**Hypertensive Disorders of Pregnancy**

**Hypertension**
- Diastolic BP ≥ 90 mmHg
  - average of at least 2 measurements
  - same arm
  - > 5 min apart
  - > 5-10 min rest
- Systolic BP ≥ 140 mmHg
  - warrants closer observation

**Severe Hypertension**
- Systolic BP ≥ 160 mmHg
- Or Diastolic BP ≥ 110 mmHg
- Confirm BP after 15 mins

**Measurement of BP**
- Rest for a minimum of 10 minutes
- Use manual sphygmomanometer
- Sitting position
- Appropriate size cuff
- Never place cuff over clothing
- Korotkoff sounds I and V (disappearance)
- Ambulatory BP monitoring may be more reflective of actual BP status

**Definitions**
- Gestational Hypertension
  - onset of hypertension ≥ 20 weeks
- Preeclampsia
  - if preexisting HTN – resistant HTN, new/worsening proteinuria, or adverse condition
  - if gestational HTN – new onset proteinuria or adverse condition
Hypertensive Disorders of Pregnancy

Definitions

Proteinuria
- ≥ 300 mg/d on 24 hr urine collection
- ≥ 2+ on dipstick suggests ≥ 300 mg/d proteinuria but unreliable
- Urinary Protein / Creatinine Ratio (UPCR)
  - a spot urine protein assessment (not first void)
  - UPCR correlates well with 24 hr urine collection
  - >30 mg/mmol UPCR suggests proteinuria

Adverse Conditions

Severe Complications
- Preeclampsia-related conditions that warrant delivery

Definitions / Terminology

<table>
<thead>
<tr>
<th>CNS</th>
<th>Headache/visual sx</th>
<th>Eclampsia</th>
<th>PRES</th>
<th>Cortical blindness/retinal detachment</th>
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<tbody>
<tr>
<td></td>
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<td>CVA</td>
<td>TIA/RIND stroke</td>
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<tr>
<td>CVS/RESP</td>
<td>Chest pain/SOB</td>
<td>Uncontrolled severe HTN despite &gt; 12 hrs, 3 meds myocardial ischemia/infarct + inotropic support</td>
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<tr>
<td></td>
<td>O2 sat &lt; 97%</td>
<td>O2 sat &lt; 90% Need for &gt; 50% O2 &gt; 1hr</td>
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<td></td>
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<td>Intubation</td>
<td>Pulmonary edema</td>
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<thead>
<tr>
<th>Hematologic</th>
<th>Adverse Conditions</th>
<th>Severe Complications</th>
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<tbody>
<tr>
<td></td>
<td>↑ WBC</td>
<td>plt &lt; 50 x 10^9/L</td>
</tr>
<tr>
<td></td>
<td>↑ INR/PTT</td>
<td>Transfusion</td>
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<tr>
<td></td>
<td>↓ plt</td>
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<tr>
<td></td>
<td>↑ Cr</td>
<td>Acute kidney injury</td>
</tr>
<tr>
<td></td>
<td>↑ Uric acid</td>
<td>New finding Cr &gt; 150</td>
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<td></td>
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<td>New indication dialysis</td>
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<th>Hepatic</th>
<th>Adverse Conditions</th>
<th>Severe Complications</th>
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<tr>
<td></td>
<td>Nausea and vomiting</td>
<td>Hepatic dysfunction</td>
</tr>
<tr>
<td></td>
<td>RUQ or epigastric</td>
<td>Hepatic rupture or</td>
</tr>
<tr>
<td></td>
<td>pain</td>
<td>hematoma</td>
</tr>
<tr>
<td></td>
<td>↑ AST, ALT, LDH, BR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>↓ Albumin</td>
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</tbody>
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Definitions / Terminology (cont’d)

Classification

Pre-existing Hypertension +/- with co morbid conditions +/- with preeclampsia

Gestational Hypertension +/- with co morbid conditions +/- with preeclampsia

Preeclampsia de novo

Other Hypertensive Effects
- Transient
- White Coat
- Masked
Hypertensive Disorders of Pregnancy

