# Hypertensive Disorders of Pregnancy

**Title:** Hypertensive Disorders of Pregnancy  
**Approving Authority:** Edmonton Women’s Health Zone Clinical Department Executive Committee  
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Introduction

Hypertensive disease in pregnancy is a serious disorder that occurs in 2-10% of pregnancies. This disorder occurred in 4.5% of Alberta women giving birth in 2011. The most recent report from the Canadian Perinatal Surveillance System indicates that pre-eclampsia was one of the leading causes of direct maternal death (1.4 per 100,000 deliveries from 2002/2003 to 2010/2011). The incidence of eclampsia in Canada, excluding the province of Quebec, in 2006/2007 to 2010/2011 was 59.4 per 100,000 deliveries. The underlying mechanism of death in women with preeclampsia generally centers around high systolic blood pressure directly causing several maternal complications, such as intracranial hemorrhage, seizure, pulmonary edema, liver rupture and multi-organ system failure.

In addition to maternal morbidity and mortality, hypertensive disorders of pregnancy are associated with such perinatal risks as asphyxia, intrauterine growth restriction, prematurity, placental abruption and perinatal mortality.

The purpose of this guideline is to standardize the approach to diagnosis, assessment and management for women presenting with hypertensive disorders of pregnancy, in order to improve care for the mother and fetus and decrease the incidence of morbidity and mortality.

The goal for treatment is to obtain a blood pressure of less than 155/105 mmHg. These guidelines are based on current recommendations from the Society of Obstetricians and Gynaecologist of Canada, and evidenced based practice standards.

1. Policy

Obstetrical consultation or transfer of care is required for patients under the care of a general practitioner or midwife.

- Family practice physicians will follow the consultation requirements as outlined in:
  - Family Physicians’ Guideline for Physician consultation and Transfer of Responsibility for Care Edmonton Zone
- Midwives will follow the consultation requirements as outlined in:
  - Midwifery Guidelines for Physician Consultation and Transfer of Responsibility for Care – Edmonton Zone

2. Roles of Nurses, Midwives and Physicians

- All professionals working within Obstetrics need to have knowledge regarding pathophysiology, signs and symptoms, diagnostic criteria, treatment options, complications and current practice guidelines in relation to hypertensive disease in pregnancy
- All professionals working within obstetrics should be familiar with content of MORE (Managing Obstetrical Risk Efficiently) and/or ALARM (Advances in Labour and Risk Management).

3. Definitions

- **Pre-existing hypertension** is defined as hypertension that develops either pre-pregnancy or at less than 20 weeks gestation
- **Gestational Hypertension** is defined as hypertension that develops for the first time at or beyond 20 weeks gestation
Pre-eclampsia is defined as a gestational hypertension with one or more of the following:
- New proteinuria
- or one or more adverse conditions
- or one or more severe complications\textsuperscript{8,9} (Table 1)

Resistant hypertension is defined as hypertension after 20 weeks gestation requiring 3 antihypertensive medications to control blood pressure\textsuperscript{8,viii}

Severe pre-eclampsia is defined as pre-eclampsia with one or more severe complications\textsuperscript{8,9} (see table 1)

Eclampsia is defined as a severe form of pre-eclampsia or a complication of severe pre-eclampsia with seizure activity not attributable to other causes\textsuperscript{8,9,vii}

Other hypertensive effects
- Transient hypertensive effect is an office or in hospital systolic BP>140mmHg and/or a diastolic BP 90mmHg based on the average of at least 2 measurements, taken at least 15 minutes apart\textsuperscript{8,9}
- White-coat hypertensive effect is a BP that is elevated in the office (systolic $\geq$140 mmHg or diastolic $\geq$ 90 mmHg), but consistently normal outside of the office (<135/85 mmHg) by ambulatory monitoring or home monitoring\textsuperscript{8,9}
- Masked hypertensive effect is a BP that is consistently normal in the office (systolic $<$ 140 mmHg or diastolic $<$ 90 mmHg), but elevated outside of the office ($\geq$ 135/85 mmHg) by ambulatory monitoring or home monitoring\textsuperscript{8,9}

4. Classification of Hypertensive Disorders of Pregnancy\textsuperscript{vii,viii}

Hypertensive disorders of pregnancy have been reclassified and re-defined as new knowledge is gained. To facilitate communication between caregivers by providing a common language the Society of Obstetricians and Gynecologists of Canada provides the following classifications for Hypertensive Disorders of Pregnancy.\textsuperscript{vii,viii}

a. **Pre-existing hypertension**
   Divided into two subgroups as
   - Pre-existing Hypertension \textbf{with co-morbid conditions}\textsuperscript{8,9}  
     i.e. pre-gestational Type I or Type II Diabetes, renal disease, and indication for antihypertensive therapy outside of pregnancy
   - Pre-existing Hypertension \textbf{with evidence of Pre-eclampsia} includes development of one or more of the following\textsuperscript{8,9}:
     - Resistant hypertension
     - or
     - new or worsening proteinuria
     - or
     - the presence of 1 or more adverse conditions or severe complications (Table 1)

b. **Gestational hypertension**
   Divided into two subgroups as
   - Gestational Hypertension \textbf{with co-morbid conditions}\textsuperscript{8,9}  
     i.e. pre-gestational Type I or Type II Diabetes, renal disease
Gestational Hypertension with Pre-eclampsia includes one or more of the following:\(^8,^9\):
- new proteinuria
- or
- the presence of 1 or more adverse conditions or severe complications (Table 1)

