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Guidelines for Management of Hypertensive Disorders in Pregnancy

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Guidelines Definition
Clinical guidelines are systematically developed statements that assist clinicians and patients in making decisions about appropriate treatments for specific conditions.

They allow deviation from a prescribed pathway according to the individual circumstances and where reasons can be clearly demonstrated and documented.

Minor Amendments
If a minor change is required to the document, which does not require a full review please identify the change below and update the version number.

Type of change	Why change made	Page number	Date of change	Version 1 to 1.1	Name of responsible person
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1. Introduction

Hypertensive disorders during pregnancy affect around 8-10% of all pregnant women and can be associated with substantial complications for the woman and the baby.[1]

Women can have hypertension before pregnancy, or it can be diagnosed in the first 20 weeks (known as chronic hypertension), new onset of hypertension occurring in the second half of pregnancy (pregnancy-induced or gestational hypertension) or new hypertension with features of multi-organ involvement (pre-eclampsia).[1]

These guidelines have been developed for Cwm Taf Morgannwg University Health Board, incorporating previous guidance from Cwm Taf University Health Board and Abertawe Bro Morgannwg University Health Board. These guidelines replace any previous health board versions.

2. Definitions

Chronic hypertension: Hypertension that is present at the booking visit, or before 20 weeks, or if the woman is already taking antihypertensive medication when referred to maternity services. It can be primary or secondary in aetiology.

Pregnancy-induced hypertension (PIH) or gestational hypertension: Hypertension of at least 140/90 mmHg on two separate occasions ≥4 hours apart arising de novo after the 20th week of gestation in a previously normotensive woman and resolving completely by the 6th postpartum week

Pre-eclampsia: Is defined by the International Society for the Study of Hypertension in Pregnancy as gestational hypertension of at least 140/90 mmHg on two separate occasions ≥4 hours apart accompanied by significant proteinuria of >30 mgs/mmol, arising de novo after the 20th week of gestation in a previously normotensive woman and resolving completely by the 6th postpartum week.

Severe Pre-eclampsia: is pre-eclampsia with severe hypertension (≥ 160/110), +/or symptoms, +/or biochemical impairment, +/or haematological impairment. Signs and symptoms of severe pre-eclampsia:

- Severe headache.
- Visual disturbance.
- Severe epigastric pain/liver tenderness.
- Vomiting.

- Clonus ≥ 3 beats.
- Platelet count falling to below 100x109/l
- HELLP Syndrome
- Papilloedema
- Abnormal liver enzymes(ALT or AST >70 IU/L)

Eclampsia: Occurrence of tonic clonic convulsions in women with pre-eclampsia.

HELLP syndrome: Haemolysis, elevated liver enzymes and low platelet count.

3. Reducing the risk of hypertensive disorders in pregnancy

Offer Aspirin 75mg-150 mg daily to pregnant women from 12 weeks gestation until the birth of the baby:

a) If she has any of the following *high risk* factors:
- 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.

b) Or if she has more than 1 *moderate risk factor* of the following factors for pre-eclampsia:
- First pregnancy
- Age 40 years or older
- Pregnancy interval of more than 10 years
- Body mass index (BMI) of 35 kg/m2 or more at first visit
- Family history of pre-eclampsia
- Multi-fetal pregnancy

ASPRE trial (2017) recommends 150mg Aspirin *at night*. Consider 75 mg aspirin daily if booking weight <75 kg.

4. Management of pregnancy with chronic hypertension

- Counsel the patients about the importance of weight management, exercise and healthy eating.
- Stop antihypertensive treatment in women taking ACE inhibitors or ARBs, thiazides or thiazide like diuretics if they become pregnant

(preferably within 2 working days of notification of pregnancy) and offer alternatives. The BNF states this is due to increased risk of congenital abnormalities.

- Advise women who take antihypertensive treatments other than ACE inhibitors, ARBs, thiazide or thiazide-like diuretics that the limited evidence available has not shown an increased risk of congenital malformation with such treatments.
- Continue with existing antihypertensive treatment if safe in pregnancy, or switch to an alternative treatment, unless:
    - Sustained systolic blood pressure is less than 110 mmHg or
    - Sustained diastolic blood pressure is less than 70 mmHg or
    - 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 140 mmHg or higher or
    - Sustained diastolic blood pressure of 90 mmHg or higher.
- 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 (NICE 2019).
- Base the choice on any pre-existing treatment, side-effect profiles, contra-indications, risks (including fetal effects) and the woman's preference.
- **Aim for a target blood pressure of 135/85 mmHg with medications**.

