

National Partnership for Maternal Safety

Consensus Bundle on Severe Hypertension During Pregnancy and the Postpartum Period

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Complications arising from hypertensive disorders of pregnancy are among the leading causes of preventable severe maternal morbidity and mortality. Timely and appropriate treatment has the potential to significantly reduce hypertension-related complications. To assist health care providers in achieving this goal, this patient safety bundle provides guidance to coordinate and standardize the care provided to women with severe hypertension during pregnancy and the postpartum period. This is one of several patient safety bundles developed by multidisciplinary work groups of the National Partnership for Maternal Safety under

the guidance of the Council on Patient Safety in Women's Health Care. These safety bundles outline critical clinical practices that should be implemented in every maternity care setting. Similar to other bundles that have been developed and promoted by the Partnership, the hypertension safety bundle is organized into four domains: *Readiness, Recognition and Prevention, Response, and Reporting and Systems Learning*. Although the bundle components may be adapted to meet the resources available in individual facilities, standardization within an institution is strongly encouraged. This commentary provides information to assist with bundle implementation.

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postpartum period. It is organized into four action domains: *Readiness, Recognition and Prevention, Response, and Reporting and Systems Learning* (Box 1). Given the wide diversity of maternity care settings, it is not anticipated that every facility will be immediately able to adopt all 14 key elements. This bundle is not meant to be a single national protocol, but rather a framework for facilities to adopt to foster optimal care of these at-risk patients. Low-resource hospitals should be able to incorporate most of these recommendations, but should also have processes in place for timely transfer to higher resourced facilities, particularly if they cannot implement key elements of the bundle. Although this bundle is primarily for inpatient acute care birthing facilities, elements may also be applicable to the outpatient office setting.

Obstetric hypertension guidelines and checklists to facilitate timely recognition and treatment of hypertension to quickly reduce blood pressure below severe thresholds have been shown to improve maternal outcomes and reduce cerebral complications.⁶ What follows is a description of the domains of the patient safety bundle that are outlined in Box 1.

READINESS (EVERY UNIT)

The *Readiness* domain includes five elements to prepare health care facilities for the timely management of women who present with hypertensive emergencies during pregnancy.

1. Standard Diagnostic Criteria and Monitoring and Treatment for Severe Preeclampsia or Eclampsia

Health care facilities caring for women during pregnancy and the postpartum period should ensure that all staff have standardized education in diagnostic criteria and use standardized protocols for the monitoring and treatment of preeclampsia (Box 2). Severe systolic hypertension is defined in the American College of Obstetricians and Gynecologists' 2014 Hypertension in Pregnancy Task Force Report and the Canadian Hypertension Guideline Committee as a systolic blood pressure of 160 mm Hg or greater or a diastolic blood pressure of 110 mm Hg or greater (or both) in women during pregnancy and the postpartum period.^{3,7} Acute-onset severe hypertension that is accurately measured and persistent for 15 minutes or greater is considered to represent a hypertensive emergency that requires the prompt administration of antihypertensive medication with the goal of avoiding cerebral hemorrhage or stroke.⁸ Prompt treatment (preferably within 30–60 minutes of detection) is recommended without waiting 4

hours to ensure a diagnosis of preeclampsia or for laboratory results.³

2. Unit Team Education, Reinforced by Regular Unit-Based Drills With Debriefs

Because giving prompt attention to severe hypertension can be lifesaving,⁸ every care unit must have a coordinated and practiced response to this urgent situation. Team-based drills improve staff knowledge,⁹ confidence,¹⁰ appropriate documentation,¹¹ and interdisciplinary communication¹² and, most importantly, reduce preventable adverse outcomes.^{13–15} Postdrill debriefings allow for reinforcement of good performance and identification of areas needing improvement.¹⁶ Simulation-based interdisciplinary professional team training should include all personnel and obstetric care providers who care for the woman and her fetus or newborn (Box 3). The scenario objectives must be clear, concise, and based on the best evidence available.

