

# The Newcastle upon Tyne Hospitals NHS Foundation Trust

## Maternity: Hypertension and Pregnancy / Pre-eclampsia

Version No	9
Effective From:	31 July 2024
Expiry Date:	31 July 2027
Date Ratified:	31 July 2024
Ratified By:	Obstetric Governance Group, Family Health Board

### 1 Introduction

Hypertensive disease and pregnancy, in particular severe pre-eclampsia and eclampsia, remains a leading direct cause of maternal death in the UK and contribute to significant maternal and perinatal morbidity. MBRRACE continue to report substandard care of these women, in particular inadequate treatment of systolic hypertension.

### 2 Guideline Scope

This guideline covers risk assessment for and screening for pre-eclampsia as well as diagnosing and managing hypertension and proteinuria during pregnancy, labour and birth. It aims to guide the delivery of safe maternity care for women with the diagnosis of severe pre-eclampsia or eclampsia so that potential morbidity from severe hypertension, fluid overload and eclampsia can be minimised.

N.B. This guideline is based on NICE guidance: 'Hypertension in pregnancy: diagnosis and management' (NG133) updated April 2023 in light of new NICE diagnostic guidance 'PLGF-based testing to help diagnose suspected preterm pre-eclampsia' (DG49 July 2022), however there are inconsistencies between the 2 guidelines which are to be considered by the NENC ICB and this guidance updated in due course.

### 3 Clinical Management of Hypertensive disease and Pregnancy

#### 3.1 Definitions

- **Hypertension:** Diastolic blood pressure 90–109 mmHg, systolic blood pressure 140–159 mmHg
- **Severe hypertension:** Diastolic blood pressure  $\geq$  110 mmHg, systolic blood pressure  $\geq$  160 mmHg
- **Chronic hypertension:** Hypertension on medication pre-pregnancy or hypertensive at booking, no proteinuria
- **Gestational/Pregnancy induced hypertension:** New hypertension presenting after 20 weeks without significant proteinuria

- **Pre-eclampsia** - New hypertension presenting after 20 weeks and the coexistence of 1 or more of the following new-onset conditions:
  - significant proteinuria (PCR  $\geq$  30g/mmol) **or**
  - other maternal organ dysfunction:
    - renal insufficiency (creatinine 90 micromol/litre or more, 1.02 mg/100 ml or more)
    - liver involvement (elevated transaminases [alanine aminotransferase or aspartate aminotransferase over 40 IU/litre] with or without right upper quadrant or epigastric abdominal pain)
    - neurological complications such as eclampsia, altered mental status, blindness, stroke, clonus, severe headaches or persistent visual scotomata
    - haematological complications such as thrombocytopenia (platelet count below 150,000/microlitre), disseminated intravascular coagulation or haemolysis
  - Uteroplacental dysfunction such as fetal growth restriction, abnormal umbilical artery Doppler waveform analysis, or stillbirth.
- **Severe pre-eclampsia** - Pre-eclampsia with severe hypertension (see section 3.5) and/or with symptoms, and/or biochemical and/or haematological impairment
- **Eclampsia** - One or more generalised convulsions in the setting of pre-eclampsia and in the absence of other neurological conditions whilst pregnant or within 6 weeks of delivery
- **HELLP syndrome** - Haemolysis, elevated liver enzymes and low platelet count.
- **Pregnancy induced proteinuria:** New proteinuria (PCR  $\geq$  30) without hypertension presenting in pregnancy

## 3.2 Reducing the risk of hypertensive disorder in pregnancy

### 3.2.1 Symptoms of pre-eclampsia

Advise pregnant women to see a healthcare professional immediately if they experience symptoms of pre-eclampsia. Symptoms include:

- Severe headache
- Problems with vision, such as blurring or flashing before the eyes
- Severe pain just below the ribs
- Vomiting
- Sudden swelling of the face, hands or feet.

### **3.2.2 Low dose aspirin**

Low dose aspirin reduces the risk of pre-eclampsia if started before 16 weeks.

Advise pregnant women at high risk of pre-eclampsia to take 150 mg of Aspirin at night daily from 12 weeks until 36 weeks gestation. This includes women with:

- Hypertensive disease during a previous pregnancy
- Chronic kidney disease
- Autoimmune disease such as systemic lupus erythematosus or antiphospholipid syndrome
- Type 1 or type 2 diabetes
- Chronic hypertension

Advise pregnant women with more than 1 moderate risk factor for pre-eclampsia to take 150 mg of aspirin at night from 12 weeks until 36 weeks gestation. Factors indicating moderate risk are:

- First pregnancy
- Age 40 years or older
- Pregnancy interval of more than 10 years
- Body mass index (BMI) of 35 kg/m<sup>2</sup> or more at first visit
- Family history of pre-eclampsia
- Multiple pregnancy

## **3.3 Antenatal management of hypertension and/or proteinuria in pregnancy**

### **3.3.1 PLGF based testing in suspected pre-eclampsia**

- Placental growth factor (PLGF)-based testing, used with standard clinical assessment, is recommended to help rule out pre-eclampsia for people between 20 weeks and birth.
- PLGF-based test results should be used alongside clinical information for decision-making. The tests are not a substitute for clinical assessment.
- NICE recommends testing just once when a person presents with possible symptoms of preterm pre-eclampsia (an episode)
- PLGF-based tests should not be used to make decisions about whether to offer a planned early birth to people with preterm pre-eclampsia.

### 3.3.2 Chronic hypertension

- Continue with existing antihypertensive treatment if safe in pregnancy, or switch to an alternative treatment, unless:
  - Sustained systolic blood pressure is less than 110mmHg or
  - Sustained diastolic blood pressure is less than 70mmHg or
  - The woman has symptomatic hypotension
- Offer antihypertensive treatment to pregnant women who have chronic hypertension and who are not already on treatment if they have:
  - Sustained systolic blood pressure of 140mmHg or higher or
  - Sustained diastolic blood pressure of 90mmHg or higher
- Consider Home BP monitoring (HBPM) if suitable (see section 3.4)
- When using medicines to treat hypertension in pregnancy, aim for a target blood pressure of 135/85mmHg.
- Consider labetalol to treat chronic hypertension in pregnant women. Consider nifedipine for women in whom labetalol is not suitable, or methyldopa if both labetalol and nifedipine are not suitable. Base the choice on any pre-existing treatment, side-effect profiles, risks (including fetal effects) and the woman's preference. See Appendix 4. For suggested anti-hypertensive regimens.
- Arrange ultrasound for growth and fetal well-being: See guideline for 'Screening for and Management of Fetal Growth Restriction. Only perform CTG if clinically indicated.
- **Worsening hypertension and/or suspected of developing pre-eclampsia**
  - Women should be reviewed on the MAU/Maternity Day-care. Follow the 'Flowchart for Chronic hypertension' (see Appendices 1 & 2).
  - If protein > 1+ then a urine protein/creatinine ratio (PCR) should be requested. This should be done prior to any blood tests being taken.
    - PCR is calculated in the Biochemistry lab using an MSU sample. Send URGENTLY using a biochemistry request form.
    - $PCR \geq 30$  and  $BP \geq 140/90$  mmHg, treat as pre-eclampsia – see section 3.4 and Appendix 6.
    - $PCR < 30$  and  $BP \geq 140/90$  mmHg: Take blood for placental growth factor-based testing (sFlt-1/PLGF ratio) to help rule out and predict pre-eclampsia.
- **Timing of birth:** For women with chronic hypertension whose blood pressure is lower than 160/110 mmHg after 37 weeks, with or without antihypertensive treatment, timing of birth and maternal and fetal indications for birth should be agreed between the woman and senior obstetrician (Consultant or ST6/7).