Antenatal appointments

In women with chronic hypertension, schedule additional antenatal appointments based on the individual needs. This may include:

- Weekly appointments if hypertension is poorly controlled
- Appointments every 2 to 4 weeks if hypertension is controlled.

Fetal monitoring in chronic hypertension

- In women with chronic hypertension, carry out an ultrasound for fetal growth and amniotic fluid volume assessment, and umbilical artery Doppler velocimetry at 28 weeks, 32 weeks and 36 weeks.
- Carry out cardiotocography only if clinically indicated.

Timing of birth

- Do not offer planned early birth before 37 weeks to women with chronic hypertension whose blood pressure is lower than 160/110 mmHg, with or without antihypertensive treatment, unless there are other medical indications.
- 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 the senior obstetrician.
- If planned early birth is necessary, offer a course of antenatal corticosteroids and magnesium sulfate if indicated (refer to CTMUHB guideline Pre-term Labour)

Postnatal investigation, monitoring and treatment

In women with chronic hypertension who have given birth, 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 treatment is changed after birth.

In women with chronic hypertension who have given birth:

- Aim to keep blood pressure lower than 140/90 mmHg
- Continue antihypertensive treatment, if required
- Offer a review 2 weeks after the birth, with their GP or specialist.

If a woman has taken methyldopa to treat chronic hypertension during pregnancy, stop within 2 days after the birth and change to an alternative antihypertensive treatment.

Offer a medical review 6–8 weeks after the birth with their GP or specialist as appropriate.

5. Management of 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
- Multi-fetal pregnancy
- BMI of 35 kg/m2 or more
- Gestational age at presentation
- Previous history of pre-eclampsia or gestational hypertension
- Pre-existing vascular disease
- Pre-existing kidney disease.

Offer women with gestational hypertension the tests and treatment listed in the following table

	Hypertension: BP= 140/90–159/109 mmHg	**Severe hypertension: BP= 160/110 mmHg or more**
Admission to hospital	Do not routinely admit to hospital	Admit, but if BP falls below 160/110 mmHg then manage as for hypertension
Antihypertensive pharmacological treatment	Offer pharmacological treatment if BP remains above 140/90 mmHg	Offer pharmacological treatment to all women
Target blood pressure	Aim for BP of 135/85 mmHg or less	
Blood pressure measurement	Once or twice a week (depending on BP) until BP is 135/85 mmHg or less	Every 15–30 minutes until BP is less than 160/110 mmHg
Dipstick proteinuria testing	Once or twice a week (with BP measurement)	Daily while admitted
Blood tests	Measure full blood count, liver function and renal function at presentation and then weekly	
Fetal assessment	• Offer fetal heart auscultation at every antenatal appointment • Carry out ultrasound assessment of the fetus at diagnosis and, if normal, repeat every 2 to 4 weeks, if clinically indicated • Carry out a CTG only if clinically indicated	• Offer fetal heart auscultation at every antenatal appointment • Carry out ultrasound assessment of the fetus at diagnosis and, if normal, repeat every 2 weeks, if severe hypertension persists • Carry out a CTG at diagnosis and then only if clinically indicated

*BP = blood pressure

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.

Timing of birth

- Do not offer planned early birth before 37 weeks to women with gestational hypertension whose blood pressure is lower than 160/110 mmHg, unless there are other medical indications.
- 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.
- If planned early birth is necessary, offer a course of antenatal corticosteroids and magnesium sulfate if indicated (refer to CTMUHB guideline Pre-term Labour)
-

Postnatal investigation, monitoring and treatment

- In women with gestational hypertension who have given birth, 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 treatment is changed after birth.
- In women with gestational hypertension who have given birth:
    - Continue antihypertensive treatment if required
    - Reduce antihypertensive treatment if their blood pressure falls below 130/80 mmHg.
- If a woman has taken methyldopa to treat gestational hypertension, stop within 2 days after the birth and change to an alternative treatment if necessary.
- For women with gestational hypertension who did not take antihypertensive treatment and have given birth, start antihypertensive treatment if their blood pressure is 150/100 mmHg or higher.
- Offer women who have had gestational hypertension and who remain on antihypertensive treatment, a medical review with their GP or specialist 2 weeks after transfer to community care.
- Offer all women who have had gestational hypertension a medical review with their GP or specialist 6–8 weeks after the birth.