For hypertension drills, it is important to include the following: 1) learning objectives; 2) proper equipment and knowledge in its use; 3) proper multidisciplinary staff participation; 4) a script or scenario for your impersonated patient, family, and other participants; and 5) supporting materials (eg, admission record, laboratory results) (Box 3). Templates are available for download to aid writers in creating their own scenarios as well as previously published case scenarios that can be used.⁵

3. Process for Timely Triage of Women With Hypertension During Pregnancy and the Postpartum Period, Including the Emergency Department and Outpatient Areas

On presentation for postpartum care (eg, in the emergency department or other outpatient setting), all women of reproductive age should be questioned about a current or recent pregnancy. Those with any symptoms or signs of preeclampsia require further diagnostic evaluation and treatment with immediacy depending on the blood pressure and the severity of the other symptoms. Each hospital protocol should reflect the consult and transfer procedure for women with symptoms of preeclampsia or eclampsia during pregnancy and the postpartum period.⁵

4. Rapid Access to Medications Used for Severe Hypertension or Eclampsia

Blood pressure control and seizure prevention are cornerstones in the management of patients with preeclampsia or eclampsia.³ The control of severe hypertension is the first priority. Ideally, medications to address blood pressure and seizure prophylaxis should



Box 1. Severe Hypertension During Pregnancy and the Postpartum Period Patient Safety Bundle: Council on Patient Safety in Women's Health Care

Readiness (Every Unit)

1. Standards for early warning signs, diagnostic criteria, monitoring and treatment of severe preeclampsia or eclampsia, including order sets and algorithms
2. Unit education on protocols, unit-based drills (with postdrill debriefs)
3. Process for timely triage and evaluation of women with hypertension during pregnancy and the postpartum period, including emergency department and outpatient areas
4. Rapid access to medications used for severe hypertension or eclampsia: medications should be stocked and immediately available on labor and delivery and in other areas where patients may be treated; include brief guide for administration and dosage
5. System plan for escalation, obtaining appropriate consultation, and maternal transport, as needed

Recognition and Prevention (Every Patient)

6. Standard protocol for measurement and assessment of blood pressure and urine protein for all women during pregnancy and the postpartum period
7. Standard response to maternal early warning signs including listening to and investigating patient symptoms and assessment of laboratory values (eg, complete blood count with platelets, aspartate transaminase, and alanine transaminase)
8. Facility-wide* standards for educating women on signs and symptoms of hypertension and preeclampsia prenatally and postpartum

Response (Every Case of Severe Hypertension or Preeclampsia)

9. Facility-wide standard protocols with checklists and escalation policies for management and treatment of:
 - Severe hypertension
 - Eclampsia, seizure prophylaxis, and magnesium overdosage
 - Postpartum presentation of severe hypertension or preeclampsia
10. Minimum requirements for protocol:
 - Notification of physician or primary care provider if systolic blood pressure is 160 mm Hg or greater or diastolic blood pressure is 110 mm Hg or greater for two measurements within 15 minutes
 - After the second elevated reading, treatment should be initiated as soon as possible, preferably within 60 minutes of verification
 - Includes onset and duration of magnesium sulfate therapy

Box 1. Severe Hypertension During Pregnancy and the Postpartum Period Patient Safety Bundle: Council on Patient Safety in Women's Health Care (continued)

- Includes escalation measures for those unresponsive to standard treatment
 - Describes manner and verification of follow-up within 7–14 days postpartum or earlier if with symptoms
 - Describe postpartum patient education for women with preeclampsia
11. Support plan for patients, families, and staff for intensive care unit admissions and serious complications of severe hypertension

Reporting and Systems Learning (Every Unit)

12. Establish a culture of huddles for high-risk patients and postevent debriefs to identify successes and opportunities
13. Multidisciplinary review of all severe hypertension and eclampsia patients admitted to an intensive care unit for systems issues
14. Monitor outcomes and process metrics

*Facility-wide indicates all areas where pregnant or postpartum women are cared for (eg, labor and delivery, postpartum critical care, and emergency departments; others depending on the facility).
Modified from Council on Patient Safety in Women's Health Care. Available at: <http://www.safehealthcareforeverywoman.org/>. Retrieved April 7, 2017.

