Quality and Safety: Hypertension Disorders of Pregnancy

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Objectives

• Define and review the categorization of hypertension in pregnancy
• Discuss management of preeclampsia
• Review criteria for expectant management of severe preeclampsia
• Examine systems/approaches for optimizing care of pregnant women with hypertensive emergencies or eclampsia
• Review pertinent literature about MEWS/MEOWS
Epidemiology

• The incidence of preeclampsia has increased 25% in the past two decades\textsuperscript{1}
• Hypertensive disorders in pregnancy are common (5-10% of all pregnancies in the United States)\textsuperscript{2}
• Preeclampsia is the leading cause of maternal and perinatal morbidity and mortality worldwide\textsuperscript{3}

\textsuperscript{2} Kuklina et al. Hypertensive disorders and severe obstetric morbidity in the US. Obstet Gynecol 2009

*Note: Number of pregnancy-related deaths per 100,000 live births per year.*

Pregnancy Risk Assessment Monitoring System:
http://www.cdc.gov/reproductivehealth/maternalinfanthealth/pmss.html
Selected Maternal Mortality Rates 2010-2013

Source: www.smfm.org/data/mortality-map
Pregnancy Risk Assessment Monitoring System:
http://www.cdc.gov/reproductivehealth/maternalinfanthealth/pmss.html

Percentage of all pregnancy-related deaths

Non-cardiovascular disease: 15.3%
Cardiovascular disease: 14.7%
Infection/sepsis: 12.7%
Hemorrhage: 11.3%
Cardiomyopathy: 10.8%
Thrombotic pulmonary embolism: 9.0%
Hypertensive disorder of pregnancy: 7.6%
Cerebrovascular accident: 6.5%
Amniotic fluid embolism: 5.7%
Anesthesia complications: 0.2%

Note: The cause of death is unknown for 6.2% of all pregnancy-related deaths.

Pregnancy Risk Assessment Monitoring System:
http://www.cdc.gov/reproductivehealth/maternalinfanthealth/pmss.html


Note: The cause of death is unknown for 6.2% of all pregnancy-related deaths.
Missed Opportunities are common

- California Pregnancy associated mortality reviews
- University of Illinois Regional Perinatal Network
- New York/ACOG District 2
Figure 1: Major Themes in QIOs among Preeclampsia Deaths, CA-PAMR 2002-2004
New definitions
Classification of Hypertensive Disorders of Pregnancy

- Preeclampsia-Eclampsia
- Chronic Hypertension
- Chronic Hypertension with superimposed preeclampsia
- Gestational Hypertension
## TABLE E-1. Diagnostic Criteria for Preeclampsia

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Requirement</th>
</tr>
</thead>
</table>
| 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.
# Preeclampsia

## TABLE E-1. Diagnostic Criteria

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<tbody>
<tr>
<td>and</td>
<td>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</td>
</tr>
</tbody>
</table>
| 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:

<table>
<thead>
<tr>
<th>Thrombocytopenia</th>
<th>Platelet count less than 100,000/microliter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renal insufficiency</td>
<td>Serum creatinine concentrations greater than 1.1 mg/dL or a doubling of the serum creatinine concentration in the absence of other renal disease</td>
</tr>
<tr>
<td>Impaired liver function</td>
<td>Elevated blood concentrations of liver transaminases to twice normal concentration</td>
</tr>
<tr>
<td>Pulmonary edema</td>
<td></td>
</tr>
<tr>
<td>Cerebral or visual symptoms</td>
<td></td>
</tr>
</tbody>
</table>

* Each measured as mg/dL.
Preeclampsia

**TABLE E-1. Diagnostic Criteria for Preeclampsia**

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| 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

| 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 |

* Each measured as mg/dL.
Preeclampsia with severe features

**BOX E-1. Severe Features of Preeclampsia (Any of these findings)**

- Systolic blood pressure of 160 mm Hg or higher, or diastolic blood pressure of 110 mm Hg or higher on two occasions at least 4 hours apart while the patient is on bed rest (unless antihypertensive therapy is initiated before this time)
- Thrombocytopenia (platelet count less than 100,000/microliter)
- Impaired liver function as indicated by abnormally elevated blood concentrations of liver enzymes (to twice normal concentration), severe persistent right upper quadrant or epigastric pain unresponsive to medication and not accounted for by alternative diagnoses, or both
- Progressive renal insufficiency (serum creatinine concentration greater than 1.1 mg/dL or a doubling of the serum creatinine concentration in the absence of other renal disease)
- Pulmonary edema
- New-onset cerebral or visual disturbances
FIGURE 5-1. Management of mild gestational hypertension or preeclampsia without severe features.
Expectant Management of Preeclampsia with Severe Features

- Delivery at 34 weeks 0 days
- Delivery promptly with:
  - Pulmonary edema
  - Renal failure
  - Abruption
  - Severe thrombocytopenia
  - DIC
  - Persistent cerebral symptoms
  - Non-reassuring fetal testing
  - Fetal demise regardless of gestational age
Figure 5.2: Management of severe preeclampsia at less than 34 weeks of gestation.