6. Management of pre-eclampsia

Carry out a full clinical assessment at each antenatal appointment for women with pre-eclampsia.

Offer admission to hospital for surveillance and any interventions needed if there are concerns for the wellbeing of the woman or baby. Concerns could include any of the following:

- Sustained systolic blood pressure of 160 mmHg or higher
- Any maternal biochemical or haematological investigations that cause concern, for example, a new and persistent:
  - Rise in creatinine (≥ 90 micromol/litre, ≥ 1 mg/100 ml) *(Note that healthy women normally have a creatinine in the low normal range, therefore the significance of a rise in creatinine within normal limits should also be considered)* **or**
  - Rise in alanine transaminase (> 70 IU/litre, or twice upper limit of normal range) **or**
  - Fall in platelet count (< 150,000/microlitre)
- Signs of impending eclampsia
- Signs of impending pulmonary oedema
- Other signs of severe pre-eclampsia
- Suspected fetal compromise
- Any other clinical signs that cause concern

Offer women with pre-eclampsia the tests and treatments listed in the following table.

	Hypertension: BP = 140/90–159/109 mmHg	**Severe hypertension: BP = 160/110 mmHg or more**
Admission to hospital	Admit if any clinical concerns for the wellbeing of the woman or baby or if high risk of adverse events	Admit, but if BP falls below 160/110 mmHg then manage as for hypertension
Antihypertensive pharmacological treatment	Offer pharmacological treatment if BP remains above 140/90 mmHg	Offer pharmacological treatment to all women
Target blood pressure once on	Aim for BP of 135/85 mmHg or less	

antihypertensive treatment		
Blood pressure measurement	At least every 48 hours, and more frequently if the woman is admitted to hospital (at least 4 times daily)	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	
Blood tests	Measure full blood count, liver function and renal function twice a week	Measure full blood count, liver function and renal function 3 times a week
Fetal assessment	Offer fetal heart auscultation at every antenatal appointment. Carry out ultrasound assessment of the fetus at diagnosis and, if normal, repeat every 2 weeks. Carry out a CTG at diagnosis and then only if clinically indicated.	

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.

Timing of birth in women with pre-eclampsia

Before 34 weeks	Continue surveillance unless there are indications for planned early birth.

From 34 to 36 $^{+6}$ weeks	Continue surveillance unless there are indications for planned early birth. When considering the option of planned early birth, take into account the woman's and baby's condition, risk factors (such as maternal comorbidities, multi-fetal pregnancy) and availability of neonatal unit beds. Consider a course of antenatal corticosteroids in line with the CTMUHB guideline on Pre-term Labour.
37 weeks onwards	Initiate birth within 24–48 hours.

Thresholds for considering planned early birth could include (but are not limited to) any of the following known features of severe pre-eclampsia:

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

Involve a senior obstetrician in any decisions on timing of birth for women with pre-eclampsia.

Discuss with the anaesthetic team if birth is planned in a woman with pre-eclampsia.

Discuss with the neonatal team if birth is planned in a woman with pre-eclampsia, and neonatal complications are anticipated.

Offer intravenous magnesium sulfate and a course of antenatal corticosteroids if indicated, if early birth is planned for women with preterm pre-eclampsia

7. Fetal monitoring

Fetal monitoring in chronic hypertension

- In women with chronic hypertension, carry out an ultrasound for fetal growth and amniotic fluid volume assessment, and umbilical artery doppler velocimetry at 28 weeks, 32 weeks and 36 weeks.
- In women with chronic hypertension, only carry out cardiotocography if clinically indicated.

Fetal monitoring in gestational hypertension

- In women with gestational hypertension, carry out an ultrasound for fetal growth and amniotic fluid volume assessment and umbilical artery doppler velocimetry at diagnosis and if normal repeat every 2 to 4 weeks, if clinically indicated as per CTMUHB Fetal Growth Assessment guidance.
- In women with gestational hypertension, only carry out cardiotocography if clinically indicated.