be stored together in standardized, premixed concentrations with infusion supplies to expedite administration and minimize the risk for erroneous dosing. This may be best accomplished through the use of a Preeclampsia-Eclampsia Medications Emergency Box that is readily available on the unit.^{16,17} Also included in this supply box should be calcium gluconate with guidelines for administration in the event of magnesium toxicity. Parenteral magnesium sulfate remains the best medication for primary prevention or to reduce the recurrence of eclampsia (Box 4). Intravenous labetalol and hydralazine are currently recommended as primary antihypertensive agents for acute reductions of critical maternal blood pressure related to preeclampsia.⁸ Oral nifedipine is acceptable as a first-line antihypertensive medication, particularly when intravenous access is not yet established. A standardized readily available protocol or checklist for the administration of these medications (see *Response*, Section 9) will aid in prompt and more effective treatment.⁸ Ideally, compliance should be tracked.



Box 2. Diagnostic Criteria for Preeclampsia

Blood pressure

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

and

Proteinuria

- Greater than or equal to 300 mg per 24-hour urine collection (or this amount extrapolated from a timed collection)
- or
- Protein/creatinine ratio greater than or equal to 0.3*
- Dipstick reading of 1+ (used only if other quantitative methods not available)

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

Thrombocytopenia

- Platelet count less than 100,000/microliter

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

Cerebral or visual symptoms

*Each measured as mg/dL.

Reprinted with permission from Executive summary: Hypertension in pregnancy. American College of Obstetricians and Gynecologists. *Obstet Gynecol* 2013;122:1122–31.

5. System Plan for Escalation, Obtaining Appropriate Consultation, and Maternal Transport, as Needed

Hypertensive disorders in pregnancy can rapidly progress in severity, putting both the woman and

Box 3. Hypertension in Pregnancy Simulation Training

Potential Scenarios

- Hypertensive emergency
- Eclampsia
- Magnesium Toxicity

Learning Objectives

- Recognition of signs and symptoms of hypertensive disorders in pregnancy
- Describe management of hypertensive disorders in pregnancy
- Stabilization of the pregnant woman before intervention on fetal behalf
- Proper use of medications
- Team communication
- Appropriate escalation
- Appropriate use of emergency checklists

Participants

- Maternity care providers
- Nursing
- Pediatrics
- Anesthesia
- Primary care providers
- Emergency medicine
- Critical care
- Pharmacist or other support staff

her fetus at risk for adverse outcomes. Reviews of mortality data reveal that in many cases, death might have been averted if obstetric care providers had been alerted to disease progression.³ Therefore, awareness of signs of progression, prompt notification of obstetric care providers, appropriate consultation, and transport to another facility when needed is imperative for effective management. Every unit should have criteria for consultation, escalation of care, protocols for assessment of fetal status, and rapid stabilization and transport should that be indicated.

RECOGNITION AND PREVENTION (EVERY PATIENT)

6. Standard Protocol for Measurement and Assessment of Blood Pressure and Urine Protein for All Women During Pregnancy and the Postpartum Period

The adoption of standard methods for the measurement and assessment of blood pressure and urine protein for women during pregnancy and the postpartum period is crucial so that subsequent interventions will be based on reliable and reproducible vital



Box 4. Medications Commonly Used for Hypertension During Pregnancy

Magnesium Sulfate

- Magnesium sulfate not recommended as an antihypertensive agent
- Should be used for: seizure prophylaxis and controlling seizures in eclampsia
- Intravenous (IV) bolus of 4–6 g in 100 mL over 20 minutes followed by IV infusion of 2 g/h; continue for 24 hours postpartum
- Contraindications or relative contraindications: renal failure, myasthenia gravis

Labetalol

- 20 mg IV bolus followed by 40 mg if not effective within 10 minutes; then, if not effective, 80 mg every 10 minutes; maximum total dose of 300 mg in the first hour
- Contraindications or relative contraindications: asthma, congestive heart failure

Hydralazine

- 5–10 mg IV every 20 minutes; maximum total dose of 20 in the first hour
- Contraindications or relative contraindications: tachycardia