Abbreviation: HELLP, hemolysis, elevated liver enzymes, and low platelet count.
FIGURE 5-2. Management of severe preeclampsia at less than 34 weeks of gestation.

Abbreviation: HELLP, hemolysis, elevated liver enzymes, and low platelet count.
Indications for delivery during expectant management

- Maternal Indications
  - Recurrent severe hypertension
  - Recurrent symptoms of severe preeclampsia
  - Progressive renal insufficiency
  - Persistent thrombocytopenia
  - Pulmonary edema
  - Abruption
  - Labor or Rupture of membranes
Indications for delivery during expectant management

• Fetal Indications
  ▫ Gestational age >34 0/7 weeks
  ▫ Severe fetal growth restriction <5%
  ▫ Persistent oligohydramnios (DVP <2cm)
  ▫ BPP 4/10 or less on two occasionals 6 hours apart
  ▫ Reversed end-diastolic flow on dopplers
  ▫ Recurrent variable or late decelerations during NST
  ▫ Fetal death
# Management of HTN (emergency)

## TABLE 7-1. Antihypertensive Agents Used for Urgent Blood Pressure Control in Pregnancy

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>Comments</th>
</tr>
</thead>
</table>
| Labetalol | 10–20 mg IV, then 20–80 mg every 20–30 min to a maximum dose of 300 mg or Constant infusion 1–2 mg/min IV | Considered a first-line agent  
Tachycardia is less common and fewer adverse effects  
Contraindicated in patients with asthma, heart disease, or congestive heart failure |
| Hydralazine | 5 mg IV or IM, then 5–10 mg IV every 20–40 min or Constant infusion 0.5–10 mg/h | Higher or frequent dosage associated with maternal hypotension, headaches, and fetal distress—may be more common than other agents |
| Nifedipine | 10–20 mg orally, repeat in 30 minutes if needed; then 10–20 mg every 2–6 hours | May observe reflex tachycardia and headaches |

Abbreviations: IM, intramuscularly; IV, intravenously.
Tools for Improving Safety for Preeclampsia

- Education (providers and patients)
- Protocols
- Checklists
- Simulation
- Debriefings
- Maternal Early Warning Systems
**READINESS**

Every Unit
- Standards for early warning signs, diagnostic criteria, monitoring and treatment of severe pre-eclampsia/eclampsia (include order sets and algorithms)
- Unit education on protocols, unit-based drills (with post-drill debriefs)
- Process for timely triage and evaluation of pregnant and postpartum women with hypertension including ED and outpatient areas
- Rapid access to medications used for severe hypertension/eclampsia: Medications should be stocked and immediately available on L&D and in other areas where patients may be treated. Include brief guide for administration and dosage.
- System plan for escalation, obtaining appropriate consultation, and maternal transport, as needed

**RECOGNITION & PREVENTION**

Every Patient
- Standard protocol for measurement and assessment of BP and urine protein for all pregnant and postpartum women
- Standard response to maternal early warning signs including listening to and investigating patient symptoms and assessment of labs (e.g. CRP with platelets, AST and ALT)
- Facility-wide standards for educating prenatal and postpartum women on signs and symptoms of hypertension and preeclampsia

ACOG District II Safe Motherhood Initiative
“Readiness”

- System based plan for every unit
- Criteria and plan for escalation
  - Who and how
  - Initiate emergency diagnostics and therapeutics
- Plan for rapid stabilization and transport
## Preeclampsia Early Recognition Tool (PERT)

