HYPERTENSION DISORDERS IN PREGNANCY

Mari Charisse Trinidad, MD
OBJECTIVES

• Define hypertension disorders in pregnancy
• Describe current understanding of the pathophysiology of preeclampsia
• List risk factors for preeclampsia
• List possible complications and adverse outcomes from hypertension disorders in pregnancy
• Describe the implications of hypertension disorders in pregnancy on future pregnancies and long term health
OBJECTIVES

• Describe most current practice and evidence based care in the management of hypertension disorders in pregnancy
  • Antenatal
  • Intrapartum
  • Postpartum
ECLAMPSIA

• Greek *eclampein*
  • (ec)εκ(=forth)+(lampo)λάμπω(=to shine)

• 1619: Word “eclampsia” first appeared in a treatise on gynaecology by Varandaeus based upon the flashing lights/spots before the eyes of pregnant women with preeclampsia
  • Headache accompanied by heaviness and convulsions during pregnancy considered bad
    (Aphorism XXXI 507, Coan Prognosis. Hippocrates, 400 BCE)

• 1739: Bossier de Sauvages differentiated eclampsia from epilepsy

• 1797: Demanet noted a connection between edematous women and eclampsia
ECLAMPSIA

- **1843**: John Lever discovered albumin in the urine of eclamptic women
- **1843**: Connection between premonitory symptoms (headache, temporary loss of vision, severe pain in the stomach, and edema of the hands, arms, neck, and face) during the later months of pregnancy and the development of puerperal convulsions was also recognized in by Dr. Robert Johns.
- **1897**: Vaquez and Nobecourt were credited with the discovery of eclamptic hypertension
ECLAMPSIA / PREECLAMPSIA
Historical management

• Charms and amulets
• Warm baths
• Phlebotomy / Blood letting
• Use of opiates
• Warm baths
• Splashing of the face with cold water
• Delivery
ECLAMPSIA / PREECLAMPSIA
Historical management

• **1906**: Horn first used magnesium sulfate to manage preeclampsia-eclampsia

• **1920s**: Parental use of magnesium sulfate in the treatment of preeclampsia-eclampsia was popularized by Lazard and Dorsett
HYPERTENSION DISORDERS IN PREGNANCY
PATHOPHYSIOLOGY
PATHOPHYSIOLOGY

• Exact mechanisms underlying preeclampsia are incompletely understood
• Likely genetic and environmental factors
• Poor early placental development and/or co-morbid microvascular circulatory disorders are contributory
HYPERTENSION DISORDERS IN PREGNANCY
RISK FACTORS
RISK FACTORS

• Primiparity
• Previous pregnancy with preeclampsia
• Family history of preeclampsia
• Multiple pregnancy
• Obesity
• Advanced maternal age (older than 40)
• Co-morbid medical conditions
  • Chronic hypertension
  • Chronic renal disease
  • Diabetes mellitus
  • Antiphospholipid antibody syndrome
  • Autoimmune disease (ex., SLE)
HYPERTENSION DISORDERS IN PREGNANCY
DEFINITIONS
DEFINITIONS

HYPERTENSION DISORDERS IN PREGNANCY

- Chronic Hypertension (of any cause)
- Gestational Hypertension
- Preeclampsia - Eclampsia
- Chronic hypertension with superimposed preeclampsia
# DEFINITIONS

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chronic Hypertension</strong> (of any cause)</td>
<td>Hypertension (BP ≥ 140/90 mm Hg) prior to pregnancy or before 20 weeks gestation</td>
</tr>
<tr>
<td><strong>Gestational Hypertension</strong></td>
<td>New onset hypertension (BP ≥ 140/90 mm Hg) at or after 20 weeks gestation in a woman with previously normal blood pressures in the absence of accompanying proteinuria</td>
</tr>
<tr>
<td></td>
<td>Hypertension should resolve postpartum, usually within 3 months after birth</td>
</tr>
</tbody>
</table>
### DEFINITIONS