Nifedipine

- 10–20 mg orally every 30 minutes; maximum total dose of 50 mg in the first hour
- Note: Nifedipine is not given sublingually
- Contraindications or relative contraindications: tachycardia

signs and laboratory values. The method most often used in the hospital setting to measure blood pressure is the oscillatory method, or automated blood pressure machine. This method may underestimate both systolic and diastolic readings, often by as much as 10 mm Hg.¹⁷ In some outpatient settings, blood pressure measurement is performed using the aneroid (mechanical type with a dial) sphygmomanometer, which, if well maintained, provides accuracy that is similar to mercury sphygmomanometers.

The recommended steps to use in obtaining blood pressure measurements and the recommended appropriate cuff sizes are described in Box 5. Implementation of standard procedures to obtain blood pressure measurements must be integrated into protocols and practice guidelines for each practice setting. Outcome measures should be required to validate the adoption of these standards to assess the success of

Box 5. Steps to Obtain Accurate Blood Pressure Measurement

Step 1: Prepare Equipment

- a. Mercury sphygmomanometer is the gold standard, can use validated equivalent automated equipment
- b. Check cuff for any defaults
- c. Correct size cuff: width of bladder 40% of circumference and encircle 80% of arm

Step 2: Prepare the Patient

- a. Sitting or semireclining position with back supported and arm at heart level
- b. Patient to sit quietly for 5 minutes before measurement
- c. Bare upper arm, free of any restrictive clothing
- d. Feet should be flat, not dangling from examination table or bed, and legs uncrossed

Modified from Peters RM. High blood pressure in pregnancy. *Nurs Womens Health* 2008;12:410–21. Copyright 2008, with permission from the Association of Women's Health, Obstetric and Neonatal Nurses.

implementation. After staff education, a program to monitor skills and remediation when needed should be established.¹⁸

The presence of proteinuria, measured in a 24-hour urine collection or as a spot protein/creatinine ratio, has long been accepted as a criterion for the diagnosis of preeclampsia. A urine dipstick reading of 1+ or greater also suggests significant proteinuria, but because of the high number of false-positive and -negative results, it should be used only when quantitative methods are not available (Box 2).³

7. Standard Response to Maternal Early Warning Signs

Misinterpretation or failure to recognize worsening signs of preeclampsia can result in delayed diagnosis and appropriate treatment. Early recognition and treatment of maternal “triggers” was identified as a critical factor in reducing maternal morbidity and mortality in the 2002–2004 data from the California Pregnancy-Associated Mortality Review.¹⁹ Thus, it is important for health care facilities to develop and implement systems for early recognition of deterioration. There are a number of protocols currently available, such as the Maternal Early Warning Criteria or the Preeclampsia Early Recognition Tool.^{20,21} These tools are designed to get prompt bedside evaluation of a patient by a physician or other clinicians with the ability to initiate emergency



therapeutic interventions as needed. These tools are based on mandating prompt bedside evaluation of patients with critical blood pressures, tachycardia, oliguria, agitation, confusion, unresponsiveness, loss of vision, the report of a persistent headache, shortness of breath, or hypoxia. Assessment tools should be readily available on obstetric units and all other departments caring for women during pregnancy and the postpartum period and, when possible, built into the electronic medical record system.

8. Facility-Wide Standards for Educating Women on Signs and Symptoms of Hypertension and Preeclampsia Prenatally and Postpartum

Patient factors such as failure to understand the severity of the illness or delays in reporting symptoms that could represent severe illness have been shown to contribute to preventable maternal deaths from preeclampsia during pregnancy and the first weeks postpartum.^{2,22} Preeclampsia symptoms are frequently nonspecific and thus may not be recognized by the woman and her family as special concerns in pregnancy or early puerperium. Lack of knowledge of specific symptoms can contribute to a delay in seeking care.²³