<table>
<thead>
<tr>
<th>ASSESS</th>
<th>NORMAL (GREEN)</th>
<th>WORRISOME (YELLOW)</th>
<th>SEVERE (RED)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awareness</td>
<td>Arousal, oriented</td>
<td>Hypotension, aura, difficulty awakening</td>
<td>Unresponsive</td>
</tr>
<tr>
<td>Headache</td>
<td>None</td>
<td>Mild headache</td>
<td>Severe head ache</td>
</tr>
<tr>
<td>Vision</td>
<td>None</td>
<td>Blurred or impaired</td>
<td>Temporary blindness</td>
</tr>
<tr>
<td>Systolic BP</td>
<td>120-140</td>
<td>140-159</td>
<td>&gt;160</td>
</tr>
<tr>
<td>Diastolic BP</td>
<td>80-100</td>
<td>90-120</td>
<td>&gt;100</td>
</tr>
<tr>
<td>RR</td>
<td>60-110</td>
<td>111-129</td>
<td>&gt;130</td>
</tr>
<tr>
<td>Respirations</td>
<td>11-20</td>
<td>21-30</td>
<td>&gt;30 or &gt;36</td>
</tr>
<tr>
<td>BGL</td>
<td>Absent</td>
<td>Present</td>
<td>Present</td>
</tr>
<tr>
<td>UO</td>
<td>100</td>
<td>20-30</td>
<td>&gt;50</td>
</tr>
<tr>
<td>Pain, Abdomen</td>
<td>None</td>
<td>Acute, chronic</td>
<td>Acute, chronic</td>
</tr>
<tr>
<td>or Chest</td>
<td></td>
<td>Abdominal pain</td>
<td>Abdominal pain</td>
</tr>
<tr>
<td>Fetal Signs</td>
<td>Category I:</td>
<td>Category II:</td>
<td>Category III</td>
</tr>
<tr>
<td></td>
<td>Non-reactive NST</td>
<td>Reactive NST</td>
<td></td>
</tr>
<tr>
<td>Urea</td>
<td>250</td>
<td>30-40</td>
<td>&gt;30 (at 2 hrs)</td>
</tr>
<tr>
<td>Proteins</td>
<td>Trace</td>
<td>&gt;300 mg/dl</td>
<td>&gt;1000 mg/dl</td>
</tr>
<tr>
<td>HCT</td>
<td>&gt;0.3</td>
<td>0.3-0.8</td>
<td>0-1.3</td>
</tr>
<tr>
<td>Platelets</td>
<td>&gt;100,000</td>
<td>100,000-300,000</td>
<td>&lt;100,000</td>
</tr>
<tr>
<td>Creatinine</td>
<td>&gt;0.6</td>
<td>0.6-1.1</td>
<td>&gt;1.3</td>
</tr>
<tr>
<td>Magnesium level</td>
<td>K+ = 1</td>
<td>K+ = 1.5</td>
<td>K+ = 2.2</td>
</tr>
</tbody>
</table>

### Yellow - Worsome
- Increase assessment frequency
- Triggers to DO
  - Notify provider
  - Notify charge RN
  - Obtain evaluation
  - Order lab work:
    - Hematocrit
    - Magnesium level
  - Consider magnesium supplementation

### Red - Severe
- Triggers: 1 of any type listed below
- TO DO
  - Immediate evaluation
  - Transfer to higher acuity level
  - 1:1 staff ratio
  - Consider obstetric consult
  - CT Scan
  - I&O (intravenous, hemorrhage)
  - Lab work (hematocrit in 20 min)
  - In patient evaluation
  - Magnesium sulfate loading or maintenance infusion
  - Chest Pain
  - Consult CT angiogram
  - Respiration: SPO2 at 121 per re breathe order
  - SPO2 (oxygen)
  - Chest x-ray

### Green - Normal
- Proceed with protocol

---

“Recognition and Prevention”

- Protocol for measurement and assessment of blood pressures
- Standard Response (MEWS or MEOWS)
- Educate pregnant and postpartum women
Standardized Measurement of Blood pressures

PATIENT CARE AND TREATMENT RECOMMENDATIONS

ACCUARATE BLOOD PRESSURE MEASUREMENT

Kristi Gabel, RNC-OB, C-EFM, MSN, CNS, Sutter Roseville Medical Center

BACKGROUND

The current method used most often in the hospital setting for accurate measurement of blood pressure is the oscillatory method, or automated blood pressure machine, which tends to underestimate both systolic and diastolic readings by as much as 10 mm Hg.¹,²

In the clinic setting and physician offices, blood pressure measurement is often used with the aneroid (mechanical type with a dial) sphygmomanometer. Refer to Table 1 for steps in obtaining accurate blood pressure measurement and Figure 1 for recommended cuff sizes.

Table 1: Steps for Obtaining Accurate Blood Pressure Measurements³

<table>
<thead>
<tr>
<th>Step 1: Prepare equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Mercury sphygmomanometer is gold standard, can use validated equivalent automated equipment</td>
</tr>
<tr>
<td>b. Check cuff for any defects</td>
</tr>
<tr>
<td>c. Obtain correct size cuff: width of bladder 40% of circumference and encircle 80% of arm (See Figure 1)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 2: Prepare the patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Use a sitting or semi-reclining position with back supported and arm at heart level</td>
</tr>
<tr>
<td>b. Patient to sit quietly for 5 minutes prior to measurement</td>
</tr>
<tr>
<td>c. Bare upper arm of any restrictive clothing</td>
</tr>
<tr>
<td>d. Patient's feet should be flat, not dangling from examination table or bed, and her legs uncrossed</td>
</tr>
<tr>
<td>e. Assess any recent (within previous 30 minutes) consumption of caffeine or nicotine. If blood pressures are at the level that requires treatment, consumption of nicotine or caffeine should not lead to delays in instituting appropriate anti-hypertensive therapies</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 3: Take measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Support patients arm at heart level, seated in semi-reclining position</td>
</tr>
<tr>
<td>b. For auscultatory measurement: use first audible sound (Korotkoff I) as systolic pressure and use disappearance of sound (Korotkoff V) as diastolic pressure</td>
</tr>
<tr>
<td>c. Read to the nearest 2 mm Hg</td>
</tr>
<tr>
<td>d. Instruct the patient not to talk</td>
</tr>
<tr>
<td>e. At least one additional readings should be taken within 15 minutes</td>
</tr>
<tr>
<td>f. Use the highest reading</td>
</tr>
<tr>
<td>g. If greater than or equal to 140/90, repeat within 15 minutes and if still elevated, further evaluation for preeclampsia is warranted</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 4: Record Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Document BP, patient position, and arm in which taken</td>
</tr>
</tbody>
</table>

