natriuretic peptide (BNP) and/or maternal echocardiography is strongly recommended to evaluate cardiac function and detect dilated cardiomyopathy.

EVIDENCE GRADING
LEVEL OF EVIDENCE: C

References

1. Aukes, A. M., Wessel, I., Dubois, A. M., Aarnoudse, J. G. & Zeeman, G. G. Self-reported cognitive functioning in formerly eclamptic women. *American Journal of Obstetrics and Gynecology* 197, 365 e361-366, doi:10.1016/j.ajog.2007.06.044 (2007).
2. Postma, I. R., Wessel, I., Aarnoudse, J. G. & Zeeman, G. G. Neurocognitive functioning in women with a history of eclampsia: Executive functioning and sustained attention. *American Journal of Perinatology* 27, 685-690, doi:10.1055/s-0030-1253099 (2010).
3. Wiegman, M. J. et al. Long-term visual functioning after eclampsia. *Obstetrics and Gynecology* 119, 959-966, doi:10.1097/AOG.0b013e31824da5a8 (2012).
4. Zeeman, G. G., McIntire, D. D. & Twickler, D. M. Maternal and fetal artery Doppler findings in women with chronic hypertension who subsequently develop superimposed pre-eclampsia. *Journal of Maternal, Fetal and Neonatal Medicine* 14, 318-323, doi:10.1080/jmf.14.5.318.323 (2003).
5. Harper, L., Tita, A. & Karumanch, S. A. in *Creasy and Resnik's maternal-fetal medicine: Principles and practice*. Eighth edition. (eds R Resnik et al.) Ch. 48, (Elsevier, 2019).
6. Pretorius, T., van Rensburg, G., Dyer, R. A. & Biccard, B. M. The influence of fluid management on outcomes in preeclampsia: A systematic review and meta-analysis. *International Journal of Obstetric Anesthesia* 34, 85-95, doi:10.1016/j.ijoa.2017.12.004 (2018).
7. Ortner, C. M. et al. Point-of-care ultrasound abnormalities in late-onset severe preeclampsia: Prevalence and association with serum albumin and brain natriuretic peptide. *Anesthesia and Analgesia* 128, 1208-1216, doi:10.1213/ANE.0000000000003759 (2019).
8. Lavie, A. et al. Maternal cardiovascular hemodynamics in normotensive versus preeclamptic pregnancies: A prospective longitudinal study using a noninvasive cardiac system (NICaS). *BMC Pregnancy Childbirth* 18, 229, doi:10.1186/s12884-018-1861-7 (2018).
9. Anthony, J. & Schoeman, L. K. Fluid management in pre-eclampsia. *Obstetric Medicine* 6, 100-104, doi:10.1177/1753495X13486896 (2013).

Airway Management in Pregnant or Postpartum Women Having Seizures

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Key principles

1. Seizures involve loss of consciousness and violent movements, with the potential for airway obstruction (blocked ventilation) resulting in hypoxemia, regurgitation and aspiration of gastric contents, head trauma, traumatic brain injury and tongue biting.
2. Many of the sequelae of seizures, such as hypertensive brain hemorrhage and fetal and maternal hypoxic brain damage, are due to the cessation of respiration and failure to deliver oxygen to the maternal brain and the placenta.
3. Maternal hypoxia is the most common cause of “fetal distress” following an eclamptic seizure.
4. Airway management is the first priority in seizure management, even prior to the administration of magnesium sulfate.
5. An anesthesiologist should be called by obstetric or emergency medicine physicians immediately to establish a secure, patent and clear airway when a patient suffers a seizure.
6. Anesthetizing the preeclamptic patient may present special challenges related to lack of maternal cooperation for neuraxial anesthesia. For eclamptic patients, swelling of the airway tissues can make intubation more difficult. Emergency induction of anesthesia may lead to both maternal and fetal compromise.

Background

Seizures in peripartum women are frightening and uncommon occurrences in labor and delivery and emergency departments. The seizures typically have an abrupt start with facial twitching, followed by a 15-20 second tonic phase, and progresses to a generalized clonic phase characterized by apnea, which can last about 1 minute. Many providers immediately administer magnesium sulfate to stop the abnormal seizure movements. However, more important than treating the seizure (which usually stops after 1-2 minutes), is to first maintain and protect the airway, and prevent the patient from experiencing a head injury. Seizures are not usually a direct cause of death, but intracranial hemorrhage and hypertensive encephalopathy are potentially lethal.¹⁻³ The patient may also suffer traumatic brain injury.³ Therefore, **airway management is the first priority in seizure management**, even prior to the administration of magnesium sulfate.³

Patients with preeclampsia and eclampsia are at risk for difficult intubation due to airway edema.⁴ Trachea size is also reduced because of mucosal capillary engorgement in pregnancy.² For these reasons, an anesthesiologist should be called immediately to establish a secure, patent and clear airway when a patient suffers a seizure.³

Basic airway maintenance skills need to be taught and actively maintained by nurses and physicians working in labor and delivery, since this “skill set” is used infrequently in this environment. Anesthesiologists and certified registered nurse anesthetists (CRNAs) have airway management experience to care for patients who may not be ventilating or oxygenating adequately. The purpose of seizure control is to prevent maternal injury, provide oxygenation, provide cardiorespiratory support and prevent aspiration.³ The anesthesiologist is an important member of the obstetric team for controlling and preventing morbidity or mortality from seizures. An anesthesiologist should be involved in educating the Labor and Delivery staff about airway management.^{1,2}

Recommendations for management of eclamptic seizure

- ▶ Call for help per institutional policy. Notify anesthesiology immediately. In some settings, the activation of an obstetric emergency team may be useful in obtaining all of the team members necessary for management of the event. Have equipment necessary for emergency and difficult airway management including oxygen source, face mask, pulse oximetry, carbon dioxide detector, oropharyngeal airways, various size and types of laryngoscopy blades, endotracheal tubes, bougie, laryngeal mask airway (LMA), and, if available, video laryngoscopy and fiberoptics, in the assembled Difficult Airway Cart. For

readiness, clinicians should be familiar with the American Society of Anesthesiology Guidelines for Management of the Difficult Airway and the Algorithm for Unanticipated Difficult Airway in Obstetric Patients by American Society of Anesthesiology.⁵

- ▶ Before medicating, place the patient into the left lateral decubitus position (side lying position) to first maintain airway patency (tongue displays to side) and decreases aspiration risk. Next, raise the head of bed to decrease risk and provide padding around patient to prevent seizure-related trauma.
- ▶ Open airway with a jaw thrust and/or oral airway, if needed. Do not insert any object other than an oral airway, if needed, into the patient’s mouth. Be aware that nasal airways can often cause nosebleeds. Check for air movement and reposition if there is no air movement. Be aware that an oral airway can make the patient vomit and may not be necessary.
- ▶ Apply supplemental oxygen by mask (if not already intubated) obtain suction, apply pulse oximeter to check oxygen saturation, apply frequent BP monitoring device, monitor ECG and continue FHR monitoring if fetus in utero.
- ▶ Obtain IV access.
- ▶ Administer magnesium sulfate. For readiness, clinicians should be familiar with the Acute treatment algorithm. (See Appendix E: Acute Treatment Algorithm on page 195)
- ▶ Control blood pressure if necessary, with IV meds, but be aware that hypoxia and hypercarbia will elevate blood pressure. For readiness, clinicians should be familiar with antihypertensive agents. (See Section: Antihypertensive Agents in Preeclampsia on page 121)

- ▶ The initial focus should be on opening and protecting the airway and supplying the patient with oxygen. Laryngoscopy will result in an acute hypertensive episode, so pre-intubation medication to decrease the hypertension should be utilized. Some possible agents include IV esmolol 1-2 mg/kg, lidocaine 1-1.5 mg/kg, labetalol 1mg/kg, nicardipine 15-30 mcg/kg, nitroglycerin 1.5 - 2.5 mcg/kg, hydralazine 5-10 mg or opioids like remifentanyl 0.5 -1 mcg/kg, alfentanil 7.5-10 mcg/kg, fentanyl 1-3 mcg/kg.
- ▶ If opioids are being used, be aware of potential for neonatal effects such as respiratory depression.
- ▶ Because of insufficient evidence to support one drug as first line therapy to decrease hypertensive response to intubation, the consensus of the Hypertensive Disorders of Pregnancy Task Force and the cited review article recommends esmolol or nitroglycerin, in combination with propofol. Esmolol and nitroglycerin are widely available, predictable, have rapid onset and fewer side effects. An exaggerated hypertensive response can potentially result in hemorrhagic stroke.^{2,4}
- ▶ Cardiorespiratory resuscitation of the woman is the key to protecting the fetus. This is often counterintuitive for many Labor and Delivery personnel, who may incorrectly focus on the fetus, when indeed, the management of the patient is the top priority during and after a seizure.
- ▶ Following a maternal seizure, fetal bradycardia is commonly seen due to maternal hypoxia. Stabilization of the mother is the first priority, followed by fetal resuscitation.
- ▶ Cesarean delivery should be reserved for unsuccessful cardiorespiratory resuscitation of the mother or continual non-reassuring FHR tracings. However, the team should be prepared, and on standby, for emergent surgery.
- ▶ Regular education should be conducted in labor and delivery for management of the airway during an eclamptic seizure.
- ▶ After experiencing a severe maternal event, such as stroke, women should be debriefed about their particular condition(s), its long-term physical and mental health consequences, and a discussion about how the patient experienced care. (See Section: Patient Education on Page 65)

EVIDENCE GRADING
LEVEL OF EVIDENCE: B

References

1. Harper, L., Tita, A. & Karumanch, S. A. in Creasy and Resnik's maternal-fetal medicine: Principles and practice. Eighth edition. (eds R Resnik et al.) Ch. 48, (Elsevier, 2019).
2. Chestnut, D., Polley, L., Tsen, L. & Wong, C. Chestnut's obstetric anesthesia: Principles and practice. 6th ed., (2020).
3. Parthasarathy, S., Kumar, V. R., Sripriya, R. & Ravishankar, M. Anesthetic management of a patient presenting with eclampsia. *Anesthesia Essays and Researches* 7, 307-312, doi:10.4103/0259-1162.123214 (2013).
4. Hawkins, J. & McQuaid-Hanson, E. Anesthesia for the patient with preeclampsia. <https://www.uptodate.com/contents/anesthesia-for-the-patient-with-preeclampsia/print> (UpToDate, Waltham, MA (2020).
5. Balki, M., Cooke, M. E., Dunington, S., Salman, A. & Goldszmidt, E. Unanticipated difficult airway in obstetric patients: Development of a new algorithm for formative assessment in high-fidelity simulation. *Anesthesiology* 117, 883-897, doi:10.1097/ALN.0b013e31826903bd (2012).

Severe Hypertension and Hypotension in Women with Amphetamine or Cocaine Use

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Key principles

1. For pregnant or postpartum patients who present with a history of chronic amphetamine/methamphetamine use, or exaggerated response to standard hypertension medications, the obstetric provider should notify the anesthesiologist and discuss hypertension treatment.
2. Cocaine and amphetamine use can lead to life threatening hemodynamic instability, seizures, hyperthermia and placental abruption.
3. Acute intoxication can resemble preeclampsia/eclampsia and even malignant hyperthermia.
4. Management of both hypertension and hypotension in patients with chronic abuse of amphetamine and/or cocaine may be difficult.

Background

Substance use disorders are common in women of childbearing age in the United States, with 32.1 million women over the age of 12 using illicit drugs, and of these, 2.8 million use cocaine and methamphetamine, many associated with polydrug use.^{1,2} Many drugs not only affect maternal and fetal well-being, but also alter maternal responses to administered medications and treatment. In particular, acute and chronic amphetamine or cocaine use may result in physiologic and pharmacodynamic changes that prove difficult to manage in the parturient. Both substances are associated with increased risk of abruption and fetal anomalies.

Cocaine blocks the presynaptic reuptake of sympathomimetic neurotransmitters including dopamine, serotonin and norepinephrine. Thus, the acute use of cocaine results in the relative neurotransmitter concentrations increasing at the catecholamine's site of action, producing

adrenergic stimulation both centrally and peripherally. Cocaine may cause intense vasoconstriction producing hypertension, coronary ischemia, and reduced uterine artery blood flow; other effects include tachycardia, arrhythmias, altered sensorium, and hyperthermia. With chronic abuse of cocaine, the sympathomimetic neurotransmitters become depleted and hypotension and lethargy may ensue.

Amphetamines cause similar effects to those of cocaine, including hypertension, arrhythmias, tachycardia, dilated pupils, hyperreflexia and even hyperthermia. Women are more susceptible than men for methamphetamine-associated pulmonary arterial hypertension.³ In addition, monoamine oxidase inhibition can decrease catecholamines degradation. Amphetamines can induce seizure activity that could be misdiagnosed as eclampsia. In overdose cases, the hypertension and hyperthermia can be fatal.

Beta-blockers have the potential to cause unopposed alpha-adrenergic stimulation with worsening of coronary and peripheral vasoconstriction but this is uncommon. Combined alpha/beta-blockers such as labetalol and carvedilol have not been associated with this phenomenon and are reasonable options for treatment of cocaine/amphetamine induced hypertension with tachycardia.⁴ Direct vasodilators like hydralazine can be used but may increase tachycardia.

Treating hypertensive disorders of pregnancy

Treatment of hypertension in patients with chronic cocaine/amphetamine abuse may cause an exaggerated decrease in blood pressure. Hypotension may be difficult to treat due to altered vasopressor response and depleted endogenous catecholamine stores. Unexpected, severe hypotension may also occur after regional anesthesia or general anesthesia.⁵

Use of epidural during early labor is encouraged to potentially reduce catecholamine levels. Of note, regional anesthesia may be associated with unpredictable hypotension, resistant to treatment. Cardiac arrest has also been reported following both regional and general anesthesia. During labor, women with chronic use of cocaine or amphetamines are in a state of catecholamine depletion and potentially altered adrenergic receptor responses. Trauma patients may also exhibit catecholamine depletion, having maintained their BP through

extensive release of stored catecholamines. The initial antihypertensive treatment of elevated BP due to acute intoxication with cocaine/amphetamine or even pain with coincident significant trauma may exacerbate subsequent hypotension.

Treating hypotension

Treatment of hypotension may be difficult in the catecholamine-depleted patient. The mechanism of action in ephedrine includes a direct effect, as well as a significant secondary release of norepinephrine, which would be decreased in the catecholamine depleted state, considerably blunting ephedrine's effectiveness. The vasopressors of choice should be direct acting agents, administered intravenously. Preferred agents include phenylephrine, epinephrine and norepinephrine. While norepinephrine has the strongest, direct-acting vasoconstriction, it should be administered via central access.⁶ Please note that greater than typical bolus doses may be required. Infusions may also be very useful, depending on circumstances. Typical doses of direct acting vasopressors are listed below:

- ▶ Phenylephrine 100 mcg IV bolus
- ▶ Epinephrine 50-100 mcg IV bolus (stronger)
- ▶ Norepinephrine 4-8 mcg IV bolus or infusion 2-20 mcg/min⁴ (risk of skin ischemia if given through small peripheral IV, prefer central line or secondary large bore IV fast flowing).

LEVEL OF EVIDENCE
EVIDENCE GRADING: B

References

1. National Center for Health Statistics. Health, United States, 2012: With special feature on emergency care. <https://www.cdc.gov/nchs/data/abus/abus12.pdf> (Hyattsville, MD, 2013).
2. Leffert, L. in Chestnut's obstetric anesthesia: Principles and practice. Sixth edition. Ch. 53, 1256-1260 (Elsevier, 2020).
3. Zhao, S. X., Kwong, C., Swaminathan, A., Gohil, A. & Crawford, M. H. Clinical characteristics and outcome of methamphetamine-associated pulmonary arterial hypertension and dilated cardiomyopathy. *Journal of the American College of Cardiology Heart Failure* 6, 209-218, doi:10.1016/j.jchf.2017.10.006 (2018).
4. Kuczkowski, K. M. Anesthetic implications of drug abuse in pregnancy. *Journal of Clinical Anesthesia* 15, 382-394, doi:10.1016/s0952-8180(03)00056-4 (2003).
5. Ghuran, A. & Nolan, J. Recreational drug misuse: Issues for the cardiologist. *Heart* 83, 627-633, doi:10.1136/heart.83.6.627 (2000).
6. Pancaro C, Shah N, Pasma W, Saager L, Cassidy R, van Klei W, Kooij F, Vittali D, Hollmann MW, Kheterpal S, Lirk P. Risk of major complications after perioperative norepinephrine infusion through peripheral intravenous lines in a multicenter study. *Anesthesia and Analgesia* 131, 1060-1065, doi: 10.1213/ANE.0000000000004445 (2020).

Postpartum Management of New-Onset Hypertension and Preeclampsia

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Key Principles

1. New-onset hypertension in the postpartum period should be assumed to be preeclampsia until proven otherwise.
2. The treatment of postpartum preeclampsia is generally the same as treatment of antepartum cases, with the exception of the use of some antihypertensive medications not used during pregnancy.

Background

Occurring in approximately 11% of pregnancy, hypertensive disorders of pregnancy (HDP) are the leading cause of postpartum readmissions with profound economic, health, and emotional costs for affected women, their families and society.¹ In a study of 2013 and 2014 Nationwide Readmissions Databases in the United States, Mogos, et al. (2018) found that postpartum readmission rates were highest for women whose pregnancies were complicated by superimposed preeclampsia or eclampsia (4.6%), followed by preeclampsia with severe features or eclampsia (3.6%), existing hypertension (3.0%), and preeclampsia without severe features or pregnancy-induced hypertension (2.5%). Readmission rates for HDP-complicated deliveries all were statistically significantly higher than the rates for both uncomplicated normotensive pregnancies (0.6%) and complicated normotensive pregnancies (1.0%, $P < 0.001$).¹ Evidence also indicates readmission rates for HDP-complicated deliveries have been climbing

over the past few years.¹ The postpartum period should continue to be regarded as a high-risk period for women, especially women with HDP.

Delivery of the placenta has long been considered the most important therapeutic intervention toward the cure of preeclampsia; however, the clinical manifestations of endothelial cell damage can continue up to 6 weeks postpartum. Signs and symptoms can manifest or worsen in the postpartum period, and preeclampsia can develop de novo in women who did not previously have any hypertensive disorder of pregnancy (HDP).

Preeclampsia can develop more than 48 hours after delivery, which for many patients, is after postpartum discharge. Most women who present with eclampsia and stroke in the postpartum period have these symptoms for hours or days before presentation.² Though uncommon, postpartum manifestations of preeclampsia are associated with significant morbidity and mortality. Many women with no history of HDP have a routine follow-up with a physician no

sooner than six weeks postpartum. For this reason, continued and close monitoring of women for signs and symptoms of preeclampsia remains critical in the postpartum period. Educating patients and their families regarding the signs and symptoms of preeclampsia empowers them to access care when necessary. If preeclampsia is suspected, swift and timely diagnosis and treatment is paramount.

The risk of postpartum readmissions for HDP-complicated deliveries (approximately 2.5–4.6%) at the national level is substantially higher than other deliveries (1.0%) and, according to other studies, has been climbing over the past few years.¹ The postpartum period should continue to be regarded as a high-risk period for women, especially women with HDP.

Diagnosing delayed postpartum preeclampsia

Delayed postpartum preeclampsia is defined as hypertension that begins 2 or more days after childbirth in women who did not previously have HDP. The diagnostic criteria for delayed postpartum preeclampsia are the same as for preeclampsia prior to delivery. **Newly elevated (BP) in previously normotensive, postpartum women should not be attributed to lack of sleep, stress, or pain.** An elevated BP should be evaluated thoroughly and no differently than in the antenatal setting; *new-onset hypertension should be assumed to be preeclampsia until proven otherwise.*

Symptoms of preeclampsia may have a broad differential in the postpartum setting. A headache may represent a migraine triggered by sleep deprivation or a postdural puncture headache. In this population a high index of suspicion is required and preeclampsia should be considered first and ruled out in the presence of any severe features, such as headache, blurry vision, or right upper quadrant (RUQ) / epigastric pain.

Evaluating postpartum preeclampsia

The following evaluation is recommended for newly elevated BP \geq 140/90 mm Hg or symptoms considered to be severe. BP values of 160/110 mm Hg or higher should be treated in accordance with the Acute Hypertension Treatment Algorithm.

- ▶ Serial surveillance of BP
- ▶ Complete blood count (CBC), serum creatinine, ALT, AST, uric acid
- ▶ Catheterized urine specimen for urine: protein creatinine ratio

Additionally, depending on signs/symptoms, further evaluation may be warranted including RUQ ultrasound for persistent abdominal pain and computerized tomography (CT) and/or magnetic resonance imaging (MRI) of the brain for persistent headache or other neurologic symptoms. (See Section: Neurologic Complications of Hypertension: Posterior Reversible Encephalopathy Syndrome (PRES) and Stroke on page 137)

Treating inpatient postpartum preeclampsia

Barring contraindications described in section Preventing and Managing Eclamptic Seizures on page 126, magnesium sulfate should be continued 24 hours after delivery in patients who have preeclampsia with severe features. For patients who develop severe features after the conclusion of this 24-hour period, the decision to treat with magnesium is controversial and little data is available to guide this decision. The risk of seizure declines with progressive time since delivery, though it is not eliminated. The risk of other sequelae, such as stroke from severe hypertension, are unchanged in the postpartum state and must be addressed with the same urgency as with ante- and intrapartum patients. Treatment with magnesium sulfate may be considered for patients who develop

de novo severe features in the postpartum setting and who did not previously receive magnesium sulfate. Additionally, retreatment with magnesium sulfate should be considered for patients who represent with severe features after a period of time without severe features (e.g., several days). This recommendation should be based on expert opinion, and treatment should be individualized. For patients with absolute or relative contraindications to magnesium sulfate, and who are more than 48 hours after delivery, the benefits of treatment with magnesium sulfate are likely outweighed by the potential complications. The risk of other sequelae, such as stroke from severe hypertension, are unchanged in the postpartum state and must be addressed with the same urgency as with ante- and intrapartum.

Treating trigger pressures with the use of antihypertensives should be implemented irrespective of a history of chronic hypertension. A significant number of patients with preeclampsia/gestational hypertension (17.5%), require antihypertensive treatment following delivery and prior to discharge. Severe hypertension, preterm/cesarean delivery, and use of magnesium sulfate are highly predictive of the need for postpartum antihypertensives. Laboratory abnormalities alone, such as increases in AST, ALT, and creatinine, or decreased platelets, do not reliably predict the requirement for postpartum antihypertensives.³

Postpartum hypertension/ persistent hypertension treatment

Several risk factors have been associated with the requirement for prolonged use of antihypertensive therapy postpartum. These include multiparity, obesity⁴ and the diagnosis of preeclampsia with severe features based on BP criteria.⁵ Women with a history of chronic hypertension/suspected chronic hypertension

prior to pregnancy are also likely to require discharge with antihypertensive medications, and should be counseled regarding their importance.⁴

Antihypertensive medications may be used more liberally in women with chronic hypertension in the postpartum period than during pregnancy, as there are no longer fetal issues influencing management. Therefore, the goal should be a lower BP range of 130-150 mm Hg systolic and 80-100 mm Hg diastolic.⁶ Many obstetric care providers are most comfortable with prescribing labetalol and nifedipine, as these are used frequently in the antepartum setting and ACOG has also endorsed the use of these medications.² A small, retrospective study demonstrated that postpartum use of nifedipine more rapidly established BP control compared to labetalol.⁷

Methyldopa, however, should be used with caution because of its increased risk for depression, for which postpartum women are already at significant risk, particularly those diagnosed with preeclampsia.^{6,8-9} If used, patients should undergo more frequent assessment for postpartum depression.