Classification

1. Pre-existing Hypertension (pre-pregnancy or < 20 wks gestation)
   a. with co-morbid conditions (e.g. DM, renal disease, antihypertensive therapy outside pregnancy)
   b. with preeclampsia (superimposed preeclampsia)
      - resistant hypertension (use of 3 antihypertensives)
      - new or worsening proteinuria
      - or ≥ 1 adverse condition
      - or ≥ 1 severe complication
      - severe preeclampsia – if one or more severe complications

2. Gestational Hypertension (onset ≥ 20 wks gestation)
   - with co-morbid conditions (e.g. DM, renal disease, etc.)
   - with preeclampsia
   - new proteinuria
   - or ≥ 1 adverse condition
   - or ≥ 1 severe complication

3. Preeclampsia
   • de novo gestational hypertension with
      - new proteinuria
      - or ≥ 1 adverse condition
      - or ≥ 1 severe complication

4. Other Hypertensive Effects
   • Transient hypertensive effect – elevated BP due to environmental stimuli (e.g. pain)
   • White coat by hypertensive effect – BP is elevated in the office but is consistently normal outside the office
   • Masked hypertensive effect – BP that is consistently normal in the office but is elevated outside the office

Condition Incidence in pregnancy Risk of preeclampsia
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Preeclampsia 1% - 2%
Pre-existing hypertension 1% 26%
Gestational Hypertension 5% ~ 6%
Gestational Hypertension < 34 wks 5%

Women at increased risk
• With pre-existing HTN the risk in pregnancy is
  – pre-eclampsia 26%
  – caesarean delivery 41%
  – perinatal mortality 40/1000
  – admission to NICU 20%
Hypertensive Disorders of Pregnancy

Morbidity / Mortality with Preeclampsia

• Maternal
  – stroke (systolic BP ≥ 160 mmHg)
  – pulmonary edema
  – hepatic failure, jaundice
  – abruption
  – acute renal failure

• Fetal
  – oligohydramnios
  – IUGR
  – metabolic acidosis
  – death

Risk Factors

• There is no single predictor of preeclampsia
  – previous preeclampsia
  – anti-phospholipid antibodies
  – multiple gestation
  – pre-existing medical conditions (e.g. DM, renal disease, periodontitis)
  – obesity (BMI ≥ 35)
  – family history of preeclampsia (mother or sister)
  – first visit sBP ≥ 130 mmHg or dBP ≥ 80 mmHg
  – first ongoing pregnancy

Possible predictors of early onset preeclampsia in women at risk

• PaPP-A, Inhibin, Activin and placental growth factors
• Bilateral notching on uterine artery Doppler waveforms in the mid trimester
• Uterine artery pulsatility index PI > 1.0

Initial Evaluation

• Identify risk factors
• Clinical evaluation of mother
• Evaluation of status of fetus
• Laboratory investigation

Evaluation of Mother – Clinical

• Blood pressure
  – assess severity (severe if ≥ 160/110)
  – high BP related to risk of CVA not seizure
• Pulse oximetry
  – < 97% associated with risk severe complications
• Central Nervous System
  – presence and severity of headache
  – vision disturbances – blurring, scotomata
  – tremulousness, irritability, somnolence
  – hyperreflexia
**Evaluation of Mother – Clinical**
- Cardiorespiratory
  - chest pain
  - dyspnea
  - distended neck veins
- Hematologic
  - bleeding, petechiae
- Hepatic
  - RUQ and epigastric pain
  - severe nausea and vomiting

**Evaluation of Mother – Laboratory**
- CBC (platelets)
- Creatinine, uric acid
- AST or ALT, LDH
- Urine protein
  - PTT INR Fibrinogen
  - Glucose, Bilirubin, ammonia
  - Albumin