Appropriate Cuff Size

Figure 1: Recommended cuff sizes

<table>
<thead>
<tr>
<th>Arm Circumference (cm)</th>
<th>Cuff Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>22-26</td>
<td>“Small Adult”: 12x22cm</td>
</tr>
<tr>
<td>27-34</td>
<td>“Adult”: 16x30cm</td>
</tr>
<tr>
<td>35-44</td>
<td>“Large Adult”: 16x36cm</td>
</tr>
<tr>
<td>45-52</td>
<td>“Adult Thigh”: 16x42cm</td>
</tr>
</tbody>
</table>

Photo courtesy of and printed with permission by Kristi Gabel, RNC-OB, C-EFM, MSN, CNS, Sutter Roseville Medical Center 2013.
“Response”

• Standardized protocols for management and treatment of HTN, Eclampsia, postpartum presentations
• Checklists
• Practiced simulations
Protocols for Hypertensive Emergency

**ACUTE TREATMENT:**

- Antihypertensive medications administered within 1 hour and ideally as soon as possible upon arrival at a healthcare facility for blood pressures of 160 systolic, and/or 110 diastolic or greater is a critical initial step in decreasing morbidity and mortality.
- Magnesium sulfate therapy for seizure prophylaxis should be administered to any patients with:
  - Severe preeclampsia with subjective neurological symptoms such as headache or blurry vision or right upper quadrant or epigastric abdominal pain AND
  - Should be considered in patients with preeclampsia without severe features (mild).
- Magnesium sulfate is the approved initial therapy for an eclamptic seizure.
- Algorithms for acute treatment of severe hypertension and eclampsia should be readily available or preferably posted in all labor and delivery units.
- Early post-discharge follow-up should be the norm for all patients diagnosed with preeclampsia/eclampsia. The Task Force recommends that follow-up occur within 3-7 days if blood pressure medication was used during the labor and delivery or postpartum and within 7-14 days if the diagnosis of preeclampsia was made but no medication was used. Current ACOG guidelines recommend for women in whom gestational hypertension, preeclampsia, or superimposed preeclampsia is diagnosed, that BPs be monitored in the hospital or that equivalent outpatient surveillance be performed for at least 72 hours postpartum and again 7-10 days after delivery or earlier in women with symptoms.
- Postpartum patients presenting with hypertension, preeclampsia, or eclampsia to the Emergency Department should be either assessed by or admitted to an obstetrical service. If they are treated in the Emergency Department and discharged, adequate follow-up must be arranged with an obstetrical provider.
- All institutions should consider preparing a severe preeclampsia/eclampsia box of medications and supplies needed for the treatment of preeclampsia (see Appendix). Additional medications such as second-line antihypertensives should be institution specific.

The following protocol should be initiated if the systolic blood pressure is ≥ 160 mmHg OR the diastolic blood pressure is ≥ 110 mmHg.

__Notify physician__

__Administer hydralazine, 5 mg IV over 2 minutes__

__Repeat blood pressure in 15 minutes__

__If either blood pressure threshold is still exceeded, administer hydralazine 10 mg IV over 2 minutes. Repeat blood pressure in 15 minutes__

__If either blood pressure threshold is still exceeded, administer labetalol, 20 mg IV over 2 minutes__

__Repeat blood pressure in 10 minutes__

__If either blood pressure criteria is still exceeded, administer labetalol 40 mg IV over 2 minutes and obtain emergency maternal-fetal medicine, internal medicine or anesthesia consultation._
Committee on Patient Safety and Quality Improvement  
Committee on Professional Liability

This document reflects emerging concepts on patient safety and is subject to change. The information should not be construed as dictating an exclusive course of treatment or procedure to be followed.