Fetal monitoring in pre-eclampsia or severe gestational hypertension

- Carry out CTG at time of diagnosis
- If conservative management of pre-eclampsia or severe gestational hypertension is planned, carry out all the following tests at diagnosis:
    - Ultrasound for fetal growth and amniotic fluid volume assessment
    - Umbilical artery Doppler velocimetry.
- If the results of all fetal monitoring are normal, do not routinely repeat CTG unless clinically indicated i.e. if any of the following occur:
    - The woman reports a change in fetal movement
    - Vaginal bleeding
    - Abdominal pain
    - Deterioration in maternal condition.
- Offer repeat ultrasound for fetal growth and amniotic fluid volume assessment or umbilical artery Doppler velocimetry every 2 weeks, with subsequent surveillance and monitoring determined by the findings of these scans.
- Carry out an ultrasound for fetal growth and amniotic fluid volume assessment and umbilical artery Doppler velocimetry starting at between 28 and 30 weeks (or at least 2 weeks before previous gestational age of onset if earlier than 28 weeks) and repeating 4 weeks later in women with previous:
    - severe pre-eclampsia
    - pre-eclampsia that resulted in birth before 34 weeks
    - pre-eclampsia with a baby whose birth weight was less than the 10th centile

- intrauterine death
- placental abruption

8. Management of Severe Pre-Eclampsia in the community setting (refer to Appendices A and B for management and documentation of events)

To support the timely management and appropriate escalation for women presenting with Eclampsia in the community please:

- Call for help – pull the emergency bell in the Free-standing Midwifery Led Unit
- Dial 999 paramedic ambulance request
- Initiate transfer - transfer must be to labour ward
- Contact Labour Ward and inform them of the situation and to expect the transfer in order for preparations to made for the arrival
    - Airway – position the woman in left lateral position
    - Maintain airway
    - If available (GP setting or when ambulance in attendance) administer high flow oxygen
    - When available (Paramedic ambulance) gain intravenous access and obtain Preeclampsia blood screening in preparation of arrival in the obstetric labour ward

9. Management of Severe Pre-Eclampsia in Critical Care setting

Admit the woman to Labour ward – level 2 care requirement. Contact the Senior Obstetrician, Senior Midwife, Anaesthetist, Haematologist (if required) and Neonatal Team (refer to Appendix C and Appendix D).

Essential maternal resuscitation equipment must be immediately available. These women should be admitted immediately to Labour ward.

9.1 Initial management:

1. Monitor BP every 15 minutes until stabilised then every 30 min for 4 hours then 4 hourly if stable and asymptomatic
2. IV cannula
3. Blood investigations (FBC, U&Es, LFTs, coagulation studies, Group and save)
4. Urometer for hourly urine output monitoring
5. Fluid balance chart (hourly monitoring)
6. Fluid restriction

7. Documentation on HDU Maternal Early Obstetric Warning Score (MEOWS) observation chart
8. Medications (see below)
9. Anti-embolism stockings

9.2 Communication

- Communication is essential between Obstetrician, Anaesthetist, Labour Ward Co-ordinator and also Paediatrician if appropriate (preterm etc.)
- A clear plan for fetal assessment/monitoring and delivery should be documented in the woman's health record.
- Consultant Obstetrician should be informed of admission and should attend all cases of eclampsia.
- Communication with the woman and her partner/family is essential to provide clear information at what will be an anxious time for them

9.3 Blood pressure control

- Start antihypertensive treatment if BP remains above 140/90 mmHg
- In women with other markers of potentially severe disease (significant proteinuria or disordered liver or haematological test results), treatment can be started at lower degrees of hypertension.
- The aim should be to stabilise the BP to 135 /85 mmHg.
- Any woman requiring IV medication to control her blood pressure should be reviewed by an anaesthetist to consider the need for placement of an arterial line.

9.4 Antihypertensives:

- Labetalol (oral or intravenous)
- Nifedipine (oral)
- Hydralazine (intravenous)

9.4.1 Labetalol

First line management for severe hypertension, except in the presence of asthma or Afro-Caribbean women when Hydralazine/Nifedipine should be used.

Dose of labetalol:

Initially orally 200mg before venous access. This should lead to a reduction in BP in about half an hour. Repeat dose after 30 minutes if no response and BP is 160/105 mmHg or higher.

