## Summary
The TESS Ad Hoc Advisory Working Group

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Appendix A
This guideline reflects both the variable presentation and the systemic nature of gestational hypertension with proteinuria and/or adverse conditions (referred to as pre-eclampsia in this guideline) and the other hypertensive disorders of pregnancy. Recommendations for the comprehensive evaluation and management of organ dysfunction associated with pre-eclampsia are included.

The main points in the guideline are:

1. Pre-eclampsia is a systemic disorder that may affect many organ systems.
2. For pre-eclampsia remote from term (<34 weeks), expectant management is associated with improved perinatal outcomes. Expectant management requires obsessive surveillance to mitigate maternal risks and is a “package”.
3. Initial assessment and ongoing surveillance of women with a hypertensive disorder of pregnancy should include assessment of all vulnerable maternal organs as well as the fetus. A set of standardized orders is included in Appendix A.
4. Initiate antihypertensive drug treatment:
   - Immediately (in the absence of pre-pregnancy renal disease or diabetes)
     - SBP ≥160 mmHg or DBP ≥110 mmHg
     - SBP 140-159 mmHg and/or DBP 85-109 mmHg, based on practitioner preference, training, and experience
   - In the presence of pre-pregnancy renal disease or diabetes
     - SBP >140 mmHg or DBP >90 mmHg
5. Recommended treatment of non-severe hypertension in pregnancy
   - Treatment goal: DBP 80-105 mmHg (depending on practitioner preference)
     - First choice agent: Methyldopa (Aldomet)
     - Second choice agents: Labetalol (Trandate); Nifedipine (Adalat PA or XL)
     - Special indications (renal or cardiac diseases): diuretics
6. Drugs to avoid: angiotensin-converting enzyme inhibitors; angiotensin II receptor antagonists; atenolol
7. Acute management of severe hypertension
   - Reduce DBP by 10 mmHg in the first instance and maintain the blood pressure at or below that level.
     - First choice agent: Nifedipine
     - Second choice agent: Labetalol
8. Anticonvulsant therapy
   - Prophylaxis: MgSO₄ (4g IV stat, then 1g/hr)
   - Management of eclampsia: MgSO₄ (4g IV stat, then 1g/hr)
   - Management of recurrent seizures: MgSO₄ (2g IV stat, then increase to 1.5g/hr)
9. Fluids: total intake should not exceed 80 ml/hr; tolerate urine outputs as low as 10 ml/hr.
1. INTRODUCTION

This guideline has been developed to reflect both the variable presentation and the systemic nature of pre-eclampsia and the other hypertensive disorders of pregnancy. The recommendations are derived from the pattern of investigation used in other centres of excellence, in response to international guidelines, in response to current practice across Canada, and preliminary evidence that it may be possible to predict those women most at risk of doing poorly. It must be remembered that up to 40% of women who develop eclampsia (seizures) will not have had both hypertension and proteinuria in the week preceding their first seizure. Therefore, to proffer the greatest safety to women, we should consider (and continue to consider) pre-eclampsia in all women presenting with either hypertension or proteinuria in pregnancy, as well as those women who present with the symptoms of pre-eclampsia in the absence of both hypertension and proteinuria.

Pre-eclampsia remains the most common cause of maternal mortality in North America, and it is apparent that the surveillance of women with suspected or confirmed pre-eclampsia is variable between practitioners. In an era of effective blood pressure control, it is end organ failure (especially hepatic and respiratory complications) that most commonly causes women to die from pre-eclampsia. This guideline includes recommendations for the comprehensive evaluation of organ dysfunction.

The pattern of investigations presented in this guideline aims to standardize the approach to care within British Columbia, with consideration that the choice of Mondays to Thursdays provides the best timing for delivery of infants (away from Friday evenings and weekends). Of course, some or all of these investigations may be performed at other additional times, at the discretion of the attending physician.

Since the introduction of the pre-printed physician orders (Appendix A) in September 2003, the incidence of an internationally-determined combined adverse maternal outcome has fallen from 5.1% to 0.8% (p<0.05) in those women admitted to BC Women’s Hospital and Health Centre with pre-eclampsia for whom these orders were used.

2. RELEVANCE

The following data is from the British Columbia Perinatal Database Registry for fiscal years 2001/02, 2002/03, and 2003/04. During this three-year period, there were a total of 119,387 pregnancies (singleton and multiples) of which 6,691 (5.6%) were complicated by hypertension, and 112,696 were non-hypertensive pregnancies. For this dataset, hypertension is defined as any of the following conditions (classified by ICD 10 codes):

- O10: Pre-existing hypertension complicating pregnancy, childbirth and the puerperium
- O11: Pre-existing hypertensive disorder with superimposed proteinuria
- O13: Gestational [pregnancy-induced] hypertension without significant proteinuria
- O14: Gestational [pregnancy-induced] hypertension with significant proteinuria
- O15: Eclampsia

The provincial rates for hypertensive disorders of pregnancy (HDP) by fiscal year were 5.5% in 2001/02, 5.7% in 2002/03, and 5.7% in 2003/04. As expected, due to increasing maternal age at first pregnancy, frequency of multiple births, and rates of obesity (all independent risk factors for the HDP), BC experienced an increased incidence in the HDP from fiscal years 2001/02 to 2003/04.

Of the 6,691 pregnancies which were complicated by hypertension during this three-year period, 68% were gestational [pregnancy-induced] hypertension without significant proteinuria, 19% were gestational [pregnancy-induced] hypertension with significant proteinuria, 9% were pre-existing hypertension complicating pregnancy, childbirth and the puerperium, 2% were pre-existing hypertensive disorder with superimposed proteinuria, and 2% were eclampsia.
2.1 ADVERSE MATERNAL OUTCOME

When evaluating pregnancy complications in BC, serious maternal morbidity is a more relevant outcome to use than maternal mortality, as mortality is a rare event. When adverse maternal outcomes are compared between hypertensive pregnancies (N=6,691) and non-hypertensive pregnancies (N=112,696) for fiscal years 2001/02 to 2003/04, women with HDP have higher rates of: oligohydramnios 5.1% versus 2.2%, abruption 1.88% versus 1.15%, pulmonary oedema 0.28% versus 0.02%, and acute renal failure 0.09% versus 0.01%.

2.2 ADVERSE NEONATAL OUTCOME

For fiscal years 2001/02 to 2003/04, there were a total of 121,085 (singleton and multiple) infants born. Of these, 6,952 infants were born of women with pregnancy complicated by hypertension, and 114,133 were born of women with non-hypertensive pregnancies. Rates of adverse neonatal outcomes for those infants born of women with pregnancy complicated by hypertension are compared with infants born of women with non-hypertensive pregnancies.