Clinical Guidelines and Standardization of Practice to Improve Outcomes

**ABSTRACT:** Protocols and checklists have been shown to reduce patient harm through improved standardization and communication. Implementation of protocols and guidelines often is delayed because of lack of health care provider awareness or difficult clinical algorithms in medical institutions. However, the use of checklists and protocols clearly has been demonstrated to improve outcomes and their use is strongly encouraged. Checklists and protocols should be incorporated into systems as a way to help practitioners provide the best evidence-based care to their patients.
A CHECKLIST FOR CHECKLISTS

Development

- Do you have clear, concise objectives for your checklist?
- Is each item:
  - A critical safety step and in great danger of being missed?
  - Not adequately checked by other mechanisms?
  - Actionable, with a specific response required for each item?
  - Designed to be read aloud as a verbal check?
  - One that can be affected by the use of a checklist?
- Have you considered:
  - Adding items that will improve communication among team members?
  - Involving all members of the team in the checklist creation process?

Drafting

- Does the Checklist:
  - Utilize natural breaks in workflow (pause points)?
  - Use simple sentence structure and basic language?
  - Have a title that reflects its objectives?
  - Have a simple, uncluttered, and logical format?
  - Fit on one page?
  - Minimize the use of color?
- Is the font:
  - Sans serif?
  - Upper and lower case text?
  - Large enough to be read easily?
  - Dark on a light background?
  - Are there fewer than 10 items per pause point?
  - Is the date of creation (or revision) clearly marked?

Validation

- Have you:
  - Trialed the checklist with front line users (either in a real or simulated situation)?
  - Modified the checklist in response to repeated trials?
- Does the checklist:
  - Fit the flow of work?
  - Detect errors at a time when they can still be corrected?
  - Can the checklist be completed in a reasonably brief period of time?
  - Have you made plans for future review and revision of the checklist?

Please note: A checklist is NOT a teaching tool or an algorithm
Surgical Safety Checklist
Ben Taub Hospital: OBSTERICAL USE ONLY
In the event of an emergent case, do not delay proceeding in an expeditious manner to complete this checklist; defer checklist until the appropriate clinical time.

SIGN – IN
Surgeon completes during Time Out, with attending present
- Indication and categorization (urgent, scheduled) of surgery confirmed □ Yes □ No
- Consent signed with correct attending identified and all appropriate procedures documented □ Yes □ No
- All team members have been introduced by name and role □ Yes □ No
- Patient and team members have verified her identity, surgical site & procedure □ Yes □ No
- Known Allergy? □ Yes □ No
- Has Antibiotic Prophylaxis been given within the last 60 minutes? □ Yes □ No □ Not Indicated
- Fire Safety Assessment complete □ Yes □ No
- Review current hemoglobin/hematocrit, platelets
- Medications currently being administered and plan for intra-op and post-operative dosing is discussed □ Yes □ No
- Airway and risk of aspiration have been evaluated and appropriate equipment is available □ Yes □ No
- If risk of blood loss >1000cc for cesarean delivery, blood products are readily available □ Yes □ No (review patient specific risks of PPH/uterine atony and devise the plan)
- Surgeon: Review critical and unexpected steps, operative duration, anticipated complications and patient – specific concerns (examples: arrest of descent may need a vaginal hand and/or consideration of dorsal lithotomy position)
- Anesthesia: Review patient - specific concerns (including regional versus general anesthesia plan)
- Nursing Staff: Review patient - specific concerns, equipment, supplies, sterility
- All essential imaging studies have been reviewed (placental location, characterization verified) □ Yes □ No
- Fetal lie verified (Leopold’s maneuver sufficient) □ Yes □ No
- Discuss: Is Neonatology needed at delivery? □ Yes □ No
- Team discusses post-operative recovery location, duration and anticipated post-op complications

SIGN – OUT
Nurse Verbally Confirms with the surgeon and anesthesia providers
- Instrument, Sponge and Needle counts are correct □ Yes □ No
- Specimens are labeled and pathology request complete □ Yes □ No
- Equipment and/or supply concerns have been escalated to charge nurse □ Yes □ No

SURGEON, ANESTHESIA PROFESSIONALS AND NURSE REVIEW THE KEY CONCERNS FOR RECOVERY AND MANAGEMENT OF THIS PATIENT
- Team discusses post-operative recovery location, duration and anticipated post-op complications

10/2015: Modified for Ben Taub Obstetric use from the WHO Surgical Safety Checklist (1st Edition)
Toolboxes and Safety Bundles

Safety Action Series

Severe Hypertension
Patient Safety Bundle
Severe Hypertension in Pregnancy Checklist

Trigger for initiating this checklist is a SBP ≥160 or DBP ≥110

- Initiate magnesium sulfate for seizure prophylaxis (if not already initiated)
- Load 4-6 grams 10% magnesium sulfate in 100 ml solution IV over 30 minutes
- Magnesium sulfate on infusion pump
- Magnesium sulfate and pump labeled
- Magnesium sulfate 10 grams of 50% solution IM (5 grams in each buttock) if no IV access
- Magnesium sulfate maintenance 1-2 grams/hour continuous infusion