### 3.3.3 Gestational hypertension

- In women with gestational hypertension, take account of the following risk factors that require additional assessment and follow-up:
  - Nulliparity
  - Age 40 years or older
  - Pregnancy interval of more than 10 years
  - Family history of pre-eclampsia
  - Multiple pregnancy
  - BMI of 35 kg/m<sup>2</sup> or more
  - Gestational age at presentation
  - Previous history of pre-eclampsia or gestational hypertension
  - Pre-existing vascular disease
  - Pre-existing kidney disease
- Consider labetalol to treat gestational hypertension. Consider nifedipine for women in whom labetalol is not suitable, and methyldopa if labetalol or nifedipine are not suitable. Base the choice on side-effect profiles, risk (including fetal effects) and the woman's preferences. See Appendix 4. for suggested medication regimens.
- Women should be reviewed on the MAU/Maternity Day-care. Follow the 'Flowchart for gestational hypertension' (see Appendices 1, 3 and 4.)
  - If protein  $\geq$  1+ then a urine PCR should be requested. This should be done prior to any blood tests being performed.
    - PCR is calculated in the Biochemistry lab using an MSU sample. Send URGENTLY using a biochemistry request form. Write on the form requesting Urine protein/creatinine ratio
    - PCR  $\geq$  30 – treat as pre-eclampsia – see section 3.4 and Appendix 6.
    - Take blood for placental growth factor-based testing (sFlt-1/PLGF ratio) to help rule out and predict pre-eclampsia in women presenting with suspected pre-eclampsia.

**See table below and Appendix 3. Flowchart for gestational hypertension and ongoing management**

**Table 1. Management of Gestational Hypertension**

Management	Hypertension: Blood pressure of 140/90–159/ 109mmHg	Severe hypertension: Blood pressure of 160/110mmHg or more
Admission to hospital	Do not routinely admit to hospital	Admit but if BP falls below 160/110mmHg manage as hypertension
Anti- hypertensive treatment	Offer pharmacological treatment if BP remains above 140/90 mmHg	Offer pharmacological treatment to all women
Target blood pressure once on antihypertensives	Aim for BP of 135/85 mmHg or less	
Blood pressure measurement	Once or twice a week until BP is 135/85 mmHg or less	Every 15–30 minutes until BP is less than 160/110 mmHg 4 times a day while admitted, or more often if concern
Dipstick proteinuria testing	Once a week (with BP measurement)	Daily while admitted
Blood tests	Measure full blood count, liver function and renal function at presentation and then weekly.	Measure full blood count, liver function and renal function at presentation and then weekly
Placental growth factor (PLGF)-based testing	Carry out PLGF-based testing on 1 occasion if there is suspicion of pre-eclampsia	Carry out PLGF-based testing on 1 occasion if there is suspicion of pre-eclampsia
Fetal assessment	<ul style="list-style-type: none"> <li>• Offer fetal heart auscultation at every antenatal appointment</li> <li>• Carry out ultrasound assessment of the fetus at diagnosis and repeat every 2-4 weeks, if clinically indicated.</li> <li>• Carry out a CTG only if clinically indicated</li> </ul>	<ul style="list-style-type: none"> <li>• Offer fetal heart auscultation at every antenatal appointment</li> <li>• Carry out ultrasound assessment of the fetus at diagnosis and, if normal, repeat every 2 weeks, if severe hypertension persists</li> <li>• Carry out a CTG at diagnosis and then only if clinically indicated</li> </ul>

- **Timing of birth:** For women with gestational hypertension whose blood pressure is lower than 160/110 mmHg after 37 weeks, timing of birth, and maternal and fetal indications for birth should be agreed between the woman and the senior obstetrician (Consultant or ST6/7).

### 3.5 Pregnancy induced (Gestational) Proteinuria

See Appendix 5. Flowchart on for guidance and follow up.

### 3.6 Home Blood pressure Monitoring

- Screening for hypertension represents a significant workload for community midwives and hospital clinicians. Much of this work can be reduced by empowering patients to take their own blood pressure at home.
- Home BP readings are more representative of the day-to-day blood pressure and are less susceptible to 'white coat' hypertension and elevated clinic BP readings.
- Providing women with the adequate equipment, training and support to check their blood pressure (BP) means fewer visits to a health care setting and less risk of unnecessary intervention.
- Home BP service does require midwifery and clinician oversight. At present there is only the resource to offer home BP to selected high-risk patients (e.g. cardiology and renal patients).
- If home BP monitoring is thought to be needed for patients outside of the cardiology/renal/diabetes setting then this should be discussed with the Maternal Medicine Midwife, who can liaise with a Maternal Medicine consultant.

#### 3.4.1 Inclusion and Exclusion Criteria

- Home BP monitoring should only be offered if compliance guaranteed i.e. may not be suitable for vulnerable women, women with learning difficulties or if interpretation services are required (see section 3.4.4 for follow up for these women)
- Home BP monitoring **should not** be offered to women who require admission for severe hypertension/PET or as determined by antenatal flowcharts.

#### 3.4.2 Pathway

- Arrange face-to-face appointment. Check suitability/need for Home BP monitoring.
- Provide OMRON M3 home blood pressure monitor. Explain that it is validated for use in pregnancy and pre-eclampsia, and check appropriately sized cuff, up to 42cm arm circumference.
- Loan form. Complete a blood pressure monitor loan form with the woman (included below). File a copy in the patient notes and in the Home BP file in antenatal clinic.
- Set up home BP monitoring on Badgernet and explain how to the patient how to enter readings.

- Maternal Medicine consultant to determine and provide verbal and written instructions on:
  - Frequency of readings
  - BP target
  - What to do if readings are persistently above the target
- Demonstrate/explain how to use the device. Give written instructions on how to take a blood pressure reading (see below: *How to take your blood pressure at home*). Ask the woman to take her blood pressure twice, at least one minute apart and to record the second reading into Badgernet.
- What to do after taking BP instructions. Give written instructions (rainbow coloured chart below) about self-monitoring of blood pressure (attached document: *Blood pressure thresholds for self-monitoring*), and check that the mother understands how to use the chart and who to contact with an abnormal reading. .
- Follow up. Confirm date with the woman, and whether this will be telephone (or face to face. It is recommended to telephone the patient after 2-3 days to check she is happy with home BP measurements. Ask the woman to call her midwife or the maternity units as she would normally if she has any concerns about herself or her baby or if she thinks that she needs medical attention.
- Returning the monitor. Explain arrangements to the woman for return of the blood pressure monitor, either at the time of coming in for birth or, more likely, at a time postnatally when postnatal BP monitoring has been completed.
- Cleaning and documentation. Once returned, wipe the blood pressure monitor thoroughly with a cleaning wipe, and check that all components are correct (e.g. cuff, connector, batteries). Record the monitor as 'returned' in the Home BP file.
- Service evaluation. Keep details of which women have used the home BP service so appropriate evaluation of outcomes can be undertaken.

**SEE next page for 'RCOG Self-monitoring of blood pressure in pregnancy March 2020'**



### 3.4.3 Blood pressure thresholds for home BP monitoring

Level	Blood pressure /mmHg	Action
High	SYS 150 or more OR DIA 100 or more	Your blood pressure is high. Sit quietly for 5 minutes then measure it again and note the reading. If your repeated reading is raised, please contact your maternity unit for review today (within 4 hours) and continue to monitor your BP daily. <b>If your repeated SYS (systolic) reading is 160 or more, make sure that you make contact with a healthcare professional in this time.</b>
Raised	SYS 140-149 OR DIA 90-99	Your blood pressure is raised. Sit quietly for 5 minutes then measure it again and note the reading. If your repeated reading is raised, please contact your maternity unit within 24 hours and continue to monitor your BP daily.
High Normal	SYS 135-139 OR DIA 85-89	Your blood pressure is normal but moving towards the raised threshold. Sit quietly for 5 minutes then measure it again and note the reading. If your repeat reading is still high end of normal, please monitor your blood pressure daily.
Normal	SYS 110-134 AND DIA 70-84	Your blood pressure is normal. Continue blood pressure monitoring and your current care.
Low	SYS 109 or less AND DIA 69 or less	<b>If you are not taking blood pressure medication:</b> Your blood pressure is normal. If you are feeling well this blood pressure does not need any further action. <b>If you are taking blood pressure medication:</b> Your blood pressure is low. Repeat once more in 5 minutes. If you repeat reading is still low, contact your maternity unit within 24 hours or within 4 hours if you feel unwell (e.g. dizzy or faint).

Source: RCOG Self-monitoring of blood pressure in pregnancy March 2020

### 3.7 Management of pre-eclampsia

- Women with suspected pre-eclampsia in community or ANC, having home BP monitoring, should be reviewed on Maternity Day-care 2/week as a minimum. Follow the 'Flowchart for pre-eclampsia' (see Appendix 6.)
- Women may be admitted directly to the ward/delivery suite from other areas if concern. There should be a discussion with the obstetric team on call and the co-ordinator if this is the case.