Outcomes include: birth weight (BW) less than 10th percentile 12.1% versus 7.15%, BW less than 3rd percentile 4.96% versus 2.36%, admission of term newborns (>37 weeks gestational age) to level III NICU 1% versus 0.5%, 5-minute APGAR score less than three 0.89% versus 0.66%, umbilical artery pH less than seven 0.58% versus 0.19%, and intermittent positive pressure ventilation greater than five minutes 0.42% versus 0.24%.

3. RISK FACTORS

- Family history
- Extremes of reproductive age
- Primigravida
- Multiple gestation
- Diabetes, renal disease, hypertension prior to pregnancy
- Collagen vascular disease
- No mid-trimester fall in blood pressure
- Excessive weight gain (>1kg/wk; >2lbs/wk)
- Finger and facial oedema

4. CLASSIFICATION

4.1 MEASUREMENT OF BLOOD PRESSURE

Blood pressure should be measured:

- With the patient resting at 45˚ supported and with the upper arm at the level of the heart
- Using a cuff size that is appropriate as too small a cuff will overestimate blood pressure and too large a cuff will underestimate blood pressure
- Using manual sphygmomanometry – either a mercury device or a calibrated aneroid device is the standard. Automated devices, most of which are deflationary, may underestimate both systolic and diastolic values by 10-15 mmHg, especially in women with pre-eclampsia. Automated devices may be useful to follow trends in blood pressure, but in women considered to be at high risk these measurements should be validated against manual readings on a regular basis.

- Using Korotkoff V (disappearance of pulse sounds) for diastolic blood pressure as this value is more consistent and is the international standard.
4.2 CURRENT CANADIAN HYPERTENSION SOCIETY (CHS) DEFINITIONS

In these guidelines, ‘severe pre-eclampsia’ is generally synonymous with the Canadian Hypertension Society (CHS) definition of ‘gestational hypertension ± proteinuria with adverse conditions.’ We have adapted the Yorkshire guidelines to be consistent with the current CHS definition of adverse conditions, with the addition of severe systolic hypertension and either eclampsia or HELLP syndrome arising in the absence of hypertension and/or proteinuria.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Pre-existing hypertension</strong></td>
<td>Diastolic hypertension that predates pregnancy or is diagnosed before 20 weeks gestation. In most cases hypertension persists &gt; 42 days postpartum. It may be associated with proteinuria.</td>
</tr>
<tr>
<td>1. Essential</td>
<td>Primary.</td>
</tr>
<tr>
<td>2. Secondary</td>
<td>Secondary to such conditions as renal disease, phaeochromocytoma and Cushing syndrome.</td>
</tr>
<tr>
<td><strong>B. Gestational hypertension</strong></td>
<td>Diastolic hypertension develops after 20 weeks gestation. In most cases it resolves &lt; 42 days postpartum.</td>
</tr>
<tr>
<td>1. Without proteinuria</td>
<td>Corresponds to previous terminology such as “pregnancy induced hypertension” and “non-proteinuric hypertension”. Protein excretion in 24-hour urine collection is &lt; 0.3 g/d.</td>
</tr>
<tr>
<td>a. Without adverse conditions</td>
<td></td>
</tr>
<tr>
<td>b. With adverse conditions</td>
<td>Convulsions (eclampsia), very high diastolic pressure (&gt;110 mmHg), thrombocytopenia (platelet count &lt;100 x 10^9/L), oliguria (&lt; 500 ml/d), pulmonary oedema, elevated liver enzyme levels, severe nausea and vomiting, frontal headache, visual disturbances, persistent abdominal pain in right upper quadrant, chest pain or shortness of breath, suspected abruptio placentae, HELLP syndrome, IUGR, oligohydramnios, or absent or reversed umbilical artery end diastolic flow as determined by Doppler velocimetry.</td>
</tr>
<tr>
<td>2. With proteinuria</td>
<td>Corresponds to alternative terminology such as “pre-eclampsia”, “pre-eclamptic toxaemia” and “toxaemia”. Protein excretion in 24-hour urine collection is &gt; 0.3 g/d.</td>
</tr>
<tr>
<td>a. Without adverse conditions</td>
<td></td>
</tr>
<tr>
<td>b. With adverse conditions</td>
<td>Same conditions as in 1b; protein excretion &gt;3 g/d 24-hour urine collection, especially with hypoalbuminaemia (albumin level &lt;18 g/L).</td>
</tr>
<tr>
<td><strong>C. Pre-existing hypertension + superimposed gestational hypertension with proteinuria</strong></td>
<td>Pre-existing hypertension (as defined in A) associated with further worsening of pressure and protein excretion &gt; 0.3 g/d in 24-hour urine collection after 20 weeks gestation. Corresponds to alternative terminology “chronic hypertension with superimposed pre-eclampsia”.</td>
</tr>
<tr>
<td><strong>D. Unclassifiable antenatally</strong></td>
<td>Hypertension with or without systemic manifestations if blood pressure was first recorded after 20 weeks gestation. Reassessment is necessary at or after 42 days postpartum. If the hypertension has resolved by then, the condition should be reclassified as gestational hypertension with or without proteinuria; if the hypertension has not resolved by then, the condition should be reclassified as pre-existing hypertension.</td>
</tr>
</tbody>
</table>
5. PATHOPHYSIOLOGY

Pre-eclampsia is a multisystem disease, with variable progression leading to signs and symptoms requiring imminent treatment. Pre-eclampsia is associated with generalized vasospasm and progressive involvement of essential organs such as the kidney, liver, brain, and haematological systems. Maternal endothelial cell damage associated with the release of substances from the poorly perfused placenta initiates a dysfunctional cascade of coagulation, vasoconstriction and intravascular fluid redistribution that results in the clinical syndrome of pre-eclampsia/eclampsia. The following diagram models the pathogenesis of pre-eclampsia (Figure 1).

![Diagram of pre-eclampsia pathogenesis](image)

Figure 1. The pathogenesis of pre-eclampsia.

In this model of pre-eclampsia, the maternal syndrome develops from a number of alternative pathways leading to uteroplacental mismatch, whereby the fetoplacental demands outstrip the maternal circulatory supply. In response to the mismatch, and probably due in part to recurrent ischemia-reperfusion injury within the intervillous (maternal blood) space of the placenta and accelerated placental apoptosis, a soup of endothelium-damaging substrates is released with resulting endothelial cell activation and consequent development of the maternal syndrome of pre-eclampsia. Some elements of the soup, namely activated peripheral blood leukocytes, can cause direct end-organ damage. There is cross-talk between elements of the soup (not illustrated).