**Evaluation of Fetus**
- Fetal movement
- NST
- Ultrasound
  - Fetal size (growth restriction)
  - AFV (oligohydramnios)
  - Doppler flow studies

**Prevention of Preeclampsia**
**Women at low risk**
- Calcium supplemental ≥ 1 g/d (if poor calcium intake)
- Low dose ASA not beneficial

**Women at increased risk**
- Maternal age < 18, multiple gestation, pre-existing HTN/medical conditions, and/or previous preeclampsia, anti-phospholipid antibodies
  - low dose ASA (75-160mg/d) started pre-pregnancy or at diagnosis of pregnancy (but before 16 wk gestation) until delivery
  - calcium 1-2g/d
  - avoid inter-pregnancy weight gain, increase 3rd trimester rest at home, and/or reduce workload or stress

**Management Goals**
- Prevention severe maternal complications
  - i.e. organ damage, seizure, CVA, DVT, death
- Prevention of severe fetal complications
  - i.e. abruption, stillbirth, growth restriction
- Symptomatic support

*Delivery is the beginning of the cure!*
**Anti-Hypertensive Therapy**

- Reduces risk of severe hypertension and maternal CVA
- Does not reduce risk of seizures or adverse fetal outcomes (e.g. IUGR)
- Recommended if pre-existing or severe HTN or presence of co-morbidities
- Aim sBP to < 160 mm Hg, dBP < 110 mm Hg
- Too rapid BP drop or too tight control (< 90 mmHg) may compromise fetus

**Treatment of Acute or Severe Hypertension**

- Anti-hypertensive therapy
  - nifedipine, labetalol or hydralazine
  - goal → maintain d BP to maintain placental perfusion
  - avoid abrupt drops in blood pressure
- Monitor fetal status while treating BP
- Seizure prophylaxis
- Intravascular volume status
  - foley catheter and hourly input-output
  - avoid fluid overload
- Deliver

**Treatment of Acute or Severe Hypertension**

**Severe Hypertension**

- Calcium Channel Blockers
  - Oral Nifedipine (Adalat capsule or PA tablet)
- ß-Blockers
- Arteriolar Dilators
  - IV Hydralazine (Apresoline) – not first line choice

**Anti-Hypertensive Agents – Maintenance Therapy**

**Mild to moderate HTN**

**Without co-morbid condition**

130-155/80-105 mmHg

**With co-morbid condition**

130-139/80-89 mmHg

**Drugs**

- Centrally Acting Sympatholytic Agents
  - ß-methyl-dopa (Aldomet)
- ß-Blockers
  - Labetalol (Trandate, Normodyne)
- Calcium Channel Blockers
  - Nifedipine (Adalat-PA or XL)

**Ace Inhibitors and ARB’s contraindicated!**

**Fluid Management**

- Beware of fluid overload
- At risk for pulmonary edema
- Transient oliguria less concern than fluid overload
- Monitor fluid intake and urine output hourly
- Limit IV fluids by concentrating solutions
- Max. IV intake: 1ml/kg/hr using current body weight or 80/ml/hr

**Fluid Management**

- In case of Oliguria (< 15 ml/hour)
  - assess volume status
  - follow serum creatinine
  - watch for magnesium toxicity
  - consider small fluid bolus (500ml NS)
  - do not use furosemide or dopamine
  - consultation if persistent
  - No specific intervention except to lower the threshold for early delivery
Seizure Prophylaxis

- Difficult to predict who will seize
  - not directly related to degree of hypertension or level of proteinuria
- MgSO4 is agent of choice when seizure prophylaxis is indicated or for treatment of eclampsia
  - dosage – 4 g IV followed by 1-2 g / hour IV
  - do not use phenytoin or diazepam in seizure prophylaxis / treatment in pregnancy unless contraindication to MgSO4
  - OK to use cautiously with calcium channel blocker