In non-obstetric populations, enalapril is often offered as a first-line agent for hypertensive management. The National Institute for Health and Care Excellence (NICE) guidelines suggest this for postpartum women who require long-term antihypertensive therapy.¹⁰ Renal function and potassium levels should be monitored. Women with Black African and Caribbean ancestry often respond best to nifedipine or amlodipine (if previously used successfully). If nifedipine or amlodipine alone do not control BP, the addition of labetalol or atenolol is often beneficial.¹¹

Breastfeeding considerations

Women who wish to breastfeed their infants should be encouraged to do so as soon as they are able. It should be explained that while antihypertensive medications can pass into breastmilk, they do so



at low concentrations. Such low concentrations are unlikely to be clinically significant for the infant, and do not preclude breastfeeding. There is little research on the effect of antihypertensive medications on breastmilk but currently there is no evidence of harm to the infant.¹⁰

Some β -blockers (e.g., atenolol and metoprolol) are concentrated, resulting in higher levels in breast milk,¹² whereas propranolol and labetalol (preferred for breastfeeding women) are not concentrated in breast milk and remain at low levels. Angiotensin-converting enzyme inhibitors (e.g., enalapril and captopril) concentrations in breast milk are low, and these drugs may be used safely during breastfeeding unless high doses are required. No adverse effects are known to occur with calcium channel blockers during breastfeeding.¹²

Although the concentration of diuretics in breast milk is low, these agents may reduce the quantity of milk production.⁶ While establishing an antihypertensive regimen with once-daily dosing is ideal, many postpartum patients require more frequent dosing for optimal control of BP.¹¹

Some medications used in the postpartum period may exacerbate hypertension by causing volume retention, sympathomimetic activation or vasoconstriction. Nonsteroidal anti-inflammatory drugs (NSAIDs) are frequently used for postpartum analgesia and may decrease vasoconstriction and increase sodium retention through a decrease in prostaglandins. Data support that NSAIDs may be used safely in postpartum patients with elevated BP values, with the exception of naproxen and indomethacin which were associated with an increase in BP.¹³ A randomized trial comparing the use of ibuprofen and acetaminophen in patients with preeclampsia with severe features found that ibuprofen was not associated with an increased duration of severe-range BP. Another cohort study of postpartum patients on magnesium sulfate for seizure prophylaxis and also NSAIDs did not demonstrate differences in BP, a need for antihypertensive medications, or other adverse events for patients given NSAIDs. Appreciating the risk of long-term opioid dependence and abuse, NSAIDs are a critical part of postpartum pain management, and should not be withheld in patients with preeclampsia in the absence of other contraindications.¹⁴

Criteria for hospital discharge

Blood pressure control

- ▶ Controlled is defined by the following criteria:
 - No severe-range BP values ($\geq 160/110$ mm Hg) for 24 hours and
 - No treatment with IV antihypertensive or immediate release nifedipine for 24 hours.
- ▶ Discharge with close outpatient follow-up may be considered when the patient is:
 - Asymptomatic and controlled on an oral antihypertensive regimen, or does not require an oral antihypertensive agent.
- ▶ Recommendations from ACOG (2020) suggest that women with gestational hypertension, preeclampsia or superimposed preeclampsia be monitored in the hospital for 72 hours, unless home monitoring can be utilized in the outpatient setting.²

Laboratory values

- ▶ Depending on the degree of dysregulation, it may take weeks for laboratory values to normalize entirely. Serum laboratory studies should be checked at least daily until all values are trending in a normal direction, at which time the patient may be considered for discharge, taking into account the entire clinical picture including symptoms and other laboratory abnormalities.

Patient education and postpartum support

Nursing staff should review detailed signs and symptoms of preeclampsia with women and their families, and provide them with clear written instructions indicating what to do should symptoms arise. Women with a diagnosis of HDP during the birth hospitalization should be sent home with a BP cuff and provided with education

about when to call the clinic or return to the hospital for evaluation.¹⁵ It is important to confirm adequate correlation between the home cuff and hospital devices.

Home BP cuffs may be ordered by the physician, and are often available at the local pharmacy, but are not necessarily covered by insurance. Large retail stores offer these devices at reasonable prices. Patients should be encouraged to have a family member bring the device into the hospital prior to discharge, so that she and her family can be taught proper use. The Preeclampsia Foundation has a [Cuff Kit™ program](#) to help high risk/low resource women procure BP cuffs. Any woman who is unable to obtain a home BP cuff may be able to use an in-store device at a local pharmacy, or should be scheduled for more frequent clinic or telehealth visits.

In a single-center, prospective single-cohort feasibility study, researchers found that among the women who had HDP and self-monitored after discharge, over half required treatment due to exacerbations in BP post discharge, of which 16% were severe.^{16,17} No hospital readmissions were noted, and over 85% were satisfied with the remote monitoring. The authors conclude telehealth is a promising opportunity to provide close postpartum monitoring, particularly for women who had HDP. In addition, this study found that racial disparities in postpartum BP monitoring were eliminated with the use of telemedicine approaches, an important consideration since hypertension can persist more commonly in Black women postpartum.¹⁸

For women who have difficulty accessing a physical clinic, it is advised to consider home health or telehealth visits by trained nurses for BP check-up and monitoring. Home health or telehealth visits are extremely important for women who have had a very severe course of the disease while hospitalized. Women who are very sick postpartum and need to nurture their baby may also be grappling with other economic or social vulnerabilities. These women may face significant barriers to being able to visit a physician clinic. With home visits or telehealth visits, nurses can monitor women for signs and symptoms of worsening health and ensure earlier treatment initiation to prevent more serious conditions.

Treating postpartum preeclampsia after discharge

Blood pressure parameters to withhold antihypertensive medications should also be provided in writing upon discharge to the patient, as once the disease resolution is in

process, patients will no longer require oral antihypertensives. However, the time course of this resolution can be unpredictable. These target parameters should be individualized to the patient, and other considerations include her baseline BP values, medical comorbidities, and the particular medication prescribed at discharge. A general guideline may be to hold the dose of medication when BP is < 115/65 mm Hg. Once the disease resolves, patients will no longer require oral antihypertensives. .

Outpatient follow-up schedule

- ▶ Patients treated with antihypertensive medications during hospitalization should have a follow-up appointment scheduled within 3-7 days of discharge.
- ▶ All other patients diagnosed with hypertension but not treated with antihypertensives should be seen for follow-up within 7-14 days of discharge.



EVIDENCE GRADING
LEVEL OF EVIDENCE: B

References

1. Mogos, M. F., Salemi, J. L., Spooner, K. K., McFarlin, B. L. & Salihu, H. H. Hypertensive disorders of pregnancy and postpartum readmission in the United States: National surveillance of the revolving door. *Journal of Hypertension* 36, 608-618, doi:10.1097/HJH.0000000000001594 (2018).
2. ACOG. Gestational hypertension and preeclampsia: Practice Bulletin No. 222 of the American College of Obstetricians and Gynecologists. *Obstetrics and Gynecology* 135, 1492-1495, doi:10.1097/AOG.0000000000003892 (2020).
3. Asali, A. et al. Can we predict the need for antihypertensive treatment during the early postpartum period for women with preeclampsia or gestational hypertension? *Pregnancy Hypertension* 17, 133-137, doi:10.1016/j.preghy.2019.05.020 (2019).
4. Wiese, S. et al. Predicting postpartum hypertension: A study of high risk women discharged without antihypertensive therapy. *Obstetrics and Gynecology* 131S, s96
5. Levine, L. D., Nkonde-Price, C., Limaye, M. & Srinivas, S. K. Factors associated with postpartum follow-up and persistent hypertension among women with severe preeclampsia. *Journal of Perinatology* 36, 1079-1082, doi:10.1038/jp.2016.137 (2016).
6. ACOG. Chronic hypertension in pregnancy: Practice Bulletin No. 203 of the American College of Obstetricians and Gynecologists. *Obstetrics and Gynecology* 133, e26-e50, doi:10.1097/AOG.0000000000003020 (2019).
7. ACOG. Gestational hypertension and preeclampsia: Practice Bulletin No. 222 of the American College of Obstetricians and Gynecologists. *Obstetrics and Gynecology* 135, 1492-1495, doi:10.1097/AOG.0000000000003892 (2020).
8. Beatty, C. A. & Dangel, A. Timely discharge: Oral nifedipine is superior to labetalol for postpartum BP control in patients with preeclampsia. *Obstetrics and Gynecology* 131s, 201-202S (2018).
9. Webster, J. & Koch, H. F. Aspects of tolerability of centrally acting antihypertensive drugs. *Journal of Cardiovascular Pharmacology* 27 Suppl 3, S49-54, doi:10.1097/00005344-199627003-00007 (1996).
10. Easterling, T. et al. Oral antihypertensive regimens (nifedipine retard, labetalol, and methyldopa) for management of severe hypertension in pregnancy: An open-label, randomised controlled trial. *Lancet* 394, 1011-1021, doi:10.1016/S0140-6736(19)31282-6 (2019).
11. National Institute for Health and Care Excellence (NICE). Hypertension in pregnancy: Diagnosis and management. <https://www.nice.org.uk/guidance/ng133/resources/hypertension-in-pregnancy-diagnosis-and-management-pdf-66141717671365> (2019).
12. Wasden, S. W., Ragsdale, E. S., Chasen, S. T. & Skupski, D. W. Impact of non-steroidal anti-inflammatory drugs on hypertensive disorders of pregnancy. *Pregnancy Hypertension* 4, 259-263, doi:10.1016/j.preghy.2014.06.001 (2014).
13. Hale, T. W. *Hale's medications & mothers' milk: A manual of lactational pharmacology.* (Springer Publishing Company, 2019).
14. Pope, J. E., Anderson, J. J. & Felson, D. T. A meta-analysis of the effects of nonsteroidal anti-inflammatory drugs on blood pressure. *Archives in Internal Medicine* 153, 477-484 (1993).
15. Blue, N. R. et al. Effect of ibuprofen vs acetaminophen on postpartum hypertension in preeclampsia with severe features: A double-masked, randomized controlled trial. *American Journal of Obstetrics and Gynecology* 218, 616 e611-616 e618, doi:10.1016/j.ajog.2018.02.016 (2018).
16. Barton, J. R., Saade, G. R. & Sibai, B. M. A proposed plan for prenatal care to minimize risks of covid-19 to patients and providers: Focus on hypertensive disorders of pregnancy. *American Journal of Perinatology* 37, 837-844, doi:10.1055/s-0040-1710538 (2020).
17. Hoppe, K. K. et al. Telehealth with remote blood pressure monitoring for postpartum hypertension: A prospective single-cohort feasibility study. *Pregnancy Hypertension* 15, 171-176, doi:10.1016/j.preghy.2018.12.007 (2019).
18. Hirshberg, A., Downes, K. & Srinivas, S. Comparing standard office-based follow-up with text-based remote monitoring in the management of postpartum hypertension: A randomised clinical trial. *British Medical Journal Quality and Safety* 27, 871-877, doi:10.1136/bmjqs-2018-007837 (2018).
19. Hirshberg, A., Sammel, M. D. & Srinivas, S. K. Text message remote monitoring reduced racial disparities in postpartum blood pressure ascertainment. *American Journal of Obstetrics and Gynecology* 221, 283-285, doi:10.1016/j.ajog.2019.05.011 (2019).

Long-Term Follow-Up after Hypertensive Disorders of Pregnancy

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Key Principles

1. There is a graded relationship between the severity of preeclampsia/eclampsia and the long-term risk of cardiac disease.
2. Women with a history of preeclampsia or eclampsia need to be educated on the association with cardiovascular disease (CVD) and encouraged to have appropriate monitoring and annual follow-up visits with their primary care provider.

Background

Women with a history of preeclampsia have an increased risk of cardiovascular disease, hypertension, renal disease, diabetes and premature death in their later years. Several reviews and meta-analyses have associated preeclampsia with this increased risk. The odds of developing these complications for women with a history of preeclampsia is approximately twice that of women without preeclampsia during pregnancy.¹⁻³ The risk is even higher for women with recurrent preeclampsia⁴ and women with early onset preeclampsia that leads to preterm delivery.⁵ In addition, there is a graded relationship (radiant effect) between the severity of preeclampsia/eclampsia and the risk of CVD. The relative risk ranges from 2.00 for preeclampsia without severe features to 5.03 for preeclampsia with severe features.^{5,6}

The underlying pathophysiology that accounts for this increased risk of CVD associated with preeclampsia is not well understood. One theory is that the disease is related to endothelial dysfunction, which is a hallmark of patients with hypertensive disorders of pregnancy (HDP) such as preeclampsia/eclampsia. The question about

whether future CVD risk is due to the underlying biologic traits of the patient or exposures to stresses during pregnancy continues to be a subject of debate.⁷⁻⁹

National guidelines

In 2011, the American Heart Association (AHA) published guidelines entitled: *Effectiveness based guidelines for the prevention of CVD in women*.¹⁰ The AHA emphasized the following points:

- ▶ Pregnancy provides a unique opportunity to estimate a woman's lifetime risk for developing CVD.
- ▶ History of preeclampsia, gestational diabetes, or any HDP is considered a major risk factor for developing CVD.
- ▶ Women with histories of a HDP need to be referred to primary care providers or cardiologists for annual visits to carefully monitor their health.

The AHA guidelines include a number of CVD risk categories which need to be taken into consideration to identify CVD disease risk factors.

In 2014, the AHA and American Stroke Association (ASA) guidelines for stroke prevention were published.¹¹ A summary of the recommendations pointed out the following:

- ▶ A history of preeclampsia/eclampsia should be elicited for women who are past child-bearing age, as this history is an important indicator of risk throughout the life cycle.
- ▶ Clinicians need to be aware of the association between adverse pregnancy outcomes, CVD, and stroke.
- ▶ Implement follow-up evaluations for all women with a history of preeclampsia or eclampsia, between six months to one year postpartum.
- ▶ Share information and resources with women and their families, counseling women for lifestyle changes including weight management, increased physical activity, smoking cessation/avoidance, and evaluation of blood pressure (BP), lipids, glucose, and body mass index (BMI).
- ▶ Coordination of care with a primary care clinician is essential.

Provider and patient education

In addition to medical treatment, clinicians can provide women with the appropriate counseling for cardiovascular health and jointly develop recommendations for non-medical interventions that will lessen their risk. Examples of non-medical interventions include smoking cessation, working toward an ideal BMI, implementing appropriate dietary counseling, and a regular exercise plan.

Medications such as low-dose aspirin and statins

can be added to the treatment regimen as indicated by appropriate laboratory evaluations and clinician judgment.

Pregnancy and the postpartum period present a great opportunity to identify women who are at greater risk for cardiovascular and neurovascular morbidity due to their preeclampsia diagnosis. As CVD is the leading cause of death for women in the United States, and it is essential that women and maternity providers are informed and educated about these risks and understand appropriate interventions for risk mitigation.¹² During the postpartum period, women are motivated to improve their health and wellbeing; however, their providers do not always counsel women about their CVD risks.¹³ A study by Young et al. found that “only 9% of internists and 38% of obstetrician/gynecologists were counseling women with a history of preeclampsia about CVD risk reduction.¹⁴ Survey data from women who had experienced preeclampsia found that while 95% reported attending their initial postpartum visit, just 39% reported learning about the association with CVD risk from their health care providers.¹²

One reason for the lack of counseling is a knowledge gap among maternity providers, and future cardiologists about evidence-based guidelines for CVD prevention.^{12,15} It is important for health care providers to understand the links between HDP and future risks of CVD.

Many organizations, such as ACOG, AWHONN, and the March of Dimes periodically run education campaigns on preeclampsia. They have developed resource materials to educate clinicians and patients on CVD including informative articles, infographics, and patient handouts.

EVIDENCE GRADING

LEVEL OF EVIDENCE: B

References

1. Brown, M. C. et al. Cardiovascular disease risk in women with pre-eclampsia: Systematic review and meta-analysis. *European Journal of Epidemiology* 28, 1-19, doi:10.1007/s10654-013-9762-6 (2013).
2. Behrens, I. et al. Risk of post-pregnancy hypertension in women with a history of hypertensive disorders of pregnancy: Nationwide cohort study. *British Medical Journal* 358, j3078, doi:10.1136/bmj.j3078 (2017).
3. Stuart, J. J. et al. Hypertensive disorders of pregnancy and maternal cardiovascular disease risk factor development: An observational cohort study. *Annals of Internal Medicine* 169, 224-232, doi:10.7326/M17-2740 (2018).
4. Funai, E. F. et al. Risk factors for pre-eclampsia in nulliparous and parous women: The Jerusalem perinatal study. *Paediatric and Perinatal Epidemiology* 19, 59-68, doi:10.1111/j.1365-3016.2004.00623.x (2005).
5. Ray, J. G., Vermeulen, M. J., Schull, M. J. & Redelmeier, D. A. Cardiovascular health after maternal placental syndromes (CHAMPS): Population-based retrospective cohort study. *Lancet* 366, 1797-1803, doi:10.1016/S0140-6736(05)67726-4 (2005).
6. McDonald, S. D., Malinowski, A., Zhou, Q., Yusuf, S. & Devreux, P. J. Cardiovascular sequelae of preeclampsia/eclampsia: A systematic review and meta-analysis. *American Heart Journal* 156, 918-930, doi:10.1016/j.ahj.2008.06.042 (2008).
7. Grandi, S. M. et al. Hypertensive disorders in pregnancy and the risk of subsequent cardiovascular disease. *Paediatric and Perinatal Epidemiology* 31, 412-421, doi:10.1111/ppe.12388 (2017).
8. Powe, C. E., Levine, R. J. & Karumanchi, S. A. Preeclampsia, a disease of the maternal endothelium: The role of antiangiogenic factors and implications for later cardiovascular disease. *Circulation* 123, 2856-2869, doi:10.1161/CIRCULATIONAHA.109.853127 (2011).
9. Romundstad, P. R., Magnusson, E. B., Smith, G. D. & Vatten, L. J. Hypertension in pregnancy and later cardiovascular risk: Common antecedents? *Circulation* 122, 579-584, doi:10.1161/CIRCULATIONAHA.110.943407 (2010).
10. Mosca, L. et al. Effectiveness-based guidelines for the prevention of cardiovascular disease in women—2011 update: A guideline from the American Heart Association. *Journal of the American College of Cardiology* 57, 1404-1423, doi:10.1016/j.jacc.2011.02.005 (2011).
11. Kernan, W. N. et al. Guidelines for the prevention of stroke in patients with stroke and transient ischemic attack: A guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke* 45, 2160-2236, doi:10.1161/STR.0000000000000024 (2014).
12. Burgess, A. & Feliu, K. Women's knowledge of cardiovascular risk after preeclampsia. *Nursing for Women's Health* 23, 424-432, doi:10.1016/j.nwh.2019.07.001 (2019).
13. Cusimano, M. C., Pudwell, J., Roddy, M., Cho, C. K. & Smith, G. N. The maternal health clinic: An initiative for cardiovascular risk identification in women with pregnancy-related complications. *American Journal of Obstetrics and Gynecology* 210, 438 e431-439, doi:10.1016/j.ajog.2013.12.001 (2014).
14. Young, B., Hacker, M. R. & Rana, S. Physicians' knowledge of future vascular disease in women with preeclampsia. *Hypertension in Pregnancy* 31, 50-58, doi:10.3109/10641955.2010.544955 (2012).
15. Ehrental, D. B. et al. Evaluation of the Heart Truth professional education campaign on provider knowledge of women and heart disease. *Women's Health Issues* 23, e87-93, doi:10.1016/j.whi.2013.01.001 (2013).



Reporting and Systems Learning

The following sections are designed to help U.S. hospital leaders review opportunities for quality improvement and document fidelity to The Joint Commission Standards for Maternal Safety and include:

In this section you will find the following:

- ▶ Perspectives on, and examples of, debriefs and multidisciplinary reviews
- ▶ Recommendations for correctly documenting and coding HDP in the ICD-10 era

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Learning From Cases: Debriefs and Multidisciplinary Case Reviews

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Key Principles

1. Debriefs and multidisciplinary reviews are two key components of the Standards for Maternal Safety by The Joint Commission (TJC). When practiced together, debriefs and multidisciplinary reviews are foundational learning about improvement activities for creating a highly-reliable clinical team and maintaining a culture of safety.
2. Debriefing after the event allows the team to reflect on their performance, and then problem-solve in real time. Debriefing can become a routine part of activities on the unit if the format is kept simple and some key barriers are proactively addressed.
3. Multidisciplinary case reviews are thorough and structured evaluations of patient care with a focus on team and system readiness, recognition and response. Identified deficits are used to inform the clinical team and guide system-level improvements to prevent similar severe maternal morbidities in the future.
4. A multi-faceted communication plan is needed to share meaningful learnings and subsequent process improvement work to the clinical team. This communication plan acts as an ongoing feedback and learning loop to enhance team communication and support a systems' learning culture.

Background

To ensure the safest possible outcomes for women and newborns, it is imperative for facilities that provide maternity care to establish a systems' learning culture dedicated to perinatal quality, safety, and performance improvement. This systems' learning culture cannot be accomplished without a commitment to conducting debriefings and multidisciplinary case reviews on an ongoing basis.

All hospitals accredited by TJC, regardless of resources or level of care provided, are required to implement standards of care for maternity patients with severe hypertension/preeclampsia that comply

with their Standards for Maternal Safety as of January 1, 2021. The elements of practice (EPs) are presented in the Section: Implementing and Sustaining Maternal Quality, Safety, and Performance Improvement on page 15.

Debriefings (EP5) and multidisciplinary case reviews (EP6) are two key components of the standards, and are also recommended by ACOG and are part of the AIM Severe Hypertension Maternal Safety Bundle.¹ The goal of multidisciplinary case reviews are to formally assess the overall care that the health care team provided and review the care system and

REPORTING AND SYSTEMS LEARNING

implementation for potential gaps. Addressing these gaps could potentially improve care for the next patient.

Debriefings and case reviews facilitate a common purpose. While their context and approach may differ, the purpose of debriefings and case reviews are the same: to identify deficits in a patient's care, which if addressed, could potentially improve care for the next patient. Whether a requirement or a recommendation, debriefs and case reviews are standard mechanisms for reviewing events at birth facilities to facilitate learning and drive improvement. This chapter provides suggestions and resources on how to approach EP5 and EP6. Integrating system learnings from debriefings (e.g., simulated drills or actual events) and multidisciplinary case reviews can be one of the most important drivers for quality, safety, and process improvement efforts at the birth facility. Debriefings and case reviews can help clinical staff and unit leadership identify opportunities for improvement, including such issues as:

- ▶ Deviation from standards of care during an eclamptic seizure.
- ▶ Insufficient administration of an IV antihypertensive medication to decrease a severe-range blood pressure.
- ▶ An adverse outcome from a delay in care due to a disagreement between Labor and Delivery and the Intensive Care Unit about responsibilities for the treatment plan.

The system learnings from debriefs and case reviews can inspire and guide quality, safety, and performance improvements to address the above issues:

- ▶ Define clearly delineated nursing roles in the event of an eclamptic seizure.
- ▶ Develop a standardized order set with escalating doses of antihypertensive

medications as per Toolkit recommendations. (See Appendix F: Sample Acute-Onset, Severe Hypertension and Eclampsia Medication Kit on page 198)

- ▶ Establish a service agreement with the Intensive Care Unit.

Implementing these types of improvements in care can demonstrate the power of the debriefings and multidisciplinary case reviews to create and sustain a systems' learning culture and to improve outcomes for women and their newborns.²

Debriefings – Just do it

A debriefing is an immediate opportunity to quickly confer among the care team involved in an emergent patient care situation or following a simulated case/drill to discuss how the event unfolded, share observations about the care given, and highlight any needed improvements. It is essential that the debriefing is perceived by staff as a safe, non-punitive exercise that is designed to improve team performance. This seemingly simple activity of debriefing is a key piece in establishing long term improvements in patient care and safety.³

Debriefings are a 'best practice' that have proven difficult for many units to embrace. Making debriefings a standard part of daily practice can be a challenging proposition. The key is to start simple and keep them limited to 5-10 minutes. Once a team sees that debriefings can be safe and valuable exercises they are more likely to embrace this practice.