**Table 2. Management of Pre-eclampsia**

	Degree of hypertension	
	<b>Hypertension: Blood pressure: 140/90–159/109mmHg</b>	<b>Severe hypertension: Blood pressure: <math>\geq</math> 160/110mmHg</b>
Admission to hospital	Admit if any clinical concerns for the wellbeing of the woman or baby i.e.: <ul style="list-style-type: none"> <li>• Maternal biochemical investigations that cause concern e.g. a new and persistent: <ul style="list-style-type: none"> <li>○ rise in creatinine: &gt;90 or</li> <li>○ rise in alanine transaminase: &gt; 70 or</li> <li>○ fall in platelet count (&lt; 150)</li> </ul> </li> <li>• Signs of impending eclampsia or pulmonary oedema</li> <li>• Suspected fetal compromise</li> <li>• Fetal growth restriction (&lt; 3<sup>rd</sup> centile)</li> </ul> <p>Otherwise, consider management as outpatient – follow Flowchart – see Appendix 5.</p>	Admit, but if BP falls below 160/110 mmHg then manage as for hypertension
Anti-hypertensive treatment	Offer pharmacological treatment if BP remains above 140/90 mmHg	Offer pharmacological treatment to all women
Target blood pressure on antihypertensive treatment	Aim for BP of 135/85 mmHg or less	Aim for BP of 135/85 mmHg or less
Blood pressure measurement	At least every 48 hours, and more frequently if the woman is admitted to hospital	Every 15–30 minutes until BP is less than 160/110 mmHg, then at least 4 times daily while the woman is an inpatient, depending on clinical circumstances
Dipstick proteinuria testing	Only repeat if clinically indicated, for example, if new symptoms and signs develop or if there is uncertainty over diagnosis	Only repeat if clinically indicated, for example, if new symptoms and signs develop or if there is uncertainty over diagnosis
Blood tests	Measure full blood count, liver function and renal function twice weekly	Measure full blood count, liver function and renal function 3 times a week
Fetal assessment	<ul style="list-style-type: none"> <li>• Offer fetal heart auscultation at every antenatal appointment</li> <li>• Carry out ultrasound assessment of the fetus at diagnosis and if normal repeat every 2 weeks.</li> <li>• Carry out a CTG at diagnosis and then only if clinically indicated</li> </ul>	<ul style="list-style-type: none"> <li>• Offer fetal heart auscultation at every antenatal appointment</li> <li>• Carry out ultrasound assessment of the fetus at diagnosis and, if normal, repeat every 2 weeks.</li> <li>• Carry out a CTG at diagnosis and then only if clinically indicated</li> </ul>

- Offer labetalol to treat hypertension in pregnant women with pre-eclampsia. Offer nifedipine for women in whom labetalol is not suitable, and methyldopa if labetalol or nifedipine are not suitable. Base the choice on any pre-existing treatment, side-effect profiles, risks (including fetal effects) and the woman's preference. See Appendix 4. for guidance
- **Timing of birth:**  
Consider using a prediction model to help plan timing of delivery for maternal reasons – does not predict fetal outcomes (NICE 2019):  
<https://pre-empt.bcchr.ca/evidence/fullpiers>

<b>Weeks of pregnancy</b>	<b>Timing of birth</b>
<b>Before 34 weeks</b>	Continue surveillance unless there are indications (see below) for planned early birth. Offer intravenous magnesium sulphate and a course of antenatal corticosteroids
<b>34 – 36+6 weeks</b>	Continue surveillance unless there are indications (see below) for planned early birth.  When considering the option of planned early birth, take into account the woman and baby's condition, risk factors (such as maternal comorbidities, multiple pregnancy) and availability of neonatal unit beds. Consider a course of antenatal corticosteroids
<b>&gt; 37 weeks</b>	Initiate birth within 24–48 hours.

Aim for 37 weeks. Consider earlier delivery if:

- Severe pre-eclampsia:
- Inability to control maternal blood pressure despite using 3 or more antihypertensives in appropriate doses
- Ongoing neurological features, such as severe intractable headache, repeated visual scotomata, or eclampsia
- Progressive deterioration in liver function, renal function, haemolysis, or platelet count
- Maternal pulse oximetry less than 90%
- Placental abruption
- Reversed end-diastolic flow in the umbilical artery Doppler, a non-reassuring cardiotocograph, or stillbirth
- Other features not listed above may also be considered in the decision to plan early birth.

Any decisions on timing of birth for women with pre-eclampsia before 37 weeks should be discussed with a consultant.

Discuss with the anaesthetic team if birth is planned in a woman with preeclampsia.

Discuss with the neonatal team if birth is planned in a woman with preeclampsia and neonatal complications are anticipated.

### 3.5 SEVERE PRE-ECLAMPSIA / ECLAMPSIA protocol

#### 3.5.1 Assessment and Diagnosis - Inclusion criteria for using clinical algorithms described within this guideline

- a) Severe hypertension  $\geq 160/110$  mmHg and:
- Significant proteinuria (PCR  $\geq 30$ ) and
  - Decision to deliver baby within next 24 hours +/- significant symptoms (see table below)
- b) Hypertension **140-159/90-109** mmHg and:
- Significant proteinuria (PCR  $\geq 30$ ) and
  - Significant signs / symptoms (see table below) and
  - Decision to deliver baby within next 24 hours
- c) Hypertension **140-159/90-109** mmHg and:
- On-going treatment with two or more antihypertensive therapies
  - Significant signs / symptoms (see table below)
- d) Severe hypertension  $\geq 160/110$  mmHg with history of eclampsia in previous pregnancy or evidence of multi-system disease.
- e) Eclampsia – tonic/clonic convulsions

<b>Significant signs / symptoms (at least one of)</b>
Severe or persistent headache
Visual disturbance – blurring / flashing
Severe pain just below ribs / vomiting
Sudden facial swelling and/or shortness of breath and/or sudden weight gain
Altered mental state/CVA
Papilloedema
Elicited clonus ( $\geq 3$ beats)
Tender liver
HELLP syndrome <ul style="list-style-type: none"><li>- Falling platelets <math>&lt;100 \times 10^9/L</math> or</li><li>- Rising ALT <math>\geq 70</math> iu/L or</li><li>- Haemolysis</li></ul>
Serum creatinine $\geq 90$ mmol/l

### 3.5.2 Communication

The following team members should include:

- Obstetric consultant on call and Obstetric tier 2
- Anaesthetic registrar on call for delivery suite (who may choose to inform the Anaesthetic consultant on call)
- Delivery suite co-ordinator
- NNU and the neonatal team, if delivery is anticipated < 37 weeks gestation

All equipment and drugs required for the treatment of a woman with severe PET or eclampsia can be found on the 'severe pre-eclampsia' emergency response trolley kept in room 11 on delivery suite. A MEWs chart should be used to document observations and there should be clear documentation of ongoing care, clinical signs, fluid balance, and blood results.

### 3.5.3 Fetal assessment and delivery planning

- **Gestation**

For gestations <37 weeks or suspected growth restriction the paediatric staff/NNU should be informed

- **Mode of delivery**

An assessment should be made as to whether induction and vaginal delivery is possible or whether caesarean section is advisable depending on gestation, fetal presentation, the CTG and/or umbilical artery Doppler, the woman's condition and cervical assessment (Consultant Obstetrician decision). This decision and reasons behind it should be documented in the hospital notes.

- **Fetal Monitoring**

The fetus should be monitored with electronic fetal monitoring.

### 3.5.4 Anticonvulsant

- **Magnesium sulphate** is the only anticonvulsant used for the prophylaxis and treatment of eclampsia. All women with severe hypertension or severe pre-eclampsia who fit or who have previously had an eclamptic fit should receive magnesium sulphate. Consider giving magnesium sulphate to women with severe preeclampsia where delivery is planned within 24hr.