- If BP still above threshold or oral not tolerated:

- **IV Bolus:**
    - 50mg (10ml of ampoule 5mg/ml) over 2 minutes. Should have effect within 5 min.
    - Repeat at 5 minute intervals to a total maximum of 200mg labetalol until BP is controlled.
- **Maintenance:**
    - Labetalol (5mg/ml) via a syringe pump.
    - Start infusion at a rate of 4ml/hr (20mg/hr). This should be doubled every 30 min if necessary to maximum of 32 ml/hr (160 mg/hr) until BP has dropped and stabilised at acceptable level.

- There is no need to give a fluid pre-load with labetalol.
- The pulse rate should remain over 60 beats per minute.
- Labetalol has a low pH and may cause venous irritation and tissue damage in cases of extravasation.
- If a central venous access device is unavailable, administer via a large peripheral vein monitoring insertion site closely using a recognised phlebitis scoring tool.
- Resite cannula at first signs of inflammation.

<u>Contraindications for use of labetalol:</u>

- Asthma - use hydralazine
- Hypersensitivity to Labetalol
- Second or third degree AV block,
- cardiogenic shock,
- hypotension,
- bradycardia < 45-50bpm,
- Prinzmetal's angina,
- untreated phaeochromocytoma, metabolic acidosis and severe peripheral circulatory disturbances.
- Uncontrolled , incipient or digitalis refractory heart failure
- Sick sinus syndrome (including sino- atrial block) Low cardiac output following Myocardial Infarction.

<u>Side effects of labetalol:</u>

- Tiredness/weakness
- Headache
- Rashes
- Scalp tingling
- Difficulty in micturition
- Epigastric pain
- Nausea/vomiting
- Postural hypotension

See BNF or SPC for a full list of contraindications and cautions for use.

Ante-natal maternal use of labetolol can cause adverse effects in the neonate. Neonatal monitoring is required for: hypoglycaemia, hypotension, bradycardia, hypothermia and respiratory depression.

9.4.2 Hydralazine

To be used when labetalol is contra-indicated (usually asthma) or as a second line if labetalol fails to control the BP.

Dose of hydralazine:

Initial dose:

- Mix 20mg (1ml) of hydralazine with 20mls of sodium chloride 0.9% to result in 1mg/ml of hydralazine.
- Give 5ml (5mg) over 15 minutes and check blood pressure.
- If systolic BP >160mmHg after 20 mins, repeat dose of 5ml (5 mg) over 15 minutes.
- Consider using up to 500 ml crystalloid sodium chloride 0.9% before or at the same time as the first dose of intravenous hydralazine in the antenatal period

Maintenance dose:

Using a 50ml syringe, draw up 40mg (2ml) of hydralazine and make up to a final volume of 40ml with sodium chloride 0.9%, producing a final concentration of 1mg in 1ml.

- Administer via a syringe pump (1mg/ml) with a one way valve.
- Start infusion at 5ml (5 mg) /hour
- Titrate to systolic to BP 140-150mmHg.
- Usual rate is 2-3ml/hr (2-3mg/hour)
- Max. infusion rate 18ml/hour
- Stop increasing dose if diastolic BP <100 is reached or pulse >120 beats/minute, or significant adverse effect
- Reduce by 1 ml/hour every 30 minutes.

Contraindications for Hydralazine

- Known hypersensitivity
- Coronary artery disease
- Mitral valve rheumatic heart disease
- Tachycardia

Side Effects of Hydralazine

- Tachycardia
- Palpitations/Flushing
- Chest pain
- Gastrointestinal disturbances

- Agitation
- Anxiety

See BNF or SPC for a full list of contraindications and cautions for use.

9.4.3 Nifedipine (Immediate release oral):

Indications:

- If tachycardic ≥ 120 beats / minute
- Asthmatic
- Women with African or Caribbean family origin:
  - Consider nifedipine 10 mg orally (not sublingual)
  - Recheck BP in 30 minutes
  - Repeat nifedipine 10mg orally if BP not below threshold
  - Maintenance dose nifedipine (modified release) 10 mg orally qds

Contraindications of Nifedipine

- Acute attacks of angina
- Cardiogenic shock
- Significant aortic stenosis
- Unstable angina within 1 month of myocardial infarction

Side effects of Nifedipine

- Abdominal pain
- Dizziness
- Drowsiness
- Flushing
- Headache
- Nausea
- Palpitations
- peripheral oedema
- skin reactions
- tachycardia
- vomiting

See BNF or SPC for a full list of contraindications and cautions for use.