Contraindications: pulmonary edema, renal failure, myasthenia gravis

Anticonvulsant Medications
(for recurrent seizures or when magnesium is contraindicated):
- Lorazepam (2-4 mg IV x 1, may repeat x 1 after 10-15 minutes)
- Diazepam (5-10 mg IV every 5-10 minutes to maximum dose of 10 mg)
- Phenytoin (15-20 mg/kg IV x 1, may repeat 10 mg/kg IV after 30 minutes if no response); avoid with hypotension, may cause cardiac arrhythmias
- Kapera (500 mg IV or orally, may repeat in 12 hours); dose adjustment needed if renal impairment

Antihypertensive Medications
- Labetalol (20, 40, 80, 160 mg IV over 2 minutes, escalating doses, repeat every 10 minutes or 200 mg orally if no IV access); avoid in asthma or heart failure, can cause neonatal bradycardia
- Hydralazine (5-10 mg IV over 2 minutes, repeat in 30 minutes until target blood pressure is reached)
- Repeat blood pressure every 10 minutes during administration

*Maximum cumulative IV administered doses should not exceed 25 mg hydralazine, 220 mg labetalol in 24 hours.

If first line agents are unsuccessful, recommend emergency consultation with a specialist (e.g., IMFM, Internal medicine, OB anesthesia, critical care) for second line management decisions

Postpartum
- Antihypertensive therapy is suggested for women with persistent postpartum hypertension, SBP of 150 mm Hg or DBP of 100 mm or higher on at least two occasions that are at least 4 hours apart. Persistent SBP of 160 mm Hg or DBP of 110 mm Hg or higher should be treated within 1 hour.
- Blood pressure monitoring is recommended 72 hours after delivery and/or outpatient surveillance (e.g., visiting nurse evaluation) within 3 days and again 7-10 days after delivery or earlier if persistent symptoms.

ACOG Safe Motherhood Initiative

Davis ♦
Simulations
“Reporting and Systems Learning”

- Huddles for high risk patients
- Monitor outcomes and process metrics
- Debriefings
Maternal Early Warning Systems

• Goal of identifying patients early who have high risk of morbidity/mortality and improving outcomes

• Two types of systems:
  ▫ Triggering (one parameter triggers system)
  ▫ Scoring (different parameters contribute)

Pediatric Early Warning Systems

<table>
<thead>
<tr>
<th>Table 1</th>
<th>The Pediatric Early Warning Score system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>2</td>
</tr>
<tr>
<td>Age-specific items</td>
<td></td>
</tr>
<tr>
<td>&lt;3 mo</td>
<td></td>
</tr>
<tr>
<td>HR</td>
<td>&lt;90</td>
</tr>
<tr>
<td>RR</td>
<td>&lt;20</td>
</tr>
<tr>
<td>SBP</td>
<td>&lt;50</td>
</tr>
<tr>
<td>3–12 mo</td>
<td></td>
</tr>
<tr>
<td>HR</td>
<td>&lt;80</td>
</tr>
<tr>
<td>RR</td>
<td>&lt;20</td>
</tr>
<tr>
<td>SBP</td>
<td>&lt;70</td>
</tr>
<tr>
<td>1–4 y</td>
<td></td>
</tr>
<tr>
<td>HR</td>
<td>&lt;70</td>
</tr>
<tr>
<td>RR</td>
<td>&lt;15</td>
</tr>
<tr>
<td>SBP</td>
<td>&lt;75</td>
</tr>
<tr>
<td>4–12 y</td>
<td></td>
</tr>
<tr>
<td>HR</td>
<td>&lt;60</td>
</tr>
<tr>
<td>RR</td>
<td>&lt;12</td>
</tr>
<tr>
<td>SBP</td>
<td>&lt;80</td>
</tr>
<tr>
<td>&gt;12 y</td>
<td></td>
</tr>
<tr>
<td>HR</td>
<td>&lt;50</td>
</tr>
<tr>
<td>RR</td>
<td>&lt;8</td>
</tr>
<tr>
<td>SBP</td>
<td>&lt;86</td>
</tr>
<tr>
<td>General items</td>
<td></td>
</tr>
<tr>
<td>Pulses</td>
<td>Absent</td>
</tr>
<tr>
<td>O2 saturation (%)</td>
<td>&lt;85</td>
</tr>
<tr>
<td>Capillary refill</td>
<td>CRT &gt;3</td>
</tr>
<tr>
<td>LOC</td>
<td>&lt;7</td>
</tr>
<tr>
<td>Oxygen therapy</td>
<td>&gt;50% or &gt;4 L/min</td>
</tr>
<tr>
<td>Bolus fluid</td>
<td>Any</td>
</tr>
<tr>
<td>Temperature</td>
<td>&lt;35</td>
</tr>
</tbody>
</table>