#### HYPERTENSION DISORDERS OF PREGNANCY

New onset hypertension (BP $\geq 140/90$ mm Hg) at or after 20 weeks gestation in a woman with previously normal blood pressures accompanied by new onset proteinuria

OR

In the absence of proteinuria but associated with
- Thrombocytopenia
- Impaired liver function
- New renal insufficiency
- Pulmonary edema
- New onset cerebral or visual disturbances
# Definitions

## Hypertension Disorders of Pregnancy

<table>
<thead>
<tr>
<th><strong>Preeclampsia - Eclampsia</strong></th>
<th><strong>In the absence of proteinuria</strong> but associated with:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- <strong>Thrombocytopenia</strong> (platelet count less than 100,000/microliter)</td>
</tr>
<tr>
<td></td>
<td>- <strong>Impaired liver function</strong> (liver transaminases elevated to twice normal)</td>
</tr>
<tr>
<td></td>
<td>- <strong>New renal insufficiency</strong> (elevated serum creatinine &gt; 1.1 mg/dl or doubling of serum creatinine in the absence of other renal disease)</td>
</tr>
<tr>
<td></td>
<td>- <strong>Pulmonary edema</strong></td>
</tr>
<tr>
<td></td>
<td>- <strong>New onset cerebral disturbances</strong></td>
</tr>
</tbody>
</table>

## DEFINITIONS

### HYPERTENSION DISORDERS OF PREGNANCY

<table>
<thead>
<tr>
<th>Condition</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preeclampsia - Eclampsia</strong></td>
<td>Eclampsia is the occurrence of seizure in the setting of preeclampsia*</td>
</tr>
<tr>
<td><strong>Chronic hypertension with superimposed preeclampsia</strong></td>
<td>New onset of signs and symptoms of preeclampsia in a woman with chronic hypertension</td>
</tr>
</tbody>
</table>

*National High Blood Pressure Education program Working Group on high blood pressure in pregnancy, 2000.*
HYPERTENSION - KEY POINTS
Establishing the diagnosis in pregnancy

• Same criteria for diagnosis as in nonpregnant

• New onset persistent elevation of systolic blood pressure (BP) of 140 mm Hg or higher, or a diastolic BP of 90 mm Hg or higher on two occasions at least 4 hours apart in a woman with a previously normal blood pressure

• Hypertension greater than or equal to 160 mm Hg systolic, or greater than or equal to 110 mm Hg diastolic
  • Hypertension confirmed in a short interval (minutes) to facilitate timely antihypertensive therapy
HYPERTENSION - KEY POINTS

Establishing the diagnosis in pregnancy

• New onset BP ≥ 140 / 90 mm Hg more than 4 hours apart

• New onset BP ≥ 160 / 110 mm Hg confirmed in a repeat measurement 15 minutes after
HYPERTENSION - KEY POINTS
Establishing the diagnosis in pregnancy

• OPTIMAL MEASUREMENT
  • Patient comfortably seated, legs uncrossed, back and arm supported
    • OR in left lateral position if supine
  • Middle of cuff is at the level of the right atrium (midpoint of the sternum)
  • Patient instructed to relax, not talk
  • Ideally, wait 5 minutes before taking first measurement
  • Bladder of cuff encircles ≥80% of arm
HYPERTENSION DISORDERS IN PREGNANCY
PROTEINURIA – KEY POINTS
PROTENURIA - KEY POINTS
Establishing the diagnosis the preeclampsia

• 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 0.3 (each measured as mg/dl)

• Dipstick reading 1+ (used only if other quantitative not available)
HYPERTENSION DISORDERS IN PREGNANCY
PREECLAMPSIA WITH SEVERE FEATURES – KEY POINTS
SEVERE FEATURES - KEY POINTS
Establishing the diagnosis of preeclampsia

| Severe range hypertension | Systolic blood pressure of 160 mm Hg or greater, or diastolic blood pressure of 110 mm Hg or greater on two occasions at least 4 hours apart while the patient is on bed rest (unless antihypertensive therapy is initiated before this time) |
SEVERE FEATURES - KEY POINTS
Establishing the diagnosis of preeclampsia