Health care providers should inform pregnant women about signs and symptoms of preeclampsia and, if these are evident, stress the importance of contacting health care providers. These conversations should occur in the context of childbirth education classes, prenatal care visits, during hospitalization, and at postpartum encounters. Strategies should be used to ensure comprehension among women with varying degrees of health literacy. Recommended strategies include using nonmedical language wherever possible, reinforcing key issues with print (and video, where available) materials, and requesting information through “teach back” to ensure that the woman and her family members demonstrate understanding.^{3,23}

RESPONSE (EVERY CASE OF SEVERE HYPERTENSION OR PREECLAMPSIA)

9. Facility-Wide Standard Protocols With Checklists and Escalation Policies for Management and Treatment

Severe Hypertension

Treatment guidelines^{3,5} recommend that whenever a systolic blood pressure 160 mm Hg or greater or diastolic blood pressure 110 mm Hg or greater is reached, it should be verified within 15 minutes and if confirmed by a second reading, prompt antihypertensive treatment should be given, ideally within

30–60 minutes of verification. Intravenous labetalol and hydralazine are first-line medications in this situation (Box 4). Another first-line medication option is nifedipine, particularly if intravenous access has not been established or if there are contraindications or relative contraindications to either labetalol (asthma, congestive heart failure) or hydralazine (tachycardia). Dosing regimens are outlined in Box 4.⁸ The pharmacokinetics and effect on blood pressure of these three first-line agents are very similar. Oral labetalol has a slower onset of action and would not be expected to acutely lower blood pressure as quickly as the other three medications. Algorithms, checklists, and flow diagrams for these medications should be readily available and posted in patient care areas as well as for eclampsia and magnesium toxicity.^{3,5} Any system impediments to timely treatment should be addressed.

Magnesium sulfate is recommended for women with preeclampsia with severe features to prevent, and reduce recurrence of, convulsions in patients presenting with eclampsia (Box 4).^{2,3,7,24} For women without severe features but with a blood pressure of greater than 140 but less than 160 mm Hg systolic or greater than 90 but less than 110 mm Hg diastolic, it is recommended that magnesium sulfate not be administered universally for the prevention of eclampsia.^{3,7}

Infusion of magnesium sulfate should be continued for at least 24 hours postdelivery and potentially longer when the woman remains symptomatic with severe features.³ The serum half-life of magnesium sulfate is estimated to be 5 hours in women with normal renal function. Based on the relatively long half-life of infused magnesium, discontinuing it either before operative vaginal birth or cesarean delivery to avoid uterine atony or anesthetic drug interactions is not recommended.³

Magnesium sulfate is recognized as a high-alert medication. Standard protocols that provide rapid access to and guidelines for administration of magnesium sulfate should be readily available in all areas of the hospital that interact with women during pregnancy and the postpartum period.^{3,5} Magnesium is cleared exclusively by renal excretion. Magnesium toxicity can be avoided by confirming adequate renal function with hourly urinary output assessment (typically with the placement of a Foley catheter) and a normal serum creatinine, serial evaluation for presence of patellar deep tendon reflexes, and close observation of respiratory rate. There is little risk of causing magnesium toxicity with the loading dose alone. Serum magnesium levels are not routinely required but should be monitored in the presence of renal dysfunction, when deep tendon reflexes are absent, or both. In women



with renal insufficiency, the maintenance dose should be reduced and serum magnesium levels followed to sustain serum concentrations in the 4.8- to 8.4-mg/dL (4–7 mEq/L) range.¹⁸ Relatively predictive symptoms of magnesium sulfate toxicity are seen at the following maternal serum concentrations: loss of deep tendon reflexes 9.6–12 mg/dL (greater than 7 mEq/L), respiratory depression 12–18 mg/dL (greater than 10 mEq/L), and cardiac arrest 24–30 mg/dL (greater than 25 mEq/L).