Dose	Drug	Dose	Rate	Total time for infusion
Loading dose	10% MgSO <sup>4</sup>	4g/40ml	160ml/h	IV over 5 - 15 mins
Maintenance	10% MgSO <sup>4</sup>	1g/10ml	10ml/h	Up to 24 hours post birth or last fit

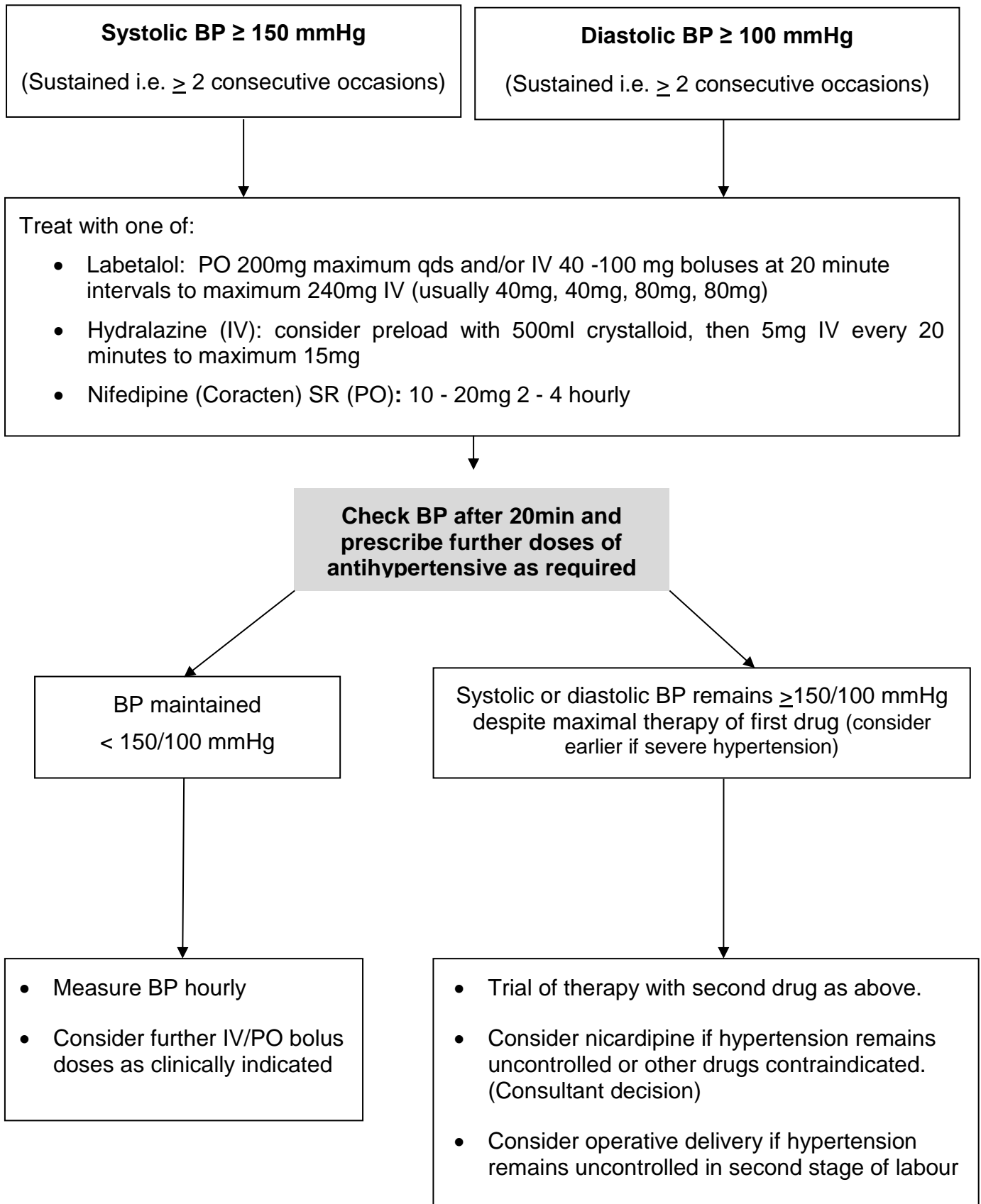
- All doses should be administered in a 50 ml syringe through a syringe pump. If using a prefilled 50ml syringe of MgSO<sub>4</sub> when administering the loading dose, 10mls should be expelled and the pump set as above to administer the remaining 40mls.

- Consider an extra dose of 2 - 4g, which should be given over 5 to 15 minutes if there are additional seizures whilst already on magnesium therapy.
- The decision to discontinue Magnesium Sulphate will be made by a Consultant Obstetrician, usually 18 - 24 hours after delivery.
- **Contraindications** (absolute)
  - Heart block
  - Myocardial damage
  - Hypersensitivity to magnesium sulphate
- **Contraindications** (relative)
  - Neuromuscular disease, e.g. myasthenia gravis
  - Severe renal impairment
- **Monitoring**
  - Hourly reflexes: patellar (if no epidural) / biceps (in presence of epidural)
  - Continuous ECG for at least 1 hour after loading dose
  - Continuous pulse oximetry – document hourly on the high dependency chart
- **Toxicity** is rare and is associated with the following clinical signs, listed in order of correlation with increasing blood Mg levels (not routinely measured):
  - Loss of tendon reflexes, generalised weakness, nausea
  - Somnolence, double vision, slurred speech
  - Muscle paralysis, respiratory arrest
  - Cardiac arrest
  - If any of these signs are present, the MgSO<sub>4</sub> infusion should be stopped and there should be urgent medical review. Administration of 10ml calcium gluconate IV should be considered.

### 3.5.5 Antihypertensive Therapy

Prompt treatment of severe hypertension is imperative to prevent cerebral haemorrhage following the loss of autoregulation of cerebral blood flow. Severe hypertension is defined as a systolic blood pressure  $\geq 160$  mmHg OR a diastolic blood pressure  $\geq 110$  mmHg. However the aim is to keep **systolic BP <150 mmHg and diastolic BP < 100 mmHg.**

### Algorithm A: Antihypertensive Drug Therapy for Severe Hypertension



### Maintenance antihypertensive therapy:

- IV infusions of labetalol or hydralazine should be considered for blood pressure control where intermittent IV boluses are required more than hourly.
- Intravenous nicardipine should only be used as a second line agent or where there is a contra-indication to labetalol or hydralazine.
- All patients on a nicardipine infusion should have invasive, continuous blood pressure monitoring.

The following table details the doses:

Drug	How to draw up	Minimum		Maximum		Time at which to assess rate of infusion
		Dose	Rate	Dose	Rate	
Labetalol	50ml syringe: 2 ampoules (40ml/200mg)	40mg/ hour	<b>8ml</b> / hour	120mg/ hour	<b>24ml</b> / hour	Every 30 min
Hydralazine	50ml syringe: 40mg hydralazine made up to 40ml with n/saline	10mg / hour	<b>10ml</b> / Hour	40mg / hour	<b>40ml</b> / hour	Every 30 min
Nicardipine	50ml syringe: 1 ampoule (10mg) made up to 50mls with 5% glucose. Protect solution from light	1mg / hour  Titrate in 0.5mg (2.5ml) steps	5ml) / hour	Usual max:  4mg / hour  Absolute max. 15mg (150ml/ hour)	Usual max:  <b>20ml</b> / hour  Absolute max. 15mg (150ml/ hour)	Every 30 min
<b>CAUTION – Please check correct rate is entered into infusion pump.</b>						

### 3.5.6 Fluid Guidance

Maintenance fluids should be limited to a maximum of 80ml/hour including all oral intake and drug infusion volumes, unless there is ongoing fluid loss (e.g. haemorrhage) or evidence of hypovolaemia. An indwelling Foley's catheter with urometer should be utilised to monitor urine output and calculate (and document) fluid balance hourly. Medical staff to review patient if urine output <100mls /4 hours.

### 3.5.7 Referral to Critical Care

All patients should be reviewed by the delivery suite anaesthetic team who will liaise with the Intensive Care Unit (ITU) team as necessary. ITU care is indicated for women with severe PET and other significant co-morbidities (e.g. massive haemorrhage or acute renal failure) and for women needing ventilatory support.