**IN THE ABSENCE OF PROTEINURIA**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thrombocytopenia</td>
<td>Platelet count less than 100,000/microliter</td>
</tr>
<tr>
<td>Impaired liver function</td>
<td>Abnormally elevation in blood concentration of liver transaminases (elevated to twice normal concentrations)</td>
</tr>
</tbody>
</table>

**OR**

Severe persistent right upper quadrant or epigastric pain unresponsive to medication, *not* accounted for by alternative diagnosis
### SEVERE FEATURES - KEY POINTS
Establishing the diagnosis of preeclampsia

**IN THE ABSENCE OF PROTEINURIA**

| New progressive renal insufficiency | Elevated serum creatinine > 1.1 mg/dl  
| OR 
| Doubling of serum creatinine in the absence of other renal disease |
| Pulmonary edema |
| New onset cerebral or visual disturbances |
SEVERE FEATURES - KEY POINTS

CRITERIA NO LONGER USED

• Proteinuria greater than 5 g per 24 hour urine collection
• Presence of fetal growth restriction
KEY POINTS – DEFINITIONS

RECOMMENDED VERBAGE

• Chronic hypertension
• Gestational hypertension
• Preeclampsia
  • WITHOUT SEVERE FEATURES
  • WITH SEVERE FEATURES
• Eclampsia
• Chronic hypertension with superimposed preeclampsia
KEY POINTS – DEFINITIONS

DISCOURAGE USE OF FOLLOWING TERMS

- Toxemia of pregnancy
- Pregnancy induced hypertension or PIH
- Mild preeclampsia
HYPERTENSION DISORDERS IN PREGNANCY MANAGEMENT
• To admit or not to admit?
• To deliver or not to deliver?
MAIN CONSIDERATIONS

• MATERNAL STATUS
  • Maternal risks with prolongation of the pregnancy

• FETAL STATUS
  • Fetal benefits with prolongation of the pregnancy

• GESTATIONAL AGE

• INSTITUTIONAL RESOURCES
  • Medical and allied staff
  • Labor and Delivery capabilities
  • Maternal intensive care resources
  • Neonatal intensive care resources
FAMILY BIRTH CENTER

Evaluation of New-Onset Hypertension in Pregnancy

New-onset hypertension (≥140mmHg systolic OR ≥90mmHg diastolic) after 20 weeks’ gestation in previously normotensive patient

Further evaluation
Serial blood pressure measurements every 30 minutes for 4 hours
Send CBC, creatinine, AST, urine protein/creatinine (P/C) ratio

All subsequent blood pressures <140/90mmHg

Discharge to home

Two or more blood pressures 140-159mmHg systolic OR 90-109mmHg diastolic four hours apart

Evaluate for any severe features:
- New-onset cerebral or visual disturbances (refractory headache)
- Pulmonary edema
- Thrombocytopenia (<100,000 /uL)
- Elevated liver enzymes (AST or ALT ≥ twice normal)
- Serum creatinine >1.1mg/dL or doubling of previous
- Severe, persistent right upper quadrant or epigastric pain unresponsive to medication and not accounted for by alternative diagnoses (or both)

Blood pressures ≥160mmHg systolic OR ≥110mmHg diastolic

IV antihypertensive medications to reduce blood pressure to ≤160/110mmHg
- Labetalol stepwise escalating dose 20-40-80-80mg IV every 10 minutes, maximum 220mg/24 hours
- Hydralazine 5-10mg IV every 20 minutes, maximum 30mg
- Nifedipine 10-20mg oral every 20 minutes, maximum 60mg/24 hours (may be administered concurrent with magnesium prophylaxis)