If magnesium toxicity is suspected, an appropriate health care provider must be notified, the magnesium infusion should be immediately discontinued, supplemental oxygen administered, and a serum magnesium level assessed. If magnesium toxicity is recognized, 10 mL of 10% calcium gluconate should be administered intravenously (1 g total) and slowly (ie, over 2–5 mL/min) to avoid hypotension, bradycardia, or both.¹⁷ Calcium competitively inhibits magnesium at the neuromuscular junction, but its effect is transient because the serum concentration of magnesium is unchanged. Symptoms of magnesium toxicity can recur after calcium gluconate if the magnesium level remains elevated. If respiratory arrest is identified, prompt resuscitative measures including intubation and assisted ventilation are indicated.²⁵

Eclampsia

Eclampsia is defined as the development of convulsions with or without coma unrelated to other cerebral conditions during pregnancy and the postpartum period in women with signs and symptoms of preeclampsia. An eclamptic convulsion constitutes a life-threatening emergency. The basic principles in the management of eclampsia involve the following measures: 1) support of cardiorespiratory functions; 2) prevention of recurrent seizures; 3) correction of maternal hypoxemia and acidemia; 4) control of severe hypertension (see previous discussion); and 5) initiation of the planning process for a timely birth.

The natural tendency for obstetric care providers caring for a woman with eclampsia is to quickly intervene with therapy to immediately abolish the seizure activity. This approach to patient care with eclampsia is unwise and potentially dangerous to the patient. Although medications such as diazepam or lorazepam can arrest or shorten an eclamptic convulsion, either therapy can result in maternal apnea, cardiac arrest, or both. Parenteral magnesium sulfate does not cause any significant maternal or neonatal central nervous system depression when properly used; it is the drug of choice to treat and prevent eclamptic convulsion in the United States.^{26,27}

Patients should receive the same intravenous loading dose of 4–6 g of magnesium sulfate administered per infusion pump over 15–20 minutes as is given to women requiring magnesium for seizure prophylaxis in the setting of preeclampsia, followed by a maintenance dose of 2 g/h as a continuous intravenous infusion.³ If the woman develops recurrent convulsions after the initial infusion of magnesium sulfate, a further dose of 2 g can be infused over 3–5 minutes. A more rapid infusion or administration of magnesium sulfate by an intravenous push should be avoided because of the risk of magnesium toxicity including respiratory arrest.

Postpartum Presentation of Severe Hypertension or Preeclampsia

Because women with postpartum preeclampsia typically present first either to the emergency department or to an ambulatory care office, awareness by health care providers and preparedness for the likely presentation of postpartum preeclampsia in these practice settings are very important components of an effective and timely response to this occurrence. Given that emergency room staff may be less familiar with preeclampsia and eclampsia, checklists and algorithms for the treatment of postpartum women with these conditions may be particularly useful. Seventy-five percent of deaths secondary to gestational hypertensive disorders occur after birth, with 41% in one study occurring more than 48 hours postpartum.²⁸ Up to half of women eventually diagnosed with postpartum preeclampsia were not diagnosed with preeclampsia in the antepartum or immediate peripartum period.²⁹

Because maternal blood pressure has been shown to decrease for the first 48 hours and then increase with a peak 3–6 days after birth for a woman with preeclampsia during the postpartum period, peak blood pressures are likely to occur after most women have been discharged home.³⁰ Thus, checking maternal postpartum blood pressure within the first 7–10 days postpartum is recommended for women with preeclampsia or hypertensive disorders to determine whether there is a need for further evaluation and treatment.³

Thus, timely recognition followed by timely treatment is a most important response to postpartum preeclampsia. If postpartum blood pressure readings in triage meet or exceed either a systolic measurement of 160 mm Hg or a diastolic level of 110 mm Hg, further evaluation and treatment should be accomplished quickly in the emergency department, optimally within 30–60 minutes. Obstetric consultation



should be obtained immediately when the diagnosis of postpartum preeclampsia is considered and magnesium sulfate infusion begun without delay. Because this medication is not frequently used in emergency departments, protocols for its use should be readily available and in-service training regarding the use of magnesium sulfate should be held when appropriate. Magnesium in the emergency department may be stocked in formulations that are different from those typically used for women with preeclampsia or eclampsia. This combination of factors increases the risk for errors in the absence of well-designed practice protocols and checklists to address this issue.