Lengthy debriefings can then be reserved for only the most problematic of cases. Debriefings cover complex issues, or involve cases too complicated to cover in 5-10 minutes. They can be followed up with a multidisciplinary case review where specific times, clinical details, and documentation will be needed to better evaluate the event.

Components of a rapid (5-10 minute) debrief (aka 'Hot Debrief')

- ▶ “What went well?”
- ▶ “What could have gone better?”
- ▶ “What needs to be followed up on later and by whom?”

Rapid debrief example

A woman at term is undergoing a medically indicated induction due to a diagnosis of preeclampsia with severe features and has been very stable on magnesium sulfate throughout the induction. A debrief was called by the charge nurse to discuss difficulties that arose in treating the patient’s elevated BP of 190/105 mm Hg.

What went well?

Charge nurse: Both available physicians were involved with a cesarean section, but I didn’t panic, because I knew the patient had PRN orders for labetalol. Although trying to get the labetalol was frustrating, we did treat the patient in less than 30 minutes.

What could have gone better?

Charge nurse: I couldn’t find any labetalol. The labetalol automated medication dispensing system compartment was empty. I tried the emergency medication kits, but we only had one, and that was empty too. I was still working on accessing medication when the physician came out of the operating room, and changed the order to hydralazine, because it was immediately available.

Physician: I don’t understand why I wasn’t notified of the difficulty in obtaining labetalol. I was in house and can give a verbal order for a new medication. It’s important that patients are treated as soon as possible. I am pleased that the patient was treated within 30 minutes.

What needs to be followed up on later and by whom?

Charge nurse: I will speak with the unit director to be sure we follow-up with pharmacy regarding the processes for restocking automated medication dispensing system and emergency medication kits. We will share this debrief and our follow-up action plan with the perinatal safety committee. Everyone needs to be in the loop on this.

When this type of rapid debrief is done frequently, and becomes a routine, expected part of unit workflow, then the practice becomes second nature among staff. When complicated cases occur, clinicians better understand their role in the standardized protocols.

Addressing barriers to implementing debriefs

Debriefs can be challenging to hardwire into perinatal units for several reasons:

- ▶ There may be urgent, competing issues simultaneously requiring the attention of the clinicians involved.
- ▶ It may be difficult to gather relevant participants together at the same time.
- ▶ Private locations to hold the debrief may not be available.
- ▶ Ongoing discussion of when and where to do the debriefing may continue until it eventually becomes too difficult to pick a location. Consequently, a location is never decided upon and the debrief never occurs.
- ▶ Defaulting to delaying the debrief causes too much time to pass for the debrief to be useful.

Nurse and physician leadership at the birth facility should set clear expectations, standardize the basic elements of debriefings, and educate and role model to staff of their value. Understanding how debriefs can improve maternal and newborn outcomes will help staff understand the ‘why’ of sustaining the practice and commit to continuous quality improvement.

Set the expectation that debriefings are to be done immediately following an event, once the patient is stable, and before the physician leaves the unit.

The goal is that all team members who were directly involved in a simulated drill, or a patient’s care during the severe maternal event, be

present for a debriefing. The reality is that this isn’t always possible, but it should be clear to the team that not having all team members present is not a reason to skip the debriefing. Waiting even a day can result in missed opportunities for improvement. When people who need to be involved in the debriefing are no longer on the unit, they can be included via phone or other technology. If that is not possible, the team should proceed with the people who are present, and then follow-up with others post debrief.

If possible, designate a private area, such as a break or conference room on the unit, as the ‘go-to’ debriefing room where everyone is expected to gather. Using patient care areas for a debriefing is problematic because of the difficulty of maintaining confidentiality and the chance of disruptions and distractions. Make debriefs easy to conduct by storing blank debriefing forms in the designated room.

Setting clear expectations and establishing an accountability structure will reinforce the practice of routine debriefings after emergent and severe maternal events. The charge nurse and the involved physician(s) may share responsibility for conducting the debriefings. Consider partnering with a nurse or simulation educator to track and monitor that debriefs are conducted for all appropriate cases. The nurse or simulation educator can advise on how to track debrief outcomes after drills and actual severe maternal events as a quality/performance improvement metric.

The rapid debriefing form (See Appendix R: Sample Perinatal Safety Debrief Form on page 237) serves multiple purposes to support the debriefing process. For the person conducting the debriefing, the form acts as their script to lead the team through the questions that need to be answered. The form can then be used to document the debriefing and serve as a tracking document of any issues that need to be followed

REPORTING AND SYSTEMS LEARNING

up after the debriefing. These debriefing forms are then reviewed periodically by the perinatal patient safety and quality team, who can close the loop on any outstanding systems issues, monitor trends or evolving concerns, and highlight any systems learnings that need to be shared with the unit staff. When creating a rapid debriefing form, strive to keep it focused and uncomplicated. This type of format will make the debriefing process easier for the team to conduct, and make it more likely that the debriefing form is followed and completed.

Staff often experience routine implementation of debriefings as a major culture shift in the birthing facility. Achieving a just culture of systems learning focused on continuous improvement in quality, safety and performance improvement requires that staff and providers collaborate and receive strong support from facility leadership. Since debriefings are an important tool for establishing a systems learning culture and transforming care, it is worthwhile to actively and effectively address these barriers. The goal is to change debriefing, from what may be perceived as a dreaded activity, to just part of the everyday, routine work that happens on the unit.

Multidisciplinary review of severe maternal morbidity events

The Joint Commission's Standards for Maternal Safety requires birth facilities to review cases of women with hypertensive disorders of pregnancy (HDP), based on facility-defined criteria regarding the effectiveness of the care, treatment, and services for process improvement efforts. Hospitals should already have existing policies in place to undertake structured case analyses of sentinel events or the serious adverse events involving any patient.

It is rare that women with HDP experience serious adverse events that meet TJC or facility criteria for review. Therefore, in service of

creating a systems' learning and continuous quality improvement culture, we recommend that birth facilities expand the types of cases to review to better understand the factors contributing to the outcome. Selection of cases could include those that meet the definition of severe maternal morbidity by AIM/ACOG coding criteria, which are: 1) transfusion of 4 or more units of blood and 2) admission of a pregnant or postpartum woman to an ICU.

Additional types of cases may warrant a multidisciplinary case review:

1. Cases with the most serious manifestations of the disease, such as women who experienced eclampsia, severe HELLP syndrome, stroke, or cases involving women whose care required multiple, intensive resources or presented pressing clinical challenges.
2. Cases whose course of care revealed practices that fell below the standard of care or revealed gaps in the delivery system. Examples of these gaps include delayed diagnosis due to unchecked labs or missed severe-range BP values, or delayed treatment to prevent a seizure.
3. Obstetric leaders may want to consider reviewing all SMM cases.

While patients diagnosed with HDP who experience the most serious manifestations of the disease may not have experienced any significant gaps of care, as cases like these may be on the review list because of their severity. Even when it appears the patient received excellent care and had a good outcome, these types of challenging cases offer tremendous potential for new insights into opportunities for improvement and an opportunity to recognize staff.⁴

Establishing a local *Perinatal Patient Safety Program* committee to report out these systems-learning to leadership will ensure meaningful

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next steps in your organizations perinatal quality, safety and performance improvement journey.

A multi-disciplinary case review is a complementary workflow to the debrief, so that the 'lessons learned' from the debrief can be added to the multidisciplinary case review findings for systems learning.

Multidisciplinary case reviews empower systems-learning

A multi-disciplinary case review is a preplanned and coordinated review of severe maternal events used to identify quality and safety opportunities for improvement in the birth facility. It is not a peer review. A recommended strategy for conducting multidisciplinary case reviews is to have a standing perinatal patient safety program committee, or a subgroup, that meets monthly or quarterly to review all cases identified by AIM/ACOG coding criteria supplemented with the two types of cases mentioned above and by the unit's event debriefing process. This committee includes representation from obstetrics, neonatology, anesthesiology, nursing, quality and patient safety departments. If resources permit, the cases can be previewed by an experienced nurse knowledgeable about obstetrics and quality to address any coding or diagnosis discrepancies to help identify the primary issues that need the committee's attention. Conducting multidisciplinary reviews on a regular basis (i.e. monthly or quarterly) are key to systems-learning in all birth facilities and ensuring ongoing perinatal quality, safety, and performance improvements.

Multidisciplinary case reviews can also be performed as a stand-alone, focused review occurring soon after a severe maternal event

or for a case that is identified by the perinatal patient safety program committee that needs a more in-depth review. Along with the representation noted for the standing committee, a focused review of a specific case should also include specialists such as intensivists, cardiologists, behavioral health specialists, emergency medicine physicians, social workers, peer support specialists, and psychiatrists. Additional expertise may be required to understand the context and identify opportunities for improvement of that particular case.

The AIM/ACOG patient safety tool, [Severe Maternal Morbidity Review](#), contains several best practices for conducting facility reviews of severe maternal events. The AIM/ACOG patient safety tool, [Support after a Severe Maternal Event](#), provides guidance on how to provide timely and effective support to the patient and family after a severe maternal event. The CMQCC Maternal Data Center also offers a highly usable review system for all SMM cases including hypertensive disorders.

Additional considerations

- ▶ Add patient advocates or work with your institution's patient and family advisory council to gain meaningful insights from the 'voices of women and their family members' during your multidisciplinary case reviews.
- ▶ Conduct perinatal morbidity & mortality (M&M) meetings, at least annually, at your hospital to share the multidisciplinary case reviews insights with other departments.
- ▶ If your hospital or your state participates in a state-based perinatal quality collaborative (PQC), consider partnering with the PQC leadership to present your organizational 'lessons learned' with others in webinars and/or in-person/virtual events.



Communication plan

A team communication plan is needed to share valuable insights and subsequent performance/process improvement results with all team members and also with patient advocates. The communication plan serves as a critical piece of an ongoing feedback/learning loops that helps maintain engagement and supports a culture of continuous quality improvement. It is important to ensure that the key systems learnings and results of improvement efforts are shared with frontline staff and patient advocates. Ongoing communication lets staff and patient advocates know that their concerns are heard, and that debriefs, drills, and multidisciplinary case reviews are more than a box to check and actually improve patient care.

It is important to facilitate and normalize timely monitoring of care effectiveness, identify opportunities for improvement, and establish a feedback mechanism to nursing and physician leadership for systems-learning. Ongoing communication reassures the team that their investment of time and perspectives is valuable. Conducting debriefs and multidisciplinary reviews on a regular basis, not only enhances learning identifying opportunities for improvement within the unit, but the findings can be used to provide focused feedback to facility leadership. Sharing the opportunities for improvement, and the actual improvement efforts and results, can better help leadership understand the resources needed to provide the safest and most respectful care for women with HDP.

Resources

CMQCC Guide to Rapid Debrief Tools

AIM Patient Safety Tool: Severe Maternal Morbidity Review Forms

AHRQ Comprehensive Unit Safety Program (CUSP)

AHRQ Patient Safety Net (PSNet) Debriefing for Clinical Learning

Military Health System (MHS) Debriefs Toolkit

American Hospital Association (AHA) TeamSTEPPS

American Heart Association Get with the Guidelines (AHA GWTG): Hot Debriefing Forms

If you are in a state that has a perinatal quality collaborative (PQC), contact your local PQC Leadership to learn more about their perinatal quality, safety, and performance improvement initiatives and resources.

EVIDENCE GRADING

LEVEL OF EVIDENCE: B

References

1. Bernstein, P. S. et al. National Partnership for Maternal Safety: Consensus bundle on severe hypertension during pregnancy and the postpartum period. *Obstetrics and Gynecology* 130, 347-357, doi:10.1097/AOG.0000000000002115 (2017).
2. Halamek, L. P., Cady, R. A. H. & Sterling, M. R. Using briefing, simulation and debriefing to improve human and system performance. *Seminars in Perinatology* 43, 151-178, doi:10.1053/j.semperi.2019.08.007 (2019).
3. Gardner, R. Introduction to debriefing. *Seminars in Perinatology* 37, 166-174, doi:10.1053/j.semperi.2013.02.008 (2013).
4. Pettker, C. M. Systematic approaches to adverse events in obstetrics, Part I: Event identification and classification. *Seminars in Perinatology* 41, 151-155, doi:10.1053/j.semperi.2017.03.003 (2017).

Documenting Maternal Hypertensive Diagnoses with Accurate ICD-10 Coding

Elliott K. Main, MD, Stanford University School of Medicine, CMQCC

Key Principles

1. There can be significant confusion around the classification of hypertensive disorders of pregnancy (HDP). Inaccurate diagnoses are common and the majority of errors were related to poor documentation by providers rather than misunderstandings by the coder.
2. Providers must appropriately reevaluate to capture the evolution of the disease because the treatment will change as the disease evolves and or the gestational age advances.
3. The specific diagnosis is not important when determining treatment: All patients with HDP who reach threshold blood pressure (BP) levels need to be treated with antihypertensive medications.

Background: Diagnostic accuracy and importance

Making a timely and correct diagnosis is fundamental for improving outcomes in HDP. Inaccurate diagnoses of preeclampsia is not uncommon. In one academic center study, only 45% of the ICD-9 diagnoses of preeclampsia without severe features (formerly called 'mild') were confirmed by chart review.¹ Half of the inaccurate diagnoses were actually gestational hypertension and the other half were preeclampsia with severe features. On chart review, eclampsia was also poorly coded with only 41% (5 of 12) cases correctly identified. Of these 7 incorrect cases, 6 were preeclampsia with severe features and one was preeclampsia without severe features. This study illustrates that even in a university hospital, there can be significant confusion around the classification of HDP. The majority of the diagnostic errors were related to poor documentation by providers rather than misunderstandings by the coder. There are no studies looking at accuracy of HDP coding in the ICD-10 era.

If the diagnosis is not clear, or is inaccurate, it is not surprising that patients may receive the wrong treatment (e.g., expectant management rather than expeditious delivery). The need for clear diagnostic accuracy is even more important in a progressive disease, such as preeclampsia, that typically worsens over time, and requires ongoing monitoring and possible changes in management. Providers must appropriately reevaluate the patient to capture the evolution of the disease because the treatment will change as the disease evolves and or the gestational age advances. The correct diagnosis based on signs and symptoms for gestational hypertension, preeclampsia without severe features, preeclampsia with severe features, eclampsia, or superimposed preeclampsia must be made and appropriately documented. As noted throughout the Toolkit, the specific diagnosis is not important when determining treatment—all patients with HDP and who reach threshold BP levels need to be treated with antihypertensive medications. (See Section: Antihypertensive Agents in Preeclampsia on page 121)



Recommendations for improving ICD-10 Coding

1. Clinicians should review the most recent ACOG criteria for diagnosing HDP categories during pregnancy and postpartum.²
2. Posting a summary of the categories and their criteria on the labor floor and/or in the electronic medical record is useful.
3. Clearly document and communicate the initial diagnosis based on initial signs and symptoms.
4. Clearly document and communicate any changes in diagnosis and treatment plan.
5. Coders should review progress notes to identify the most advanced stage of HDP during hospital admission as the discharge diagnosis code.
6. As a quality improvement effort, cases reviewed in the facility's perinatal quality review committee should also focus on the correct categorization. Feedback can be quite effective for improving coding quality.

Coding guidance for HDP

ICD-10 code terminology comes close but does not perfectly match current ACOG definitions for hypertensive disorders of pregnancy (HDP).² Table 1 shows how HDP ICD-10 codes are distributed among women at delivery in California. Note that nearly 40% of mothers had more than a single code.

Table 1. Frequency of HDP ICD-10 codes at delivery in California (CMQCC Maternal Data Center): 2018, Total Women = 441,143

ACOG category	ICD-10 CM	Description	Number of women with diagnosis code	Rate per 1,000 deliveries
Chronic Hypertension	O10.0x	Pre-existing essential hypertension complicating pregnancy, childbirth and the puerperium	3,804	8.6
	O10.1x	Pre-existing hypertensive heart disease complicating pregnancy, childbirth and the puerperium	55	0.1
	O10.2x	Pre-existing hypertensive chronic kidney disease complicating pregnancy, childbirth and the puerperium	210	0.5
	O10.3x	Pre-existing hypertensive heart and chronic kidney disease complicating pregnancy, childbirth and the puerperium	7	0.0
	O10.4x	Pre-existing secondary hypertension complicating pregnancy, childbirth and the puerperium	22	0.0
	O10.9x	Unspecified pre-existing hypertension complicating pregnancy, childbirth and the puerperium	5,724	13.0
	I10	Essential (primary) hypertension	388	0.9
	I11.x	Hypertensive heart disease (with and without heart failure)	82	0.2
	I12.x	Hypertensive chronic kidney disease (multiple stages)	223	0.5
	I13.x	Hypertensive heart and chronic kidney disease (multiple stages)	15	0.0
	I15.x	Renovascular and other secondary hypertension	30	0.1
	I16.x	Hypertensive urgencies/emergencies	300	0.7
	Preeclampsia (formerly mild to moderate)	O14.0x	Mild to moderate preeclampsia	5,243
O14.9x		Unspecified preeclampsia	6,497	14.7

ACOG category	ICD-10 CM	Description	Number of women with diagnosis code	Rate per 1,000 deliveries
Preeclampsia with severe features	O11.x	Pre-existing hypertension with preeclampsia	3,878	8.8
	O14.1x	Severe preeclampsia	9,446	21.4
	O14.2x	HELLP syndrome	1,342	3.0
	O15.x	Eclampsia	312	0.7
Gestational hypertension	O13.x	Gestational [pregnancy-induced] hypertension without significant proteinuria	20,305	46.0
	O16.x	Unspecified maternal hypertension	2,268	5.1

Improving Health Care Response to Hypertensive Disorders of Pregnancy, a CMQCC Quality Improvement Toolkit, 2021.

Table 1 shows the CMQCC approach to group the ICD-10 codes to match the ACOG categories. The first non-obvious decision is to include Preeclampsia Superimposed on Preexisting Hypertension (O11.x), which often represents Preeclampsia with Severe Features, and so was placed in that group. The second is placing Unspecified Maternal Hypertension in the Gestational Hypertension group, though expert opinions may differ. The frequencies for each diagnosis code are presented to allow independent analyses of the data.

One surprising finding is that the diagnosis with the highest frequency is gestational hypertension, with 46 per 1,000 women or 4.6%. It is important to recall that the current guidance from ACOG Practice Bulletin 222 suggests that the outcomes and the clinical approach for gestational hypertension, should be no different from that for preeclampsia.²

Coding tips for hypertensive disease in pregnancy

The California data has been reviewed with ICD Coding Consultant, Kristi Pollard, RHIT, CCS, CPC, CIRCC (Senior Coding Consultant/AHIMA-Approved ICD-10-CM/PCS Trainer, The Haugen Group). She provided the following tips for coding maternal cases with HDP in response to our questions:

Q. Should every pregnant woman with HDP have one of the O-series codes for HTN?

A. Yes, there should always be an O code for gravidas with hypertension, even in the setting of chronic hypertension.

Q. Are the non-O codes for hypertension/HDP optional? Should they ever be used alone or always with an O-code)?

A. The non-O codes are used to provide additional information about hypertensive conditions (i.e., type of hypertensive heart disease or stage of chronic kidney disease in patients with hypertensive renal disease). They are not “optional,” per coding instructions, which direct the coder to report an additional code with the O code. However, these codes are sometimes missed by the coder. As noted above, HDP should always be documented with an O-code.

Q. Can more than one of the HTN O-codes be used for the same episode of care? For example, can eclampsia or HELLP syndrome be coded along with pre-existing essential hypertension?

A. There is no instructional guidance on whether to use additional hypertension O codes with eclampsia or HELLP syndrome, so either way is fine.

Q. There were some cases with the code I10, Essential Hypertension.

A. There should be no cases for I10. Unspecified HTN in a pregnant female is fully reported with code O10.0x. I would look at the cases with I10 to make sure a code from category O10 is also assigned. If not, that is a coding error.

Q. What about the code I16 Hypertensive Urgency/Emergency?

A. The code I16 for hypertensive urgency/emergency is an additional hypertension code that should only be listed in addition to the primary hypertension type, so there should always be a code from category O10, O11, or O14.

References

1. Geller, S. E. et al. International Classification of Diseases-9th revision coding for preeclampsia: how accurate is it? American Journal of Obstetrics and Gynecology 190, 1629-1633; discussion 1633-1624, doi:10.1016/j.ajog.2004.03.061 (2004).
2. ACOG. ACOG Practice Bulletin No 222: Gestational Hypertension and Preeclampsia. Obstetrics and Gynecology 135 (2020).



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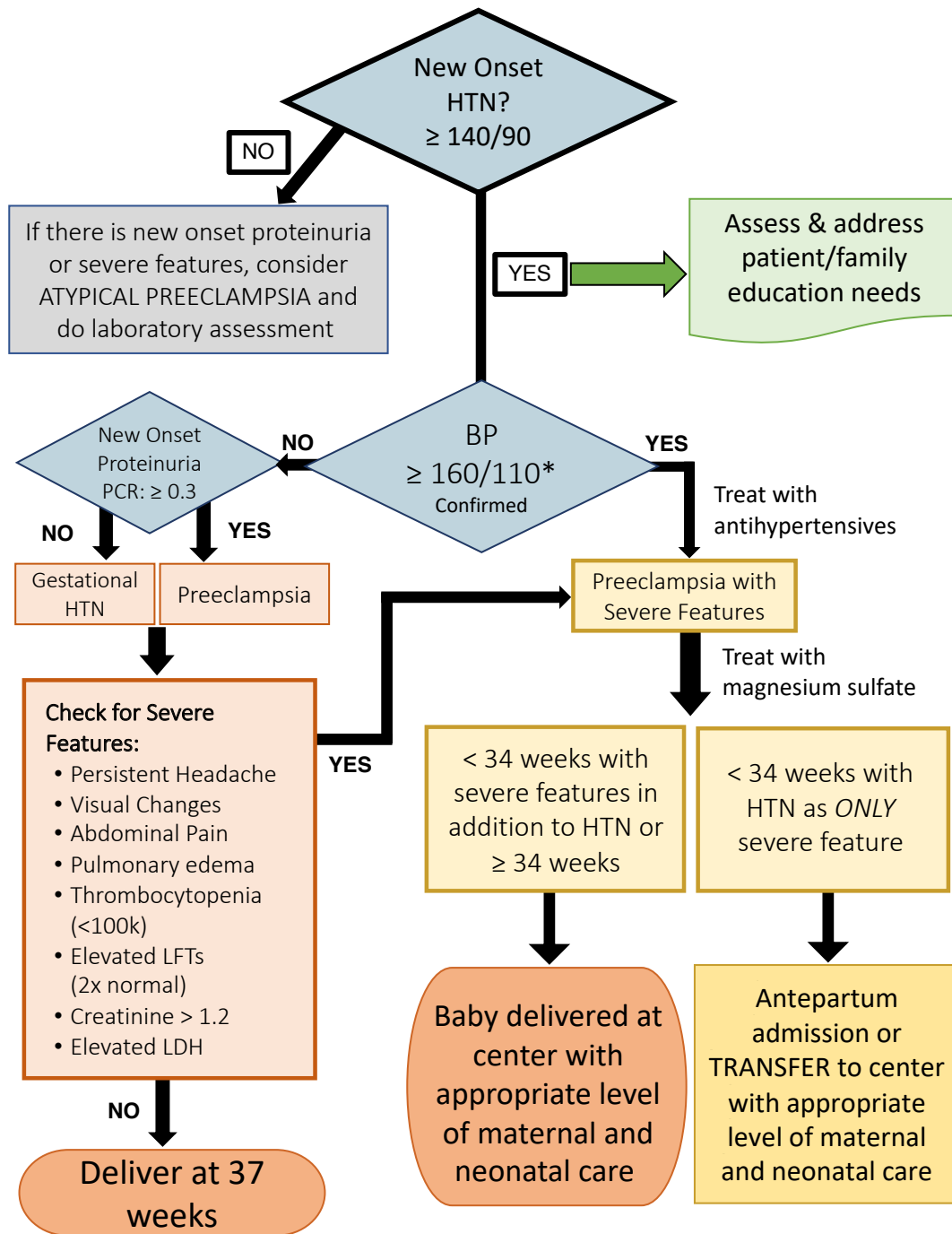
Appendix A: Classification of Evidence Grading

Level of Recommendations:

A	Recommendations are based on good and consistent scientific evidence
B	Recommendations are based on limited or inconsistent evidence.
C	Recommendations are based primarily on consensus and expert opinion.