No severe features
P/C ratio <0.3

No severe features and P/C ratio ≥0.3

Manage as Preeclampsia WITH severe features/HELLP syndrome
- Admit to inpatient status
- Administer betamethasone 12mg IM q24 hours x 2 if 22 5/7 - 33 6/7 weeks
- Obstetrical ultrasound to evaluate fetal growth
- Magnesium sulfate infusion for seizure prophylaxis: Bolus 4-6gm followed by 1-2gm/hour (1gm/hour if
INITIAL EVALUATION
MATERNAL

• Serial blood pressure evaluation
• Complete blood count with platelet count
• Serum creatinine
• Liver transaminases

• Symptoms of severe preeclampsia (i.e., severe persistent right upper quadrant or epigastric pain unresponsive to medication, not accounted for by alternative diagnosis; new cerebral or visual disturbances)
INITIAL EVALUATION
FETAL

• Ultrasound evaluation
  • Estimated fetal weight
  • Amniotic fluid index
• Nonstress test (NST)
• Biophysical profile (BPP), if NST nonreactive
### DELIVERY INDICATIONS

**MILD GESTATIONAL HYPERTENSION**
**PREECLAMPSIA WITHOUT SEVERE FEATURES**

<table>
<thead>
<tr>
<th>Indications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gestational age ≥ 37 0/7 weeks gestation</strong></td>
</tr>
<tr>
<td><strong>Suspected placental abruption</strong></td>
</tr>
<tr>
<td><strong>Gestational age ≥ 34 0/7 weeks gestation and any of the following:</strong></td>
</tr>
<tr>
<td>• Progressive labor or rupture of membranes</td>
</tr>
<tr>
<td>• Ultrasonographic estimated fetal weight &lt; 5&lt;sup&gt;th&lt;/sup&gt; percentile</td>
</tr>
<tr>
<td>• Oligohydramnios (persistent amniotic fluid index &lt; 5 cm)</td>
</tr>
<tr>
<td>• Persistent BPP ≤ 6/10 (normal BPP 8-10/10)</td>
</tr>
</tbody>
</table>
DELIVERY INDICATIONS
PREECLAMPSIA WITH SEVERE FEATURES

IMMEDIATE DELIVERY
Gestational age ≥ 34 0/7 weeks gestation

DELIVERY ONCE MATERNAL CONDITION STABLE
Gestational age ≤ 34 0/7 weeks gestation and any contraindication to continued expectant management:

- Eclampsia
- Pulmonary edema
- Disseminated intravascular coagulation
- Uncontrollable severe hypertension
- Nonviable fetus
- Abnormal fetal testing results
- Placental abruption
- Intrauterine fetal demise
DELIVERY INDICATIONS
PREECLAMPSIA WITH SEVERE FEATURES

CORTICOSTEROIDS FOR FETAL LUNG MATURITY AND DELIVERY AFTER 48 HOURS

Gestational age ≤ 34 0/7 weeks gestation and any of the following complications:

- Persistent symptoms
- HELLP or partial HELLP syndrome
- Fetal growth restriction (< 5th percentile)
- Severe oligohydramnios
- Reversed end diastolic flow (umbilical artery Doppler studies)
- Labor or premature rupture of membranes
- Significant renal dysfunction
DELIVERY INDICATIONS
PREECLAMPSIA WITH SEVERE FEATURES

Gestational age ≤ 34 0/7 weeks gestation and stable maternal and fetal status:
CONSIDER EXPECTANT MANAGEMENT ONLY AT FACILITIES WITH ADEQUATE MATERNAL AND NEONATAL INTENSIVE CARE RESOURCES

• Fetal viability – 33 6/7 weeks gestation
• Inpatient management only
• Discontinuation of magnesium sulfate
• Daily maternal and fetal tests
• Vital signs, symptoms and laboratory evaluation
• Oral antihypertensive drugs
MODE OF DELIVERY