**Table 1: Adverse Conditions and Severe Complications Associated with Preeclampsia\(^\text{VII,VIII}\)**

<table>
<thead>
<tr>
<th>Organ System Affected</th>
<th>Adverse Conditions (that increase the risk of severe complications)</th>
<th>Severe Complications (that warrant delivery)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNS</td>
<td>• Headache&lt;br&gt;• Visual symptoms</td>
<td>• Eclampsia&lt;br&gt;• PRES (posterior reversible leukoencephalopathy syndrome)&lt;br&gt;• Cortical blindness or retinal detachment&lt;br&gt;• Glasgow coma scale &lt; 13&lt;br&gt;• Stroke, transient ischemic attack, or reversible neurological deficit &lt; 48 hours</td>
</tr>
<tr>
<td>Cardiorespiratory</td>
<td>• Chest pain&lt;br&gt;• Dyspnea&lt;br&gt;• Oxygen Saturation , 97%</td>
<td>• Uncontrolled severe hypertension (over a period of 12 hours despite use of three antihypertensive agents)&lt;br&gt;• Oxygen saturation &lt; 90, need for ≥50% oxygen for &gt; 1 hour, intubation (other than for Cesarean section), pulmonary edema&lt;br&gt;• Positive inotropic support&lt;br&gt;• Myocardial ischemia or infarction</td>
</tr>
<tr>
<td>Haematological</td>
<td>• Elevated WBC count&lt;br&gt;• Elevated INR or PTT&lt;br&gt;• Low platelet count</td>
<td>• Platelet count &lt; 50X10^9/L&lt;br&gt;• Transfusion of any blood product</td>
</tr>
<tr>
<td>Renal</td>
<td>• Elevated serum creatinine&lt;br&gt;• Elevated serum uric acid</td>
<td>• Acute kidney injury (creatinine &gt; 150µM with no prior renal disease)&lt;br&gt;• New indication for dialysis</td>
</tr>
<tr>
<td>Hepatic</td>
<td>• Nausea or vomiting&lt;br&gt;• Right upper quadrant or epigastric pain&lt;br&gt;• Elevated serum AST,</td>
<td>• Hepatic dysfunction (INR &gt;2 in absence of disseminated intravascular coagulation</td>
</tr>
</tbody>
</table>
### 5. Diagnostic Criteria

- **Hypertension**
  The diagnosis of hypertension is based on two consecutive Blood Pressure measurements taken 15 minutes apart on the same arm meeting the following criteria:
  - Diastolic BP of greater than or equal to 90 mmHg (≥90 mmHg) and/or
  - Systolic BP of greater than or equal to 140 mmHg (≥140 mmHg)

- **Severe Hypertension**
  Systolic blood pressure greater than or equal to 160 mmHg or Diastolic blood pressure greater than or equal to 110 mmHg

- **Proteinuria**
  - Proteinuria in pregnancy is defined as excretion of proteins in urine in excess of 300 mg in 24 hours (0.3 g/d).
  - The 24-hour urine collection remains the gold standard for the measurement of urinary protein, however the test is time-consuming and the collection is often not complete.
  - Protein/creatinine ratio (UPCR) equal to or greater than 30 mg/mmol is definitive for proteinuria and correlates with a 24 hour urine collection.
  - Dipsticks permit simple and rapid testing, but results are unreliable. Positive dipstick results (≥+1) warrant further evaluation with a 24-hour urine collection for protein creatinine ratio.
  - Proteinura testing does not need to be repeated once significant proteinuria of preeclampsia has been confirmed.

- **Blood Pressure Assessment**
  Accurate blood pressure readings are essential
  - Use the proper-sized cuff and accurate sphygmomanometer
  - Aneroid automatic sphygmomanometers need to be recalibrated every 2 years
  - BP can be measured using a calibrated aneroid device, or an automated BP machine that has been validated for use in preeclampsia
  - In pre-eclampsia, automated BP machines may underestimate or overestimate both dBPs and sBPs by 5 mm Hg on average, while others suggest that the automated BP device significantly underestimates the Blood pressure in pre-eclampsia.
If an automated BP machine is used, a comparison of readings using an aneroid device is recommended.

The blood pressure assessment should not occur while the woman is talking. Wait for at least 30 minutes after smoking, consumption of coffee, or exercise. If pain is present, treat pain.

The woman should be in a sitting position with the arm at heart level and legs should be uncrossed and the back supported. Arm to arm differences should be documented and the arm with the higher blood pressure should be used if there is a consistent difference. Measure BP in the same arm with the woman in the same position each time.

Maintain a slow, steady deflation rate.

Use the Korotkoff phase V (disappearance of sound) for recording the diastolic value vs. IV (softening of sound).

If dBP greater than or equal to 90 mmHg following a 5 minute rest period, repeat blood pressure in 5 minutes.

For severe hypertension, the blood pressure reading should be confirmed after 15 minutes of rest.

6. Assessment/Investigation for Adverse Conditions and Severe Complications

Maternal
Although the severity of the disease can usually be based on the level of hypertension, some women may present only with adverse conditions and/or abnormal lab findings.

- Women may present with convulsions, headache, abdominal pain or general malaise. Headache, right upper quadrant pain and visual disturbances are potentially ominous symptoms and require immediate attention. A complete and systematic assessment is indicated.

Urine Testing
- Urinalysis (Routine and Microscopy with/without additional tests for proteinuria)

Laboratory
- CBC and platelet count
- WBC and differential
- Peripheral blood smear for red blood cell fragmentation
- Type and screen
- Serum creatinine, uric acid, glucose, AST or ALT, LDH, bilirubin, albumin
- PT, PTT, Fibrinogen, D-Dimer

Other considerations
- Perinatology consultation for fetal testing
- OB Medicine consultation
- When local resources are limited and maternal and fetal conditions permit, the outcome may be improved by transporting the mother to an appropriate referral center.

Fetal Testing
- Fetal movement count
- Fetal heart rate monitoring
Ultrasound assessment, which may include:
- Fetal growth
- Biophysical profile
- Amniotic fluid volume (AFV)
- Umbilical doppler flow studies

Other considerations
- NICU consult

7. Medical Management

Note: For standard doctors’ orders see Appendix A

- Delivery is the definitive treatment for preeclampsia.
- Preeclampsia is associated with adverse conditions, regardless of gestational age.
- Expectant management is potentially harmful in the presence of severe preeclampsia, fetal maturity, or suspected fetal compromise.
- When there are no adverse conditions and fetal maturity is not present, close observation for development of adverse conditions ± antihypertensive treatment should be considered.
- A systolic pressure (sBP) > 160 mmHg or a diastolic pressure (dBP) >110 mmHg in a pregnant woman should be considered an emergency. **Severe hypertension should be confirmed with a repeat blood pressure measurement after 15 minutes.** Pharmacologic treatment with Labetalol, Nifedipine or Hydralazine should be started.
- Treatment for hypertension may start at lower BP levels in specific circumstances such as:
  - Teenage pregnancy with pre-pregnant dBP Less than 70mmHg
  - Patients demonstrating cardiac decompensation
  - Patients demonstrating cerebral symptoms
- A component of maternal hypertension is adrenergic and may be modified by stress reduction (quiet environment; clear explanation of management plan to patient/family; minimization of negative stimuli)
- Consider delivery if the patient is at or near term regardless of the presence of adverse conditions.