ARDS: acute respiratory distress syndrome
ATN: acute tubular necrosis
DIC: disseminated intravascular coagulation
PBLs: peripheral blood leukocytes
PGs: eicosanoids
ROS: reactive oxygen species+

5.1 PLACENTAL INVOLVEMENT

When inadequate fetal vascular development, recurrent ischemia-reperfusion injury, and vasospasm affect the uteroplacental bed, fetoplacental demands outstrip the maternal circulatory supply. The fetus then becomes growth restricted and at increased risk of stillbirth and neonatal death. The incidence of IUGR in the context of pre-eclampsia ranges from 30-80%, and the majority of IUGR is associated with early-onset disease. At term, there is an increased incidence of pre-eclampsia in women with macrosomic fetuses.

5.2 HELLP SYNDROME, LIVER AND PERIPHERAL VASCULAR INVOLVEMENT

HELLP syndrome may develop in a setting of minimal changes in blood pressure and all the features below may not be present in individual patients:

- Haemolysis
- Elevated liver enzymes
- Low platelets

Vasospasm and inflammatory infiltrates affecting the liver lead to elevated liver enzymes. In addition, peripheral vascular vasospasm and coagulation cascade activation in the microcirculation leads to sequestration and activation of platelets peripherally with destruction of red blood cells.

5.3 KIDNEY INVOLVEMENT

Kidney involvement in pre-eclampsia leads to glomerular endotheliosis and excretion of protein. This prognostic sign is associated with poorer outcomes:

- Two fold increase in perinatal mortality
- The development of oliguria

5.4 CENTRAL NERVOUS SYSTEM INVOLVEMENT

Cerebral vasospasm in combination with haemorrhage, ischaemia, and oedema of the cerebral hemispheres leads to:

- Seizures
- Frontal headaches
- Occipital headaches
- Hemiplegia
- Visual disturbances
5.5 CARDIOVASCULAR: LEFT VENTRICULAR FAILURE
As a result of:
• Vasospasm
• Increased capillary permeability causing pulmonary oedema
• Cardiomyopathy of pre-eclampsia

5.6 PULMONARY OEDEMA

6. INDICATIONS FOR OUTPATIENT ASSESSMENT AND OFFICE MANAGEMENT
• Blood pressure: sBP < 140 mmHg and dBP < 90 mmHg
• Proteinuria: 1+ or less on dipstick on one occasion
• No adverse features
• Normal platelet count

In the presence of any of the above signs, closer surveillance should include:
• Frequent office visits (every 3 to 4 days)
• Close maternal and fetal assessment
• Patient education regarding decreased activity and home/childcare assistance

Weekly assessment of:
• CBC, including platelets
• Uric acid (an elevated uric acid helps with the diagnosis of gestational hypertension)
• Liver enzymes

Once hypertension and proteinuria have evolved, it is likely that a woman will be delivered for either maternal or fetal indications within two weeks.

7. INDICATIONS TO CONSIDER HOSPITALIZATION
• sBP ≥ 140 mmHg and/or dBP ≥ 90 mmHg
• Repeated proteinuria 1+ or greater on dipstick or protein:creatinine ratio >30 mg protein per mmol creatinine
• Hyperuricaemia (uric acid >350 mM)
• Platelet count <100 x 10⁹/L
• Any adverse features
• Ultrasound evidence of oligohydramnios or inadequate fetal growth.

Once hospitalized, a decision should be made whether to pursue conservative management or to proceed to immediate delivery.

7.1 INDICATIONS FOR CONSERVATIVE HOSPITAL MANAGEMENT
• Stable, well-controlled blood pressure (sBP <160 mmHg / dBP <110 mmHg), and on less than maximal oral antihypertensive therapy for at least two agents (i.e., 1200 mg labetalol/d + 2000 mg methyldopa/d + Adalat PA/XL 90 mg/d).
• Proteinuria ≤ 2+ on dipstick (<1g/day or <100 mg/mmol by PCR); this marker of disease severity may not exclude conservative management at gestational ages remote from term, a plasma albumin <20 g/L places the patient at greatly increased risk of pulmonary oedema, and should be considered a contraindication for conservative management.
• Platelet count > 100 x 10⁹/L; this marker of disease severity may not exclude conservative management at gestational ages remote from term, depending on the rate of platelet count fall, and the presence or absence of concomitant liver enzyme abnormalities or coagulopathy.
• Fetal assessment
  i. Deepest amniotic fluid pocket >2 cm on ultrasound.
  ii. Non-stress test without decelerations at gestational ages remote from term.
  iii. End diastolic flow present on umbilical artery Doppler; at gestational ages <34 weeks, absent end diastolic flow does not necessarily mandate delivery, but certainly does mandate very close surveillance. Reversed end diastolic flow on umbilical artery Doppler is an indication for delivery.

The most important factor in determining conservative management is gestational age. The presence of gestational hypertension with proteinuria at gestational age ≥ 34 weeks may signify need for delivery, depending upon:
• Progression of the disease
• Assessment of the fetus
• Status of the cervix
If the gestational age is <34 weeks, management must balance maternal risks against fetal benefits. Patient delivery may be delayed if:

- Blood pressure is controlled (i.e., sBP <160 mmHg and dBP <110 mmHg)
- Fetal assessment remains within tolerable limits (see above)
- Platelet count remains >50 - 100 x 10^9/L, depending on practitioner expertise, training and comfort

The evidence supports conservative management of patients with adverse features between gestational ages of 24 to 32 weeks in tertiary care centres in a modified intensive care unit with physicians very familiar with disease process. Studies suggest that conservative management of patients at gestational ages < 24 weeks is associated with serious maternal complications and pregnancy termination should be considered. Under these circumstances, the patient may be eligible for experimental therapy.

The BC Women’s Maternal-Fetal Medicine Team (604-875-2161) is available to give advice as needed.

### 7.2 CONSERVATIVE MANAGEMENT

- Bed rest
- Initial assessment and ongoing surveillance (as per Physician Orders, Appendix A)
- Fetal assessment including non-stress tests and / or ultrasound surveillance (full biophysical profile or AFI/umbilical artery Doppler)
- Daily assessment by the physician with close attention to:
  - Weight gain
  - Blood pressure variation over the previous 24 hours
  - Proteinurin levels
  - Fetal movement
  - General symptoms
- Use steroids if < 34 weeks

### 8. SEVERE PRE-ECLAMPSIA

#### 8.1 DEFINITIONS

Severe pre-eclampsia (generally synonymous with ‘gestational hypertension with/without proteinuria

with one or more adverse conditions’) is defined as the occurrence of one/more of the following elements (outlined in sections 8.1.1 - 8.1.5).