• Considerations in determining mode of delivery
  • Fetal gestational age
  • Fetal presentation
  • Cervical status
  • Maternal and fetal status

• Likelihood of cesarean delivery increases with decreasing gestational age
  • <28 weeks gestation: 93-97%
  • 28-32 weeks: 53-65%
  • 32-34 weeks: 31-38%
ANESTHETIC CONSIDERATIONS

• Hypotension with neuroaxial blockade
  • Spinal > Epidural analgesia

• Thrombocytopenia and neuroaxial blockade
  • Concern for epidural hematoma
  • American Society of Anesthesiologists has not recommended a safe limit
  • Health provider judgment following a review of laboratory values

• Magnesium sulfate and nondepolarizing muscle relaxants during cesarean delivery
  • CONTINUE magnesium sulfate throughout delivery
    Half life 5 hours so minimal effect with discontinuation
ANTENATAL CORTICOSTEROIDS
Recommended for patients diagnosed with a hypertension disorder in pregnancy at gestational ages ≤ 34 0/7 weeks
• Betamethasone 12 mg IM q24 hours x 2 doses
**MAGNESIUM SULFATE FOR SEIZURE PROPHYLAXIS**

DRUG OF CHOICE for the prevention of eclampsia
Recommended for preeclampsia with severe features (to be discontinued if expectant management)

**Intravenous loading dose:** 4-6 g

**Maintenance dose:** 1-2 g/hour
(1gm/hour if renal impairment)

Continue postpartum for 12-24 hours after delivery or 24 hours after an eclamptic seizure, whichever is longer
MAGNESIUM SULFATE- KEY POINTS

• Monitoring of serum magnesium sulfate levels not clinically indicated

• “Magnesium checks”
  • Respiratory rate
  • Reflexes
  • Urinary output
### ACTION POINTS WITH MAG CHECKS

<table>
<thead>
<tr>
<th>MAGNESIUM CHECK</th>
<th>Urine output</th>
<th>10 – 25 ml / hr</th>
<th>&gt; 25 ml / hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reflexes</td>
<td>Depressed</td>
<td>Normal</td>
<td></td>
</tr>
<tr>
<td>Respiratory rate</td>
<td>&lt; 16 / min</td>
<td>&gt; 16 / min</td>
<td></td>
</tr>
</tbody>
</table>

#### ACTION
- **STOP IV INFUSION OR WITHOLD NEXT IM INJECTION**
- **DECREASE IV MAINTENANCE INFUSION OR NEXT IM DOSE TO HALF**
- **CONTINUE MAINTENANCE INFUSION**
INTRAPARTUM AND DELIVERY CONSIDERATIONS

ANTIHYPERTENSIVE MEDICATIONS

INTRAPARTUM: Recommend intrapartum medical management of persistent severe range hypertension (target ≤160/110mmHg)

LABETALOL: Stepwise escalating doses 20-40-80 mg IV every 10 minutes, then hydralazine 10 mg IV and obtain emergency consultation if BP threshold still exceeded

HYDRALAZINE: 5 or 10 mg IV then 10 mg in 20 minutes (once), then labetalol 40 mg IV and obtain emergency consultation if BP threshold still exceeded

NIFEDIPINE: 10 mg oral then 20 mg every 20 minutes (up to two doses), then labetalol 40 mg IV and obtain emergency consultation if BP threshold still exceeded
HYPERTENSION URGENCY – KEY POINTS

• If BP ≥ 160/110 mm Hg, recheck BP in a short interval (15 minutes) to facilitate antihypertensive therapy

• If undelivered, institute continuous fetal monitoring
HYPERTENSION DISORDERS IN PREGNANCY
ECLAMPSIA
INITIAL EVALUATION
MATERNAL

• Serial blood pressure evaluation
• Complete blood count with platelet count
• Serum creatinine
• Liver transaminases