**Corticosteroids for Acceleration of Fetal Lung Maturity**
- Antenatal corticosteroids should be considered for all women with preeclampsia at less than or equal to 34+6 weeks’ gestation.
- Antenatal corticosteroids should be considered for women at less than or equal to 34+6 weeks gestation with gestational hypertension despite the absence of proteinuria or adverse conditions if delivery is anticipated within 7 days.
- A rescue dose of corticosteroids may be considered for women at less than or equal to 34+6 weeks gestation who remain at high risk of preterm delivery 7 days or more after the initial course of antenatal corticosteroids.
- Antenatal corticosteroids may be considered for women delivered by elective Cesarean delivery at less than or equal to 38+6 weeks gestation to reduce neonatal respiratory morbidity.

8. Pharmacological Management

Pharmacological treatment consists of antihypertensive therapy and/or eclampsia prevention or treatment depending on the severity of the disease. The goal of pharmacological treatment is to prevent maternal and fetal morbidity and mortality. Treatment with antihypertensive medication in
women with non-severe hypertension (see below for definition) prevents transient severe hypertension but does not mitigate the occurrence of major complications such as stroke, preterm labor and perinatal death. As well, there is some evidence suggesting a relationship between anti-hypertensive-induced fall in mean arterial blood pressure and the risk of SGA infants, hence, no clear evidence-based guidelines are available. The following drugs are recommended for severe hypertension, non-severe hypertension and eclampsia. It is recommended that physicians order the drugs that are most familiar to them. A sudden drop in BP or maternal hypotension should be avoided. This may occur more easily with polypharmacy. Detailed descriptions of the drug dosages, side effects and monitoring parameters can be found in the appropriate appendices.

**Severe Hypertension is defined as:**
Systolic BP greater than or equal to 160 mmHg and/or Diastolic BP greater than or equal to 110 mmHg

Recommended antihypertensive medications are:
- Intravenous Labetalol (see Appendix B)
- Short acting Nifedipine (see Appendix C)
- Intravenous Hydralazine (see Appendix D)

**Non-severe hypertension is defined as:**
Systolic BP greater than or equal to 140 - 159 mmHg and/or Diastolic BP greater than or equal to 90 - 109 mmHg

Recommended antihypertensive medications are:
- Labetalol (see Appendix B)
- Long acting Nifedipine (see Appendix C)
- Methylidopa see (Appendix E)

**Eclampsia**

Eclampsia is often preceded by premonitory signs such as headache, visual disturbances, epigastric pain, a sensation of constriction of the chest, apprehension, excitability, and hyperreflexia.

**Prophylaxis or Treatment**

There is clear evidence to support the use of Magnesium sulphate (see Appendix F for administration guidelines) in the prevention of seizures in women with severe hypertension and in the treatment of eclamptic seizures. A recurrent seizure may require a second 2-4 g Magnesium Sulfate IV bolus. The use of Magnesium sulphate in prevention of seizures in women with non-severe hypertension accompanied by proteinuria may be considered.

**Medical Management of the Patient with Eclampsia**
- Ensure environment is safe and protect from harm
• Call for additional help
• Ensure suction and oxygen are ready
• Prepare the medications that are likely to be needed

**After seizure**
• Position woman in left lateral
• Ensure airway is clear
• Administer oxygen by mask at 8 – 10 L
• Restart continuous fetal monitoring
• Monitor maternal BP, Pulse, Respirations
• Monitor maternal oxygen saturation
• Ensure IV access and Magnesium Sulphate is infusing
• Communicate with the family
• Document

10. HELLP Syndrome

• HELLP stands for hemolysis, elevated liver enzymes, and low platelet count
• This syndrome is a variant of severe pre-eclampsia
• Management of this syndrome should be according to careful clinical assessment

**Medical Management of HELLP**

• If platelet count greater than 50 X 10^9/L and no bleeding and no platelet dysfunction, no prophylactic platelet transfusion is necessary pre-op cesarean section
• If platelet count less than 50 X 10^9/L and if platelets are falling rapidly and/or there is coagulopathy, consider ordering blood products including platelets prior to cesarean section
• If platelet count less than 20 X 10^9/L consider transfusion with platelets prior to vaginal delivery or cesarean section
• If platelet count less than 50 X 10^9/L could consider administering Corticosteroids to boost platelet count and to reduce hematological complications

11. Postpartum Management

• All women with hypertensive disorders of pregnancy must be monitored carefully in the postpartum period with ongoing attention to blood pressure, renal function, seizure risk, and any end-organ dysfunction.
• Hypertension may develop for the first time Postpartum
  • The timing of seizure occurrence is distributed as follows:
    • 50% first appear before labor
    • 25% first occur during labor
• 25% begin in the early postpartum period\textsuperscript{8}
• Routine blood pressure checks are part of the postpartum care map, more frequent blood pressure measurements may be ordered.
  o At least four times a day while the woman is an inpatient\textsuperscript{37}
• Women requiring seizure prophylaxis (preeclampsia) should be treated with magnesium sulfate for a minimum of 24 hours postpartum.\textsuperscript{8}
• Laboratory investigations should be directed toward the particular end-organ that has been affected.\textsuperscript{8}
• High risk women should not be placed in low risk discharge pathways.\textsuperscript{8}
• These women should only be transferred to a postpartum unit when there is a clear trend towards improvement in clinical and laboratory assessments, and when there is an ability to provide surveillance.\textsuperscript{8}
• When there has been end-organ dysfunction, there should be evidence that it has resolved prior to the discharging the woman and when follow-up can be arranged within a week for clinical and blood pressure assessment.\textsuperscript{8}
• Post-discharge blood pressure measurement should be measured at peak postpartum blood pressure – Postpartum Day 3 to 6 in women diagnosed with hypertensive disorders of pregnancy\textsuperscript{viii}
• Because early hospital discharge is the current practice, instruction of women at discharge from the hospital should include awareness of symptoms that should be reported to a healthcare provider:
  o Severe headache
  o Visual disturbances
  o Epigastric pain\textsuperscript{34}
1.0 PURPOSE
1.1 The purpose for administering Labetalol is to reduce blood pressure in patients diagnosed with severe hypertension.