#### 8.1.1 Adverse conditions

**Maternal symptoms:**
- severe nausea and vomiting
- frontal headache
- visual disturbance
- persistent epigastric or right upper quadrant pain
- chest pain
- shortness of breath

**Maternal signs:**
- diastolic blood pressure of or over 110 mmHg (dBP >110 mmHg)
- oliguria (<500 ml/d)
- pulmonary oedema
- suspected abruptio placentae

**Maternal labs:**
- platelets <100 x 10^9/L
- elevated liver enzymes (AST and/or ALT)
- plasma albumin <18 g/L
- heavy proteinuria (>3 g/d)

**Fetal Assessment**
- intrauterine growth restriction
- oligohydramnios
- absent or reversed end diastolic flow on umbilical artery Doppler

#### 8.1.2 Severe systolic hypertension

- sBP ≥160 mmHg (based on 3 blood pressure readings in a 15 minute period)

#### 8.1.3 Eclampsia

In clinical practice there are no reliable clinical markers to predict eclampsia (seizures). The following are thought to predict the onset of eclampsia. However, even when these symptoms are present, in most instances eclampsia does not develop:

- Severe headaches (especially occipital headaches)
- Brisk reflexes >3+ (3+ is hyperactive without clonus, 4+ is hyperactive with
unsustained clonus, 5+ is hyperactive with sustained clonus
• Visual disturbances

8.1.4 HELLP syndrome (partial/complete)

8.1.5 Other signs of CNS disturbance (from Yorkshire guidelines)
• Signs of clonus (>3 beats)
• Papilloedema

9. MANAGEMENT OF SEVERE PRE-ECLAMPSIA

9.1 FOR PHARMACOLOGICAL MANAGEMENT OF SEVERE HYPERTENSION, SEE SECTION 10.2
FOR PROPHYLAXIS AND TREATMENT OF ECLAMPSIA, SEE SECTION 11

9.2 GENERAL MEASURES
The woman should be assessed and managed in a quiet, well-lit room in a high dependency care type situation.
• Ideally there should be one-on-one nursing care; at least initially, when the stability of the condition is being assessed.
• After initial assessment, transfer should be considered for maternal or perinatal reasons depending on the capacity of the local facility.
• Expectant management requires obsessive surveillance to mitigate maternal risks and is a “package”.
• Critical care flow charts should be commenced to record all physiological monitoring and investigation results. All flow charts should be for a continuous 24 hour period of high dependency care. A new flow chart should not be started until the previous one has a full 12 hour assessment. All treatments should be recorded.
• Consider involving a consultant obstetrician (even if only by telephone) and, if possible, either a consultant anesthesiologist/GP anesthesiologist or consultant internist depending on local practice. Consultants should be involved at an early stage in management.
• When oral antihypertensive treatment is possible, it should be regarded as the route of choice.

• An intravenous cannula should always be inserted. Intravenous fluid should be by controlled volumetric pump. Fluid administration should be judicious.

9.3 BASIC INVESTIGATIONS
Baseline investigations should follow those on the Physician Orders for Gestational Hypertension (Appendix A). The orders listed are the minimum required, and may need to be repeated at more frequent intervals in response to changing symptoms or signs. As such, orders may be repeated at the discretion of the clinician. Although this list is longer than standard for most units, the incremental increase in cost is small.

9.4 MATERNAL ASSESSMENT/MONITORING
• Blood pressure and pulse should be measured every 15 minutes for a minimum of 4 hours until stabilized and then half hourly (footnote1) (i.e., q15 min for >4h, then q30 min).
• At least initially, an indwelling catheter should be inserted and urine output measured hourly whenever intravenous fluids are given. All urine should be tested for proteinuria. Urine outputs as low as 10 ml/hour should be considered adequate in the absence of pre-existing renal disease. The UK Confidential Enquiries into Maternal Deaths have found that excess maternal mortality is associated with aggressive fluid use and not with transient renal compromise.18
• Fluid administration should be judicious and fluid balance should be monitored very carefully. Detailed input and output recordings should be charted (i.e., q1h). Careful fluid balance is aimed at avoiding fluid overload. Total IV input should be limited to 80 ml/hour (approximately 1 ml/kg/hr, using current weight). If oxytocin is used, it should be at high concentration (20 U/500 ml NS/Ringers) and the volume of fluid included in the total input. Oliguria at this point should not precipitate any specific intervention except to lower thresholds for considering early delivery. As these women are at high risk of Caesarean section, oral fluids should also be limited.
• Oxygen saturation should be measured continuously and charted with blood pressure. If saturation falls below 95% then medical review is essential.

1. Initially check BP manually and compare with automated readings, as there can be a difference between the two. Then when using an automated machine take the difference into account – remember you are observing for trends.
• Respiratory rate should be measured q1h (count for a full minute).
• Temperature should be measured q4h.
• When present, CVP should be measured continuously and charted with the blood pressure.

9.5 FETAL ASSESSMENT
• Non-stress test (cardiotocograph) (prior to administration of MgSO₄, if possible).
• Unless the situation mandates immediate delivery, an initial ultrasound for growth, amniotic fluid assessment, and umbilical artery Doppler flow velocity waveform are advised.

9.6 THROMBOPROPHYLAXIS
• All women should have anti-embolic stockings and/or heparin whilst they are immobile during the entire antenatal, intrapartum, and postpartum periods. Women with pre-eclampsia are at particularly increased risk for thromboembolic disease as their condition resolves.¹⁸

  • Unfractionated heparin 5000 IU sc twice daily (bid) should be given until the woman is fully mobile. A prophylactic dose of low molecular weight heparin (LMWH) can be used postpartum.¹⁹,²⁰

  • Many clinicians do not see the use of unfractionated heparin as a contraindication to the insertion of an epidural, providing there is no evidence of a coagulopathy. Ideally the epidural would be inserted 1 hour prior to the next dose of unfractionated heparin, as there is a subset of patient who become therapeutically anticoagulated during sc heparin therapy. As unfractionated heparin has its peak effect between 2 and 6 hrs following its administration it probably is wise to avoid that time period for insertion of an epidural unless the APTT is normal.¹⁹,²⁰

  • Low molecular weight heparin is being used more widely in obstetric patients. Monitoring of the anti-Xa level is not recommended as it is not predictive of the risk of bleeding. Regional anaesthesia should not be done within 12 hours of administration of LMWH for thromboprophylaxis. Women receiving LMWH for therapeutic anticoagulation should not receive regional anaesthesia for 24 hours after the last dose to ensure normal hemostasis. An epidural catheter should be removed 10-12 hours after the last dose of LMWH. Subsequent LMWH dosing should occur a minimum of 2 hours after catheter removal. If bleeding occurs during insertion of neuraxial anaesthesia initiation of LMWH therapy should be delayed 24 hours.¹⁹,²⁰

10. PHARMACOLOGICAL TREATMENT OF HYPERTENSION DISORDERS IN PREGNANCY ²¹-²³

It is clinically important to recognize that while acute hypertensive management to prevent maternal cerebral vascular accident is useful, rapid change in maternal perfusion pressure can cause profound alterations in uteroplacental perfusion and oxygen delivery that can precipitate non-reassuring FHR changes. All of these changes can be magnified in the presence of MgSO₄ which also has the potential to produce peripheral vasodilatation.