• Symptoms of severe preeclampsia (i.e., severe persistent right upper quadrant or epigastric pain unresponsive to medication, not accounted for by alternative diagnosis; new cerebral or visual disturbances)
ECLAMPSIA

• New seizure in the setting of preeclampsia
  • **Timing:** Antepartum (40-50%), intrapartum (20-35%), postpartum (10-40%)
  • Hypertension or proteinuria may be absent before eclampsia (15-30%)
  • Priorities: Airway, Breathing, Circulation
# ECLAMPSIA - KEY CONSIDERATIONS

<table>
<thead>
<tr>
<th>COMMUNICATION</th>
<th>Clearly communicate diagnosis to team members</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Call for additional assistance</td>
</tr>
<tr>
<td></td>
<td>• Obstetrics</td>
</tr>
<tr>
<td></td>
<td>• Nursing</td>
</tr>
<tr>
<td></td>
<td>• Anesthesiology</td>
</tr>
<tr>
<td></td>
<td>• Pediatrics</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PATIENT POSITIONING</th>
<th>Keep patient in a safe position</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Left lateral decubitus</td>
</tr>
<tr>
<td></td>
<td>Keep rails up</td>
</tr>
</tbody>
</table>
# ECLAMPSIA - KEY CONSIDERATIONS

<table>
<thead>
<tr>
<th>MATERNAL CARE</th>
<th>Provide oxygen by face mask</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Obtain IV access</td>
</tr>
<tr>
<td></td>
<td>Treat severe range hypertension (BP ≥ 160 mm Hg) with antihypertensive medications</td>
</tr>
<tr>
<td>FETAL CARE</td>
<td>Continuous fetal monitoring and toco, expecting decelerations</td>
</tr>
<tr>
<td>MAGNESIUM SULFATE FOR PREVENTION OF RECURRENCE</td>
<td>Loading dose 6 g IV <strong>OR</strong> 10 g IM (5 g each buttock)</td>
</tr>
</tbody>
</table>
HYPERTENSION DISORDERS IN PREGNANCY
FUTURE IMPLICATIONS
# FUTURE IMPLICATIONS

## MATERNAL HEALTH

<table>
<thead>
<tr>
<th>Future pregnancies</th>
<th>Risk of recurrence in subsequent pregnancy (10-40%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long term health</td>
<td>Increased risk of cardiovascular disease</td>
</tr>
<tr>
<td></td>
<td>• Hypertension</td>
</tr>
<tr>
<td></td>
<td>• Ischemic heart disease</td>
</tr>
<tr>
<td></td>
<td>• Venous thromboembolism</td>
</tr>
<tr>
<td></td>
<td>Overall mortality after preeclampsia increased</td>
</tr>
</tbody>
</table>
## FUTURE IMPLICATIONS

### CHILD HEALTH

<table>
<thead>
<tr>
<th>Long term health</th>
<th>Low birth weight associated with higher risk of diabetes mellitus and ischemic heart disease in later life</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hypertension in later life</td>
</tr>
</tbody>
</table>
OBJECTIVES

• Define hypertension disorders in pregnancy

• Describe current understanding of the pathophysiology of preeclampsia

• List risk factors for preeclampsia

• List possible complications and adverse outcomes from hypertension disorders in pregnancy

• Describe the implications of hypertension disorders in pregnancy on future pregnancies and long term health
OBJECTIVES

• Describe most current practice and evidence based care in the management of hypertension disorders in pregnancy
  • Antenatal
  • Intrapartum
  • Postpartum
REFERENCES


Magnesium Sulfate Use in Obstetrics. ACOG Committee Opinion #573, Sept 2013.

Emergent Therapy for Acute-Onset, Severe Hypertension with Preeclampsia or Eclampsia. ACOG Committee Opinion #623, Feb 2015.
REFERENCES

Sibai BM. Etiology and treatment of postpartum hypertension-preeclampsia. AJOG, June 2012, 470-475.