These recommendations align with those used by American College of Obstetricians and Gynecologists (ACOG).

Appendix B: Suspected Preeclampsia Algorithm



Based on ACOG Practice Bulletin 222, June 2020

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

TREAT BP ACCORDINGLY

If abnormal labs or symptoms, proceed to delivery

*Clinicians may consider antihypertensive therapy at 155/105 mm Hg given the association with increased maternal morbidities at this threshold in several studies as discussed in Toolkit Section: Borderline Severe-Range Blood Pressures: A Clinical Conundrum on page 35.

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

Appendix C: Simulation Scenarios

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NOTE: The HDP Task Force does not endorse any particular simulation system and the references to trade names in this section are included as reference only. This is a SAMPLE developed by a particular facility as an example to work from. You may need to adjust based on the individual circumstances of your facility.

Preeclampsia with Severe Features and Eclampsia in Postpartum Unit

Part 1: General directions for use

General

1. This scenario is written using Laerdal LLEAP software and can be used with either SimMan3G or SimMan Essentials. It is designed to operate the simulator and the patient monitor display in a standardized fashion with minimal input from the operator.
2. This scenario can be varied depending on several factors and can be used with little or no dedicated simulation equipment. This could be as simple as using cue cards with a staff member acting as the patient.

Possible Variants:

1. Clinical area: this scenario is written for use in the postpartum unit but could easily be adapted for use in LDR, ED, etc.
2. Patient simulator options:
 - a. Other Laerdal simulators including SimMom
 - b. Other high fidelity simulator manufacturers
 - c. Use of a confederate to act as the patient
 - i. this can be highly effective to better simulate seizure-like activity
 - ii. It is critical that participants do not attempt to do procedures on the “patient” e.g. IV start, intubation, etc.
3. Pre-programmed content vs. “on the fly” – Using the parameters in the scenario algorithm, the operator could run the case manually instead of using the pre-programmed case file.
4. Providing vital signs during the case
 - a. Use of other patient monitor simulators
 - b. Use of vital sign generator apps that work on phones, tablets, etc.
 - c. Use PowerPoint slides on a tablet, or even cardboard “cue cards” to indicate changes in vital signs and patient status.
 - d. Cue cards to provide vital signs
5. Patient care materials: can be run with or without patient care materials like IV, medications, etc.
6. Video for debriefing: the use of video for debriefing can be a powerful when done appropriately but is not necessary for effective debriefing. There are several AV capture options if desired.

Part 2: Scenario overview

<p>Scenario Program File</p>	<p>Preeclampsia/Eclampsia/PP Unit 3G v1.0 (SimMan3G) or Preeclampsia/Eclampsia/PP Unit Ess v1.0 (SimMan Essentials)</p>
<p>Scenario Time</p>	<p>15-20 minutes</p>
<p>Debriefing Time</p>	<p>20-45 minutes – will vary depending on how the team manages preeclampsia/eclampsia and hypertension as well as what TeamSTEPPS concepts will be covered.</p>
<p>Target Group</p>	<p>Postpartum nurses, OB physicians, Anesthesiologists, & CRNAs</p>
<p>Case Summary</p>	<p>This is a case of a patient in the postpartum unit with postpartum preeclampsia with severe features that progresses to eclampsia. The patient requires antihypertensive treatment as well as magnesium sulfate to control seizures. Despite an initial magnesium bolus and drip, the patient continues to seize and will require an additional magnesium bolus to control her seizures. Varying airway compromise can be added if desired.</p> <p>This case is designed to ensure staff are following ACOG & CMQCC guidelines for treatment of preeclampsia and eclampsia. Therefore, there is a great emphasis on appropriate medication dosing and timing per these guidelines.</p> <p>There are two very important operational conditions to make this scenario work effectively.</p> <ol style="list-style-type: none"> 1. The appropriate dosing interval between antihypertensives requires the operator to “artificially speed up time” during the case in order to complete the case in 15-20 minutes. 2. It is critical that the participants recognize the patient is seizing. Options: <ol style="list-style-type: none"> a. Use of a “seizure mattress” works well to create seizures. b. SimMan3G has a seizure feature but the effectiveness of this feature is limited, so a confederate may need to point out seizure if the team does not recognize one is occurring. c. If using a confederate for the patient, that person should simulate a generalized tonic-clonic seizure and post-ictal state.

<p>Teaching Personnel</p> <p>Recommend 4 Instructors: Must include at least 1 MD and 1 RN</p>	<p>Instructor Roles:</p> <ol style="list-style-type: none"> 1. GUI operator/Voice of patient: can be operated by sim technician if available 2. AV capture operator: collect data for debriefing and data collection purposes. 3. Lead debriefer: may be AV capture operator or another instructor who works alongside to insure all relevant information for debrief & data collection is collected accurately. 4. Confederates to act as family member. They should be holding the new infant and can point out the seizure if not apparent to the team.
<p>Participants</p>	<ol style="list-style-type: none"> 1. Physicians (minimum 1 OB/emergency medicine physician, may include anesthesia, trainees, etc. if desired) 2. Nurses (4-5) to include no more than 1 LVN. (May use 3-4 RNs with 1 Tech/MA)
<p>Learning Objectives</p>	<ol style="list-style-type: none"> 1. Demonstrate superior teamwork and communication skills using the TeamSTEPPS model with a focus on shared mental model and role clarity throughout the case. 2. Recognize and treat preeclampsia with severe features, and eclampsia with hypertension, by treating with: <ol style="list-style-type: none"> a. Antihypertensives per ACOG/CMQCC guidelines b. Magnesium sulfate for seizures 3. Maintain airway and oxygenation in seizing and post-ictal patient
<p>References</p>	<ol style="list-style-type: none"> 1. ACOG. Gestational hypertension and preeclampsia. Practice Bulletin No. 222 of the American College of Obstetricians and Gynecologists. <i>Obstetrics and Gynecology</i> 135, 1492-1495, doi:10.1097/AOG.0000000000003892 (2020). 2. Bernstein PS, Martin JN Jr, Barton JR, et al. National Partnership for Maternal Safety: Consensus Bundle on Severe Hypertension During Pregnancy and the Postpartum Period. <i>Obstetrics and Gynecology</i> 2017; 130:347.

Improving Health Care Response to Hypertensive Disorders of Pregnancy, a CMQCC Quality Improvement Toolkit, 2021.

Part 3: Detailed objectives

<p>Medical Management</p>	<ol style="list-style-type: none"> 1. Identify the patient with postpartum preeclampsia with severe features that progresses to eclampsia <ol style="list-style-type: none"> a. Identify possible signs and symptoms of postpartum preeclampsia <ol style="list-style-type: none"> i. Neuro: Headache, Visual Complaints, Altered Mental Status, CVA, Seizure ii. Abdominal pain – especially RUQ or epigastric pain iii. Shortness of breath – pulmonary edema b. Identify the hypertensive emergency that is part of preeclampsia with severe features in this case, i.e., SBP \geq 160 mm Hg OR DBP \geq 110 mm Hg 2. Manage the patient with postpartum preeclampsia with severe features that progresses to eclampsia <ol style="list-style-type: none"> a. Treat hypertension per ACOG and CMQCC guidelines <ol style="list-style-type: none"> i. Target BP = 130-150/80-100 mm Hg ii. Labetalol IV - escalating doses 20mg, 40mg, 80mg, q10 min prn iii. Hydralazine IV - escalating doses 5-10mg, 10 mg, q 20 min prn iv. Nifedipine PO (immediate release) - escalating doses 10 mg, 20 mg, q20 min prn b. Treat refractory eclampsia with magnesium sulfate. <ol style="list-style-type: none"> i. Initial magnesium sulfate load and drip ii. Additional magnesium sulfate bolus for recurrent seizures. Can include other medications including benzodiazepines if desired 3. Maintain airway and oxygenation – basic airway positioning, optional intubation
<p>Psychomotor Skills</p>	<ol style="list-style-type: none"> 1. Prepare, and administer critical medications 2. Seizure precautions – positioning, padding of rails, etc. 3. Provide airway support with basic airway positioning, optional intubation

<p>Teamwork & Communication Skills (TeamSTEPPS)</p>	<ol style="list-style-type: none"> 1. Communication: <ol style="list-style-type: none"> a. SBAR to team responding to call for help b. Call outs before meds are given and after medications have been given – timing of antihypertensive dosing is critical for this scenario. c. Check backs (i.e. closed loop communication) <ol style="list-style-type: none"> i. Team leader to team members re: role clarity ii. RN call backs to confirm dosages d. Importance of team recorder to keep team on track with times of meds/interventions 2. Leadership – joint duty of primary nurse and primary physician <ol style="list-style-type: none"> a. Role clarity for team members – primary nurse b. Shared mental model – physician – briefs team after initial assessment on patient condition and plan of care. 3. Situation Monitoring <ol style="list-style-type: none"> a. Situational Awareness b. Maintains shared mental model – briefing during case to keep up to date and address challenges in treatment. c. Cross-monitoring – “watching each other’s back” 4. Mutual Support <ol style="list-style-type: none"> a. Task assistance – help with medications, seizure precautions, airway etc. as needed b. Assertion for important information <ol style="list-style-type: none"> i. Speak up in firm and respectful manner – offer explanation of concern and proposed solution ii. CUS – I’m <u>C</u>oncerned! I am <u>U</u>ncomfortable! This is a <u>S</u>afety issue! 5. Demonstrate successful strategies to deal with concerned family members who may become an obstruction to patient care
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Part 4: Patient background information

Patient Information	Background OPTION #1
Age	25
Weight	197 lb.
HPI	25 y/o G1P1 who is post-op day 2 from a primary c/s for fetal macrosomia. Prenatal course uncomplicated and c/s uneventful. QBL 800ml. Post-op course to date has been uneventful. The patient has been doing well until approx. 24 hours ago when she delivered and had a worsening headache and dizziness. In the last 6-8 hours, she has developed some RUQ abdominal pain with nausea. She is not vomiting but is having a difficult time taking adequate po due to pain and nausea.
PMHx	None
Medications	Prenatal Vitamins, Ibuprofen 800mg tid
Allergies	None
Social Hx	Married, works as cashier at grocery store. No EtOH, Drugs, Tobacco.
Presentation	Patient calls the nurse after developing a worsening headache and dizziness. The nurse should evaluate the patient's VS and note that she is now markedly hypertensive. If the RN does not check VS, the patient should complain about worsening symptoms including RUQ pain and nausea.
Vital Signs	T 98.3, HR 93 BP 170/109, RR 16, SpO2 99% on RA.
Labs	WBC 13, Hgb 10.7, Hct: 32, Plt: 220, ALT 42, AST 27, BUN 10, Cr. 0.7, Uric Acid: 5.6

Patient Information	Background OPTION #2
Age	42
Weight	221 lb.
HPI	42 y/o G1P1 is 8 hours s/p vaginal delivery at 38 weeks. Prenatal course was complicated by some mild-range hypertension that did not require antihypertensive medication. QBL 250ml and she has been doing well otherwise
PMHx	HTN – not on medications

Patient Information	Background OPTION #2
Medications	Prenatal Vitamins, Ibuprofen 800mg tid
Allergies	None
Social Hx	Married, works as a corporate attorney. No EtOH, Drugs, Tobacco.
Presentation	Patient calls the nurse after developing a worsening headache and dizziness. The nurse should evaluate the patient's VS and note that she is now markedly hypertensive. If the RN does not check VS, the patient should complain about worsening symptoms including RUQ pain and nausea.
Vital Signs	T 98.3, HR 93 BP 170/109, RR 16, SpO2 99% on RA.
Labs	WBC 13, Hgb 10.7, Hct: 32, Plt: 220, ALT 42, AST 27, BUN 10, Cr. 0.7, Uric Acid: 5.6

Improving Health Care Response to Hypertensive Disorders of Pregnancy, a CMQCC Quality Improvement Toolkit, 2021.

Simulation scenarios for preeclampsia with severe features and eclampsia in postpartum unit

Part 5: Equipment/materials list

Simulation Equipment:

- Option #1 – SimMan 3G – Instructor PC & Patient Monitor PC – Seizures produced using “Tonic-Clonic” seizure on GUI
- Option #2 – SimMan Essential or 3G – Instructor PC & Patient Monitor PC with “Seizure Mattress” – Seizures produced from seizure mattress independent of GUI.
- Option #3 – SimMom
- Option #4 – Standardized patient with Instructor PC & Patient Monitor PC.
- Option #5 – Standardized patient with low fidelity cue cards for VS OR use of VS apps on phone/iPads
- Microphone for GUI operator to simulate patient's voice
- Video Capture: can use Laerdal software or other AV capture software e.g. Vosaic Connect for video debriefing and data collection. Alternatively, can use combo of laptop with iPad or GoPro for video capture.
- Debrief using laptop and video projector.
- Low fidelity option includes note taker rather than video capture, with review of notes for

debrief. Video is preferable if equipment and expert debriefer available.

- Low fidelity infant simulator/doll for family member to hold at bedside

Patient Care Equipment:

- ID band on patient (simulator or standardized patient)
- IV in place
- Normal saline and IV pole
- Crash cart – should be outside room if planning on more advanced airway issues
- 100% O2 Non-Rebreather Mask
- Adult ambu bag and oxygen tubing
- Suction module, canister, tubing, yankauer tip
- Optional - Medication pump to administer magnesium sulfate

Medication:

Unless otherwise specified, nursing should draw up meds or mix medication drips

- Magnesium 6g
- Magnesium 4g
- Magnesium 2g x 2 – one for drip and another for additional bolus
- Labetalol 10mg, 20mg, 40mg and 80mg
- Hydralazine 5 and 10mg – multiple doses
- Nifedipine immediate release 10 mg tabs – multiple doses
- Optional - Benzodiazepines – Ativan, Versed, or Valium

Moulage:

None

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Part 6: Program algorithm and operator notes

Case Summary and Key Points

This is a case of a patient with postpartum preeclampsia with severe features that progresses to eclampsia. The patient develops severe signs and symptoms of preeclampsia that progress to eclampsia and requires anti-hypertensive treatment as well as magnesium sulfate to control seizures. Despite an initial magnesium sulfate bolus and drip, the patient continues to seize and will require an additional magnesium sulfate bolus to control her seizures. Varying airway compromise can be added if desired. This case is designed to ensure staff are following ACOG & CMQCC guidelines for treatment of preeclampsia and eclampsia. Therefore, there is a great emphasis on appropriate medication dosing and timing per these guidelines.

There are also important operational conditions to make this scenario work effectively

1. The appropriate dosing interval is 10 min for IV labetalol, 20 min for IV hydralazine, and 20 min for PO nifedipine (immediate release tabs). This requires the operator to “artificially speed up time” during the case in order to complete the case in a timely fashion. There are cues built into the scenario that prompt a call out that 10 min have passed approx. 90-120 seconds into the frame. This cue should be discussed in the pre-scenario briefing so that participants won't be surprised during the scenario.
2. It is critical that the participants recognize the patient is seizing. Use of a “seizure mattress” is ideal to create seizures, but if not available, SimMan3G does have a seizure feature. Unfortunately, the effectiveness of this seizure feature is limited, so a confederate may be required to point out the seizure if the team does not recognize that a seizure is occurring.

The scenario flows as noted in the diagram below

1. Scenario advances when anti-HTN meds are ordered, given, or “Advance Next Frame” is clicked. Note the events that connect frames in diagram below.
2. The event menu contains antihypertensive meds, critical scenarios controls and magnesium doses. Note the Magnesium tab that must be clicked to see the magnesium bolus doses and magnesium drip. (Figure 1 on page 189)
3. The resources menu shows the ED Monitor setup as well as the GUI setup for this case (Fig. 2).
4. Seizure control will be up to the instructor, but there are instructor messages to cue seizures at the recommended time. It is recommended to have the patient seize for the first time after the primary nurse completes their initial assessment and is ready to call for help. This will insure that the whole team responds. If you want the team to treat refractory seizures, have the patient seize again approx. 20 min into the case because the first mag bolus should be complete at that time.
5. The case ends after the BP is under control and the patient is no longer seizing.

Example of simulation models:

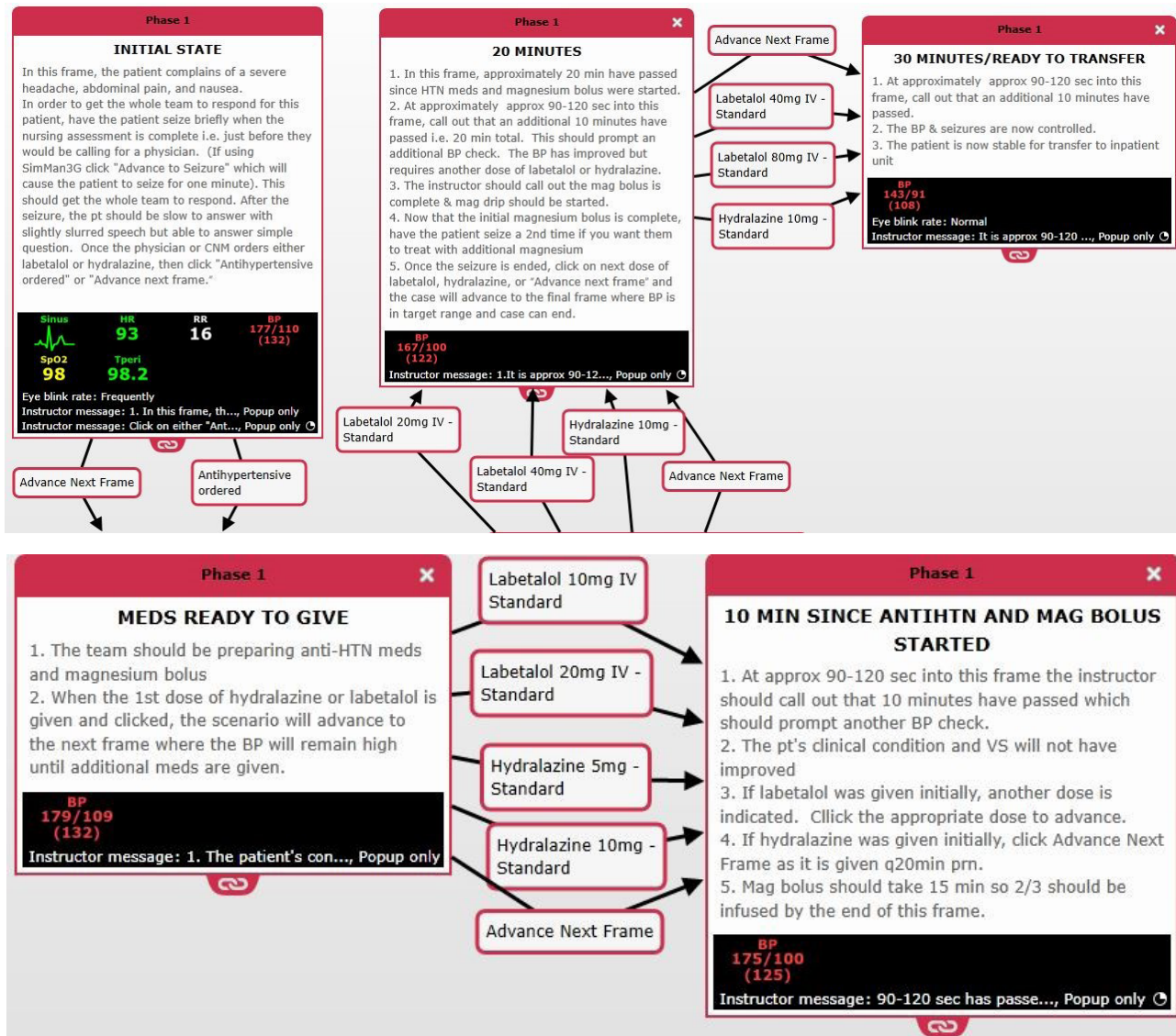


Figure 1. Event Menu

EVENT MENU (Fig. 1)

Action	Count	Magnesium Dose	Count
Advance Next Frame	0	Magnesium 6g bolus - Standard	0
Advance to Seizure	0	Magnesium 4g bolus - Standard	0
Antihypertensive dose #1 ordered	0	Magnesium 2g bolus - Standard	0
Magnesium bolus ordered	0	Magnesium drip 2g/hr	0
Labetalol 10mg IV Standard	0		
Labetalol 20mg IV - Standard	0		
Labetalol 40mg IV - Standard	0		
Labetalol 80mg IV - Standard	0		
Hydralazine 5mg - Standard	0		
Hydralazine 10mg - Standard	0		

At any point in the case, this advances to the next frame

If using SimMan3G, this will trigger a seizure lasting 1 min and close the eyes halfway

This advances the scenario from the initial state.

Click the appropriate event depending on the dose of medication given. They will advance depending on the frame at the time they are given

Figure 2. Event Menu (Resource Menu)

Resources

Monitor layout

ED with ETCO2 ✎ ✕

Click to replace monitor layout

LLEAP GUI layout

ED CPR1.scenario.SimMan3G.userlayout.xml ✕

Click to replace LLEAP GUI layout

Improving Health Care Response to Hypertensive Disorders of Pregnancy, a CMQCC Quality Improvement Toolkit, 2021.