- Duncan et al
# National Early Warning System

<table>
<thead>
<tr>
<th>Physiologic Parameters</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiration rate</td>
<td>&lt;8</td>
<td>9–11</td>
<td>12–20</td>
<td>21–24</td>
<td>&gt;25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxygen saturation</td>
<td>&lt;91</td>
<td>92–93</td>
<td>94–95</td>
<td>&gt;96</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any supplemental oxygen</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>≤35.0</td>
<td>35.1–36.0</td>
<td>36.1–38.0</td>
<td>38.1–39.0</td>
<td>&gt;39.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic blood pressure</td>
<td>≤90</td>
<td>91–100</td>
<td>101–110</td>
<td>111–219</td>
<td>&gt;220</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heart rate</td>
<td>≤40</td>
<td>41–50</td>
<td>51–90</td>
<td>91–110</td>
<td>111–130</td>
<td>&gt;131</td>
<td></td>
</tr>
<tr>
<td>Level of consciousness</td>
<td>A</td>
<td>V, P, or U</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Maternal Early Warning System

- Concern that other systems are not applicable to pregnant women
- 2007 Saving Mothers Lives report from the Confidential inquiries into Maternal and Child Health in the United Kingdom
OBSTETRICS

Existing models fail to predict sepsis in an obstetric population with intrauterine infection

Justin R. Lappen, MD; Melissa Keene, MD; Marybeth Lore, MD; William A. Grobman, MD, MBA; Dana R. Gossett, MD

OBJECTIVE: Multiple scoring systems exist to identify inpatients who are at risk for clinical deterioration. None of these systems have been evaluated in an obstetric population. We examined the Systemic Inflammatory Response Syndrome (SIRS) and Modified Early Warning score (MEWS) criteria in pregnant women with chorioamnionitis.

STUDY DESIGN: This was an 18-month retrospective analysis of patients with chorioamnionitis. SIRS and MEWS scores were calculated; clinical outcomes were ascertained, and test characteristics were calculated for the primary outcome of sepsis, intensive care unit transfer, or death.

RESULTS: Nine hundred thirteen women with chorioamnionitis were identified. Five women experienced sepsis; there was 1 death. Five hundred seventy-five of the 913 women (63%) met SIRS criteria (95% confidence interval, 59.8–66.2%; positive predictive value, 0.9%). Ninety-two of the 913 women (10.3%) had a MEWS score of ≥5 (95% confidence interval, 8.3–12.2%; positive predictive value, 0.05%).

CONCLUSION: SIRS and MEWS criteria do not identify accurately patients who are at risk for intensive care unit transfer, sepsis, or death among pregnant women with intrauterine infection and should not be used in an obstetric setting.

Key words: chorioamnionitis, intensive care unit, MEWS, sepsis

**MEWS**

- The National Partnership for Maternal Safety

<table>
<thead>
<tr>
<th>Table 1. The Maternal Early Warning Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter</td>
</tr>
<tr>
<td>Systolic BP (mm Hg)</td>
</tr>
<tr>
<td>Diastolic BP (mm Hg)</td>
</tr>
<tr>
<td>Heart rate (beats per min)</td>
</tr>
<tr>
<td>Respiratory rate (breaths per min)</td>
</tr>
<tr>
<td>Oxygen saturation on room air, at sea level, %</td>
</tr>
<tr>
<td>Oliguria, mL/hr for $\geq 2$ hours</td>
</tr>
<tr>
<td>Maternal agitation, confusion, or unresponsiveness; Patient with preeclampsia reporting a non-remitting headache or shortness of breath</td>
</tr>
</tbody>
</table>

BP, blood pressure.

These triggers cannot address every possible clinical scenario that could be faced by an obstetric clinician and must not replace clinical judgment. As a core safety principle, bedside nurses should always feel comfortable to escalate their concerns at any point.
Use of maternal early warning trigger (MEWT) tool reduces maternal morbidity

Laurence Shields, Suzanne Wiesner, Barbara Pelletreau, Herman Hedriana

1Marian Regional Medical Center, Santa Maria, CA, 2Dignity Health, Department of Patient Safety, San Francisco, CA, 3Sacramento Maternal Fetal Medicine, Sacramento, CA

OBJECTIVE: To determine if implementation of a MEWT tool can reduce maternal morbidity.