Care must be taken to avoid rapid and profound changes in maternal blood pressure. Therefore, each of these antihypertensive medications must be carefully titrated when considering acute management.

It must be noted that there is no evidence that antihypertensive agents alter fetal heart rate patterns.²⁴ Therefore, should the fetal heart rate pattern deteriorate following the initiation of antihypertensive medication, those changes should be ascribed to deteriorating placental function, and not to the medications themselves.

Control of blood pressure is essential to prevent maternal morbidity. Antihypertensive drug usage should aim to decrease the dBP <110 mmHg. A significantly lower diastolic blood pressure may cause decreased placental perfusion, and fetal compromise.

After severe hypertension has been addressed, there are insufficient data to determine the blood pressure associated with optimal maternal and perinatal outcomes. ‘Less tight’ control (i.e., dBP 90-109 mmHg) is associated with more transient hypertension. ‘Tight’ control or normalizing maternal blood pressure (i.e., dBP <90 mmHg) may adversely effect fetal growth.¹³,²⁵

Aim to reduce sBP <160 mmHg and dBP <110 mmHg, slowly and carefully.

10.1 INITIATION OF ANTIHYPERTENSIVE DRUG TREATMENT ²¹-²³

A. Immediately (in the absence of pre-pregnancy renal disease or pregestational diabetes)

  • sBP ≥ 160 mmHg or dBP ≥ 110 mmHg

  • At sBP 140-159 mmHg and/or dBP 85-109 mmHg, the initiation of antihypertensive medication will be based on practitioner preference, training, and experience
B. In the presence of pre-pregnancy renal disease or pregestational diabetes
- sBP ≥ 140 mmHg or dBP ≥ 90 mmHg

10.2 ACUTE MANAGEMENT OF SEVERE HYPERTENSION

As a guide, stabilization of blood pressure is to reduce diastolic blood pressure (dBP) by 10 mmHg in the first instance and to maintain the blood pressure at or below that level.

A. First choice agents:

A.1 Nifedipine (capsules or PA tablets)

Nifedipine is the first choice agent as many women who develop severe pregnancy hypertension are already on high/maximal doses of labetalol, so will be somewhat insensitive to further 'stat' dosing with labetalol. Also, nifedipine may more effectively control severely increased BP than does hydralazine and labetalol.\(^{13,14}\)

However, nifedipine capsules should not be used in women with known atherosclerotic cardiovascular disease or at increased risk for atherosclerotic cardiovascular disease (e.g., insulin-dependent diabetes >15y duration, maternal age >45y).

This can be given as either a 5 mg capsule to swallow (in the first instance) or as a 10 mg oral tablet ('PA') (not a slow release tablet, ‘XL’).

Blood pressure should be measured every 10 minutes in the first half hour after treatment, as there can be a very marked drop in pressure when severe pre-eclampsia is treated. The dose should be repeated if a satisfactory blood pressure response has not occurred by 30 minutes (capsule) or 45 minutes (PA tablet). If two 5 mg capsules are ineffective, 10 mg capsules may be administered.

If nifedipine (capsules or PA) controls blood pressure, then it may be changed postnatally to a slow release preparation (Adalat XL), which lasts 12-24 hours.

There has been some concern over interaction between magnesium sulphate and nifedipine; however, the risk is <1%.\(^{26}\)

After two ‘stat’ doses of nifedipine, regular antihypertensive agents (e.g., labetalol, nifedipine XL, alpha-methyldopa) should either be instituted or increased in dose.

A.2 Labetalol

If the woman can tolerate oral therapy, dosing can be done immediately before venous access and so can achieve as quick a result as an initial intravenous dose. Initially, 200 mg can be given orally. This should lead to a reduction in blood pressure in 30 - 60 min, and peak at 2 - 3 hr. A second oral dose can be given if needed.

If there is no initial response to oral therapy by 30 minutes, or if it cannot be tolerated, control should be by a repeated bolus of labetalol or by a labetalol infusion. Labetalol is supplied in 100 mg/20 ml vial, or 5 mg/ml.

Give a bolus infusion of 20 mg (4 ml of labetalol, 5 mg/ml) over at least 2 minutes. This should have an onset of effect by 5 minutes and should be repeated if dBP has not been reduced within 30 minutes. This can be repeated q 30 min to a maximum dose of 200 mg (40 ml of labetalol, 5 mg/ml). If labetalol is given at a rate < 10 mg/min, continuous ECG monitoring is not required.

Following this, a labetalol infusion should be commenced: labetalol 5 mg/ml at a rate of 20 mg/hr (4 ml/hr of labetalol, 5 mg/ml) via a volumetric pump. The infusion rate should be doubled every half hour to a maximum of 160 mg/hr (32 ml/hr) until dBP has been reduced by 10 mmHg and maintained at or below that level.

B. Alternative:

Hydralazine

Given the relationship between uncontrolled severe maternal hypertension and maternal death, the randomized controlled trial evidence of antihypertensive medications for use in severe pregnancy hypertension were reviewed.\(^{14}\) Of 21 trials (893 women), eight compared hydralazine with nifedipine and five compared hydralazine with labetalol. Hydralazine was associated with a trend towards less persistent severe hypertension than labetalol (relative risk (RR) 0.29 [95% confidence interval (CI) 0.08, 1.04]; two trials), but more severe hypertension than nifedipine or isradipine (RR 1.41 [0.95, 2.09]; four trials); there was significant heterogeneity in outcome between trials and differences in methodological quality.
Hydralazine was associated with more maternal hypotension (RR 3.29 [1.50, 7.23]; 13 trials); more Caesarean sections (RR 1.30 (1.08 to 1.59); 14 trials); more placental abruption (RR 4.17 [1.19, 14.28]; five trials); more maternal oliguria (RR 4.00 [1.22, 12.50]; three trials); more adverse effects on fetal heart rate (RR 2.04 [1.32, 3.16]; 12 trials); and more low Apgar scores at one minute (RR 2.70 [1.27, 5.88]; three trials). For all but Apgar scores, analysis by risk difference showed heterogeneity between trials. Hydralazine was associated with more maternal side effects (RR 1.50 [1.16, 1.94]; 12 trials) and with less neonatal bradycardia than labetalol (risk difference -0.24 [-0.42, -0.06]; three trials).