Part 7: Debriefing objectives

Estimated Debriefing Time	20-45 minutes – will vary significantly depending on the detail of the discussion regarding medical management as well as considering what TeamSTEPPS concepts will be covered.
Debriefing Objectives	Recommend 2-3 TeamSTEPPS skills and 1-2 medical management issues for a maximum of 4-5 objectives
Teamwork & Communication Skills	
TeamSTEPPS	There are several TeamSTEPPS tools that the team will need to employ to successfully manage this case. There are a few that are especially applicable.
(TeamSTEPPS) 1. Initial SBAR to team	<ol style="list-style-type: none"> 1. Establishing a shared mental model at the outset of the case: Initial SBAR from RN to responding team <ol style="list-style-type: none"> a. Did the critical information get relayed to the team? b. Did entire team and/or latecomers “receive” report? i.e. did they actually stop and listen or immediately jump into doing tasks?
(TeamSTEPPS) 2. Role Clarity – leaders, checklist reader	<ol style="list-style-type: none"> 2. Role Clarity <ol style="list-style-type: none"> a. Was there clearly a lead physician and a lead nurse? b. Were there clearly understood roles/task clarity for other critical tasks? (including closed loop communication during assignment) c. Was there a designated checklist reader?
(TeamSTEPPS) 3. Call outs with QBL/VS and when tasks are complete	<ol style="list-style-type: none"> 3. Other important communication: <ol style="list-style-type: none"> a. Call outs before meds are given and after medications have been given to reduce delays and potential errors b. Check backs (i.e. closed loop communication) e.g. RN call backs to confirm dosages

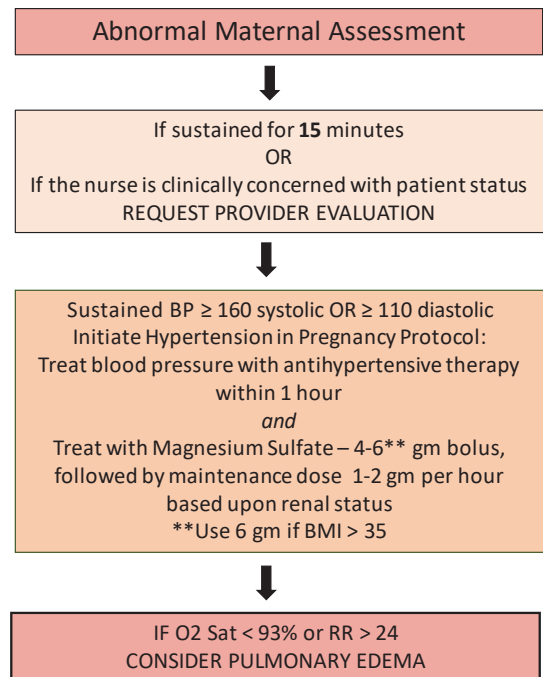
<p>(TeamSTEPPS)</p> <p>4. Situation monitoring and communication to maintain shared mental model</p>	<p>4. Situation Monitoring</p> <ul style="list-style-type: none"> a. Situational Awareness b. Maintains shared mental model – briefing during case to keep up to date, assess response to treatment, and address challenges in treatment.
Medical Management	
<p>(Medical Management)</p> <p>1. Manage HTN using alternative medication regimens.</p>	<p>1. Identify the patient with postpartum preeclampsia with severe features with hypertensive emergency that progresses to eclampsia (i.e. SBP \geq 160 OR DBP \geq 105)</p>
<p>(Medical Management)</p> <p>2. Manage refractory seizures with magnesium</p>	<p>2. Manage the patient with postpartum preeclampsia with severe features that progresses to eclampsia</p> <ul style="list-style-type: none"> a. Treat hypertension per ACOG guidelines using alternative regimens that do NOT utilize labetalol. Since the patient seizes and is post-ictal, PO medications are not recommended. The team should treat BP with IV hydralazine + IV metoprolol b. Treat preeclampsia/eclampsia with magnesium. May require additional mag bolus for refractory seizures. c. Maintain airway and oxygenation – basic airway positioning, optional intubation

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Appendix D: Preeclampsia Screening Tools

A. Preeclampsia Early Recognition Tool integrated within a Maternal Early Warning System

Physiological Parameters	(Yellow) Triggers (Two or more)	(Red) Triggers (One or more)
Systolic BP, mm Hg (repeat in 15 min)	< 90 or > 155* - 159	≥ 160
Diastolic BP, mm Hg (repeat in 15 min)	105* - 109	≥ 110
Mean Arterial Pressure: mm Hg	< 65 or > 110	< 55
Heart Rate: beats per min	< 50 or 110-120	> 120
Respiratory Rate: breaths per min	< 12 or 25-30	> 30
Oxygen Saturation: % on room air	< 95	< 93
Oliguria: ml/hr for ≥ 2 hours	35-49	< 35
Severe (Red) triggers		
Altered mental status	Maternal agitation, confusion or unresponsiveness	
Neurologic	Unrelenting, severe headache unresponsive to medication	
Visual Disturbances	Blurred or impaired vision	
Physical	Shortness of breath or epigastric pain	
If "Yellow" or "Red" BP Triggers, recheck BP within 15 minutes		
*Lowering the threshold for treatment should be considered at systolic BP of 155 mm Hg or diastolic BP of 105 mm Hg. See Section Borderline Severe-Range Blood Pressures		



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

B. Preeclampsia Early Recognition Tool (PERT), page 1 of 2

ASSESS	NORMAL (GREEN)	WORRISOME (YELLOW)	SEVERE (RED)
Awareness	Alert/oriented	<ul style="list-style-type: none"> ▶ Agitated/confused ▶ Drowsy ▶ Difficulty speaking 	Unresponsive
Headache	None	<ul style="list-style-type: none"> ▶ Mild headache ▶ Nausea, vomiting 	Unrelieved headache
Vision	None	Blurred or impaired	Temporary blindness
Systolic BP (mm Hg)	100-139	≥ 155-159	≥ 160
Diastolic BP (mm Hg)	50-89	90-109	≥ 110
HR	61-110	110-120	> 120
Respiration	11-24	< 12 or 25-30	< 10 or > 30
SOB	Absent	Present	Present
O2 Sat (%)	≥ 95	< 95	< 93
Pain: Abdomen or Chest	None	<ul style="list-style-type: none"> ▶ Nausea, vomiting ▶ Chest pain ▶ Abdominal pain 	<ul style="list-style-type: none"> ▶ Nausea, vomiting ▶ Chest pain ▶ Abdominal pain
Fetal Signs	<ul style="list-style-type: none"> ▶ Category I ▶ Reactive NS 	<ul style="list-style-type: none"> ▶ Category II ▶ IUGR ▶ Non-reactive NST 	Category III
Urine Output (ml/hr)	≥50	35-49	≤ 35 (in 2 hrs)
Proteinuria*	Trace	<ul style="list-style-type: none"> ▶ ≥ +1** ▶ ≥ 300mg/24 hours 	Protein/Creatinine Ratio (PCR) > 0.3 Dipstick ≥ 2+
Platelets	>100	50-100	< 50
AST/ALT	< 70	> 70	> 70
Creatinine	≤ 0.8	0.9-1.1	≥ 1.1
Magnesium Sulfate Toxicity	<ul style="list-style-type: none"> ▶ DTR +1 ▶ Respiration 16-20 	Depression of patellar reflexes	Respiration < 12

B. Preeclampsia Early Recognition Tool (PERT), page 2 of 2

*Level of proteinuria is not an accurate predictor of pregnancy outcome

GREEN=NORMAL: proceed with caution

YELLOW=WORRISOME: Increase assessment frequency

1 Trigger, TO DO:

Notify provider

≥ 2 Triggers, TO DO:

- ▶ Notify charge RN
- ▶ In-person evaluation
- ▶ Order labs/test
- ▶ Anesthesia consult
- ▶ Consider magnesium sulfate
- ▶ Supplemental oxygen

**Provider should be made aware of worsening or new-onset proteinuria

RED=SEVERE: Trigger, 1 of any type listed below

1 of any type:

- ▶ Immediate evaluation
- ▶ Transfer to higher acuity level
- ▶ 1:1 staff ratio

Awareness, Headache, Visual

- ▶ Consider Neurology consult
- ▶ CT Scan
- ▶ R/O SAH/intracranial hemorrhage

BP

- ▶ Labetalol/Hydralazine/nifedipine within 30-60 min
- ▶ In-person evaluation
- ▶ Magnesium sulfate loading or maintenance infusion

Chest Pain

- ▶ Consider CT angiogram

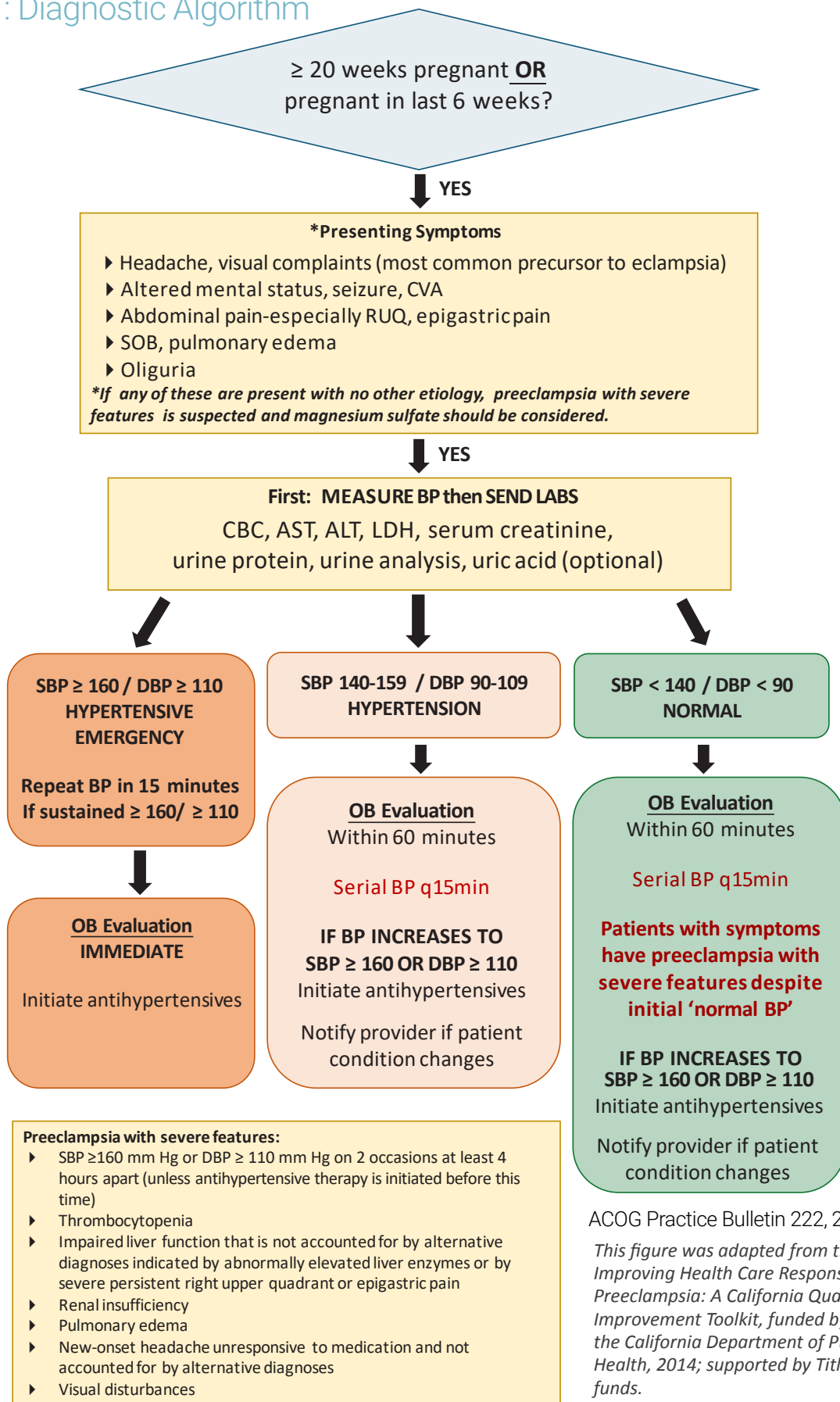
Respiration SOB

- ▶ O2 at 10L per non-rebreather mask

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

Appendix E: Acute Treatment Algorithm

Part 1: Diagnostic Algorithm



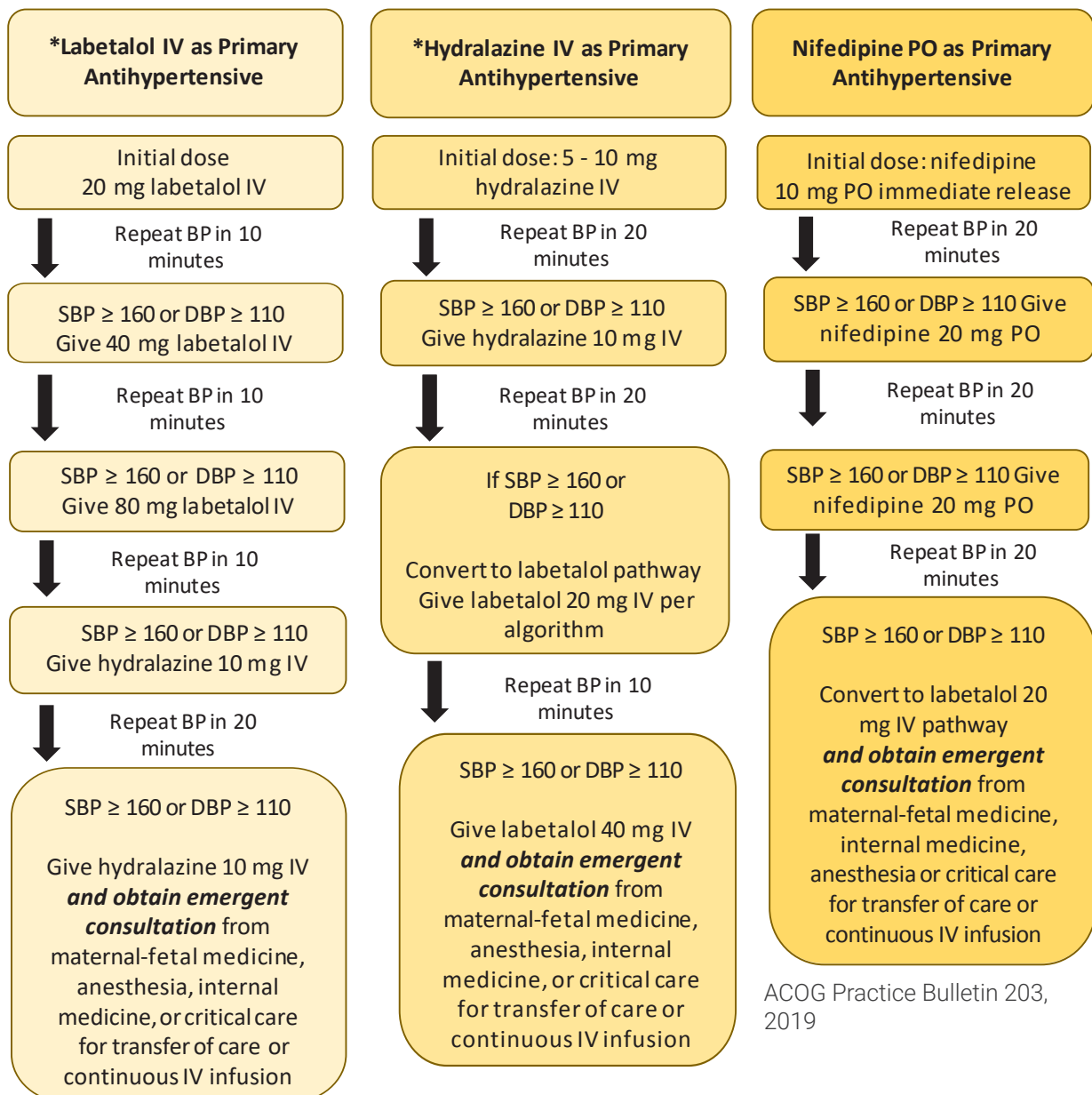
ACOG Practice Bulletin 222, 2020

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

Part 2: Antihypertensive Treatment Algorithm for Hypertensive Emergencies

Treatment Recommendations for Sustained Systolic BP \geq 160 mm Hg or Diastolic BP \geq 110 mm Hg

*Antihypertensive treatment and magnesium sulfate should be administered simultaneously. If concurrent administration is not possible, antihypertensive treatment should be 1st priority.



ACOG Practice Bulletin 203,
2019

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

Once BP threshold is achieved:

- ▶ Q10 min for 1 hr
- ▶ Q15 min for 1 hr
- ▶ Q30 min for 1 hr
- ▶ Q1hr for 4 hrs

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

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

Part 3: Magnesium Dosing and Treatment Algorithm for Refractory Seizures

Magnesium: Initial Treatment

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

For recurrent seizures while on magnesium

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

Seizures Resolve

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

Appendix F: Sample Acute-Onset, Severe Hypertension and Eclampsia Medication Kit

Each institution should prepare its own medication kit specific to its protocols.

Dose guidelines for acute-onset, severe hypertension

Medication	Dosage
Labetalol IV 100 mg/20 mL vial	Initial: 20 mg (4 mL) IV bolus followed by 40 mg (8 mL) IV if not effective within 10 minutes; followed by 80 mg (16 mL) IV if not effective within 10 minutes
Hydralazine IV 20 mg/mL vial	Initial: 5-10 mg (0.25-0.5 mL) IV bolus followed by 10 mg (0.5 mL) IV if not effective within 20 minutes
Nifedipine 10 mg immediate release tablets	10 mg PO , followed by 20 mg PO if not effective within 20 minutes; followed by another 20 mg PO if not effective within 20 minutes
Magnesium 20 g/500 mL bag	Initial (Loading Dose): 4-6 gm (100 mL–150 mL) IV over 20 minutes (BMI > 35 requires a 6 gram loading dose and 2 gm per hour maintenance) Maintenance Dose: 1-2 g/hr (25 mL/hr–50 mL/hr) continuous IV infusion
	<i>See Appendix E: Acute Treatment Algorithm on page 195 for further detail</i>
Esmolol 100 mg/10 mL vial (Anesthesiologists or intensivists ONLY)	1-2 mg/kg (0.1-0.2 mL/kg) IV over 1 minute
Propofol 10 mg/mL, 20 mL vial (Anesthesiologists or intensivists ONLY)	30-40 mg (3-4 mL) IV bolus
Calcium Gluconate 1000 mg/10 mL vial	1000 mg/10 mL IV over 2-5 minutes

Adapted and used with written permission from Lucile Packard Children's Hospital, Stanford, Gillian Abir, MBChB, and Shabnam Gaskari, PharmD, BCPPS, 2020

Appendix G: Stop Sign for Patient Information



Tell us if you
ARE PREGNANT *or*
HAVE BEEN PREGNANT
within the past 6 weeks



Come to the front of the line if you have:

- ▶ Persistent headache
- ▶ Visual change (floaters, spots)
- ▶ History of preeclampsia
- ▶ Shortness of breath
- ▶ History of high blood pressure
- ▶ Chest pain
- ▶ Heavy bleeding
- ▶ Weakness
- ▶ Severe abdominal pain
- ▶ Confusion
- ▶ Seizures
- ▶ Fevers or chills
- ▶ Swelling in hands or face

Improving Health Care Response to Hypertensive Disorders of Pregnancy, a CMQCC Quality Improvement Toolkit, 2021.

Appendix H: Patient Clinical Summary: Severe Maternal Event



Patient Clinical Summary: Severe Maternal Event (SME)			
Patient Name			
Date of SME			
SME Clinician		Phone	
SME Type	<input type="checkbox"/> Obstetric Hemorrhage <input type="checkbox"/> Severe Hypertension/Preeclampsia <input type="checkbox"/> Venous Thromboembolism <input type="checkbox"/> Other: <i>List</i>		
Patient Information			
Mom	Pregnancy Outcome	<input type="checkbox"/> Live Birth <input type="checkbox"/> Stillbirth <input type="checkbox"/> NICU	Postpartum Discharge Weight
Baby	GA (in weeks)	Birthweight	Length
Clinical Summary			
Surgery	<i>Date</i>		
	<i>Type</i>		
	<i>Organs removed</i>	<i>List</i>	
Interventional Radiology	<input type="checkbox"/> Yes <input type="checkbox"/> No	<i>Date</i>	
		<i>Type</i>	
		<i>Result</i>	
Imaging Tests	<input type="checkbox"/> Yes <input type="checkbox"/> No	<i>Date</i>	
		<i>Type</i>	
		<i>Result</i>	
Blood Transfusion	<i>Type of Blood Products</i>	<input type="checkbox"/> Red Blood Cells <input type="checkbox"/> Platelets <input type="checkbox"/> Plasma	
	<i># of units</i>	#___ Red Blood Cells #___ Platelets #___ Plasma	
Medical Treatments	<i>List</i>		
Follow-up			
Clinician Name		Phone	
Pathology/Autopsy		Phone	
<i>For further information, please contact the Hospital Medical Record Office to request your complete medical record.</i>			
Medical Record Office		Phone	
Notes			

Used with permission of the Council on Patient Safety, 2020
Patient Clinical Summary: Severe Maternal Event

Appendix I: Patient Education Checklists

The following checklists have been included to assist clinicians provide women with education about hypertensive disorders of pregnancy (HDP) throughout pregnancy and postpartum period. Using patient-education checklists throughout pregnancy and the postpartum period can assist clinicians in meeting women's and their families' information needs. The checklists emphasize important warning signs, timely responses to reports of preeclampsia-related symptoms, and creates customized care plans to safeguard maternal health and safety, especially during the postpartum period.

Educational checklists for clinicians to use with women and families

- ▶ Checklist 1: Prenatal HDP Education for All Pregnant Women
- ▶ Checklist 2: Discharge HDP Education for All Postpartum Women
- ▶ Checklist 3: Education for Outpatient Management of Preeclampsia
- ▶ Checklist 4: Education for Women Diagnosed with Preeclampsia with Severe Features
- ▶ Checklist 5: Education at Discharge for Postpartum Women with Preeclampsia
- ▶ Checklist 6: Immediate and Long-term Follow-up Counseling for Women after a HDP Diagnosis
- ▶ Checklist 7: HDP Education for Administrative Staff

Together, the checklists represent the various points during the prenatal and postpartum period where clinicians need to check in with women and their families about their information needs.

Checklist 1: Prenatal HDP Education for All Pregnant Women

<p>Goal</p>	<ul style="list-style-type: none"> <input type="checkbox"/> All pregnant women receive education about hypertensive disorders of pregnancy (HDP).
<p>Educate and Discuss</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Briefly, define preeclampsia/HDP: Serious disease of high blood pressure that can be dangerous for you up to six weeks or more after giving birth. <input type="checkbox"/> Provide <u>verbal</u> and <u>written</u> information about signs and symptoms of preeclampsia using culturally appropriate language. <input type="checkbox"/> Ask women to repeat signs and symptoms; share information with key family members, using empathy and respectful listening in the discussion. <input type="checkbox"/> If telehealth appointments, provide blood pressure cuff, instruct on accurate measurement, observe demonstration by women to verify measurement.
<p>Convey Urgency</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Emphasize urgency of symptoms to women and families, and stress importance of calling provider/hospital immediately particularly for women at risk of preeclampsia.
<p>Emergency Contact</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Provide emergency telephone number and location of hospital ED or L&D unit, if severe symptoms present. <input type="checkbox"/> Inform patient what to say to administrative staff/answering service: <i>“I am having symptoms of preeclampsia and my provider told me to call and ask to be seen right away when I experience these symptoms.”</i>
<p>Staff Training</p>	<ul style="list-style-type: none"> <input type="checkbox"/> In office or clinic settings, ensure administrative staff/answering services are trained in preeclampsia signs and symptoms, understand its seriousness, and understand when to send patient to ED or L&D for emergency care. <input type="checkbox"/> Staff should also be trained on implicit bias, respectful communication and validating patient/family perspectives.

Improving Health Care Response to Hypertensive Disorders of Pregnancy, a CMQCC Quality Improvement Toolkit, 2021.