2.0 GENERAL INFORMATION
2.1 Labetalol is a selective alpha blocker and a nonselective beta blocker. It lowers arterial pressure through the relaxation of arterial smooth muscle and vasodilation.
2.2 Labetalol is commonly used as a first-line drug in the treatment of hypertensive disorders in pregnancy.

3.0 PRIMARY HEALTHCARE PROVIDER RESPONSIBILITIES
3.1 The family practice physician and/or the Midwife may require a consult or a transfer of care to an Obstetrician.

4.0 NURSING PROTOCOLS for administration of IV Labetalol
4.1 All patients receiving intravenous Labetalol are to be cared for in labour & delivery.
4.2 RN with Specialized Clinical Competency in direct IV administration
4.3 Establish IV prior to drug administration
4.4 Ensure oxygen and suction is available and working.
4.5 Non-invasive blood pressure monitoring is required

5.0 CONTRAINDICATIONS
5.1 Uncontrolled congestive heart failure
5.2 Severe asthma
5.3 Greater than first degree A-V block
5.4 Cardiogenic shock and states of hypoperfusion
5.5 Sinus bradycardia
5.6 Hypersensitivity to Labetalol

6.0 USE CAUTIOUSLY IN PATIENTS DIAGNOSED WITH:
   6.1 Asthma
   6.2 Hepatic failure – dosage reduction is recommended

7.0 PHARMACOKINETICS

<table>
<thead>
<tr>
<th>Route</th>
<th>Onset</th>
<th>Peak</th>
<th>Duration</th>
<th>Half Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV</td>
<td>immediate</td>
<td>5-10 minutes, maybe longer in some</td>
<td>5.5 hours</td>
<td>5.5 hours</td>
</tr>
<tr>
<td>Oral</td>
<td>varies</td>
<td>1-2 hours</td>
<td>8-12 hours</td>
<td>6-8 hours</td>
</tr>
</tbody>
</table>

8.0 POTENTIAL HAZARDS/SIDE EFFECTS

8.1 Most common:
   a. Orthostatic hypotension

8.2 Less frequent:
   b. Cardiovascular
      • bradycardia, congestive heart failure
   c. Respiratory
      • bronchospasm
   d. Gastrointestinal
      • constipation, diarrhea, nausea, vomiting
      • masking of hypoglycemia
   e. Central Nervous System
      • depression, anxiety, drowsiness, insomnia
   f. Neonatal
      • notify Neonatology as neonatal bradycardia requiring intervention may occur

8.3 Rare:
   a. Allergic reactions

9.0 DOSAGE

9.1 Direct IV
   • Bolus 20 mg direct IV administered over 2 minutes initially, then
   • 10-20 mg IV every 10 to 30 minutes titrated to BP up to a maximum dose of 300 mg
   • Higher doses of 20-80 mg IV, or 1 to 2 mg/minute, can be given and should be given if BP is not responding

9.2 Continuous infusion
   • 1-2 mg/minute
   • Increase rate by 1 mg every 15 minutes to a maximum of 4 mg/minute
9.3 **Supplied**

- 1 ampoule of 20 mL = 100 mg Labetolol (5 mg/mL)
- Oral: 100 mg and 200 mg tablets
## 10.0 MONITORING

<table>
<thead>
<tr>
<th>Parameter*</th>
<th>Frequency</th>
<th>Warning Signs</th>
<th>Action</th>
</tr>
</thead>
</table>
| BP         | Just prior to administration  
After administration:  
Q 5 min for 30 minutes  
Q 30 min for 2  
Hourly for up to 6 hours as needed then as indicated** | A Systolic greater than 160 mmHg  
Diastolic less than 90 mmHg  
Avoid rapid fall in BP | Notify house staff or physician |
| FHR        | Continuous  
Atypical or Abnormal fetal heart rate patterns  
Watch for bradycardia | Intrauterine resuscitation measures.  
Notify house staff or physician | |
| ECG        | Continuous cardiac monitoring is not necessary routinely, but should be used in patients with relevant co-morbidities (eg, coronary artery disease).* | |

*Document on appropriate record

## 11.0 PREGNANCY CATEGORY: C*32

## 12.0 LACTATION:  
Low amounts of labetalol are found in breast milk and can be detected in the serum of nursing infants.**32 Labetalol has one of lowest transfers into breast milk, with relative infant doses of less than 2 percent and not associated with adverse events in infants.36

## 13.0 REFERENCES


8 The MORE** Program 13th edition (2014), Module one, Hypertensive Disorders in Pregnancy, Salus Global Corporation. downloaded from [https://secure.moreob.com/en/?=contentManager/onStory&e=UTF-8&i=1317992669064&l=0&active=no&sort=Price&StoryID=1217960662339](https://secure.moreob.com/en/?=contentManager/onStory&e=UTF-8&i=1317992669064&l=0&active=no&sort=Price&StoryID=1217960662339), September 2014


32 Alberta Health Services, Insite, Pharmacy Services, Lexicomp Online available at http://online.lexi.com/lco/action/home?siteid=1

1. PURPOSE
   Treatment of hypertension

2. GENERAL INFORMATION
   2.1. Nifedipine is a calcium channel blocker that causes relaxation of vascular smooth muscle, reducing peripheral vascular resistance and thus lowering arterial blood pressure.
   2.2. Nifedipine inhibits calcium transport into the myocardium. The resulting decrease in angina is not generally of concern to the obstetrical population but it does explain some of the contraindications.
   2.3. Staff should be aware of the distinction between short-acting nifedipine capsules used to treat severe hypertension and, and the slow-release tablets (XL) that are used for non-severe hypertension.  

3. PRIMARY HEALTHCARE PROVIDER RESPONSIBILITIES
   3.1. The family practice physician and/or the Midwife may require a consult or a transfer of care to an Obstetrician.