### 3.5.8 Step-down care

On transfer to the postnatal ward, there should be a clear plan in the notes detailing:

- Frequency of observations and deviation from trigger thresholds on MEWS chart if required
- Requirement / frequency of further blood tests
- Plan for antihypertensive management

### 3.6 Postnatal Care

- On transfer from delivery suite to the postnatal ward: There should be a clear verbal midwifery and medical handover including a plan for postnatal care. This should be clearly documented on the blue postnatal handover sheet.
- Any woman with postnatal blood pressure concerns should be discussed with the duty Tier 2 or consultant.
- Labetalol, nifedipine and ACE inhibitors are safe to use in the postpartum period and in breastfeeding mothers. Methyldopa is to be avoided as it may contribute to postnatal depression: stop within 2 days after the birth and change to an alternative antihypertensive treatment if still required.
  - Labetalol – start at 100mg bd and titrate up to 400mg tds in 100mg steps
  - Nifedipine XL – Coracten 30mg od and titrate up to 90mg od in 30mg steps
  - Enalapril is the ACEi with most safety data in breastfeeding – start at 5mg od and titrate up to 20mg od in 5mg steps
  - These medications can be titrated downwards by the same increments as stated above. It is reasonable to adjust the dose and recheck BP after a few days and then re-assess

#### 3.6.1 Chronic hypertension

- Measure blood pressure:
  - Daily for the first 2 days after birth
  - At least once between day 3 and day 5 after birth
  - As clinically indicated if antihypertensive treatment is changed after birth
- Continue antihypertensive treatment, if required and aim to keep blood pressure lower than 140/90 mmHg

#### 3.6.2 Gestational hypertension

- Measure blood pressure:
  - Daily for the first 2 days after birth

- At least once between day 3 and day 5 after birth
- As clinically indicated if antihypertensive treatment is changed after birth
- Continue antihypertensive treatment, if required. Reduce antihypertensive treatment if their blood pressure falls below 130/80 mmHg.
- For women with gestational hypertension who did not take antihypertensive treatment and have given birth, start antihypertensive treatment if their blood pressure is 150/100mmHg or higher.
- Advise women that the duration of their postnatal antihypertensive treatment will usually be similar to the duration of their antenatal treatment (but may be longer)

### 3.6.3 Pre-eclampsia

- Women with pre-eclampsia should stay in hospital for a minimum of 3 days following delivery. Ask women with pre-eclampsia who have given birth about severe headache and epigastric pain each time blood pressure is measured.
- In women who have pre-eclampsia with mild or moderate hypertension, or after step-down from critical care:
  - Measure platelet count, transaminases and serum creatinine 48–72 hours after birth or step-down
  - Do not repeat platelet count, transaminases or serum creatinine measurements if results are normal at 48–72 hours
- In women with pre-eclampsia who did not take antihypertensive treatment and have given birth:
  - Measure blood pressure:
    - At least four times a day while the woman is an inpatient
    - At least once between day 3 and day 5 after birth
    - On alternate days until normal if blood pressure was abnormal on days 3–5.
  - Start antihypertensive treatment if blood pressure is 150/100 mmHg or higher.
- In women with pre-eclampsia who took antihypertensive treatment and have given birth:
  - Measure blood pressure:
    - At least four times a day while the woman is an inpatient
    - Every 1–2 days for up to 2 weeks after transfer to community care until the woman is off treatment and has no hypertension
  - Continue antenatal antihypertensive treatment. If a woman has taken methyldopa during pregnancy, stop within 2 days of birth and start an alternative or restart the antihypertensive treatment the woman was taking before she planned the pregnancy. Methyldopa is associated with postnatal depression.

- Consider reducing antihypertensive treatment if their blood pressure falls below 140/90 mmHg
- Reduce antihypertensive treatment if their blood pressure falls below 130/80 mmHg.
- Offer women with pre-eclampsia who have given birth transfer to community care if all of the following criteria have been met:
  - There are no symptoms of pre-eclampsia
  - Blood pressure, with or without treatment, is 150/100 mmHg or less
  - Blood test results are stable or improving.

### 3.7 Discharge from hospital

#### 3.7.1 Give letter (See Appendix 8.) to woman/GP and CMW outlining history and medication and advising:

- The community midwife to:
  - Monitor BP a minimum of twice weekly until the BP is normal on two-to-three consecutive readings.
  - Aiming to keep blood pressure lower than 140/90 mmHg
  - Seek advice from the GP or MAU if BP is persistently greater than 160/110
  - Referral of women to Postnatal Hypertension ANC if:
    - Uncontrolled BP, despite increasing medication
    - Persistently elevated BP, or BP requiring medication more than three months following delivery

N.B. Women with known, pre-existing, chronic hypertension do not need to be referred.
- Arrange a GP review of antihypertensive treatment two weeks following delivery. Medication can be reduced when BP <140/90 and stopped when BP <130/80
- Antihypertensives in the postnatal period:
  - Nifedipine, Labetalol, and ACE inhibitors are safe to use in the postpartum period and in breastfeeding mothers. Methyldopa is to be avoided as it may contribute to postnatal depression.
  - First Line (because once daily) Nifedipine – Coracten XL 30mg od and titrate up to 90mg od in 30mg steps
  - Labetalol – start at 100mg bd and titrate up to 400mg tds in 100mg steps
  - Enalapril is the ACEi with most safety data in breastfeeding – start at 5mg od and titrate up to 20mg od in 5mg steps
  - These medications can be titrated downwards by the same increments as stated above. It is reasonable to adjust the dose and recheck BP after a few days and then re-assess

### 3.7.2 Postnatal proteinuria

- Proteinuria from pre-eclampsia should have resolved by the 6-8 week GP check. Please dip the urine at this visit. If > 2+ protein, send a urinary protein-creatinine ratio (PCR) to quantify. If PCR>30, re-check the PCR again after 3 months. If there is still proteinuria at three months, then refer to the Renal New Patient Clinic at the FRH, to exclude an underlying renal cause.

### 3.7.3. Future Pregnancies and health

Advise women:

- Of their risk of hypertensive disease in a future pregnancy (see overleaf)
- To achieve and keep their BMI 18.5–24.9 kg/m<sup>2</sup> before their next pregnancy, in line with the NICE pathway on obesity
- That there is an increased risk of cardiovascular disease (hypertension and its complications).
- They should avoid smoking and exercise on a regular basis
- In future pregnancies she will require consultant led care with consideration of aspirin from 12 weeks of pregnancy
- Contraceptive advice should be offered as appropriate

#### Likelihood of recurrence of hypertensive disorders of pregnancy

	Prevalence of hypertensive disorder in a future pregnancy		
	Any hypertension in pregnancy	Pre-eclampsia	Gestational hypertension
<b>Any hypertension</b>	Approximately 21% (1 in 5 women)	Approximately 20% (1 in 5 women)	Approximately 22% (1 in 5 women)
<b>Pre-eclampsia</b>	Approximately 14% (1 in 7 women)	Up to approximately 16% (1 in 6 women)  If birth was at 28–34 weeks: approximately 33% (1 in 3 women)  If birth was at 34–37 weeks: approximately 23% (1 in 4 women)	Approximately 7% (1 in 14 women)
<b>Gestational hypertension</b>	Approximately 9% (1 in 11 women)	Between approximately 6 and 12% (up to 1 in 8 women)	Between approximately 11 and 15% (up to 1 in 7 women)
<b>Chronic hypertension</b>	Not applicable	Approximately 2% (up to 1 in 50 women)	Approximately 3% (up to 1 in 34 women)

No evidence was identified for women who gave birth at less than 28 weeks, but the NICE committee agreed that the risk was likely to be at least as high, if not higher, than that for women who gave birth between 28 and 34 weeks.

## 4 Training

Staff should familiarise themselves with this guideline. Management of severe pre-eclampsia and eclampsia is included as part of annual clinical skills training for all medical and midwifery staff who work on the labour ward. Periodic drills will be organised as part of ongoing emergency care training and feedback circulated to staff.

## 5 Monitoring section

Compliance with this guideline will be monitored by annual audit using the audit tool attached (appendix 1) by an obstetrician. The audit data will be reported to the Obstetric Governance Group who will review the report, identify any actions required to improve compliance and monitor these actions through to completion.

Standard / process / issue	Monitoring and audit			
	Method	By	Committee	Frequency
Standards based on NICE QS including: <ul style="list-style-type: none"><li>• Screening and management of pre-eclampsia once diagnosed</li><li>• Management of severe pre-eclampsia</li></ul>	30 health records of women with pre-eclampsia who have delivered.  10 health records of women with severe pre-eclampsia/eclampsia who have delivered.	Obstetric Governance Group	Obstetric Governance Group	Bi-annual

## 6 Evidence Review and Evaluation

This guidance is based on NICE and RCOG guideline and recommendations from MBRRACE.