Checklist 2: Discharge HDP Education for All Postpartum Women

<p>Goal</p>	<p><input type="checkbox"/> Ensure all postpartum women receive education about hypertensive disorders of pregnancy (HDP) prior to discharge.</p>
<p>Educate and Discuss</p>	<p><input type="checkbox"/> Briefly, define preeclampsia/HDP: Serious disease of high blood pressure that can be dangerous for you up to six weeks or more after delivery.</p> <p><input type="checkbox"/> Provide <u>verbal</u> and <u>written</u> explanation of signs and symptoms of preeclampsia prior to discharge, using culturally appropriate language.</p> <p><input type="checkbox"/> Emphasize urgency of symptoms and importance of calling provider/hospital immediately to women and families.</p>
<p>Communicate and Connect</p>	<p><input type="checkbox"/> Use simple terms, communicate with empathy and listen to concerns.</p> <p><input type="checkbox"/> Ask women to repeat signs and symptoms; share information with key family members, using empathy and respectful listening in the discussion.</p> <p><input type="checkbox"/> Call interpreter or interpretation services for language barriers.</p> <p><input type="checkbox"/> Provide adequate time to answer questions, validate emotions from woman and her family.</p>
<p>Emergency Contact</p>	<p><input type="checkbox"/> Provide emergency telephone number and location of hospital ED or L&D unit, if severe symptoms present.</p> <p><input type="checkbox"/> Inform patient what to say to administrative staff/answering service: <i>“I am having symptoms of preeclampsia and my provider told me call and ask to be seen right away when I experience these symptoms.”</i></p>
<p>Staff Training</p>	<p><input type="checkbox"/> Provide training to administrative staff, nursing and medical services on implicit bias, respectful communication and validating patient/family perspectives.</p>

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Checklist 3: Education for outpatient management of preeclampsia

<p>Goal</p>	<ul style="list-style-type: none"> <input type="checkbox"/> All women diagnosed with preeclampsia who are candidates for outpatient management to receive comprehensive education to promote early identification of severe features.
<p>Educate and Discuss</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Define preeclampsia: Preeclampsia is a serious disease related to high blood pressure. <ul style="list-style-type: none"> ▶ Explain that preeclampsia diagnosis can progress to preeclampsia with severe features, eclampsia, or HELLP syndrome quickly. <input type="checkbox"/> Provide <u>verbal</u> list of signs and symptoms that should prompt urgent in-hospital evaluation (i.e., blood pressure over of 160/110 mm Hg or higher, severe headache that doesn't go away, etc.). <input type="checkbox"/> Provide <u>written</u> signs and symptoms of preeclampsia. <input type="checkbox"/> Ensure understanding by having woman and partner/family member verbally repeat back signs and symptoms. <input type="checkbox"/> Include partner/family members in discussion, using empathy and respectful listening. <input type="checkbox"/> Emphasize urgency of symptoms and importance of calling provider/hospital or calling 911 immediately.
<p>Emergency Contact</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Provide hospital emergency contact number and address. <input type="checkbox"/> Describe location of hospital ED or L&D unit for in-hospital evaluation. <input type="checkbox"/> Inform patient what to say to administrative staff/answering service: <i>"I am having symptoms of preeclampsia and my provider told me to call and ask to be seen right away when I experience these symptoms."</i>
<p>Educate: Blood Pressure Measurement at Home</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Provide blood pressure cuff. <input type="checkbox"/> Instruct on how to take blood pressure accurately. <input type="checkbox"/> Verify a woman understands how to <u>accurately</u> take her blood pressure by asking her to demonstrate in front of provider. <input type="checkbox"/> Instruct how frequently to take blood pressure. <input type="checkbox"/> Provide women and families with additional resources from Preeclampsia Foundation: accurate blood pressure measurement instructions and educational video.

<p>Evaluate Social Constraints to Timely Assessment</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Is the woman able to follow outpatient management plan? <input type="checkbox"/> Ask about patient's work/living situation and her plan for seeking care. <ul style="list-style-type: none"> ▶ How will you come in for appointments? ▶ Can you take time off from work for frequent evaluations? ▶ Will someone be able to come with you? ▶ Are you able to check your blood pressure frequently at home or at work? <input type="checkbox"/> Ask questions about the distance from home or work to hospital and possible barriers to frequent in-person evaluations. <ul style="list-style-type: none"> ▶ Do you have reliable transportation? ▶ What barriers may prevent you from getting to the hospital immediately? ▶ When would it be feasible to call 911? ▶ Do you have primary duty for caring for small children or elderly persons? <ul style="list-style-type: none"> • Who will take care of your children when you go in for evaluations or need to get to the hospital urgently?
<p>Staff Training</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Provide training to administrative staff, nursing and medical services on implicit bias, respectful communication and validating patient/family perspectives. <input type="checkbox"/> Ensure administrative staff/answering services are trained in preeclampsia signs and symptoms, understand its seriousness, and understand when to send patient to ED or L&D for emergency care.

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Checklist 4: Education for Patients Diagnosed with Preeclampsia with Severe Features

<p>Goal</p>	<ul style="list-style-type: none"> <input type="checkbox"/> All women diagnosed with preeclampsia with severe features to receive comprehensive, clear and culturally relevant education.
<p>Educate and Discuss</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Describe preeclampsia using simple terms, i.e. “high blood pressure” instead of “hypertension.” <ul style="list-style-type: none"> ▶ Explain that a preeclampsia with severe features diagnosis can progress to eclampsia or HELLP syndrome quickly. ▶ Describe pathophysiology using simple terms. <input type="checkbox"/> Encourage questions, and include partner/family members in discussion, using empathy and respectful listening.
<p>Explain Treatment Options and Rationale</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Communicate short-term treatment plan. <input type="checkbox"/> Validate patient/family emotions and provide opportunities for shared decision-making. <input type="checkbox"/> Discuss blood pressure (antihypertensive) medication safety for woman, baby, and breastfeeding and side effects. <input type="checkbox"/> Explain magnesium sulfate safety for woman, baby, and breastfeeding and side effects. <p>In Pregnancy</p> <ul style="list-style-type: none"> <input type="checkbox"/> Explain preterm birth as a therapeutic intervention in the pathophysiology of preeclampsia. <ul style="list-style-type: none"> ▶ Use of steroids: benefits to the baby. ▶ Preterm birth risks: consult pediatrics to explain issues with preterm births; treatment plan for baby; and what to expect after birth. ▶ Discuss timing of birth. <input type="checkbox"/> Reassure women and their families that their health care team is committed to providing quality, compassionate care. <input type="checkbox"/> Acknowledge the importance of working together as a team to get the best outcomes for women and their infants. <input type="checkbox"/> Summarize key points of treatment plan that has been mutually agreed on. <input type="checkbox"/> Encourage questions.

<p>Communicate and Connect</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Use simple terms and maintain eye contact. <input type="checkbox"/> Include a key family member or support person in preeclampsia education and discussion of treatment plan. <input type="checkbox"/> Encourage woman, family or support person to contact staff if any questions arise later. <input type="checkbox"/> Call interpreter or interpretation services if language is an issue.
<p>Provide Support and Empathy</p>	<p>Postpartum</p> <ul style="list-style-type: none"> <input type="checkbox"/> Acknowledge that patients who are recovering from hypertensive disorders of pregnancy are likely to feel overwhelmed, emotionally and physically, and concerned about their newborn. <input type="checkbox"/> Sensitive assist with women’s needs around lactation; assess need for lactation support continuously. <input type="checkbox"/> If infant in NICU, create opportunities for visits. <input type="checkbox"/> Assess birthing people for signs of acute stress disorder (SMM bundle). <input type="checkbox"/> Inform women and families of their risk for mental health issues, such as anxiety or PTSD, and offer information about mental health support services. <input type="checkbox"/> Be available for follow-up questions or concerns from women and families. <input type="checkbox"/> Before discharge, provide a summary communication in writing for women and their families.
<p>Staff Training</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Provide training to administrative staff, nursing and medical services on implicit bias, respectful communication and validating patient/ family perspectives.

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Checklist 5: Education at discharge for postpartum birthing people with HDP

<p>Goal</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Promote safety and vigilance for postpartum women with hypertensive disorders of pregnancy (HDP) during the time between hospital discharge and first follow-up visit in 3-7 days.
<p>Educate and Discuss</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Explain that HDP can progress to preeclampsia with severe features, eclampsia, or HELLP syndrome during the days and weeks after birth. <input type="checkbox"/> Provide <u>verbal</u> and <u>written</u> explanation of signs and symptoms of preeclampsia complications prior to discharge. <input type="checkbox"/> Emphasize urgency of symptoms and importance of calling provider/hospital immediately during this time of “watchful waiting.”
<p>Direction</p>	<p>Send patient home with blood pressure cuff and convey simple instructions for checking accurate blood pressure.</p> <p>Resource for clinicians/ hospitals: Preeclampsia Foundation’s the Cuff Kit™ provides blood pressure cuffs to women.</p> <p>Provide additional resources: easy to follow accurate blood pressure measurement instructions available at: https://www.preeclampsia.org/accurate-blood-pressure</p>
<p>Communicate and Connect</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Use simple terms and maintain eye contact. <input type="checkbox"/> Confirm whether patient understands signs and symptoms by asking her to repeat back signs and symptoms. <input type="checkbox"/> Include a key family member in discharge education. <input type="checkbox"/> Call interpreter or interpretation services for language barriers. <input type="checkbox"/> Provide adequate time to answer questions.
<p>Emergency Contact</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Provide emergency telephone number. <input type="checkbox"/> Make sure patient knows location of L&D/ED to go to in an emergency. <input type="checkbox"/> Inform patient what to say to administrative staff/answering service: <i>“I am having symptoms of preeclampsia and my provider told me to call and ask to be seen right away when I experience these symptoms. My baby was born <insert date here>.”</i>

<p>Follow-Up</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Ensure women have an OBGYN visit scheduled within 3-7 days to check blood pressure and assess mental health, social support, infant care and other issues of concern.
<p>Keep in Mind</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Postpartum women are managing the preeclampsia diagnosis, medication regimen, reactions to medications, additional health complications, pain, and the presence of a newborn. <input type="checkbox"/> Communication should be clear, simple and focus on short-term goals.

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Checklist 6: Immediate and long-term follow-up Counseling for Women after a HDP Diagnosis

<p>Goal</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Promote health and well-being of women with preeclampsia following first OBGYN visit 3-7 days postpartum and another at the six-week postpartum visit.
<p>Check in and Connect</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Review signs and symptoms of preeclampsia with severe features. <input type="checkbox"/> Use blood pressure check as an opportunity to explain preeclampsia condition and why ongoing BP management is important. <input type="checkbox"/> Check in about blood pressure medication reactions, side effects, and effectiveness. <input type="checkbox"/> Assess for signs of acute stress or depression. <input type="checkbox"/> Enquire about infant care and family support related to preeclampsia diagnosis.
<p>Debrief and Discuss</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Invite patients to debrief the birth experience and preeclampsia diagnosis and encourage dialogue. <input type="checkbox"/> Encourage women to bring clinical summary of pregnancy hospitalization.
<p>Refer</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Refer women to primary care physician for ongoing cardiovascular health maintenance following the 6-week postpartum management; encourage women to bring clinical summary of pregnancy hospitalization. <input type="checkbox"/> Refer women to mental health or counseling services, or group support.
<p>Emergency Plan</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Convey urgency of signs and symptoms of preeclampsia with severe features. <input type="checkbox"/> Review emergency plan for contacting provider and going to L&D/ED. <input type="checkbox"/> Inform patient what to say to administrative staff/answering service: <i>“I am having symptoms of preeclampsia and my provider told me to call and ask to be seen right away, when I experience these symptoms. I gave birth to my baby ____ days ago.”</i>
<p>Keep in Mind</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Postpartum women likely will feel overwhelmed managing the preeclampsia diagnosis, medications/reactions to medications, additional health complications, pain, and the presence of a newborn in her life. <input type="checkbox"/> Communication should be clear, simple and focus on short-term goals.

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Checklist 7: HDP Education for Administrative Staff

<p>Goal</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Ensure that all administrative staff who may interface with pregnancy-capable people, especially, ED reception, office or clinic receptionist, answering services etc., are trained in HDP signs and symptoms, understand its seriousness, and can timely refer patients for medical attention.
<p>Inform and Convey Urgency</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Provide information about signs and symptoms of preeclampsia. <input type="checkbox"/> State urgency of signs and symptoms of preeclampsia. <input type="checkbox"/> Explain that if women are experiencing headache that won't go away OR have high blood pressure [a top number \geq 160 mm Hg OR a bottom number \geq 110 mm Hg], they need to go to L&D or the emergency room right away.
<p>Direct and Implement</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Provide all staff with laminated cards indicating patient symptoms that require staff to contact provider immediately and/or instruct patient to seek emergency care. <input type="checkbox"/> When training ED reception, have staff ask all women if they are currently or recently pregnant. <input type="checkbox"/> Provide all staff with instructions to give to women experiencing HDP emergencies (e.g. go to ED or L&D) and their locations. <input type="checkbox"/> Direct staff to emphasize the urgency of seeking medical care to women or family members.
<p>Review</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Evaluate staff's knowledge around HDP signs and symptoms using respectful communication.

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Appendix J: Sample Script: Physician Explanation of Hypertensive Disease Process and Management Plan

Maurice L. Druzin, MD, OB-GYN, Stanford Health

Dr. Druzin: After introducing the health care team, I start by asking the patient if she can tell us in a few words what she understands about preeclampsia and hypertensive disorders of pregnancy (HDP). This will often give me a snapshot of the patient and her family's understanding of the situation and all-around health literacy.

[Overarching description]

Preeclampsia is a disease seen only in pregnant or postpartum women. The main problem your health care team has identified is that your blood pressure is high. There is often protein in your urine, or you may have other symptoms like headache, pain in your abdomen or swelling of your face, hands, and feet.

[Emphasis on safety and protection]

Remember, there are two patients here, you and your baby, and we are going to take care of both of you. And, very importantly, what is happening to you now is NOT your fault and is not because of anything you did or did not do. We do not fully understand why some people develop this disease, and why most do not, although there are many theories.

[Pathophysiological description]

This disease happens because your placenta, which is the organ that develops when you become pregnant and allows your baby to grow from a tiny egg to a little person in 9 months, is not working as well as it should. The placenta provides your baby with blood that contains food and oxygen, which is what we all need to grow and live.

This placenta grows from your egg which attaches to the inside of your uterus, sometimes called the womb. When this egg attaches, called implantation, it sends out little roots, which are new blood vessels, that move blood around our bodies, to connect with YOUR blood to feed the growing baby. You need a lot of blood to allow your baby to grow so fast, from an egg you cannot even see, to the person that will be your child.

The way in which these roots (blood vessels) develop in the placenta has to follow a very specific number of steps. If there are problems with any of these steps, this attachment (implantation) is not fully completed. If these problems occur, you will have a placenta that is not working as well as it should, called placental insufficiency, a big word, which means that it is not able to work effectively. The placenta may not be able to keep up with your baby's needs, and your baby may be smaller than usual. The good news is, that when this happens, your baby will make sure that their brain is getting enough blood and food, by shunting blood from other organs to the brain.

The placenta makes a number of things, mostly good, but sometimes bad. When the placenta starts its life with a poor root system, it gets less blood flow than it needs. This results in damage to the placenta, so the placenta starts producing abnormal bad chemicals that block the growth of new blood vessels that move blood around our bodies. This is a problem, because the placenta needs to constantly produce new blood vessels so it can grow, and feed your baby.

These bad chemicals also attack the blood vessels in YOUR body, and causes them to be narrower, leading to less blood flow to all the organs in your body such as your kidneys, liver, brain, lungs, and heart. Normally, these blood vessels will become wider or narrower, open or close, depending on what each organ needs. If your heart needs more blood, those vessels will become wider (dilate), while the blood vessels going to the kidney will become narrower, so more blood is available to go to the heart. This happens all the time with healthy blood vessels, and we are not even aware of this, because it is controlled automatically.

In preeclampsia, all the blood vessels in your body become narrower; therefore, less blood goes to all your organs, and then they can be damaged, and not work well, or sometimes stop working completely. This narrowing of blood vessels, which are normally very wide to be able to send enough blood to all your vital organs and the placenta, is called vasospasm, and causes high blood pressure, because the heart is trying to pump the same amount of blood through a smaller-sized vessel.

[Definition of key terms]

This high blood pressure is dangerous, because it can cause a vessel in your brain to tear, leading to bleeding in the brain, called a stroke.

These bad chemicals also cause the walls of all the blood vessels to become weaker, and fluid from inside leaks into the tissue around the vessel, and you start swelling, called edema. If this happens in your brain, the brain will swell and you can have a seizure, called eclampsia.

When the blood pressure is too high in blood vessels feeding the placenta, it can make the placenta break off from its attachment to the inside of the uterus, called abruption, and your baby will lose its connection with your blood supply, which it needs to grow and survive.

[Pause for questions]

At this point, you have heard a lot of things, so let's stop and give you a chance to ask questions about what I have just said.

[Communicating a short-term plan, emphasizing safety]

So, we need to do a few things to keep you and your baby safe.

First, we need to control the blood pressure with medication to prevent stroke and abruption. This will be done very soon.

Second, we need to give you a medicine called magnesium to prevent seizures. This will feel unpleasant and make you woozy and sleepy, but patients typically get used to it after a short time.

Third, we need to prepare your baby for possibly being born early, because the only way to begin to cure this disease is to remove the producer of these bad chemicals, the placenta. This means delivering your baby and the placenta.

To prepare your baby for an early birth, we are going to recommend a medicine called betamethasone (or dexamethasone), which is a type of steroid, given as two injections: one now and a second shot in 24 hours.

This steroid goes through the placenta to your baby where it does three very good things:

1. It helps your baby's lungs to mature. It tricks the lungs into producing more of a chemical called surfactant, which is something that lines the cells in the lungs, to keep the lungs open so oxygen can go into the lungs and then to your baby's blood. If you do not have enough of this chemical, the air sacs in the lung will not open up and your baby will not be able to get enough oxygen from the lungs into its blood.
2. The steroids also adjust the blood flow in your baby's brain, which prevents bleeding into the brain, a common problem in premature babies.
3. The steroids also adjust blood flow in your baby's bowel, or intestines, and prevent a problem called necrotizing enterocolitis, or NEC, which is damage to the bowel from not receiving enough blood.

Steroids can reduce these three major problems in babies by about 40%.

[Emphasis on team]

We are going to ask your baby's doctors, called neonatologists, to come and talk to you. They will explain what problems may happen to a premature baby, and how they will treat your baby.

[Emphasis on safety]

So, we have a lot of work to do to keep you and your baby safe, but this approach has been very effective in getting a healthy mom and a healthy baby.

[Summarizing key points, emphasis on safety and team]

To summarize, we will control your blood pressure, give you medicine to prevent seizures, give you a steroid shot to help your baby if it is born prematurely, and make plans for delivery. The timing of the birth depends on how you and your baby respond to our treatments.

If you respond well to our treatment, and your baby is OK, we can delay delivery for a short time.

If you are less than 34 weeks of gestation, we will try and make it to 34 weeks, but you will need to stay in the hospital until delivery.

Between 34-37 weeks of gestation, depending on how severe the preeclampsia is, we may try to make it to 37 weeks.

However, if either you or your baby develop problems, we may recommend delivery at any time, and this will all depend on gestational age at presentation, and your condition.

We will ask your baby doctors to talk to you about what to expect after your baby is born.

We are a team working to make you better and give your baby the best chance for a good life after birth. You and your family are part of this team.

We will discuss everything we plan to do with you and ask for your permission.

[Pause for questions]

What questions do you have?

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Appendix K: Sample Nursing Management Policy and Procedure

Note: This is a SAMPLE developed by a particular facility and the content is NOT specifically endorsed by the HDP Task Force. The sample is provided as an example to work from. You may need to adjust based on the individual circumstances of your facility.

Kristi Gabel, RNC-OB, C-EFM, MSN, CNS, Sutter Roseville Medical Center
Nancy Peterson, MSN, RNC-OB, PNNP, Dominican Hospital, Common Spirit Health

Purpose

To outline the nursing management of inpatients who have preeclampsia including special considerations for management of patients on magnesium sulfate, patients on antihypertensive medications and management of eclampsia.

Background

Preeclampsia is a hypertensive disorder of pregnancy characterized by vasospasm and endothelial damage, which may impact the cardiovascular, renal, hematological, neurologic, and hepatic systems as well as the uteroplacental unit. It is of unknown etiology. Preeclampsia is characterized by new-onset of hypertension and proteinuria after 20 weeks of gestation in a previously normotensive woman.

- ▶ Hypertension: two blood pressure readings of ≥ 140 systolic OR ≥ 90 diastolic taken at least four hours apart
- ▶ Proteinuria: 0.3 gm of protein in a 24-hour urine collection

Reportable conditions

Notify provider for:

- ▶ Repeated blood pressure ≥ 160 mm Hg systolic OR ≥ 110 mm Hg diastolic (taken at least 15 minutes apart)
- ▶ New or worsening complaint of any of the following:
 - Headache
 - Visual changes
 - Right Upper Quadrant (RUQ) or epigastric pain
- ▶ Abnormal lab values.

Admission assessment

- ▶ Assess for absence or presence of:
 - Headache

- Visual changes
 - Right upper quadrant or epigastric pain
 - Nausea/vomiting
 - General malaise
- ▶ Assess upper or lower deep tendon reflexes.
 - ▶ Auscultate for lung sounds, noting any presence of rales, rhonchi, wheezing, etc.
 - ▶ Assess for generalized edema and significant, rapid weight gain.
 - ▶ Assess blood pressure using an appropriately sized blood pressure cuff with patient sitting or in the upright position with the patient's arm at the level of the heart. Do not reposition the patient to her left side and retake blood pressure. It will give a false lower reading.
 - ▶ Apply external fetal monitor (if viable fetus). Follow institutional guidelines.
 - ▶ Prepare to obtain IV access as ordered by provider.
 - ▶ Prepare to administer medications to lower blood pressure and prevent seizure activity.
 - ▶ Prepare to monitor intake and output.
 - ▶ Maintain activity as ordered by provider. If on bedrest, maintain side-lying position as much as possible, avoiding supine position, and change position every two hours or more often as needed.
 - ▶ Provide emotional support and opportunity for patient family to verbalize questions, concerns and/or fears.
 - ▶ Assess maternal vital signs including: blood pressure as described above, respiratory rate, heart rate, temperature, and oxygen saturation.
 - ▶ Prepare to assess lab values as ordered.
 - ▶ Ensure oxygen and suction equipment are present and functioning.
 - ▶ Implement measures to decrease stress level, such as provision of a quiet environment and low lighting.
 - ▶ Monitor temperature per department protocol.
 - ▶ If fluid overload or oligouria is suspected the use of a Foley catheter should be used with frequent assessment of urinary output, i.e. hourly.

Antepartum ongoing assessment

Goals of patient management

- ▶ Early recognition of severe or worsening preeclampsia with severe features or development of eclampsia.

- ▶ Prolongation of pregnancy to optimize fetal maturation must be weighed against risks of pregnancy continuation.

Preeclampsia without severe features (formerly called “mild,” a term now discouraged from use):

- ▶ Obtain blood pressure, pulse, respirations, and oxygen saturation every 4 hours [awake] and 8 hours [sleeping].
- ▶ Assess lung sounds every 4-8 hours.
- ▶ Assess deep tendon reflexes (DTRs), Clonus, edema, level of consciousness (LOC), headache (HA) visual disturbances, epigastric pain every 4-8 hours depending on patient condition.
- ▶ Obtain Non Stress Test (NST) or monitor Fetal Heart Rate (FHR) with uterine activity for 30 minutes every shift or as condition warrants.
- ▶ Assess fetal movement every shift.

Preeclampsia with severe features

- ▶ Obtain blood pressure, pulse, respirations, and oxygen saturation hourly.
- ▶ Assess lung sounds every 2 hours.
- ▶ Assess deep tendon reflexes (DTRs), clonus, edema, level of consciousness (LOC), headache (HA), visual disturbances, epigastric pain every 4 hours or more frequently depending on patient condition.
- ▶ Monitor FHR and uterine activity continuously.

Intrapartum ongoing assessment

Preeclampsia without severe features (formerly called “mild,” a term now discouraged from use):

- ▶ Obtain blood pressure, pulse, respirations, and oxygen saturation hourly.
- ▶ Assess lung sounds every 4 hours.
- ▶ Assess deep tendon reflexes (DTRs), clonus, edema, level of consciousness (LOC), headache (HA), visual disturbances, epigastric pain every 4 hours.
- ▶ Monitor FHR and uterine activity continuously.

Preeclampsia with severe features

- Obtain blood pressure, pulse, respirations, and oxygen saturation every 30 minutes.
- Assess lung sounds every 2 hours.
- Assess Deep Tendon Reflexes (DTRs), clonus, edema, level of consciousness (LOC), headache (HA), visual disturbances, epigastric pain every 4 hours.
- Monitor FHR and uterine activity continuously.