4. NURSING PROTOCOLS
   4.1. Ensure patient swallows tablet(s) whole (dependant on Physician orders and formulation, see section 9)
   4.2. Avoid grapefruit juice

5. CONTRAINDICATIONS
   5.1. Immediate release formulation not for use in management of non-severe hypertension
   5.2. Cardiogenic shock
   5.3. Acute M.I.
   5.4. Hypersensitivity to the drug or any component

6. CAUTION
   6.1. Short-acting Nifedipine should be avoided in women at high risk for cardio-vascular events.
   6.2. Drug action potentiated by Cimetidine and grapefruit juice

7. PHARMACOKINETICS

<table>
<thead>
<tr>
<th>Onset</th>
<th>Peak</th>
<th>Duration</th>
<th>Half Life</th>
</tr>
</thead>
</table>

8. POTENTIAL SIDE EFFECTS
   a. Central Nervous System
      - dizziness, headache, fatigue, nervousness, sleep disturbances, blurred vision
   b. Cardiovascular
      - peripheral edema, angina, hypotension, AV block, myocardial infarction, ventricular arrhythmia
   c. Gastrointestinal
      - nausea, diarrhea, constipation, heartburn, gingival hyperplasia
   d. Respiratory
      - cough/wheezing, nasal and chest congestion, sore throat, dyspnea
   e. Dermatologic
      - dermatitis, pruritus, urticaria
   f. Neuromuscular & Skeletal
      - cramps, tremors, weakness, inflammation, joint stiffness

9. DOSAGE
   **Nifedipine XL Tablets**
   - for maintenance treatment of hypertension
   - not to be used for acute treatment
   - 20 - 60 mg bid, maximum dose 120 mg daily
   - must not be bitten, divided or crushed as this may cause a greater effect on blood pressure
   Supplied: 20 mg, 30 mg, 60 mg extended release tablets

   **Nifedipine capsules**
   - 5-10 mg repeated in 30 minutes if no response
     - to be swallowed whole
     - or bitten then swallowed, however, this may result in a greater effect on blood pressure
   Supplied: 5 mg and 10 mg capsules

10. MONITORING
    Maternal heart rate, blood pressure, signs and symptoms of congestive heart failure, peripheral edema, constipation, and orthostatic hypotension are to be monitored

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Frequency</th>
<th>Warning Signs</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP</td>
<td>Just prior to administration</td>
<td>A Systolic greater than</td>
<td>Avoid rapid fall in BP</td>
</tr>
</tbody>
</table>
### After administration:
- **Q 5 min for 30 minutes**
- **Q 30 min for 2**
- Hourly for up to 6 hours as needed then as indicated

**Diastolic less than 90 mmHg**
- Notify house staff or physician

### Heart rate

<table>
<thead>
<tr>
<th>Just prior to administration</th>
<th>After administration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 50bpm</td>
<td>Greater than 120bpm</td>
</tr>
</tbody>
</table>

- Notify house staff or physician

---

**Nifedipine (Adalat®) for the Obstetrical Patient**

<table>
<thead>
<tr>
<th>FHR</th>
<th>Continuous monitoring</th>
<th>Atypical or Abnormal fetal heart rate patterns</th>
<th>Intrauterine resuscitation measures.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Notify house staff or physician</td>
</tr>
</tbody>
</table>

---

### 11. PREGNANCY CATEGORY: C

### 12. LACTATION:  
Associated with a relative infant dose of less than 2 percent. The American Academy of Pediatrics (AAP) lists all formulations as compatible with breastfeeding.\(^{36}\)

### 13. REFERENCES

\(^{10}\)Family Physicians’ Guideline for Physician consultation and Transfer of Responsibility for Care  Edmonton Zone (2012). Zone Clinical Department Executive Committee – Edmonton, January, 2012

\(^{11}\)Midwifery Guidelines for Physician Consultation and Transfer of Responsibility for Care – Edmonton Zone. Zone Clinical Department Executive Committee – Edmonton, January, 2012


\(^{20}\)Micromedex® 2.0 Nifedipine. Downloaded September, 2014 from  

\(^{21}\)Nifedipine. Downloaded September, 2014 from  
HydrALAZINE (Apresoline®) for the Obstetrical Patient

1 PURPOSE
Treatment of severe hypertension
Treatment of hypertension secondary to pre-eclampsia/eclampsia

2 GENERAL INFORMATION
2.1 HydrALAZINE decreases systemic vascular resistance
2.2 HydrALAZINE causes vasodilation of arterioles with minimal effect on veins
2.3 Observe for a rapid fall in blood pressure

3 PRIMARY HEALTHCARE PROVIDER RESPONSIBILITIES
3.1 The family practice physician and/or the Midwife may require a consult or a transfer of care to an Obstetrician

4 PREGNANCY CONSIDERATIONS
4.1 HydrALAZINE crosses the placenta but is a drug of choice in the treatment of preeclampsia

5 NURSING PROTOCOLS
5.1 When using continuous intravenous infusion 1:1 nurse patient ratio
5.2 When using direct intravenous route 1:1 nurse patient ratio until BP is stabilized
5.3 Medical staff readily available
5.4 Resuscitation equipment readily available
5.5 Monitor closely for orthostatic hypotension during and following administration
5.6 Refer to monitoring parameters (section 11)

6 CONTRAINDICATIONS
6.1 Hypersensitivity to HydALAZINE
6.2 Acute dissecting aortic aneurysm
6.3 Mitral valve rheumatic heart disease
6.4 Myocardial insufficiency due to mechanical obstruction
6.5 Severe tachycardia and heart failure with a high cardiac output
6.6 Systemic lupus erythematosus and related diseases
6.7 Cor pulmonale

7 CAUTION
7.1 Caution when combined with MAOIs
7.2 May cause profound hypotension if administered with other parenteral antihypertensive medications
7.3 May reduce pressor response to epinephrine

Hydralazine (Apresoline for the Obstetrical Patient)