Regardless of site of care, if severe hypertension does not respond to treatment within 30–60 minutes, consultation with a maternal–fetal medicine or critical care specialist should be obtained and the woman transferred to a higher level of care. In addition, rapid access to brain imaging studies after severe hypertension is addressed may be important for those women with focal neurologic signs or with symptoms such as seizures, lethargy, confusion, an abnormal neurologic examination, or the presence of a persistent moderate-to-severe headache. Progressive lethargy and confusion may warrant endotracheal intubation and sedation to facilitate cerebral imaging.

10. Minimum Requirements for Protocol

As described elsewhere in this article, any protocols developed to address hypertensive emergencies for women during their pregnancies or postpartum should include: 1) parameters when the physician or primary care provider should be notified (eg, systolic blood pressure 160 mm Hg or greater or diastolic blood pressure 110 mm Hg or greater for two measurements within 15 minutes); 2) timely treatment after the second elevated measurement (as soon as possible, preferably within 60 minutes); 3) guidelines for initiation and duration of magnesium sulfate administration; 4) escalation measures for patients who are unresponsive to standard treatments; 5) procedures for follow-up 7–14 days postpartum; and 6) postpartum education of women with preeclampsia.

11. Support Plan for Patients, Families, and Staff for Intensive Care Unit Admissions and Serious Complications of Severe Hypertension

Health care providers must be sensitive to the needs of women as well as their families when these complications from hypertensive disorders of pregnancy arise. In the aftermath of a clinical emergency,

all involved (including the clinician) may be shaken and in need of support.³¹

Feelings of grief related to severe maternal morbidity may be compounded by an unexpected preterm birth or pregnancy loss. Common side effects from medications such as magnesium sulfate can have disconcerting side effects such as blurry vision, hot flushes, and cognitive impairment that may interfere with patient understanding. After the event, many women report their greatest comfort comes from communicating with other women who have been through preeclampsia or another hypertensive disorder of pregnancy, reporting that it alleviated their immense feelings of isolation, guilt, and remorse.³² These women and their families benefit from caring words and actions by clinicians who recognize the potential for posttraumatic or acute stress disorder, which can occur even when the acute hypertensive disorder has clinically resolved.³³ Women and their families who have undergone these challenging and unanticipated events should be offered referral for support services.

These events can also be emotionally difficult for the health care team. Attention should be paid to staff members to ensure they are receiving support they might require. Members of the team should have access to informal or formal counseling through their facilities. A variety of resources are available, including those from the Council on Patient Safety in Women's Health Care.

REPORTING AND SYSTEMS LEARNING (EVERY UNIT)

12. Establish a Culture of Huddles for High-Risk Patients and Postevent Team Debrief

After any unexpected critical event such as a hypertensive emergency during pregnancy, there is significant benefit to assembling the involved team members to debrief. The focus of the debriefing is to review what happened, determine what went well, and identify opportunities for improvement. Areas of focus, beyond concrete items such as timeliness and appropriateness of the specific interventions, include: Communication, Role Clarity, Teamwork, Situational Awareness, Decision-making, and Systems Issues. Although this may be less necessary on a busy unit that frequently deals with hypertensive emergencies, the value of this may be substantial for smaller units less accustomed to dealing with these sorts of emergencies.

A reporting form, which is not part of the medical record, is suggested to record the debriefing and issues identified to track concerns and problems that need to



be addressed.³⁴ When possible, include written insights from the woman or her advocate (eg, narrative description of her experience or answers to survey questions). The leader of the debriefing session should encourage all members of the team to share their thoughts, beginning with the individuals who are lowest in the hierarchy so that they will not be reluctant to share any thoughts that might differ from more senior staff. Having this conversation with the involved team as close to the event as possible is also advisable. This helps to foster group awareness of all the details of the event, to maximize the opportunity to identify systems issues and areas for improved team performance, and to promote consistent and accurate documentation of the event.