Postpartum to discharge ongoing assessment

Preeclampsia without severe features (formerly called “mild,” a term now discouraged from use):

- ▶ Obtain blood pressure, pulse, respirations, and oxygen saturation every 4 hours.
- ▶ Assess lung sounds every 4 hours.
- ▶ Assess deep tendon reflexes (DTRs), clonus, edema, level of consciousness (LOC), headache (HA), visual disturbances, epigastric pain every 8 hours.

Preeclampsia with severe features

- ▶ Obtain blood pressure, pulse, respirations, and oxygen saturation hourly for first 24 hours after delivery then every 4 hours.
- ▶ Assess lung sounds every 2 hours for first 24 hours after delivery then every 4 hours.
- ▶ Assess deep tendon reflexes (DTRs), clonus, edema, level of consciousness (LOC), headache (HA), visual disturbances, epigastric pain every 4 hours.

Prevention and management of eclamptic seizures

Magnesium sulfate is administered as a first line drug to prevent maternal eclamptic seizures. (See Section: Preventing and Managing Eclamptic Seizures on page 126)

Antihypertensives

Background

- ▶ A persistent systolic blood pressure ≥ 160 mm Hg OR ≥ 110 mm Hg diastolic persisting for 15 minutes or more, is treated with IV antihypertensive medication to protect the patient from cerebral vascular accident.*
- ▶ The goal of blood pressure treatment is **130-150/80-100 mm Hg** to maintain perfusion.
- ▶ Labetalol is a combined alpha and beta-blocker, resulting in decreased peripheral vascular resistance without altering heart rate or cardiac output. Its use is contraindicated in patients with bronchial asthma, heart block and severe bradycardia.
- ▶ Hydralazine is a vasodilator and results in vasodilation of vascular smooth muscle.
- ▶ Nifedipine is a calcium channel blocker that acts to relax the smooth muscle of the heart and blood vessels.

Administration

- ▶ Ensure presence of mainline IV infusion.
- ▶ Monitor the fetal heart rate continuously if a viable fetus is present.
- ▶ Maintain bedrest during and for 3 hours following medication administration. Assess for postural hypotension prior to ambulation.

- ▶ If unable to control blood pressure, contact physician regarding consideration of other medications and/or transfer to a higher level of care.
- ▶ If the patient’s BP thresholds remain below between 130-150/80-100 mm Hg then see “Nursing assessment after antihypertensive medication administration” on page 221.
- ▶ Consult with maternal-fetal medicine, internal medicine, anesthesia, or critical care subspecialists.
- ▶ Hydralazine: (If used as the first-line medication)
 - Administer initial dose IV push over 1-2 minutes (Usual dose range is 5-10 mg).
 - Repeat BP in 20 minutes after initial dose.
 - If still above BP threshold, give 10 mg hydralazine IVP over 2 minutes. Repeat BP in 20 minutes.
 - If either BP threshold is still over, switch to labetalol 20 mg IVP over 2 minutes. Repeat BP in 10 minutes.
 - If either BP threshold is still over, give a second dose of labetalol 40 mg IVP over 2 minutes.
- ▶ Labetalol: (If used as the first-line medication; maximum dose is 300 mg/24 hours)

IV Push:

 - Administer initial dose IV push over 2 minutes (Usual dose is 10-20 mg).
 - Repeat BP in 10 minutes after initial dose.
 - If still above BP threshold, give 40 mg labetalol IVP over 2 minutes. Repeat BP in 10 minutes.
 - If either BP threshold is still over, switch to hydralazine 10 mg IVP over 2 minutes. Repeat BP in 20 minutes.
 - If either BP threshold is still over, consult with maternal-fetal medicine, internal medicine, anesthesia, or critical care subspecialists.
- ▶ Nifedipine (Immediate Release): (If used as the first-line medication; maximum dose is 50 mg)
 - Administer initial dose PO (Usual dose is 10 mg).
 - Repeat BP in 20 minutes after initial dose.
 - If still above BP threshold, give 20 mg nifedipine PO. Repeat BP in 20 minutes.
 - If still above BP threshold, give another 20 mg nifedipine PO. Repeat BP in 20 minutes.
 - If either BP threshold is still over, give labetalol 20mg and consult with maternal-fetal medicine, internal medicine, anesthesia, or critical care subspecialists.

Nursing assessment after antihypertensive medication administration

- ▶ Every 10-20 minutes based on medication administered until stable, then BP every 10 minutes x 1 hour, every 15 minutes x 1 hour, every 30 minutes x 1 hour and every one hour x 4 hours. (ACOG Practice Bulletin 203)
- ▶ Additional BP monitoring should be done per provider order or as needed.

Reportable conditions to notify provider

- ▶ Systolic blood pressure greater than or equal to 160 mm Hg. Diastolic blood pressure less than 80 mm Hg or greater than or equal to 110 mm Hg following medication administration.
- ▶ Category II or III fetal heart rate tracing following antihypertensive administration.
- ▶ Sustained maternal heart rate less than 50 bpm or greater than 120 bpm during or within 30 minutes following medication administration.

Eclampsia management

Background

- ▶ Eclampsia is characterized by convulsions and loss of consciousness, which can occur without warning during the antepartum, intrapartum or postpartum period.
- ▶ The eclamptic patient is at risk for aspiration and cerebral hemorrhage.
- ▶ Fetal bradycardia frequently occurs during and following an eclamptic seizure due to tetanic contractions or maternal hypoventilation.
- ▶ Best treatment for baby is maternal stabilization.

Management

- ▶ Notify charge nurse, attending provider, and anesthesiologist/CRNA immediately. Initiate emergency pager (if institution has instituted).
- ▶ Position patient on side.
- ▶ Protect from injury.
- ▶ Prepare to administer magnesium sulfate.
- ▶ Anticipate obtaining lab tests (magnesium level, blood for liver enzymes, serum creatinine, etc.).
- ▶ Following seizure:
 - Suction mouth with Yankauer PRN
 - Give oxygen by non-rebreather mask at 10 liters per minute.
 - Provide ventilatory support as needed

- Assess blood pressure, pulse, and respirations every 5 minutes.
- Assess oxygen saturation and level of consciousness every 15 minutes until stable for a minimum of one hour.
- Monitor fetal heart rate and uterine activity continuously if viable fetus is present.
- Observe for signs and symptoms of placental abruption or impending delivery.
- Obtain order for indwelling catheter.

*Clinicians may consider antihypertensive therapy at 155/105 mm Hg given the association with increased maternal morbidities at this threshold in several studies as discussed in Section: Borderline Severe-Range Blood Pressures: A Clinical Conundrum on page 35.

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

Appendix L: FAQs for Timely Treatment for Acute-Onset Severe Hypertension during Pregnancy and the Postpartum Period

ACOG Practice Bulletin 222 (June 2020) and the AIM Hypertension Bundle are the sources of these guidelines.

Severe hypertension that is accurately measured using standard techniques and is persistent for 15 minutes or more is considered a hypertensive emergency.

- ▶ It can occur during pregnancy or postpartum
- ▶ Either systolic ≥ 160 mm Hg or diastolic $\geq 110^*$ mm Hg
- ▶ Can present as new acute-onset, or in women with chronic hypertension who are developing superimposed preeclampsia with acutely worsening, difficult to control, severe hypertension

If severe BP elevations persist for 15 minutes or more, administer antihypertensive medication.

- ▶ The 15 minutes is the definition of a hypertensive emergency that needs immediate treatment, NOT the definition of preeclampsia which in other guidelines calls for elevated BPs measured 4 hours apart.
- ▶ The second confirmatory blood pressure measurement should be done within 15 minutes. The 15-minute window provides a sufficient gap to formally confirm persistent elevated blood pressure that is independent of other causes, and that the patient requires treatment. More frequent readings (every 5 minute) are acceptable for observation purposes.
- ▶ Repeat BP measurement to ensure accuracy. Initial first line management can be with labetalol, hydralazine, or immediate-release PO nifedipine – the most important thing is that antihypertensive medications need to be initiated in a hypertensive emergency.
- ▶ Treatment of acute-onset severe hypertension is an emergency and should take precedence over starting magnesium sulfate.
- ▶ Two thirds of the preeclampsia deaths in the most recent UK Confidential Enquiries resulted from stroke. Identical findings were noted in the recent California review of maternal deaths. It should be noted that very few women die from seizures.
- ▶ Strokes can occur in women with acute-onset hypertension with systolic pressures in the 160s and diastolic pressures in the 110s.*
- ▶ Treatment of acute-onset severe hypertension is an emergency and demands an immediate response. Aim for initiation of antihypertensive medications “as soon as possible”, ideally by 30 minutes and not more than 60 minutes after the confirmation. Ultimately, the goal is to not delay care. Hospitals that address the systems issues around immediate treatment have been

able to achieve this goal.

After the second elevated reading, treatment should be initiated ASAP (within 30-60 minutes of verification).

- ▶ The emergency begins with the first measurement of severe hypertension. A confirmation blood pressure should be taken at 15 minutes, but calls to the physician and preparation/initiation of the medication can be started while waiting for the confirmatory BP measurement if clinically indicated. For the Maternal Data Center's "Timely Treatment for Severe Hypertension" measure, timely treatment is considered to be treatment within 30-60 minutes of the second (confirmatory) blood pressure.
- ▶ **Ultimately, the goal is to not delay care.**

Is there worry about fetal effects of treatment for severe-range BP?

- ▶ Following antihypertensive treatment, hypotension is uncommon, and often transient. Fetal heart rate changes are even more rare and respond well to standard intrauterine resuscitation measures.
- ▶ Fetal responses to sudden hypotension are more common in women receiving epidural anesthesia.
- ▶ In the CMQCC California Preeclampsia Collaborative, among women being treated for acute-onset severe hypertension, < 1% were associated with significant changes in the fetal heart rate pattern in the hour after treatment (and may have been related to other factors such as the preeclampsia itself).
- ▶ Severe hypertension is an emergency and requires emergent treatment.
- ▶ **The risks associated with untreated hypertensive emergency are greater than the risks of treatment.**

Are manual BP measurements required/recommended with blood pressures 140/90 or 160/110 mm Hg?

- ▶ Manual BP measurement is the "gold standard" and is encouraged with BP > 140/90 mm Hg and recommended with severe-range pressures to improve accuracy.
- ▶ **Validated** equivalent automated equipment may also be used.
- ▶ The most important factor is being consistent: same position, same arm and right-sized cuff. Patients should be sitting or semi-reclined, as described in the Hypertensive Disorders of Pregnancy Toolkit.

Other FAQs: "But what about..."

- ▶ ...BP measurements that vacillate between severe and nearly severe?

Women with acute-onset severe hypertension can have strokes. For example, serial measurements of: 162/105, 158/104, 165/100; 159/109 mm Hg shows persistence, and risk, and we recommend antihypertensive treatment.

- ▶ ...A severe-range BP followed in 15 minutes by less concerning BP (145/95 mm Hg)?

This scenario does not require treatment BUT does indicate the need for frequent monitoring of BP and observation.

- ▶ ...if in another hour after the 145/95, the BP rises again to severe-range?

Here there may be choices: begin treatment or await another BP measurement within 15 minutes to document persistent severe-range (while preparing the medication). This judgment depends, among other factors, on how low the blood pressures were between the two severe-range measurements.

- ▶ ... if the nurse does not take a confirmatory BP for 30-40 minutes and it is still severe-range? (“It was not within 15 minutes...”).

The severe-range pressure is persistent so treatment should commence immediately.

A key educational point is that one severe-range BP requires the initiation of frequent BP measurements every 15 minutes for at least one hour.

*Clinicians may consider antihypertensive therapy at 155/105 mm Hg given the association with increased maternal morbidities at this threshold in several studies as discussed in the Section: Borderline Severe-Range Blood Pressures: A Clinical Conundrum on page 35.

Improving Health Care Response to Hypertensive Disorders of Pregnancy, a CMQCC Quality Improvement Toolkit, 2021.

Appendix M: Sample Order Set for Acute Control of Hypertensive Emergencies

Note: This is a SAMPLE developed by a particular facility and the content is NOT specifically endorsed by the HDP Task Force. The sample is provided as an example to work from. You may need to adjust based on the individual circumstances of your facility.

Medications

Once any of the Preeclampsia Antihypertensive Sub phase orders have been administered, the provider should evaluate and discontinue the active subplan when the patient is stabilized and reorder the subplan in case of another hypertensive crisis.

If starting with hydralazine: (hydralazine may be preferred if maternal HR is < 60)

Hydralazine

- 10 mg, IV Push, INJ, x1, priority: NOW, Step 1.
Administer slow IV Push at a max rate of 5 mg/min
For systolic greater than or equal to 160 and/or diastolic greater than or equal to 110.
- 5 mg, IV Push, INJ, x1, priority: NOW, Step 1.
Administer slow IV Push at a max rate of 5 mg/min
For systolic greater than or equal to 160 and/or diastolic greater than or equal to 110.

Hydralazine

- 10 mg, IV Push, INJ, q20min, PRN Hypertension, Step 2, for 2 Dose/Time
Administer slow IV Push at a max rate of 5 mg/min
If systolic is greater than or equal to 160 and/or diastolic greater than or equal to 110 in 20 minutes, give additional 10mg.
If no response 20 minutes after last dose, give additional 10mg.
If no response in 20 minutes give labetalol 20mg.

Labetalol

- 20 - 40 mg, IV Push, q10min, PRN Hypertension, Step 3, for 2 Dose/Time
IV Push Rate 10 mg/min
Give 20mg IV Push if adequate response NOT achieved with hydralazine. Repeat BP in 10 minutes. If elevated, administer labetalol 40mg IV Push and obtain anesthesia consult.

If starting with labetalol:

Labetalol

20 mg, IV Push, INJ, x1, priority: NOW, Step 1

IV Push Rate: 10 mg /min

For systolic greater than or equal to 160 and/or diastolic greater than or equal to 110.

Labetalol

40 - 80, mg, IV Push, q10min, PRN Hypertension, Step 2, for 2 Dose/Time

Give 40mg if systolic greater than or equal to 160 and/or diastolic greater than or equal to 110 10 minutes after initial 20mg dose.

If no response 10 minutes after 40mg dose, increase dose to 80mg.

If 80mg given and no BP response, give hydralazine 10mg and notify provider and anesthesia.

20 - 80, mg, IV Push, q10min, PRN Hypertension, Step 2, for 3 Dose/Time

If more than 1 hour since initially achieving BP control with 20mg, and systolic is again greater than or equal to 160 and/or diastolic greater than or equal to 110, give 20mg labetalol IV Push.

If no response 10 minutes after 20mg dose, increase dose to 40mg.

If no response 10 minutes after 40mg dose, increase dose to 80mg.

If 80mg given and no BP response, give hydralazine 10mg IV Push and notify provider and anesthesia.

Hydralazine

10 mg, IV Push, INJ, x1, PRN Hypertension, Step 3

Administer slow IV Push at a max rate of 5 mg/min

Give if BP still elevated after Step 1 and Step 2 of labetalol.

Repeat BP in 10 minutes, if elevated obtain anesthesia consult.

If using nifedipine as First Line

Nifedipine

10 mg, PO, Cap, x1, priority: NOW

For systolic greater than or equal to 160 and/or diastolic greater than or equal to 110.

Nifedipine

10 mg, PO, Cap, q20min, PRN Hypertension

If systolic greater than or equal to 160 and/or diastolic greater than or equal to 110 in 20 minutes, give additional 10mg.

If no response 20 minutes after last dose give additional 10mg.

Maximum of 5 doses, if not appropriate BP response, notify provider and anesthesia.

****END OF PLAN****

Appendix N: Sample EMR Integration Care Pathway for Preeclampsia

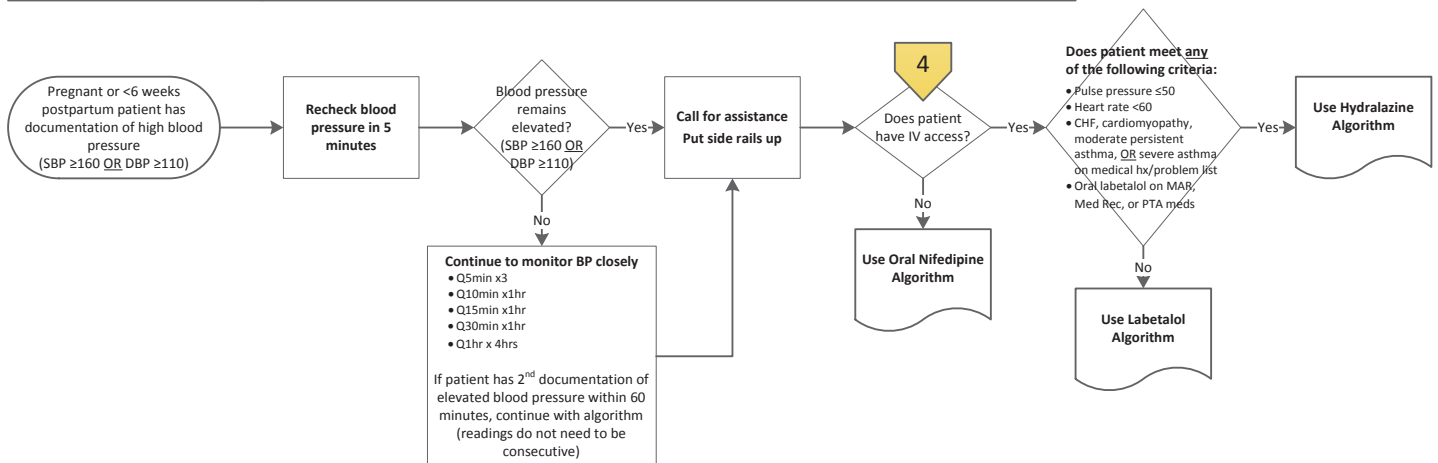
Note: This is a SAMPLE developed by a particular facility and the content is NOT specifically endorsed by the HDP Task Force. The sample is provided as an example to work from. You may need to adjust based on the individual circumstances of your facility.

LLUCH: Preeclampsia Protocol Identification and Treatment Algorithm

Sample Loma Linda University
Children's Hospital Care Pathway for
EMR Integration

Not Intended as a Standard of Care

<p>Inclusion criteria (must meet ALL of the following):</p> <ul style="list-style-type: none"> • Age ≤60 years • Pregnant or within 6 weeks postpartum • In TCBC location • Has order to Initiate Preeclampsia Protocol; <i>items in red have standing orders (TCBC-7) and do not require Initiate Preeclampsia Protocol order</i> 	<p>For all patients on this protocol:</p> <ul style="list-style-type: none"> • Notify attending physician if SBP ≥180; x54128 • Start fetal monitoring if applicable • <i>If patient has unremitting headache or neurological symptoms: Notify provider to evaluate need for brain imaging</i> • <i>If 24 - 34 weeks gestation (documented GA in EPIC): Administer antenatal corticosteroids, if not given within past 14 days</i> Betamethasone, 12 mg, IM, Q24hr, x2 (if patient received 1st dose at OSH: x1, 24 hours after prior administration) • Apply SCDs for VTE prophylaxis • Monitor strict I&O (no less than Q2hr) <i>Does not require indwelling catheter</i>
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REFERENCES:

Emergency Department Postpartum Preeclampsia Checklist. (July 2017). From *The American College of Obstetricians and Gynecologists*. Retrieved from <https://www.acog.org/-/media/Districts/District-II/Public/SMI/v2/sm03a170713PPPreeclamCheckEDRev072017.pdf?dmc=1&ts=20180911T2120353271>

Hydralazine Algorithm. (July 2017). From *The American College of Obstetricians and Gynecologists*. Retrieved from <https://www.acog.org/-/media/Districts/District-II/Public/SMI/v2/sm05a170713HydralazineAlgorithmRev072017.pdf?dmc=1&ts=20180911T2123422806>

Hypertensive Emergency Checklist. (July 2017). From *The American College of Obstetricians and Gynecologists*. Retrieved from <https://www.acog.org/-/media/Districts/District-II/Public/SMI/v2/sm01a170713HTEmergencyCheckRev072017.pdf?dmc=1&ts=20180911T2115430765>

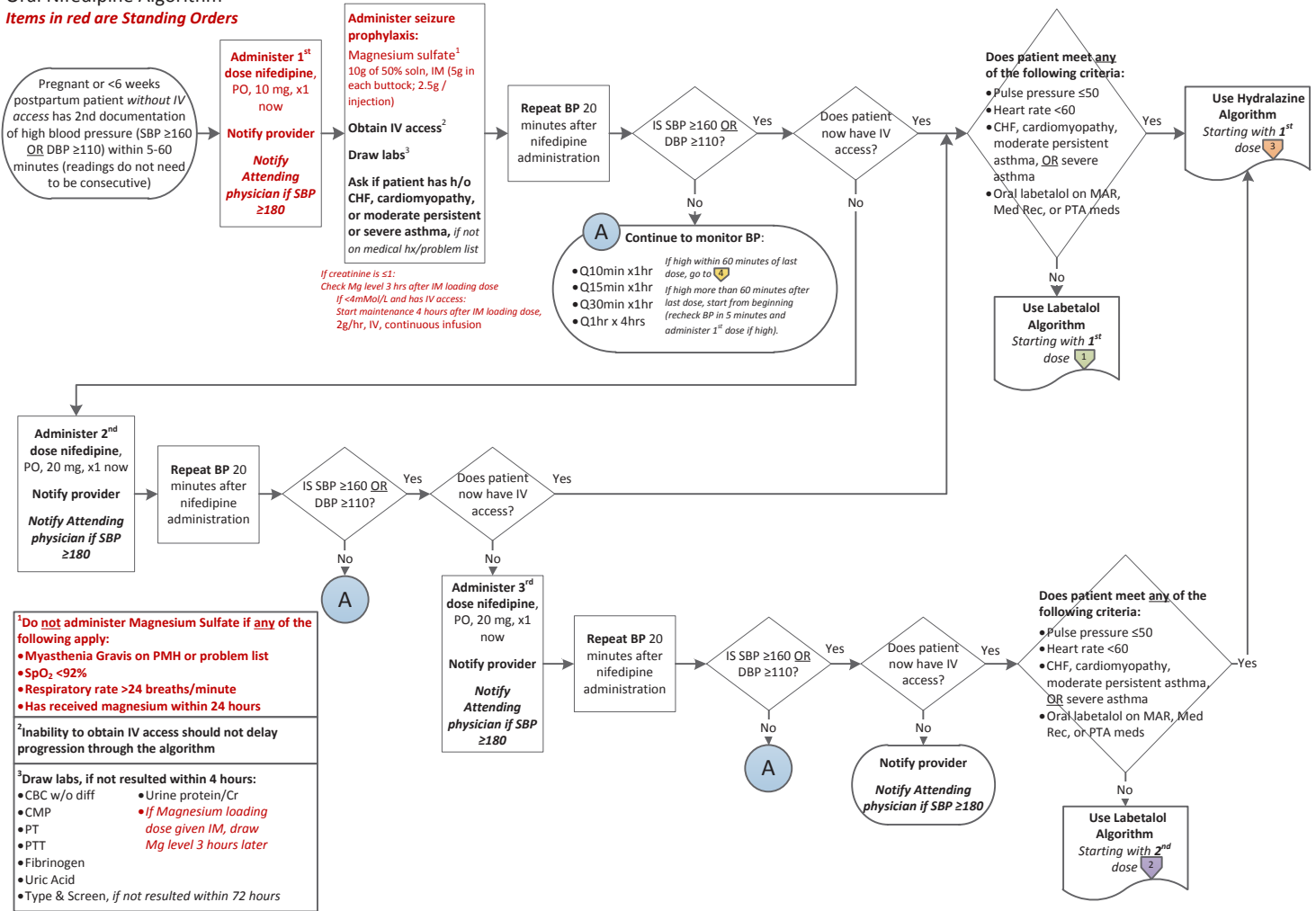
Labetalol Algorithm. (July 2017). From *The American College of Obstetricians and Gynecologists*. Retrieved from <https://www.acog.org/-/media/Districts/District-II/Public/SMI/v2/sm04a170713LabetalolAlgorithmRev072017.pdf?dmc=1&ts=20180911T2123092962>