## 7 References

- Hypertension in pregnancy: diagnosis and management. NICE guidelines and Quality Standards [NG133] Published date: July 2019, updated April 2023
- PLGF-based testing to help diagnose suspected preterm pre-eclampsia. NICE. Diagnostics guidance [DG49] Published: 27 July 2022

Antenatal Flowchart

## Hypertension, Proteinuria and Pregnancy Guidelines

### Points to note

#### Proteinuria

- Urinalysis should be performed in all women attending for a blood pressure profile and assessed using an automated reagent strip reading device (visual reading if in community)  
    **If protein 1+ or more, then a urine PCR should be requested**  
    **This should be done prior to any blood tests being performed.**  
    **Women with protein 1+ who are well and normotensive do not need to be seen urgently – make Maternity Day-care appt within 48hours**
- PCR is calculated in the Biochemistry lab using an MSU sample. Send the sample **URGENTLY** using a biochemistry request form. Write on the form requesting Urine protein/creatinine ratio
- PCR < 30 mg/mmol excludes significant proteinuria.
- Only send an MSU if symptomatic (frequency/dysuria) – see suspected UTI flowchart

#### Measurement of BP

- The measurement of the diastolic blood pressure (mmHg) refers to K5 (loss of sounds).
- If the upper arm circumference of the woman is  $\geq 33$ cms then a large cuff must be used
- NICE classification:
  - Hypertension: DBP 90 - 109mmHg, SBP 140 – 159mmHg
  - Severe hypertension: DBP  $\geq 110$ mmHg, SBP  $\geq 160$ mmHg

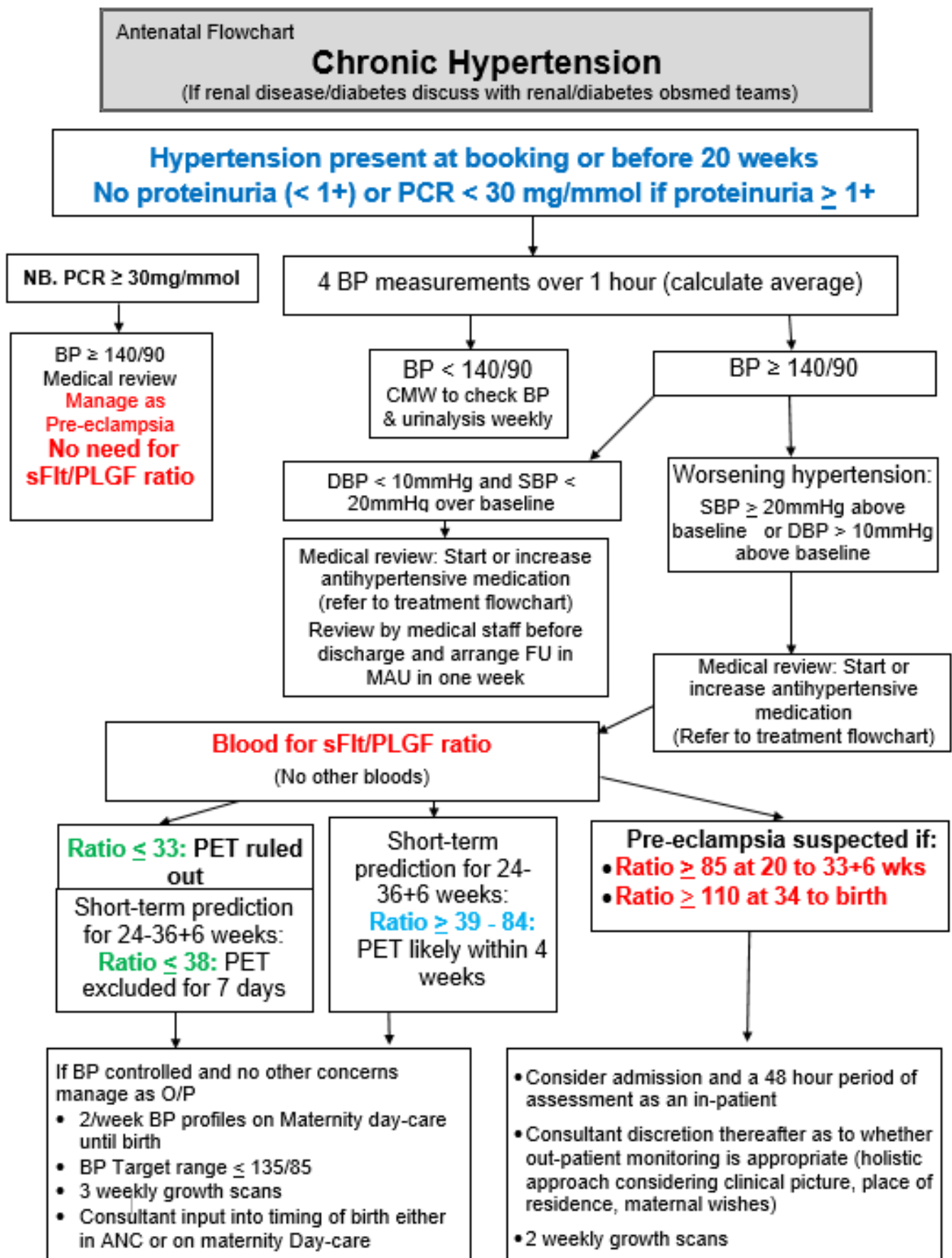
#### Bloods

- **Once PCR is known:** blood for **sFlt-1/PLGF ratio test** should be taken (**not necessary if hypertensive and PCR  $\geq 30$** ) in women:
  - Chronic hypertension with pregnancy-related increase in BP or stable BP with development of proteinuria (PCR  $\geq 30$  mg/mmol)
  - Gestational hypertension (i.e. average SBP  $\geq 140$  mm Hg and or DBP  $\geq 90$  mmHg and no proteinuria on urinalysis or PCR < 30 mg/mmol)
  - Chronic renal disease/diabetes with worsening proteinuria or hypertension

#### Symptoms of Pre-eclampsia

Women should be made aware to contact MAU if they experience any of the following: severe headache, problems with vision such as blurring, or flashing before the eye, severe pain just below the ribs, vomiting and/or sudden swelling of face, hands and feet.

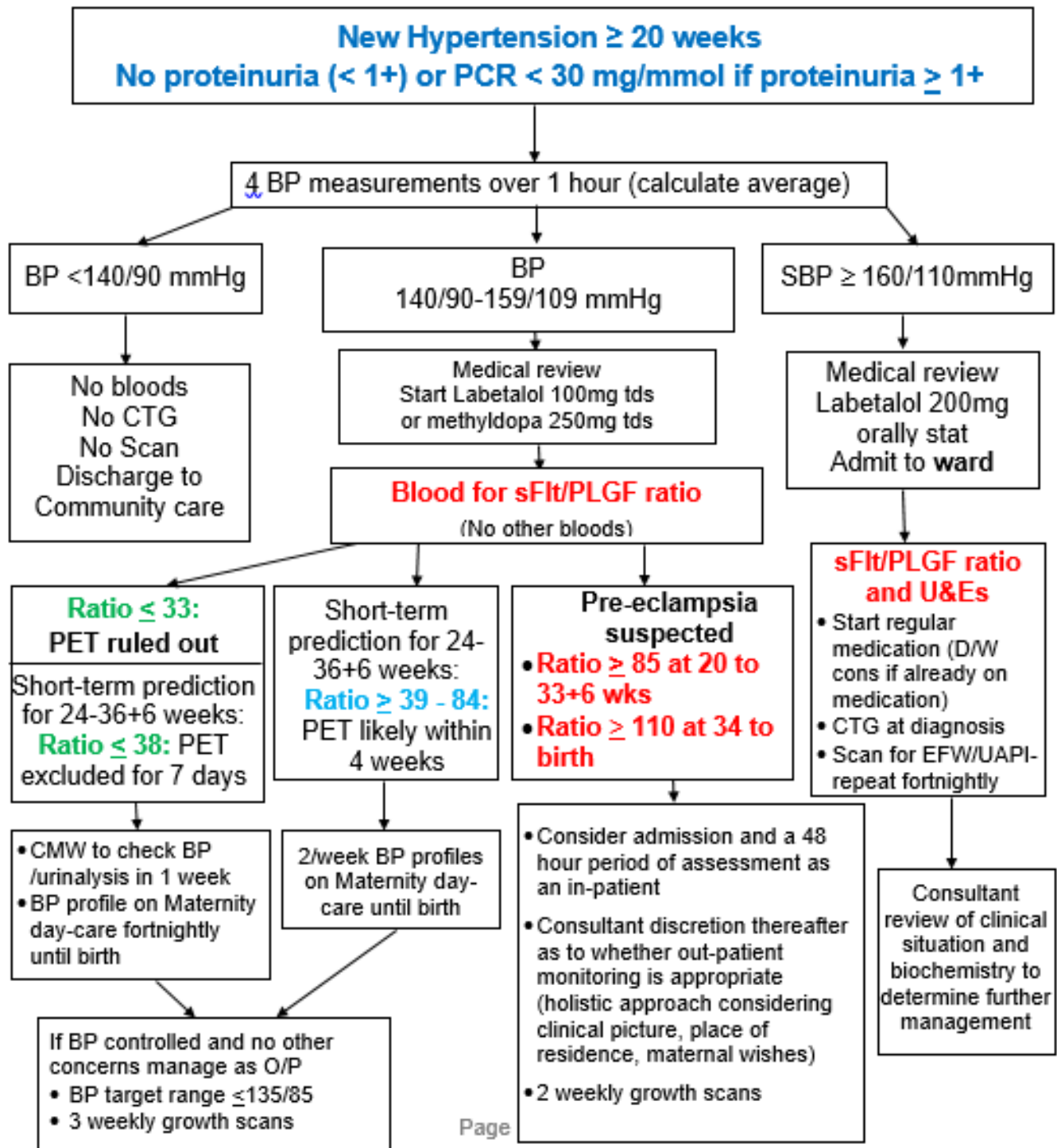
Appendix 2.