8 PHARMACOKINETICS

<table>
<thead>
<tr>
<th></th>
<th>Onset</th>
<th>Peak</th>
<th>Duration</th>
<th>Half Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydralazine IV</td>
<td>5–20 minutes</td>
<td>8 hours</td>
<td></td>
<td>2–8 hours</td>
</tr>
<tr>
<td>Hydralazine oral</td>
<td>20–30 minutes</td>
<td>1–2 hours</td>
<td>1–4 hours</td>
<td>2–8 hours</td>
</tr>
</tbody>
</table>

9 POTENTIAL SIDE EFFECTS

a. Central Nervous System
   - Headache, chills, fever, anxiety, dizziness
b. Cardiovascular
   - Palpitations, tachycardia chest pain, flushing, orthostatic hypotension, peripheral edema
c. Gastrointestinal
   - Anorexia, diarrhea, nausea, vomiting, paralytic ileus
d. Respiratory
   - dyspnea, nasal congestion
e. Hematologic
   - agranulocytosis, leucopenia, hemoglobin and erythrocyte count reduced
f. Hepatic
   - hepatotoxicity
g. Neuromuscular and Skeletal
   - muscle cramps, peripheral neuritis, weakness, rheumatoid arthritis
h. Immunologic
   - lupus-like syndrome
(Most common side effects are listed in italics)

10 DOSAGE

10.1 Hydralazine Direct IV or Intermittent IV infusion

10.2 Direct IV
   - 5 to 10 mg/dose initially then 5 to 10 mg every 20 to 30 minutes as needed
   - Titrade dose according to blood pressure
   - Administer as an undiluted solution or diluted solution up to a maximum concentration of 20 mg/mL
   - Give over 1 to 5 minutes at rates not exceeding 5 – 10 mg/minute

10.3 Hydralazine Continuous IV
   - Adjust rate according to blood pressure as ordered by physician
- Supplied: 20 mg/mL vial
- Reconstitute with 1 ml sterile water
- Add 50 mg HydrALAZINE to 500 mL of normal saline
- Concentration = 0.1 mg/mL
- Start infusion at 0.05 mg/minute, and increase rate every 15-30 minutes as ordered by physician until desired BP parameters are achieved
- Usual dose =0.1-0.2 mg/minute
- IV solution is stable for 24 hours at room temperature (does not apply to parenteral products mixed by pharmacy)
- When HydrALAZINE is diluted with IV fluids, a color change occurs over a 8 to 12 hour period. Color changes do not indicate loss of potency

HydrALAZINE (Apresoline for the Obstetrical Patient)

### Infusion Rates

<table>
<thead>
<tr>
<th>Pump Setting (mL/hr)</th>
<th>Dosage (mg/minute)</th>
<th>Dosage (mg/hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>0.05 mg/minute</td>
<td>3 mg/hour</td>
</tr>
<tr>
<td>45</td>
<td>0.075 mg/minute</td>
<td>4.5 mg/hour</td>
</tr>
<tr>
<td>60</td>
<td>0.1 mg/minute</td>
<td>6 mg/hour</td>
</tr>
<tr>
<td>75</td>
<td>0.125 mg/minute</td>
<td>7.5 mg/hour</td>
</tr>
<tr>
<td>90</td>
<td>0.15 mg/minute</td>
<td>9 mg/hour</td>
</tr>
<tr>
<td>105</td>
<td>0.175 mg/minute</td>
<td>10.5 mg/hour</td>
</tr>
<tr>
<td>120</td>
<td>0.2 mg/minute</td>
<td>12 mg/hour</td>
</tr>
</tbody>
</table>

10.4 HydrALAZINE Oral
- Not used in an obstetrical emergency

Supplied: 10, 25, 50 mg tablets

IV HydrALAZINE 20 -25 mg is approximately equal to 75 – 100 mg oral HydrALAZINE

11 MONITORING

<table>
<thead>
<tr>
<th>Parameter*</th>
<th>Frequency</th>
<th>Warning Signs</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP (direct IV)</td>
<td>Monitor BP every 5 minutes while treatment is initiated and then every 15 minutes until BP has stabilized, then every 30 minutes for 2 hours, then every hour or as ordered by Physician</td>
<td>Systolic BP greater than 160 mmHg Diastolic BP less than 90 mmHg</td>
<td>Avoid rapid fall in BP Notify house staff or physician</td>
</tr>
<tr>
<td>Heart rate (direct IV, IM)</td>
<td>Just prior to administration After administration</td>
<td>HR less than 50bpm HR greater than 120bpm</td>
<td>Notify house staff or physician</td>
</tr>
<tr>
<td>BP (continuous infusion)</td>
<td>Monitor BP every 5 minutes during infusion</td>
<td>Systolic BP greater than 160 mmHg Diastolic BP less than 90 mmHg</td>
<td>Avoid rapid fall in BP Notify house staff or</td>
</tr>
</tbody>
</table>
Table

| Heart rate (continuous infusion) | Just prior to administration and every 5 minutes during infusion | HR less than 50bpm | HR greater than 120bpm | Notify house staff or physician |
| FHR | Continuous electronic fetal heart rate monitoring | Atypical or Abnormal fetal heart rate patterns | Intrauterine resuscitation measures. Notify house staff or physician |
| Intake and Output | Monitor hourly | Urine output less than 30 ml per hour | Insert Foley Catheter | Notify house staff or physician |

12 REFERENCES


1.0 PURPOSE
Methyldopa is a deoxycarbolase inhibitor and is thought to lower arterial pressure through its effects on alpha-methylnorepinephrine.

2.0 GENERAL INFORMATION
2.1 Methyldopa is primarily excreted in urine and it is known to cross the placenta, be present in fetal cord blood, as well as in breast milk. Studies have shown no known congenital abnormalities or long term adverse effects in children exposed to the drug while in utero.