Oral Nifedipine Algorithm. (January 2018). From *The American College of Obstetricians and Gynecologists*. Retrieved from <https://www.acog.org/-/media/Districts/District-II/Public/SMI/v2/sm06a180307OralNifedipineAlgorithmFINAL03072018.pdf?dmc=1&ts=20180911T2122179523>

LLUCH: Preeclampsia Protocol

Oral Nifedipine Algorithm

Items in red are Standing Orders

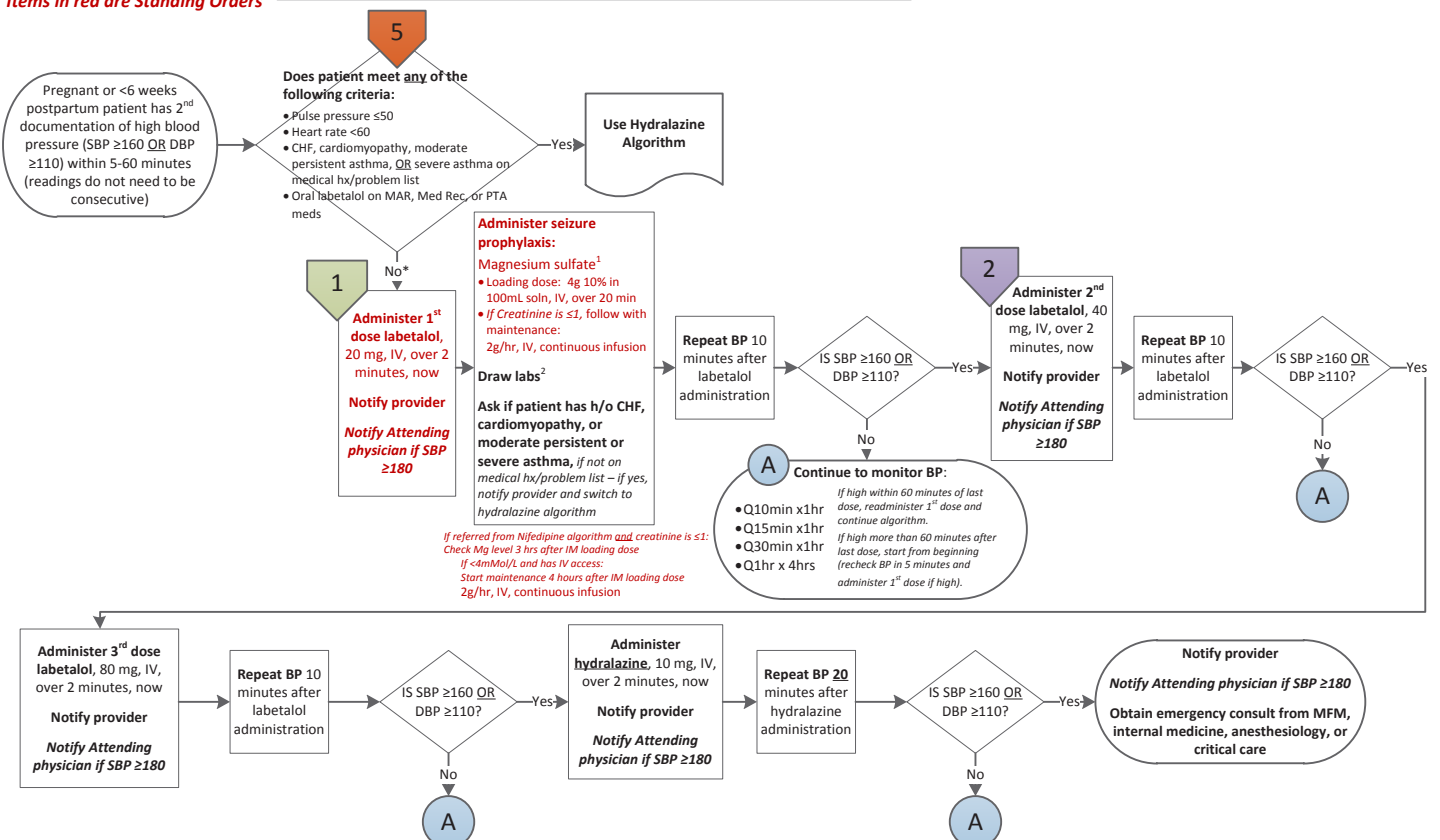


LLUCH: Preeclampsia Protocol

Labelalol Algorithm

Items in red are Standing Orders

Exclusion Criteria: Administration of dose will exceed 220 mg IV labelalol in 24 hours



*If referred from Nifedipine algorithm and creatinine is ≤1:
Check Mg level 3 hrs after IM loading dose
If <4mMol/L and has IV access:
Start maintenance 4 hours after IM loading dose
2g/hr, IV, continuous infusion*

A Continue to monitor BP:
 • Q10min x1hr *If high within 60 minutes of last dose, readminister 1st dose and continue algorithm.*
 • Q15min x1hr *If high more than 60 minutes after last dose, start from beginning (recheck BP in 5 minutes and administer 1st dose if high).*
 • Q30min x1hr
 • Q1hr x 4hrs

***If at any time pulse pressure (SBP – DBP) drops to 50 or below, OR heart rate drops below 60, notify provider and switch to Hydralazine Algorithm**

¹Do not administer Magnesium Sulfate if any of the following apply:

- Myasthenia Gravis on PMH or problem list
- SpO₂ <92%
- Respiratory rate >24 breaths/minute
- Has received Magnesium within 24 hours

²Draw labs, if not resulted within 4 hours:

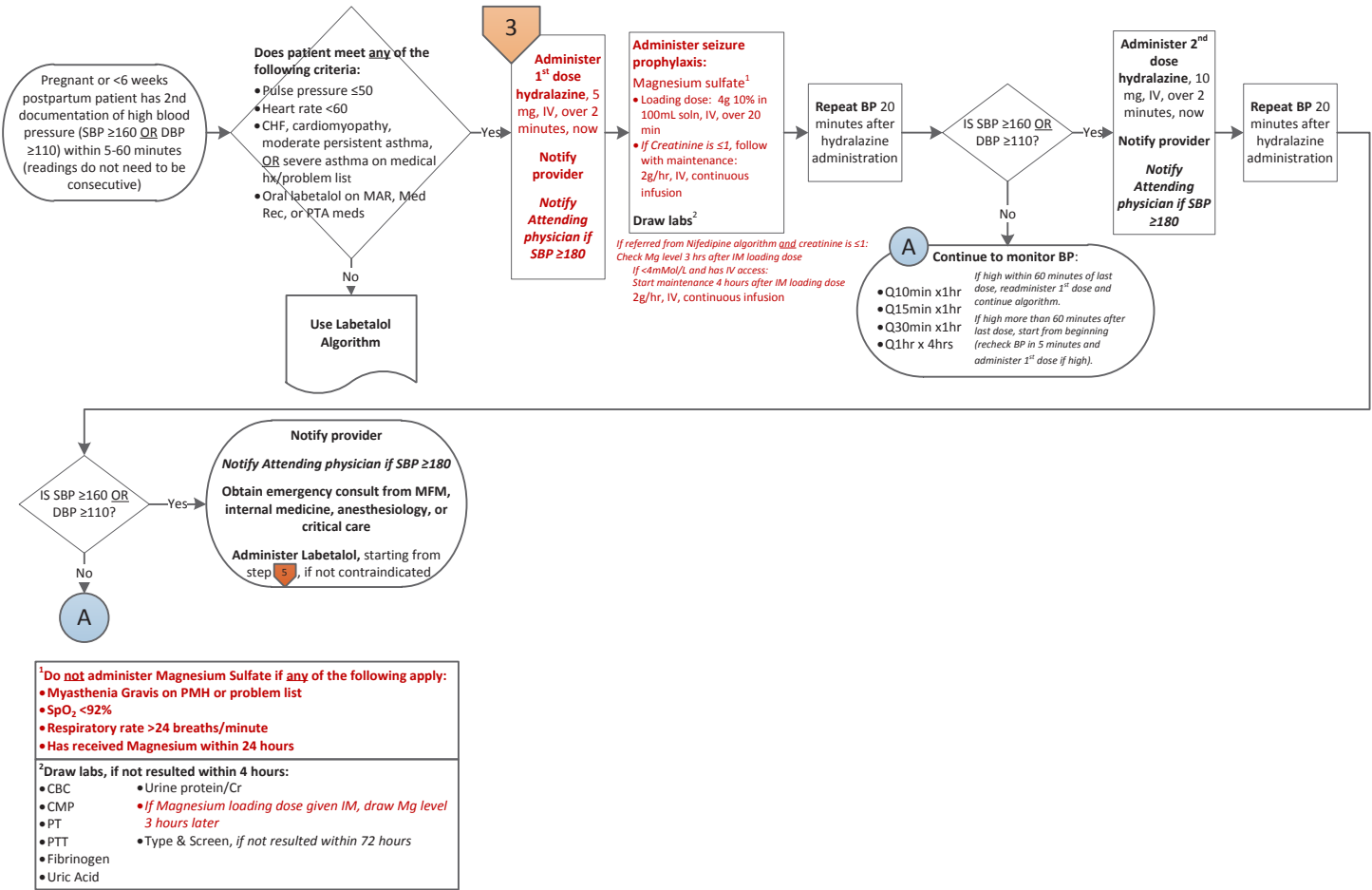
- CBC w/o diff
- PTT
- Urine protein/Cr
- CMP
- Fibrinogen
- PT
- Uric Acid
- Type & Screen, if not resulted within 72 hours
- *If Magnesium loading dose given IM, draw Mg level 3 hours later*

LLUCH: Preeclampsia Protocol

Hydralazine Algorithm

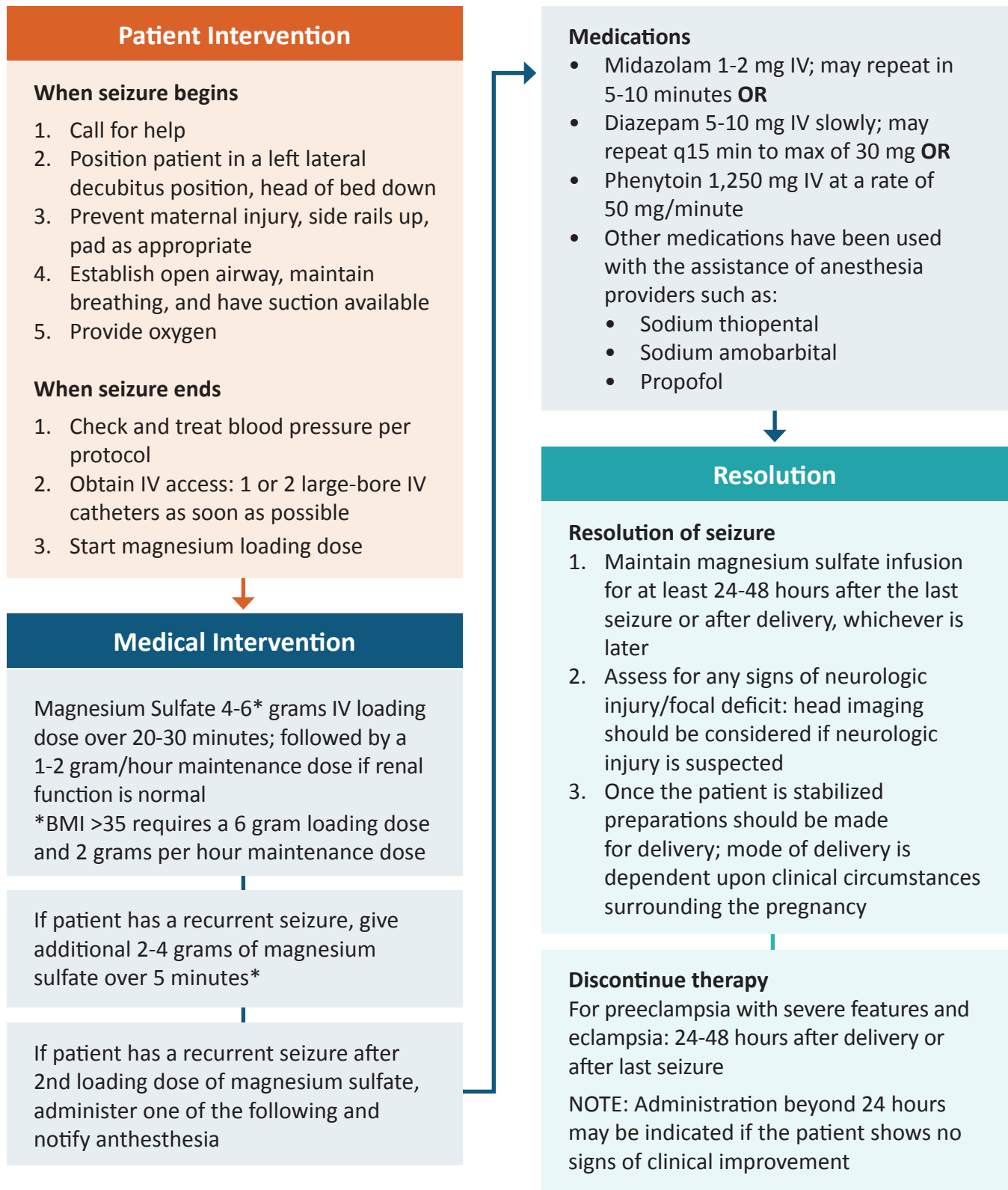
Items in red are Standing Orders

Exclusion Criteria: Administration of dose will exceed 25 mg IV hydralazine in 24 hours



Used with permission from Loma Linda University. 2020

Appendix O: Eclampsia Algorithm

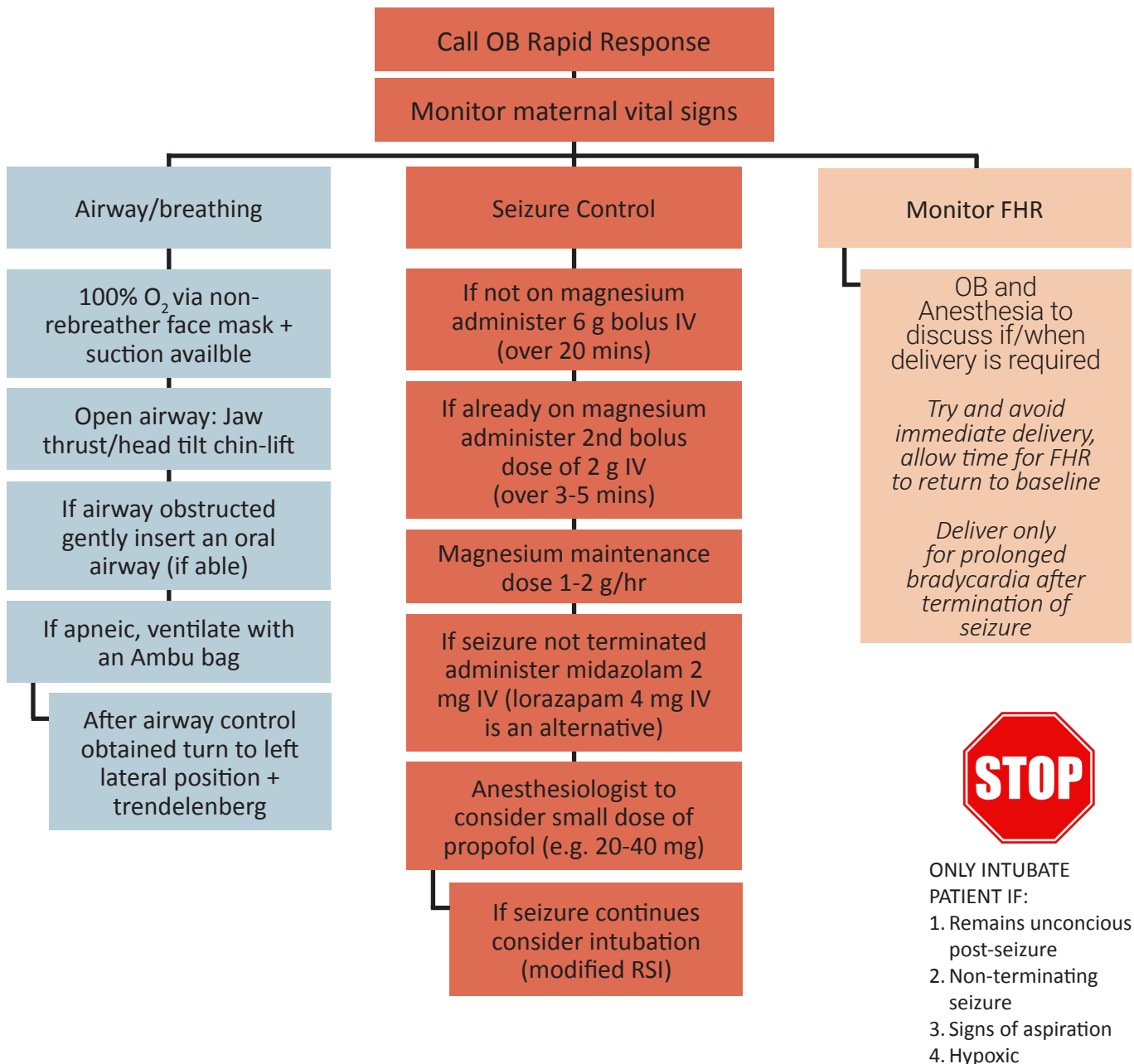


***Monitor respiration and BP, EKG and signs of magnesium toxicity.**

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

Appendix P: Sample Management of Eclampsia and Acute-Onset, Severe Hypertension

Note: This is a SAMPLE developed by a particular facility and the content is NOT specifically endorsed by the HDP Task Force. The sample is provided as an example to work from. You may need to adjust based on the individual circumstances of your facility.



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Appendix Q: Guidance for Rapid Debrief and Sample Form

Created by and used with permission from the California Maternal Quality Care Collaborative (CMQCC)

The debrief form is a tool for clinicians to learn from critical events. The purpose is not to fill out another form, but rather to guide a discussion of the care provided. Some debriefs will highlight the optimal teamwork of your staff, some will provide an opportunity to provide education, and others will highlight processes that may require improvement beyond reinforcement of existing systems. Debriefs that bring to light concerning issues can help focus deeper case review in which specific times, values, and documentation will be required to evaluate the care more thoroughly.

Debriefing is appropriate both for simulation drills and live events and is required by The Joint Commission's Standards for Maternal Safety (Effective January 1, 2021). To facilitate debriefing, participants should have a safe private area for discussion, understand that all input is valued, self-reflection is important, and be assured that all discussions during debriefings are confidential.

The sample rapid debrief tool has been designed to encourage consistent completion for all events meeting debrief criteria per institutional policy. When considering the possible criteria that could trigger the need for a debrief, it will be useful to have discussion with your perinatal quality improvement team. Appropriateness and relevance of criteria will vary among facilities. We recommend listing your facility's selected debrief triggers directly on the debrief form for quick reference.

There are a series of checkboxes specific to the event type to allow for a rapid, yet thorough, debrief and avoid missing key information. When debrief tools are non-specific, they often yield incomplete reviews of the event when providers and staff are under pressure to move on to the next case, and unable to include essential information. The questions and case details provide prompts so that the debrief can be a seamless collection of necessary information. It is important to have all members of the care team involved in the case, and especially the provider, present for the debrief so that all points of view are shared. Debriefing should be completed as soon as possible after the patient's health has stabilized and before the provider leaves the unit. A timely discussion assures that detail recall is accurate, and all members of the team are able to immediately process the care provided up to the present.

Improving Health Care Response to Hypertensive Disorders of Pregnancy, a CMQCC Quality Improvement Toolkit, 2021.

We recommend listing your facility's chosen debrief criteria directly on the form for quick reference. This is a list of possible criteria for triggering the completion of a Preeclampsia Debrief. Criteria will vary among facilities and should be decided on by your perinatal QI team.



Criteria for completing a Preeclampsia Debrief

- Persistent Severe Hypertension (≥ 160 mm Hg systolic or ≥ 110 mm Hg diastolic taken 2 times and repeated 15 minutes apart)
- Preeclampsia with Severe Features / HELLP Syndrome / Eclampsia / Other cerebral or visual disturbances
- Major Complications of preeclampsia including Pulmonary Edema, ARDS, Oliguria /Acute Renal Failure

Date: _____

Team members present for debrief (provider should be present):

Did you have the support/consultation you needed? Yes No _____

Did you have the supplies you needed? Yes No _____

Did the team work and communicate effectively? Yes No _____

Timely Treatment of Severe HTN per protocol? Yes No N/A _____

○ HTN Medications: IV Labetalol IV Hydralazine PO Nifedipine

Other: _____

Magnesium Treatment per protocol? Yes No N/A _____

Eclampsia Treatment per protocol? Yes No N/A _____

Delays: None Recognition Notification Provider Response _____

Case Details:

○ Gestational Age: _____ weeks

○ Delivery: Cesarean Vaginal Undelivered - Antepartum

○ Additional Diagnoses: DIC Abruptio Pulmonary Renal None _____

○ Maternal transfer to higher level of care? Yes No

○ Infant transfer to higher level of care? Yes No No, IUFD No, Nonviable

Successes of Management:

Opportunities for Improvement:

Debrief must be returned to Educator, Supervisor or CNS at end of shift.

Additional Feedback: _____

Submitted by (optional): _____

Educator, Supervisor, or CNS

Successes and Lessons learned shared with providers and staff through:

Staff Meeting

E-blast

Educational programming

Quality Board

Other _____

Appendix R: Sample Perinatal Safety Debrief Form

Note: This is a SAMPLE developed by a particular facility and the content is NOT specifically endorsed by the HDP Task Force. The sample is provided as an example to work from. You may need to adjust based on the individual circumstances of your facility.

Confidential and Privileged Quality Information

Add Patient Sticker or Write in Patient Name + MRN

****DO NOT FILE IN PATIENT'S CHART****

Instructions:

- A debriefing should occur as close to the event as possible, ideally as soon as both mother and infant are stable. If time does not permit, the debrief should occur prior to shift change before the Team members leave.
- Return to Department Manager or MCH Nurse Director for review.

Occurrence	Date	Time	Location
Debrief	Date	Time	Location
SITUATION			
Diagnosis:			
<input type="checkbox"/> Hypertensive Crisis	<input type="checkbox"/> Hemorrhage	<input type="checkbox"/> Seizure/ Eclampsia	<input type="checkbox"/> Vacuum/Forceps
<input type="checkbox"/> Code C: Emergency C-section	<input type="checkbox"/> Code Blue (Mom)	<input type="checkbox"/> Code White (Newborn)	<input type="checkbox"/> Code OB: OB Emergency outside LD
Reason for Debrief:			
<input type="checkbox"/> Delay in Service	<input type="checkbox"/> Communication Breakdown	<input type="checkbox"/> Strip review	
<input type="checkbox"/> Medication(s) Availability issue	<input type="checkbox"/> Blood Products Availability issue	<input type="checkbox"/> Equipment Availability issue	
<input type="checkbox"/> Other:			
<input type="checkbox"/> Team Response went well		<input type="checkbox"/> Near Miss	
BACKGROUND			

ASSESSMENT		
Discussion Topic	What went well	Opportunity for Improvement
Communication		
Team Response		
Equipment Availability		
Systems/ Resources		
Documentation		
Other		
RECOMMENDATION		
Recorder		
Participants		
Comments/ Suggestions		

Used with permission from anonymous hospital 2020.