Antenatal Flowchart  
**Gestational Hypertension**  
**(Pregnancy induced hypertension)**

Hypertension: DBP 90 - 109mmHg, SBP 140 – 159mmHg

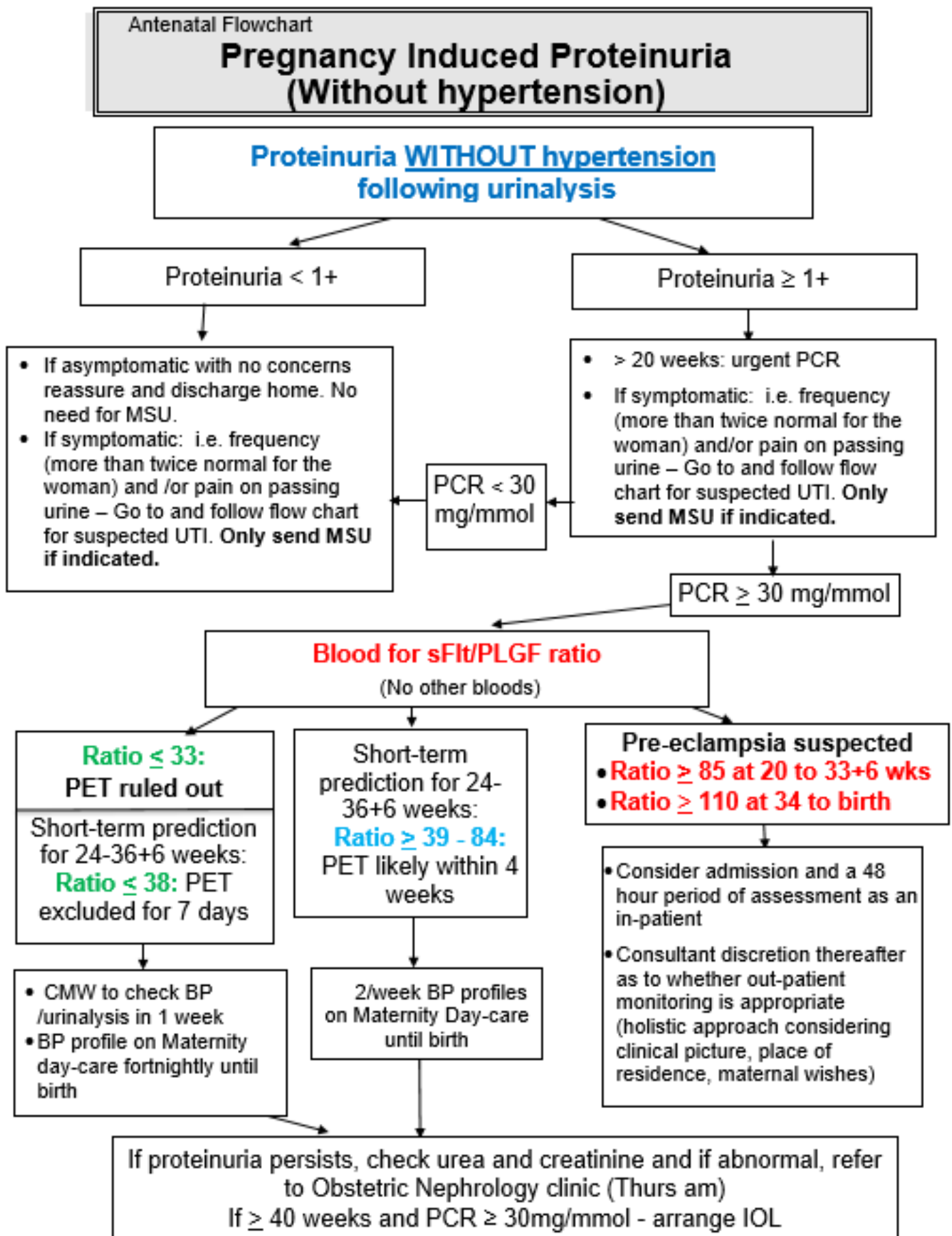
Severe hypertension: DBP  $\geq$  110mmHg, SBP  $\geq$  160mmHg