The results of this meta-analysis are not robust enough to guide clinical practice, but they do not support use of hydralazine as first line for treatment of severe hypertension in pregnancy. Adequately powered clinical trials are needed, with a comparison of labetalol and nifedipine showing the most promise.

10.3 RECOMMENDED TREATMENT OF NON-SEVERE HYPERTENSION IN PREGNANCY

Due to increased rates of hepatic metabolism and renal clearance in pregnancy, and increased vascular reactivity associated with pre-eclampsia and other forms of gestational hypertension, maintenance doses may need to be split. For example, the CPS states that labetalol is a b.i.d. medication; in women with pre-eclampsia it may need to be given up to four times per day to achieve a ‘smooth ride’ in blood pressure.

A. Treatment Goal
   dBP 80 - 110 mmHg (depending on practitioner preference)

B. First choice agents:
   B.1 Methyldopa (Aldomet ®)
   Dosage: 250 mg p.o. 2 or 3 times a day in the first 48 hours (some experts administer a loading dose of 750-1000 mg p.o.). The daily dosage may then be increased or decreased, preferably at intervals of not less than 2 days, until the desired response is achieved.
   Maximum daily dose is 2000 mg (total). Support for methyldopa results from the 7 year follow-up neurodevelopmental data from a single randomized controlled trial.

B.2 Labetalol (Trandate ®)
   Dosage: Recommended initial dose 100 mg p.o. twice daily. The dose should be adjusted semi-weekly or weekly according to the response. Maximal daily dose is 1200 mg (total).

C. Alternatives:
   Nifedipine (Adalat PA®)
   Dosage: Adalat PA: Initiate at 10 mg p.o. twice daily. Usual maintenance dose is 10 - 20 mg p.o., b.i.d.
   Adalat XL: Initiate at 30 mg daily. Usual maintenance dose is 30-60 mg given once daily or in two doses (e.g., 30 mg b.i.d.).
   Maximal daily dose of nifedipine is 90 mg (total).

D. Special indications (renal or cardiac diseases)
   • Diuretics

E. Drugs to Avoid
   • Angiotensin-converting enzyme inhibitors
   • Angiotensin II receptor antagonists
   • Atenolol

Motherisk is available to give safety information to patients, families and caregivers about antihypertensive use in pregnancy.
www.motherisk.org; (416) 813-6780

11. ANTICONVULSANT THERAPY: MAGNESIUM SULPHATE (MgSO₄)

11.1 PROPHYLAXIS

Following the MAGPIE study, women considered to have severe pre-eclampsia (see Section 8) should be started on magnesium sulphate (MgSO₄). The corollary to that is that if a woman is deemed to need magnesium sulphate, then she needs care according to these guidelines.

11.2 MANAGEMENT OF ECLAMPSIA
   • Call appropriate personnel, including the anesthesiologist (if available)
   • Commence MgSO₄ according to the protocol (see page 13): MgSO₄ is the drug of choice for both seizure termination and for the prevention of seizure recurrence.
11.3 MANAGEMENT OF RECURRENT SEIZURES

Give a stat bolus dose of MgSO\textsubscript{4} 2g IV over 20 - 30 minutes, and increase the MgSO\textsubscript{4} infusion rate from 1 g/hr to 1.5 g/hr IV. Continue observations and consider the need for ventilation.

11.4 MAGNESIUM SULPHATE PROTOCOL: USING MgSO\textsubscript{4} 50% 0.5 G/ML OR 5 G/10 ML AMPOULES

MgSO\textsubscript{4} is given as a loading dose followed by a continuous infusion for 24 hours or until 24 hours after delivery – whichever is the later.

A. Loading dose: - MgSO\textsubscript{4} 4g IV over 20 - 30 minutes
Use a 50 ml syringe and draw up 4 g (8 ml) MgSO\textsubscript{4} and then add 22 ml \(\frac{3}{5}/\frac{2}{5}\) to make a total volume of 30 ml. Administer over 30 minutes at an infusion rate of 60 ml/hour, using a volumetric infusion pump.

B. Maintenance dose: MgSO\textsubscript{4} 1g/hr IV
Draw up 20 g (40 ml) MgSO\textsubscript{4} and add to 960 ml \(\frac{2}{5}/\frac{1}{5}\) (1,000 ml total). Infuse at 1 g/hr (50 ml/hr) using a volumetric infusion pump. The maximum storage time for prepared MgSO\textsubscript{4} is 24 hours.

C. Clinical assessment

The medical staff are responsible for the assessment of the patient and the decision to continue the infusion. The decision for continuing the infusion should be made q4h.

The following observations should be performed:

i) continuous pulse oximetry
ii) hourly urine output
iii) hourly respiratory rate
iv) deep tendon reflexes q4h
v) level of consciousness q4h (Glasgow Coma Score)

The infusion should only continue if, after each 4 hour period:

i) the biceps reflex is present
ii) the respiratory rate is > 12/min.
iii) the urine output is greater than 100 ml in the previous 4 hours.

THERE IS NO NEED TO MEASURE MAGNESIUM LEVELS WITH THE ABOVE PROTOCOL.

D. The antidote is 1g (10 ml) of 10% calcium gluconate given slowly IV (approximately 1.5 ml/min or 1g/7 min)

97% of magnesium is excreted in the urine; therefore the presence of oliguria can lead to toxic levels. If the above criteria (biceps reflexes, respiratory rate, and urinary output) are not met, then administration of MgSO\textsubscript{4} should be discontinued. If magnesium is not being excreted then the serum levels should not fall and no other anticonvulsant is needed. Magnesium should be re-introduced if urine output improves.

E. Side effects

Motor paralysis, absent tendon reflexes, respiratory depression and cardiac arrhythmia (increased conduction time) can all occur, but will be minimized if MgSO\textsubscript{4} is administered slowly and the patient is observed as above.
12. DELIVERY GUIDELINES

“Planned delivery on the best day in the best way”

- The delivery should be well planned, done on the best day, performed in the best place, by the best route, and with the best support team. Timing affects the outcome for both mother and baby. If the mother is unstable, then delivery is inappropriate and increases risk. Once stabilized with antihypertensive drugs and MgSO$_4$, a decision regarding delivery should be made.