9.5 Seizure Prophylaxis

Magnesium sulfate

If a woman in a critical care setting who has severe hypertension or severe pre-eclampsia has or previously had an eclamptic fit, give

intravenous magnesium sulfate ($MgSO_4$). Document care given using Appendix E.

Consider giving intravenous magnesium sulfate to women with severe pre-eclampsia who are in a critical care setting if birth is planned within 24 hours.

Consider the need for magnesium sulfate treatment, if 1 or more of the following features of severe pre-eclampsia is present:

- Ongoing or recurring severe headaches
- Visual scotomata
- Nausea or vomiting
- Epigastric pain
- Oliguria and severe hypertension
- Progressive deterioration in laboratory blood tests (such as rising creatinine or liver transaminases, or falling platelet count).

Dosage (see appendix F for administration information)

- **Loading dose by IV injection:** 4g (16mmol magnesium) should be given via intravenous injection over 5 to 15 minutes, followed by:
- **Maintenance dose via IV Infusion**: 1g (4mmol magnesium) per hour maintained for 24 hours. If the woman has had an eclamptic fit, the infusion should be continued for 24 hours after the last fit.
- Recurrent fits should be treated with a further dose of 2g given intravenously over 5 to 15 minutes
- Seizure prophylaxis in women who are oliguric from the outset:
- Give 4g $MgSO_4$ IV loading dose over 5min. Maintenance dose should be omitted until urine output normalizes.

Monitoring:

- Blood pressure monitoring every fifteen minutes for initial loading dose and then as per Obstetric plan based on blood pressure
- Continuous pulse oximetry
- Hourly urine output
- Hourly respiratory rate
- Deep tendon reflexes 4 hourly

Stop magnesium sulfate if:

- Urine output less than 100 ml in 4 hrs
- Deep reflexes are absent after 5 hrs (not due to regional block)
- Respiratory rate less than 12 breaths per min
- Oxygen saturation less than 90 %

Contraindications:

- Hypersensitivity to magnesium.
- Heart block or myocardial damage.
- Renal failure (Hepatic coma if there is a risk of renal failure).
- Myasthenia gravis.

Cautions:

- Interaction with antihypertensive agents especially calcium channel blockers
- MgSO4 is associated with a transient (30 – 40 minutes) and usually mild reduction in BP, but this may be profound if nifedipine is also being given. Therefore, hydralazine given IV is a preferable antihypertensive.
- MgSO4 may be associated with reduction in variability of FHR.
- MgSO4 acts in synergy with neuromuscular blocking agents (if suxamethonium is given, fasciculations may not be visible).
- Any woman requiring IV MgSO4 infusion should be reviewed by an anaesthetist to consider the need for placement of an arterial line

Side effects:

- Nausea
- Blurred vision
- Drowsiness
- Slurred speech
- Respiratory depression
- Muscle weakness

ANTIDOTE: 10ml calcium gluconate 10% slowly IV over 10 min

10. Pre-term Birth

10.1 Antenatal steroids for Pre-term Birth

Offer two doses of Betamethasone 12mg intramuscularly 24 hours apart in women between 24 and 33+6 weeks and consider steroids between 34 and 35+6 weeks. Could be given 12 hours apart if earlier delivery anticipated, however urgent delivery if indicated should not be delayed to complete course of steroids.

10.2 Magnesium sulfate for Neuroprotection

Offer intravenous magnesium sulfate up to 29+6 weeks and consider it up to 33+6 weeks for neuroprotection in case of planned early delivery however urgent delivery if indicated should not be delayed.

11. Fluid management of Severe or Fulminating Pre-eclampsia (see appendix G for flowchart)

FLUID RESTRICTION IS ADVISABLE TO REDUCE THE RISK OF FLUID OVERLOAD IN THE INTRAPARTUM AND POSTPARTUM PERIODS

BEWARE: Over the last 20 years pulmonary oedema has been a significant cause of maternal morbidity and mortality in severe pre-eclampsia/eclampsia. This has often be associated with inappropriate fluid management Mothers and Babies: Reducing Risk through Audit and Confidential Enquires across the UK (MBRRACE).