3.0 PRIMARY HEALTHCARE PROVIDER RESPONSIBILITIES
3.1 The family practice physician and/or the Midwife may require a consult or a transfer of care to an Obstetrician.\textsuperscript{iv,x}

4.0 CONTRAINDICATIONS
4.1 Patients on MAOI therapy
4.2 Hypersensitivity to methyldopa
4.3 Liver disease
4.4 Active hepatic disease
4.5 Anuria
4.6 Sulfonamide allergy

5.0 CAUTIOUS USE IN PATIENTS WITH
5.1 Patients on diuretics, other hypertensive drugs, tricyclic antidepressants, antipsychotics and beta blockers
5.2 Patients on entacapone.
5.3 Patients on methyldopa may require lower doses of general anesthetics
5.4 Congestive heart disease

6.0 PHARMACOKINETICS

<table>
<thead>
<tr>
<th>Route</th>
<th>Onset</th>
<th>Peak</th>
<th>Duration</th>
<th>Half Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral</td>
<td>varies</td>
<td>3-6 hours</td>
<td>12-24 hours</td>
<td>1 ½ hours</td>
</tr>
</tbody>
</table>
REFERENCES


x Midwifery Guidelines for Physician Consultation and Transfer of Responsibility for Care – Edmonton Zone. Zone Clinical Department Executive Committee – Edmonton, January, 2012


xv Royal College of Obstetricians and Gynaecologists (2006). Guideline No. 10(A) March 2006 The management of Severe Pre-Eclampsia/Eclampsia


xvii Chandiramani, M., & Shennan, A. (2008). Hypertensive disorders of pregnancy: a UK-based perspective. Downloaded November 20, 2011 form http://ovidsp.tx.ovid.com/sp-3.5.1a/ovidweb.cgi?WebLinkFrameset=1&S=IHPEFDPOLBDJJIEPNCALAFGCMDJAA00&returnUrl=ovidweb.cgi%3f%3fs%26Title%3ds.sh.18%257c1%257c10%26FORMAT%3dttitle%26FIELDS%3dtTITLES%26S%3diHFDPOLBDJJIEPNCALAFGCMDJAA00&directlink=http%3a%2f%2fgraphics.tx.ovid.com%2fovfthpdfs%2fFPDDNCGCAFEPLB00%2fs%2f046%2f0fivt%2flive%2fgv023%2f00001703%2f00001703-20080400-00004.pdf&filename=Hypertensive+disorders+of+pregnancy%3a+UK-
Magnesium Sulphate Infusion for Eclampsia Prevention in the Obstetrical Patient

PROCEDURE

1.0 PURPOSE
To reduce the risk of and/or control seizure activity associated with pre-eclampsia and eclampsia.
Prevention of recurrent eclamptic seizures

2.0 GENERAL INFORMATION
2.1 The exact mechanism of action is not well understood.
2.2 May decrease the amount of acetylcholine released at the myoneural junction thereby depressing neuromuscular transmission
2.3 May have a direct depressant effect on smooth muscle and may cause CNS depression

3.0 GENERAL PRACTITIONER/MIDWIFE’S RESPONSIBILITIES
3.1 The General Practitioner will have obtained a transfer of care to an Obstetrician prior to initiation of infusion
3.2 The Midwife will have obtained a transfer of care to an Obstetrician prior to initiation of infusion

4.0 CONTRAINDICATIONS
4.1 Any degree of heartblock
4.2 Impaired renal function and hypermagnesemia

5.0 PHARMACOKINETICS

<table>
<thead>
<tr>
<th>Route</th>
<th>Onset</th>
<th>Peak</th>
<th>Duration</th>
<th>Half Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV</td>
<td>Immediate</td>
<td>30 minutes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6.0 POTENTIAL HAZARDS/SIDE EFFECTS
6.1 Hypermagnesemia especially in patients with impaired renal function
6.2 flushing, sweating, hypotension, headache, shortness of breath, vomiting, bradycardia, slurred speech, diplopia
6.3 Hypocalcemia
6.4 Respiratory arrest
6.5 Loss of deep tendon reflexes

7.0 DOSAGE
- Must use an infusion pump to administer this medication I.V.

Bolus:
- 4 grams over 20 minutes = 120 mL/hour

Continuous IV
- Maintenance 1 – 2 grams/hour

Supplied
- Premixed by Pharmacy as 50 grams of Magnesium Sulfate in 500 mL of 2/3-1/3 or Normal Saline
- 25 grams of Magnesium Sulfate per 50 mL glass vial (500 mg/mL)
10.0 EQUIPMENT
10.1 IV Solution 1000mL Ringers Lactate or normal saline for control
10.2 Premixed Magnesium Sulfate (MgSO\(_4\)) Solution 50g/500mLs in 2/3 – 1/3
10.3 Alaris IV tubing x 2
10.4 Alaris Pump with minimum of 2 channels
10.5 IV tray / IV equipment
10.6 Fetal monitor
10.7 BP cuff (mechanical preferred)
10.8 Reflex hammer

11.0 PROCEDURE
4.1 Check the chart to ensure physician’s order is written.
4.2 Explain the procedure to the patient.
4.3 Ensure oxygen and suction available at bedside and functional.
4.4 Prepare Control solution of 1000mL of Ringer’s Lactate. Control solution should be primed through Alaris tubing.
4.5 Prime a second Alaris IV tubing with the pre-mixed MgSO\(_4\) solution supplied by Pharmacy. Attach tubing to Alaris pump.
4.6 Establish IV with control solution.
4.7 Attach control solution tubing to Alaris pump.
4.8 Run Control infusion at 50mL/hour until MgSO\(_4\) infusion is started.
4.9 Perform baseline assessment of mother and fetus.
   a. BP, pulse, respirations
   b. Deep tendon reflexes
   c. Contractions
   d. Fetal heart rate
   e. Document in progress notes
4.10 Position patient preferably in left lateral position.
4.11 Piggyback MgSO\(_4\) solution to port on control solution tubing.
4.12 Program Alaris pump for MgSO\(_4\) infusion
   a. Two RNs are required to set the parameters on the infusion pump prior to commencing the MgSO\(_4\) infusion.
4.13 Administer 4 grams loading dose of MgSO\(_4\) solution over 20 minutes or as ordered.
4.14 At completion of 4 gm bolus Loading Dose, Alaris pump will automatically switch to the set maintenance dose as ordered. (see section 13.0 to program the Alaris pump)

12.0 NURSING RESPONSIBILITIES
12.1 Constant attendance is required during the loading dose
12.2 One to one nursing is recommended while Magnesium Sulfate is infusing
12.3 An infusion pump is required to administer and maintain infusion
12.4 Obtain premixed solution from Pyxis (or prepare solution as per procedure if premix not available).
12.5 Continuous fetal monitoring
12.6 Maternal vital signs as per Monitoring Parameters below (10.0)