- In the absence of convulsions, prolonging the pregnancy may be possible to improve the outcome of a premature fetus but only if the mother remains stable. This ‘expectant management’ is associated with markedly improved outcomes for the fetus, but does incur some, as yet unquantified, maternal risk.\textsuperscript{13,31}

- Continued close monitoring of mother and fetus is needed. It seems ideal to achieve delivery, particularly of premature infants, during normal working hours (i.e., 8 am to 4 pm).

- Even a few hours may be helpful if it allows the neonatal unit to be more organized or to transfer a mother to a place where an ICU bed is available, assuming the mother is stable before transfer (see stabilization section, p15).

12.1 STEROIDS

- If the pregnancy can be prolonged in excess of 4 hours, steroids help mature the fetal lungs and reduce neonatal mortality. Since the benefits to the fetus peak between 48 hours and 6 days, then, after 48 hours, further consideration should be given to delivery, as further delay may not be advantageous to the baby or mother. In all situations a planned elective delivery suiting all professionals is appropriate.

12.2 MODE OF DELIVERY

- The mode of delivery should be discussed with the Consultant Obstetrician. Delivery is not necessarily by Caesarean section, but if gestation is less than 32 weeks it may be preferable, as the practice of expectant management will dictate that delivery is occurring in response to deteriorating maternal and/or fetal status. After 34 weeks, vaginal delivery should be considered in a cephalic presentation. Vaginal prostaglandins will increase the chance of success. Antihypertensive treatment should be continued throughout assessment, surveillance, labour, delivery, and the immediate puerperium.

- If vaginal delivery is planned, then the second stage should be short with consideration given to elective operative vaginal delivery. An epidural will normally be used. The third stage should be managed with either OXYTOCIN 5 units I.V., or 10 units I.M. Ergometrine should not be given in any form.

12.3 ANAESTHESIA AND FLUIDS

- Consider involving the anesthesiologist early in the care of the pre-eclamptic patient. The anesthesiologist may be required to provide analgesia/anaesthesia for labour and delivery, Caesarean section anaesthesia, insertion of lines for invasive monitoring (arterial line, CVP) and management of care.

- Fluid management should be judicious with two purposes: avoidance of pulmonary oedema and avoidance of hypotension. There is an excess of maternal mortality associated with aggressive hydration in women with pre-eclampsia.\textsuperscript{18} A fluid bolus is not necessary routinely prior to regional anaesthesia for labour unless there is a compromised fetus or the woman is obviously dehydrated. One may consider a small bolus of colloid (pentastarch) to avoid hypotension during regional anesthesia for Caesarean delivery.\textsuperscript{32} Women with pre-eclampsia are not at increased risk for post-regional hypotension.\textsuperscript{33} There is no evidence that a bolus of crystalloid as a preload prevents hypotension.\textsuperscript{34}

- Epidural, combined spinal epidural and spinal anaesthesia are not specifically contraindicated in women with severe pre-eclampsia and, generally, are recommended unless there is evidence of coagulopathy, local or systemic sepsis, patient refusal or other contraindications.\textsuperscript{35,36} Studies have shown that the incidence of profound hypotension in women with severe pre-eclampsia is similar when either spinal or epidural anaesthesia is used.\textsuperscript{37-39}

- Hypotension during regional anaesthesia can be treated with both ephedrine and phenylephrine, titrated in small bolus doses or as an infusion.\textsuperscript{34,38}

- General anaesthesia may be required in the setting of acute fetal compromise or when there is a contraindication to regional anaesthesia. Considerations include a possible difficult airway that may require awake intubation as well as the need to ablate the hypertensive response to intubation.\textsuperscript{40} Labetalol 10 mg IV q5 – 10min is effective; alternatives (to be used instead of or with labetalol) include: opioids (fentanyl 3-5 mcg/kg, remifentanil 0.5-1 mcg/kg), lidocaine 1.5 mg/kg, and nitroglycerin 100-300 mcg. A full induction dose of thiopental (5-7 mg/kg) or propofol (2 mg/kg) and full intubating dose of a...
12.4 INDICATIONS FOR CENTRAL VENOUS PRESSURE (CVP) MONITORING

A CVP may be indicated:

- at Caesarean section, particularly if blood loss is excessive.
- regardless of delivery mode, if blood loss is excessive or delivery is complicated by other factors such as abruptio placentae.

Remember that a CVP may not reflect the true central haemodynamics (i.e. pulmonary capillary wedge pressure, PCWP) in women with pre-eclampsia.

13. POSTPARTUM

High risk women should not be placed onto low risk discharge pathways. Women should only be discharged when there is a clear trend towards improvement in clinical and laboratory assessments, when there is an ability to provide adequate outpatient surveillance, and when follow-up can be arranged within a week for clinical and blood pressure assessment. It is reasonable to discharge women with BP < 160/100 mmHg for at least 24 hours. The community health nurse should visit on the 1st or 2nd day after discharge, and the woman should visit her physician within 1 week of discharge.

13.1 FLUID MANAGEMENT

- Following delivery the woman should be fluid restricted in order to wait for the natural diuresis which usually occurs around 36-48 hours post delivery.
- Total intravenous fluid should be given at 80 ml/hr. This total includes normal saline, or equivalent, plus other infusions of drugs. After delivery, oral fluids can be given in a relatively unrestricted way.
- Urine output should be recorded hourly and each 4-hour block should be totalled and recorded on the chart. Each 4-hour block should total in excess of 40 ml. If two consecutive blocks fail to achieve 40 ml, then further action is appropriate, as follows:

  A. If total input is more than 750 ml in excess of output in the last 24 hours (or since starting the regime) then 20 mg of i.v. furosemide should be given. Pentaspan should then be given as above if a diuresis occurs.

  OR

  B. If total input is less than 750 ml in excess of output in the last 24 hours (or since starting the regime) then an infusion of 250 ml of pentaspan over 20 minutes should be given. The urine output should then be watched until the end of the next 4-hour block. If the urine output is still low then 20 mg of IV furosemide should be given. If a diuresis in excess of 200 ml occurs in the next hour the fluid should be replaced with 250 ml of pentaspan in addition to baseline fluids.

If the urine output fails to respond to furosemide in either situation, then a discussion with a member of the BC Women’s Maternal-Fetal Medicine Team (604-875-2161) would be appropriate.

13.2 ANALGESIA

Women with pre-eclampsia have vulnerable renal function. Therefore, non-steroidal anti-inflammatory agents should be avoided in women whose urine output is <40 ml/hr.