Women with a booking weight greater than 100kg will require review by senior Anaesthetist for fluid management (consider increased maintenance dose to maximum 1ml/kg).

- Total fluid input (oral and intravenous) should be limited to 80 ml/hour.
- Insert a urinary catheter and monitor urine output hourly (hourly bag required), document on a fluid balance chart/HDU chart (this should be a cumulative calculation of fluid balance).
- If <100mls over a 4 hour period inform the Obstetrician.
- Limit oral intake to <30mls of water per hour initially as these women are at high risk of a Caesarean Section
- Oral intake must be included in the hourly total.
- Do not pre-load with intravenous fluids before establishing low-dose epidural analgesia
- Accurate recording of fluid balance hourly including delivery and postpartum blood loss, input and output deficit.
- Selective crystalloids expansion may be necessary prior to pharmacological vasodilation to prevent maternal hypotension and fetal compromise or in oliguria
- Diuretics: only for women with confirmed pulmonary oedema
- Avoid non-steroidal analgesia until fluid recovery.

Note: Plasma volume expansion needs to be cautious, as excessive fluid loading may lead to pulmonary oedema postpartum. Hypovolaemia is not the only cause of a low urine output in pregnancy induced hypertension/gestational hypertension. Direct glomerular damage often occurs as well.

12. Intrapartum care

First Stage of Labour

- Once stabilized decision should be made regarding time and mode of delivery. Mode of delivery according to clinical circumstances. After 34 weeks, vaginal delivery should be considered. Caesarean section may be preferable under 34 weeks.
- Continuous electronic fetal monitoring is advised (if appropriate for gestation).
- During labour, measure blood pressure hourly in women with hypertension, and every 15–30 minutes until blood pressure is less than 160/110 mmHg in women with severe hypertension.
- Continue use of antenatal antihypertensive treatment during labour.
- Determine the need for haematological and biochemical tests during labour in women with hypertension using the same criteria as in the antenatal period even if regional analgesia is being considered.
- For 'mild' pre-eclampsia check platelet count within 6 hours for regional anaesthesia.
- For 'severe' pre-eclampsia or where the platelets are already less than 100 or where they are known to be falling quickly check FBC and Coagulation screen immediately before performing a neuraxial procedure (2 hours might be reasonable, with a review of the clinical picture and discussion with the consultant on-call if any results are abnormal).

Second Stage of Labour

- Don't routinely limit the duration of second stage of labour in women with controlled hypertension
    - Consider operative delivery in severe hypertension where hypertension has not responded to initial treatment
    - If the patient is to have **vaginal delivery**, epidural analgesia is the preferred method of analgesia if full coagulation profile is normal and should be recommended.
    - Do not preload women who have severe pre-eclampsia with intravenous fluids before establishing low-dose epidural analgesia or combined spinal epidural analgesia
    - Check platelet results (platelet count within 4 hours if severe pre-eclampsia):
        - If platelets >100,000 epidural is not contraindicated.
        - If platelets 80-100,000 senior Anaesthetist assesses balance of benefits and risks.
        - If abnormal (check values with Consultant Anaesthetist) - IM Pethidine (dosage will be the anaesthetist decision) + Entonox

Third Stage of Labour

- This should be managed with bolus of oxytocin 5 iu IM followed by 40 iu via intravenous infusion (40 iu of oxytocin 40 mls of sodium chloride 0.9% @10mls/hour) (NICE 2019 1.8.12)
- Ergometrine or ergometrine combined with oxytocin (Syntometrine) should NOT be used for the 3rd stage in hypertensive women