STUDY DESIGN: A previously published internally developed MEWT tool was prospectively applied to 6 pilot sites in a large system with 29 maternity units. The tool’s primary goal is timely assessment and management of patients suspected of clinical deterioration. The tool addresses 4 areas: sepsis, cardiopulmonary dysfunction, hypertension, and hemorrhage (HEM). Triggers sustained for >30 min were defined as SEVERE (required 1 abnl value): HR>130 bpm, RR>30/min., MAP<55 mmHg, O2 saturation<90%, nurse concern or NON-SEVERE (required 2 abnl values): Temp>38 or <36°C, BP>155/105 mmHg or <85/45 mmHg, HR>110 or <50 bpm, RR>24 or <10/min, O2 sat<93%, FHR>160 bpm, altered mental status, and disproportionate pain. Outcome measures were sepsis, HEM, transfusion (TX), hysterectomy (HYS), eclampsia, composite morbidity (CM), severe maternal morbidity (SMM) and ICU transfer. Two periods were analyzed: 24 months pre-MEWT and 11 months post-MEWT. Data analyzed using z-ratios for significant difference between two independent proportions. Non-Pilot sites were evaluated to determine similarities or differences between Pilot MEWT and Non-Pilot sites.

RESULTS: Use of MEWT tool resulted in significant reductions in CM, eclampsia, and use of D&C. As desired, sepsis identification and ICU transfers increased. HYS, HEM, TX and SMM declined nonsignificantly post-MEWT. At Non-Pilot sites CM significantly increased. In Non-Pilot sites all outcome parameters trended

<table>
<thead>
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<th>Table 1.</th>
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<tr>
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<tr>
<td>Deliveries</td>
</tr>
<tr>
<td>Composite Morbidity</td>
</tr>
<tr>
<td>Eclampsia/1000</td>
</tr>
<tr>
<td>D&amp;C</td>
</tr>
<tr>
<td>Hemorrhage</td>
</tr>
<tr>
<td>Transfusion</td>
</tr>
<tr>
<td>Hysterectomy/1000</td>
</tr>
<tr>
<td>CDC SMM</td>
</tr>
<tr>
<td>Sepsis/1000</td>
</tr>
<tr>
<td>ICU Transfer/1000</td>
</tr>
</tbody>
</table>
OBSTETRICS

Modified obstetric early warning scoring systems (MOEWS): validating the diagnostic performance for severe sepsis in women with chorioamnionitis

Sian E. Edwards, MBChB; William A. Grobman, MD, MBA; Justin R. Lappen, MD; Cathy Winter, RM; Robert Fox, MD; Erik Lenguerrand, PhD; Timothy Draycott, MD

OBJECTIVE: We sought to compare the predictive power of published modified obstetric early warning scoring systems (MOEWS) for the development of severe sepsis in women with chorioamnionitis.

STUDY DESIGN: This was a retrospective cohort study using prospectively collected clinical observations at a single tertiary unit (Chicago, IL). Hospital databases and patient records were searched to identify and verify cases with clinically diagnosed chorioamnionitis during the study period (June 2006 through November 2007). Vital sign data (heart rate, respiratory rate, blood pressure, temperature, mental state) for these cases were extracted from an electronic database and the single worst composite recording was identified for analysis. Global literature databases were searched (2014) to identify examples of MOEWS. Scores for each identified MOEWS were derived from each set of vital sign recordings during the presentation with chorioamnionitis. The performance of these MOEWS (the primary outcome) was then analyzed and compared using their sensitivity, specificity, positive and negative predictive values, and receiver-operating characteristic curve for severe sepsis.

RESULTS: Six MOEWS were identified. There was wide variation in design and pathophysiological thresholds used for clinical alerts. In all, 913 women with chorioamnionitis were identified from the clinical database. In all, 364 cases with complete data for all physiological indicators were included in analysis. Five women developed severe sepsis, including 1 woman who died. The sensitivities of the MOEWS in predicting the severe deterioration ranged from 40–100% and the specificities varied even more ranging from 4–97%. The positive predictive values were low for all MOEWS ranging from <2–15%. The MOEWS with simpler designs tended to be more sensitive, whereas the more complex MOEWS were more specific, but failed to identify some of the women who developed severe sepsis.

CONCLUSION: Currently used MOEWS vary widely in terms of alert thresholds, format, and accuracy. Most MOEWS have not been validated. The MOEWS generally performed poorly in predicting severe sepsis in obstetric patients; in general severe sepsis was overdetected. Simple MOEWS with high sensitivity followed with more specific secondary testing is likely to be the best way forward. Further research is required to develop early warning systems for use in this setting.

Key words: chorioamnionitis, early warning systems, patient safety, sepsis

Baylor/Ben Taub MEWS

- Standardized process of checking vitals and timing of reporting “MEWS” level triggers
- Standardized timing of physician notifications
- Scripted nursing/MD communication
- Common recognized response: physician to bedside within 15 minutes
- Upper level resident or attending evaluated the patient
- Nurse and physician must communicate the plan
Our Outcomes

- Time to normalization of vital signs $370$ min $\rightarrow <90$ minutes
- Improvement in communication
- Dramatic change in:
  - events with MD at bedside
  - Interventions
  - Diagnoses
Questions?