14. SPECIAL PROBLEMS (ANTENATAL AND POSTNATAL)

14.1 Oliguria

If oliguria persists (requiring fluid challenge or furosemide), then the electrolytes and creatinine need to be carefully assessed and checked q6h. If there is concern over rising creatinine and/or potassium, the case should be discussed with a member of the BC Women’s Maternal-Fetal Medicine Team (604-875-2161).

14.2 DROPPING O₂ SATURATIONS

If the woman has dropping oxygen saturation, it is most likely due to fluid overload.

- Input and output should be assessed together with either clinical or invasive assessment of the fluid balance. Clinical assessment should include maternal symptoms, cardiovascular and respiratory status, and a chest X-ray. However, the most appropriate treatment is likely to be furosemide (10 mg) and oxygen.
- If there is no diuresis and the oxygen saturation does not rise, then referral to a nephrologist should be considered.
14.3 BLOOD PRODUCTS
Cases requiring large volumes of colloid such as fresh frozen plasma, blood, or platelets can lead to fluid overload. Significant haemorrhage or HELLP needs to be managed by an experienced specialist practitioner. The BC Women’s Maternal-Fetal Medicine Team (604-875-2161) is available to give advice as needed.

15. STABILIZATION BEFORE TRANSFER
When the woman is ill and requires delivery, transfer for fetal reasons is often considered. However, if the woman requires transfer for delivery, it is even more important that her condition is stabilized. Therefore, we recommend the following as a minimum requirement before transfer:

- Blood pressure should be stabilized at an acceptable level according to the above protocol. Also, when the woman is ventilated it is important to ensure ventilatory requirements are stable and oxygen saturations are being maintained.
- All basic investigations should have been performed (see suggested Physician Orders) and the results clearly recorded in the accompanying notes or telephoned through as soon as available.
- Fetal well being has been assessed (see suggested Physician Orders) to be certain that transfer is in the fetal interest before delivery. Steroids should be given if the woman is preterm (<34+0 weeks).
- Appropriate personnel are available to transfer the woman. This will normally mean at least a senior nurse, often with an anesthesiologist.
- Transfer has been discussed with appropriate consultant medical staff and nursing leadership and all the relevant people at the receiving unit (e.g., the neonatal unit and neonatal medical staff, the obstetrician, the nurse in charge of delivery suite, intensive care, and the intensive care anesthesiologist (where appropriate).

The BC Women’s Maternal-Fetal Medicine Team (604-875-2161) is available to give advice as needed.

16. OUTCOME INDICATORS
16.1 MATERNAL
- Gestational hypertension without significant proteinuria (includes gestational hypertension, mild pre-eclampsia, transient hypertension of pregnancy)
- Gestational hypertension with significant proteinuria (includes HELLP Syndrome)
- Pulmonary oedema
- Acute renal failure
- Breastfeeding at discharge
- Maternal mortality

16.2 NEWBORN
- Birthweight <10th and 3rd percentiles
- Apgar < 3 at 5 minutes
- Umbilical artery pH < 7
- IPPV > 5 minutes
- NICU admission > 37 weeks
- Perinatal mortality rate
- Neonatal mortality rate

REFERENCES


Appendix A

Physician’s Orders
Guidelines for the Antepartum
assessment and surveillance of women
with either gestational hypertension
and/or gestational proteinuria

Cross out orders not applicable
Use Antepartum Admission Physician’s Orders for routine admission orders.

1. Laboratory
Blood investigations on:
   - admission, admission +1, every Monday & Thursday and day of delivery:
     - CBC
     - BUN, Creatinine
     - Na⁺, K⁺, Ca²⁺, Mg²⁺, bicarb
     - Random Glucose
     - Uric acid
     - Albumin
     - Billirubin
     - AST, ALT, LDH
     - INR, APTT
     - Fibrinogen

2. Urine
Dipstick for protein:
   - admission, admission +1, every Monday & Thursday and day of delivery
Random urine for protein:creatinine ratio:
   - admission, admission +1, every Monday & Thursday and day of delivery
   - please do prior to or immediately after, if a 24 hour urine is requested
24 hour urine for protein and creatinine clearance
   - admission and once a week to start on Sunday for Monday
   - please put height and weight on requisition

3. Oxygen assessment
Pulse oximetry
   - please do once a day on the following days
   - admission, admission +1, every Monday & Thursday and day of delivery

4. Fetal Surveillance
Nonstress Test Daily
Ultrasound for AFI, and umbilical artery Doppler and MCA Doppler
   (pulsatility index and S/D ratio)
   - admission and every Monday & Thursday
Ultrasound for EFW (Hadlock Formula)
   - on admission and every 2 weeks after admission (Mondays)
Physician’s Orders

Guidelines for the Postpartum
assessment and surveillance of women
with either gestational hypertension
and/or gestational proteinuria

Cross out orders not applicable
Use Postpartum Physician’s Orders for routine admission orders.

1. Laboratory

Blood investigations on:
- postpartum day 1, and every Monday & Thursday:
  - CBC
  - BUN, Creatinine
  - Na⁺, K⁺, Ca²⁺, Mg²⁺, bicarb
  - Random Glucose
  - Uric acid
  - Albumin
  - Bilirubin
  - AST, ALT, LDH
  - INR, APTT
  - Fibrinogen

2. Urine

Dipstick for protein:
- postpartum day 1, every Monday & Thursday

Random urine for protein: creatinine ratio:
- postpartum day 1, and every Monday & Thursday

3. Oxygen assessment

Pulse oximetry
- please do once a day on the following days
- postpartum day 1, and every Monday & Thursday
Physician's Orders
Postpartum
Treatment and Monitoring of Women with Gestational Hypertension

Treatment: A woman on antihypertensive treatment antenatally should continue her antihypertensive medication postpartum.

1. Give
   - Nifedipine XL 30 milligrams orally daily at 1800, for hypertension
     OR
   - Other ____________________________________________

2. If blood pressure $\geq 160/100$ X 2 and separated by 15 minutes:
   - Call physician
   - Give:
     - Nifedipine PA 10 milligrams orally STAT, for hypertension
       OR
     - Nifedipine capsule 5 milligrams bite and swallow STAT, for hypertension

3. After each elevation in BP $\geq 160/100$, begin increased monitoring as follows:
   - Blood pressure every hour for 3 hours
     THEN
   - Blood pressure every 4 hours while awake for 24 hours
     THEN
   - Blood pressure once every 12 hours

4. For the second episode of Blood Pressure $\geq 160/100$ within 4 hours:
   - Notify attending physician for urgent assessment of woman.