Indications for MgSO4 administration

- Severe preeclampsia
- Non severe preeclampsia associated with symptoms (headache, visual changes, RUQ pain) or signs (platelets < 100, renal insufficiency, elevated liver enzymes)
- HELLP syndrome
- Secondary prevention of recurrent seizures in eclampsia

Magnesium Sulfate – Overdose

- Close observation for toxicity
  - weakness, respiratory paralysis, somnolence, heart block
- High risk – renal failure, oliguria

Antidote

- Stop magnesium infusion
- Provide respiratory support
- 10% Calcium gluconate 10 ml IV over 3 minutes

Management of Eclampsia

- Call for help
- Maternal lateral position
  - protect the airway
  - MgSO4 bolus followed by infusion
  - post-seizure: airway, O2, vital signs, fetal surveillance
  - assess for evidence of abruption, DVT or CVA

Symptomatic Support

- Manage pain and nausea / vomiting
- Quiet environment
- Presence of supportive family member or professional
- Minimize negative stimuli
- Clear explanation of management
- Consistent, confident team approach

Transport

- Consider transporting patient if resources limited and maternal / fetal condition permits
  - maternal BP and symptoms stable
  - fetal status reassuring
- Discuss with receiving centre and patient/family
- Anti-hypertensive agents if indicated
- MgSO4 if indicated
- Accompanied by caregiver who can manage medications and airway or seizure as required
Hypertensive Disorders of Pregnancy

Delivery – The Beginning of the Cure

- Gestational hypertension is a progressive disease
- Timely delivery minimizes morbidity and mortality
- Stabilize mother before delivery
- Delay delivery to gain fetal maturity and to allow transfer only when maternal and fetal condition permits
- Corticosteroids if < 34 wks
- Magnesium (fetal neuroprotection) if < 32 wks
  √ Expectant management is potentially harmful in presence of severe conditions

When to Deliver

- Severe Pre-existing Hypertension
- Severe Gestational Hypertension
- Severe Preeclampsia
  - Should be delivered regardless of gestational age
  - Expectant management may be considered remote from term
    - center with expertise and intensive support
    - ability to intervene urgently

When to consider steroids

- Thrombocytopenia (platelets ≤ 50)
  - Dexamethasone 10 mg IV q12h (betamethasone 12 mg IM q24h) until platelets > 100 or delivery
- Reduction respiratory morbidity (usual protocol)
  - ≤ 34⁶
    - Preeclampsia
    - Gestational HTN (if delivery anticipated ≤ 7 days)
    - Rescue dose ≥ 7 days after initial course if still at high risk for delivery
  - ≤ 38⁶
    - Planned caesarean delivery

Management of HELLP Syndrome

- Platelets > 50 x 10⁹/L with no evidence of excessive bleeding – platelet transfusion not indicated
- Platelets < 50 x 10⁹/L, or count falling, or coagulopathy consider blood/Platelet transfusion or steroids
- Platelets < 20 x 10⁹/L – platelet transfusion prior to CS and vaginal delivery

Postpartum Management

- As gestational HTN / proteinuria / adverse conditions may present or worsen following delivery – monitor closely PP
- If MgSO₄ used, continue for 24 hours PP
- High risk women should not discharged in low risk pathways
- Severe PP hypertension and patients with co-morbidities
  - should be on antihypertensive agents
  - only be discharged when clearly improving
  - BP < 160/100 mmHg for at least 24 hours before discharge
  - clinical and laboratory follow up arranged within a week
Hypertensive Disorders of Pregnancy

Summary

- Severe HTN +/- preeclampsia are obstetrical emergencies
- Prompt recognition and stabilization required
- In rural communities transfer of patient may be required
- The cure is delivery
- Antihypertensive therapy is used to prevent CVAs, not seizures
- MgSO4 is the best agent for seizure prophylaxis
- No evidence that antihypertensive therapy for mild to moderate hypertension improves perinatal outcome
- Currently no therapies available that effectively prevent preeclampsia