13.0 **TO PROGRAM THE ALARIS PUMP FOR A MAGNESIUM SULPHATE INFUSION.**

13.1 Confirm ‘adult general’ profile
13.2 Select guardrails drugs on Alaris panel
13.3 Choose magnesium sulfate continuous
13.4 Select ‘eclampsia’
13.5 Concentration-choose 50 gm/500mLs
13.6 Verify
13.7 Program continuous rate first, by entering dose, rate, and volume to be infused as ordered
13.8 Program bolus dose second, by entering dose and duration as ordered
13.9 Start Alaris pump
13.10 Bolus dose will start infusing
13.11 Once bolus dose complete, ensure continuous infusion rate infusing

14.0 **MONITORING PARAMETERS**

14.1 Assess patient as per chart below and document parameters on appropriate records.

<table>
<thead>
<tr>
<th>Parameter*</th>
<th>Frequency</th>
<th>Loading Dose</th>
<th>Maintenance dose</th>
<th>Signs of Toxicity</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP</td>
<td>Q 5 minutes</td>
<td>Q 15 minutes for <strong>first</strong> hour then Q1h X 4 then Q4h or as ordered</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse</td>
<td>Q 5 minutes</td>
<td>Q 30 minutes or as ordered</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respiration</td>
<td>Q 5 minutes</td>
<td>Q 30 minutes or as ordered</td>
<td>Respiration less than 14 or greater than 26</td>
<td>Stop MgSO4 Notify house staff/physician/resident</td>
<td></td>
</tr>
<tr>
<td>Breath sounds</td>
<td>Prior to start of loading dose</td>
<td>Q 2 hours or as ordered</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deep Tendon Reflexes (DTRs)</td>
<td>Prior to start of loading dose</td>
<td>Q 1 hour or as ordered. At change of shift, the outgoing and incoming nurse will check DTR’s together to ensure consistent measurement</td>
<td>Absent patellar reflexes Loss of deep tendon reflexes</td>
<td>Stop MgSO4 Notify house staff/physician/resident</td>
<td></td>
</tr>
<tr>
<td>Intake and Output</td>
<td>Q 1 hour or as ordered Use of urinary urometer is recommended</td>
<td>Less than 30ml (CHA Regional Pharmacy 2005)</td>
<td>Notify house staff or physician</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level of Consciousness</td>
<td>Q 5 minutes</td>
<td>Q 1 hour or as ordered</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
15.0 DOCUMENTATION
15.1 Ensure documentation on the appropriate records on the following parameters: hourly intake and output, IV therapy, Medication(s), vital signs, fetal heart rate parameters, signs of labour

**Note:** Stop MgSO₄ and notify Primary Care Provider if any signs of MgSO₄ toxicity are present
- Altered level of consciousness
- Decreased respirations (less than 14)
- Absent deep tendon reflexes

16.0 MANAGEMENT DURING AN ECLAMPTIC SEIZURE
16.1 Ensure environment is safe and protect from harm
16.2 Call for additional help
16.3 Ensure the suction and oxygen are ready
16.4 Prepare the medications that are likely to be needed
16.5 Position in left lateral
16.6 Ensure airway is clear
16.7 Administer oxygen by mask at 8-10 L
16.8 Restart continuous fetal monitoring when seizure ends
16.9 Monitor maternal BP, pulse, and respirations
16.10 Monitor oxygen saturations
16.11 Ensure IV access and Magnesium Sulfate is infusing
16.12 Communicate with the family
16.13 Document

17.0 MANAGEMENT OF TOXICITY
17.1 When infusing Magnesium Sulfate have immediately available
- MgSO₄ antidote CALCIUM GLUCONATE 1g (10mL) of a 10% solution administered I.V. over 3 minutes
- Reflex hammer

18.0 MIXING MAGNESIUM SULFATE SOLUTION
In the event that a premixed bag of Magnesium Sulfate solution is not available
- Draw up 2 – 25 gram vials of MgSO₄ (50mL per vial = 500 mg/mL)
  - use filter straw for glass ampoules (see Fluid Therapy Manual “Use of Filter Straw”).
- Withdraw 100mL from a 500 mL I.V. bag of 2/3 + 1/3 or Normal saline
- Add the 50 grams of MgSO₄ (100 mL) to the remaining 400mL I.V. solution bag
- Concentration = 1 gram /10mL
19.0 REFERENCES


11 Midwifery Guidelines for Physician Consultation and Transfer of Responsibility for Care – Edmonton Zone. Zone Clinical Department Executive Committee – Edmonton, January, 2012 Alberta Health Services


Royal College of Obstetricians and Gynaecologists (2006). Guideline No. 10(A) March 2006 The management of Severe Pre-Eclampsia/Eclampsia


Chandiramani, M., & Shennan, A. (2008). Hypertensive disorders of pregnancy: a UK-based perspective. Downloaded November 20, 2011 form http://ovidsp.tx.ovid.com/sp-3.5.1a/ovidweb.cgi?WebLinkFrameset=1&S=IHPEFPDLOBDDJIEPNCALAFCGMDJAA00&returnUrl=ovidweb.cgi%3f%3f%26Titles%3dsh.18%257c1%257c12%257c10%26FORMAT%3ddie%26FIELDS%3ddtitles%26S%3diHPEFPDLOBDDJIEPNCALAFCGMDJAA00&directlink=http%3a%2f%2fgraphics.tx.ovid.com%2fovftpdf%2fPPDNCGCAFEPLB00%2fs046%2f0vft%2fF%2flive%2fsvg023%2f00001703%2f00001703-200804000-00004.pdf&filename=Hypertensive+disorders+of+pregnancy%3aa+uk-


Troiana, Nan H., Harvey, Carol J., Flood Chez, Bonnie, AWHONN High-Risk and Critical Care Obstetrics, third edition, 2013, Lippincott Williams and Wilkins

Alberta Health Services, Insite, Pharmacy Services, Lexicomp Online available at http://online.lexi.com/lco/action/home?siteid=1

The American College of Obstetricians and Gynecologists Hypertension in Pregnancy 2013