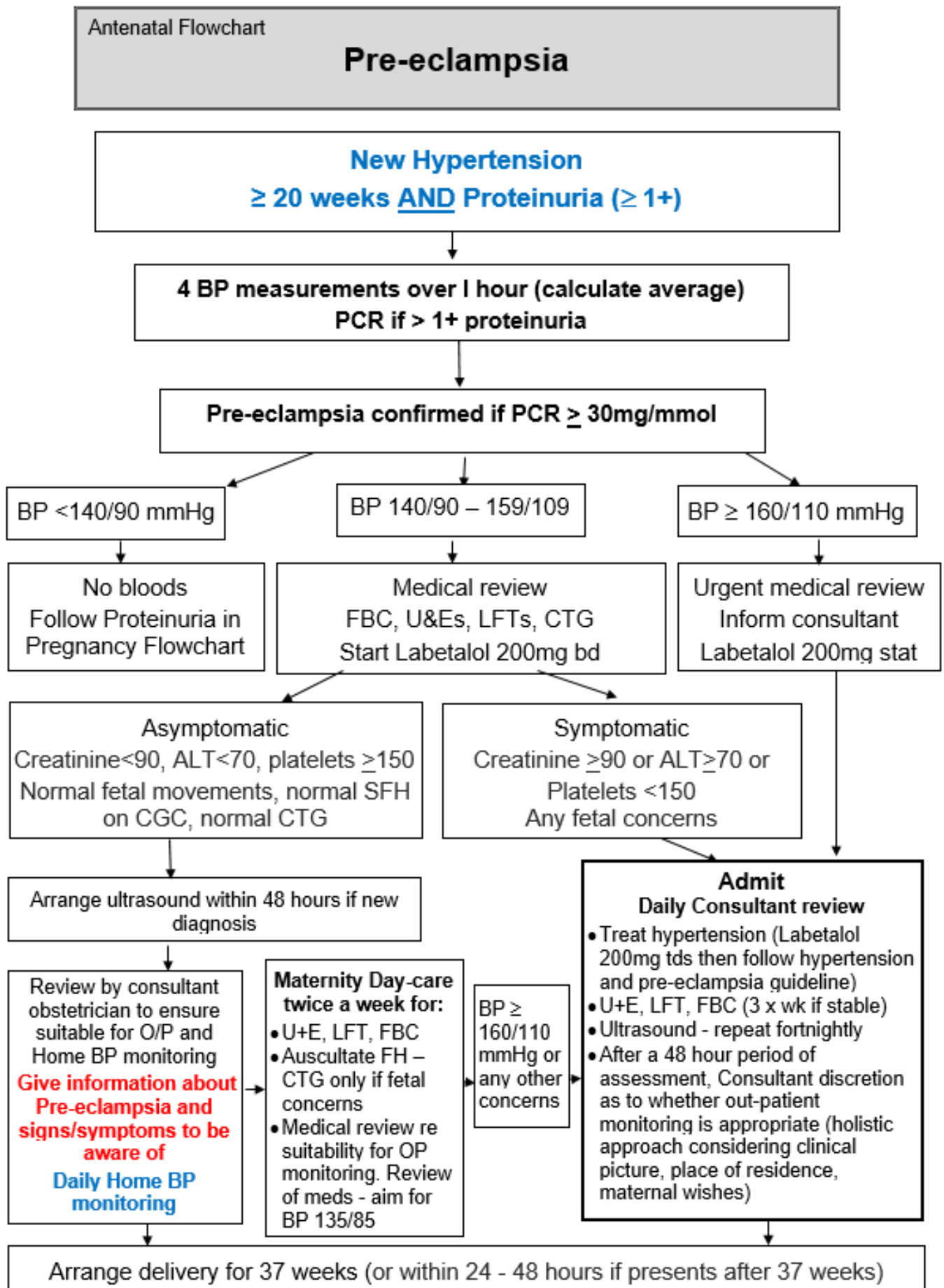


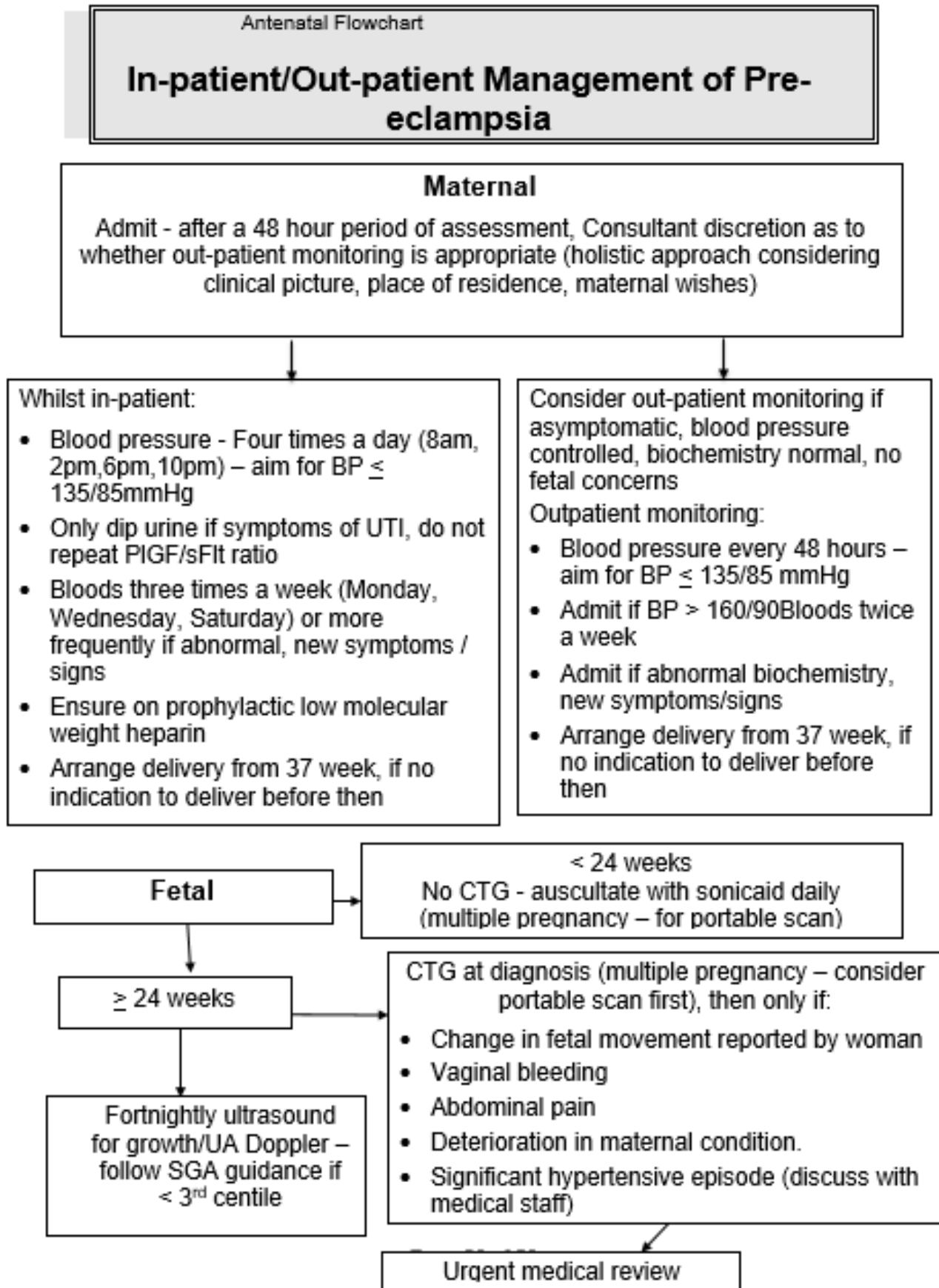


## Treatment Pathway for Hypertension

<b>Treatment pathway for hypertension:</b> <b>Labetalol +/- Methyldopa/Coracten</b> (Consider methyldopa +/- Coracten XL if labetalol not available) Not always necessary to start at step 1 and can be started at initial higher doses			
Step	LABETALOL	METHYLDOPA or CORACTEN XL Can use either methyldopa or Coracten but not both together with labetalol at this stage. Consideration for 3 antihypertensives must be discussed with a consultant	
Start	100mg BD	METHYLDOPA	CORACTEN XL
Step 1	100mg TDS		
Step 2	200mg TDS		
Step 3	200mg QDS		
Step 4	200mg QDS and add	250mg TDS	30mg once daily
Step 5	200mg QDS and	250mg QDS	60mg once daily
Step 6	200mg QDS and	500mg TDS	↓
Step 7	200mg QDS and	500mg QDS	↓
Step 8		↓ Once max Labetalol and max Methyldopa reached consultant review	↓ Once max Labetalol and max Coracten reached consultant review







## Appendix 8.

### Postnatal Letter for woman with gestational hypertension/pre-eclampsia

This woman has been diagnosed with gestational hypertension/pre-eclampsia (delete as appropriate). She has now delivered and has been discharged home with anti-hypertensive medication as detailed on the discharge documentation/BadgerNet.

As per NICE guidance, we recommend the following:

- Please could the community midwife monitor BP a minimum of twice weekly until the BP is normal on two-to-three consecutive readings:
  - Aim to keep blood pressure lower than 140/90 mmHg
  - Advice from the GP or MAU should be sought if BP is persistently > 160/110
- Please could the GP review antihypertensive treatment two weeks following delivery
- Medication can be reduced when BP<140/90 and stopped when BP <130/80
- **Antihypertensives:**

Nifedipine, Labetalol, and ACE inhibitors are safe to use in the postpartum period and in breastfeeding mothers. Methyldopa is to be avoided as it may contribute to postnatal depression.

  - First Line (because once daily) Nifedipine – Coracten XL 30mg od and titrate up to 90mg od in 30mg steps
  - Labetalol – start at 100mg bd and titrate up to 400mg tds in 100mg steps
  - Enalapril is the ACEi with most safety data in breastfeeding – start at 5mg od and titrate up to 20mg od in 5mg steps

These medications can be titrated downwards by the same increments as stated above. It is reasonable to adjust the dose and recheck BP after a few days and then re-assess
- Proteinuria from pre-eclampsia should have resolved by the 6-8 week GP check. Please dip the urine at this visit. If > 2+ protein, send a urinary protein-creatinine ratio (PCR) to quantify. If PCR>30, re-check the PCR again after 3 months. If there is still proteinuria at three months then refer to the Renal New Patient Clinic at the FRH, to exclude an underlying renal cause.

The woman should be advised:

- to maintain a healthy BMI (between 18.5 to 24.9)
- to avoid smoking
- Contraceptive advice should be offered as appropriate

She should also be made aware that:

- Gestational hypertension in a future pregnancy ranges from about 1 in 8 pregnancies to about 1 in 2 pregnancies
- Pre-eclampsia in a future pregnancy;
  - Affects up to about 1 in 6 pregnancies
  - Increases to about 1 in 4 pregnancies if it was complicated by severe pre-eclampsia, HELLP syndrome or eclampsia and led to birth before 34 weeks
  - Increases to 1 in 2 pregnancies if it led to birth before 28 weeks
- There is an increased risk of cardiovascular disease (hypertension and its complications)
- In future pregnancies she will require consultant led care with consideration of aspirin from 12 weeks of pregnancy

**Copy for community midwife/GP/ woman**