13. Multidisciplinary Review of All Severe Hypertension or Eclampsia Patients Admitted to an Intensive Care Unit for Systems Issues

Introduction of evidence-based clinical guidelines requires careful assessment of outcomes to validate these guidelines in the real world of clinical practice. To assess the successful implementation of guidelines, reasonable outcome measures must be identified and resources allocated by the hospital's leadership to obtain the appropriate data. Robust data systems are essential to obtain accurate and verifiable outcome measures. This can be implemented through institutional commitment to resource allocation to assure that reviews take place and recommendations are implemented. These reviews should measure, for example, timeliness of triage, timeliness of medication administration, occurrence of postevent debriefing and outcomes, adherence to protocols for acute management, appropriateness of response to early warning criteria, and documentation that women during pregnancy and the postpartum period are educated about symptoms of preeclampsia.¹⁷ In addition, standardized severe maternal morbidity reviews may identify factors within health systems as well as health care provider and hospital factors that may have contributed to the severe maternal event and that may be reduced or eliminated.³⁴

14. Monitor Outcomes and Process Metrics

Process, structure, and outcome measures have been developed by the National Partnership for Maternal Safety metrics workgroup to identify unit readiness, recognition, and response (Box 6). Process and structure measures should be identified and recorded by unit staff. Outcome measures can be determined through administrative codes. Individual facilities

Box 6. Suggested Hypertension in Pregnancy Structure, Process, and Outcome Pregnancy Measures

Structure Measures

- Does facility have a severe hypertension or pre-eclampsia policy and procedure updated within the past 3 years that provides a standard approach for measuring blood pressure, treatment of severe hypertension or preeclampsia, administration of magnesium sulfate, and treatment of magnesium sulfate overdose?
- Has facility developed obstetric-specific resources and protocols to support patients, families, and staff through major obstetric complications?
- Has facility established a system to perform regular formal debriefs after major obstetric complications?
- Has facility established a process to conduct multidisciplinary system-level reviews on all cases of severe maternal morbidity?
- Have some of the severe hypertension and pre-eclampsia processes (ie, order sets, tracking tools) been incorporated into the facilities' electronic health record?

Process Measures

- How many drills on maternal safety topics were performed in the facility during the past quarter or year?
- What proportion of maternity care providers and nurses have completed a bundle or unit protocol-specific education program on severe hypertension and preeclampsia within the past 2 years?
- How many women with sustained severe hypertension received treatment according to protocol within 1 hour of detection?

Outcome Measures

- **Denominator:** All women during their birth admission (excluding those with ectopic pregnancies and miscarriages) with one of the following diagnosis codes:
 - Gestational hypertension
 - Severe preeclampsia
 - HELLP syndrome
 - Eclampsia
 - Preeclampsia superimposed on pre-existing hypertension
 - Chronic hypertension
- **Numerator:** Among those patients counted in the denominator, cases with any Severe Maternal Morbidity code (as detailed on the Alliance for Innovation on Maternal Health website: <http://safehealthcareforeverywoman.org/aim-program/>).⁵

HELLP, hemolysis, elevated liver enzymes, and low platelet count.



may choose to adapt these measures to their local circumstances. Birth facilities should track their progress with change in process and structure measures and maternal outcomes. One key measurement in quality efforts to reduce severe maternal morbidity and mortality is time to treatment after the recognition of severe hypertension.

DISCUSSION

Implementation of the bundle elements as described here can be facilitated through several targeted free and open-access resources. The Alliance for Innovation on Maternal Health (<http://safehealthcareforeverywoman.org/aim-program/>) has short, animated staff training e-learning modules for each of these bundle elements. This national program also provides multiple resources and both live and web-based implementation support. The California Maternal Quality Care Collaborative has a detailed tool kit on Obstetric Hypertension as does the American College of Obstetricians and Gynecologists District II Safe Motherhood Initiative.^{16,17} Other state private and public partnership teams through the Alliance for Innovation on Maternal Health are adopting this and other maternal safety bundles. More information is available on the Alliance for Innovation on Maternal Health website.

The goal of bundles such as this one is to improve the readiness of facilities to care for women who present with severe hypertension, to enable them to better recognize women with these conditions, to improve their ability to respond in a timely and appropriate manner, and to facilitate learning from their experience through accurate reporting. Implementation of bundles such as this has the potential to reduce maternal morbidity and mortality from this often devastating condition that threatens safe motherhood.

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