13. Post Partum Care

- The patient should be kept under observation with Labour Ward level 2 care (on labour ward if appropriate) for at least 24 hours following delivery, with careful monitoring of blood pressure, fluid balance, urine output and symptoms.
- Clinicians should be aware that up to 44% of eclampsia occurs postpartum, especially at term, so women with signs or symptoms compatible with pre-eclampsia should be carefully assessed.
- Continue magnesium sulfate for 24 hours post-delivery as a minimum.
- Limit maintenance fluids to 80mls/hour. Once the woman is drinking, the intravenous infusion rate of fluids will need to be altered to ensure the total hourly (oral and intravenous) input is 80 mls per hour.
- Fluids can be increased slowly once stable but should be under the direction of a senior Obstetrician (ST3-5 or above).
- Continue fluid balance chart and monitor blood pressure 1 - 4 hourly until stable whilst in the Delivery Suite.
- Record urine output hourly and each 4 hour period added up and documented on the HDU/MEWS chart. Inform Obstetrician if <100mls in 4 hours.
- Antihypertensive therapy should be continued after delivery as dictated by the BP. Continued use of antihypertensive may be required with either continuation of the hydralazine infusion and later conversion to oral nifedipine. Pathway for hypoglycaemia will need to be consulted for neonatal observation.
- Prescribe oral nifedipine 20 mgs slow release (SR) twice daily in those with BP 150/100 or more.
- Avoid any precipitous fall in blood pressure during antihypertensive regime and watch for signs of worsening pre-eclampsia.
- Reduction in antihypertensive therapy should be made in a stepwise fashion.
- Maintain post-delivery analgesia if required. NSAID may only be administered after review of post-delivery FBC and U&E by Obstetrician or Anaesthetist
- Assess the woman's thromboembolism risk and prescribe LMWH as required.

- Repeat all pre-eclampsia biochemical and haematological investigations at least daily for the first 48 hours, and then repeat as indicated.
- Encourage mobility when safe to do so and consider referral for physiotherapy.
- On transfer to the postnatal ward from Delivery Suite, ensure diagnosis and treatments required are handed over to ward employees including the management and follow up care plan which should be documented in the woman's health record and include :
    - Frequency of BP.
    - Whether the fluid balance charting is to be continued or discontinued.
    - A plan for any blood tests.
- It is good practice for an Obstetrician to review the woman's care at least daily whilst in hospital.
- On discharge from the maternity unit a plan should be recommended for the Community Midwife and GP to follow up to monitor BP and use of continued anti-hypertensive therapy.
- All women who have had severe pre-eclampsia (requiring the magnesium sulfate regime) or eclampsia should be offered a Consultant clinic review at approximately 8 weeks.
- DATIX form should be completed for all woman who have an eclamptic seizure or who have severe pre-eclampsia requiring magnesium sulfate regime

14. HELLP Syndrome

HELLP syndrome is one of several possible crises that may develop as a variant of severe pre-eclampsia.

The incidence in pre-eclampsia pregnancies is approximately 5% to 20%, although many more women with pre-eclampsia, perhaps 20% to 50%, have mild abnormalities of hepatic enzymes without full blown HELLP syndrome.

There is increased maternal (1%) and perinatal mortality (reported rates vary from approximately 10% to 60%).

Clinical features

- Epigastric or right upper quadrant pain (65%)
- Nausea and vomiting (35%)
- Tenderness in the right upper quadrant
- Hypotension with or without proteinuria
- Other features of pre-eclampsia
- Acute kidney injury AKI (7%)

- Placental abruption (16%). This may be the presenting feature and should always prompt investigation for HELLP syndrome or pre-eclampsia as underlying cause's

Diagnosis

- Low grade haemolysis evident on peripheral blood smear, rarely enough to cause severe anaemia.
- Low (usually <100 x 10^9/L) or falling platelets.
- Elevated transaminases.
- Elevated lactate dehydrogenase (LDH) (indicative of haemolysis).
- Raised bilirubin (unconjugated, reflecting the extent of haemolysis)

The platelet count may fall below 30 x 10^9/ L in severe cases and some women develop Disseminated intravascular coagulopathy (DIC).

HELLP syndrome – points to remember

- This is one of the potential crises that may develop in pre-eclampsia
- Other features of pre-eclampsia including hypertension and proteinuria may be only mild.
- The typical features are right upper quadrant pain, abnormal liver function, low platelets and mild haemolysis.
- There is a risk of DIC, abruption, liver haematoma and liver rupture.
- Delivery of the fetus is the correct treatment once any hypertension has been controlled. Platelet transfusion is usually required.
- Women may present or deteriorate postpartum and renal impairment is uncommon.
- Women are at a greatly increased risk of developing pre-eclampsia in future pregnancies.
- The risk of recurrent HELLP syndrome is low.

15. Management of Eclampsia

- **All women who have a seizure or convulsion for the first time in pregnancy, labour or post-partum should initially be managed as eclampsia until proven otherwise.**
- **ECLAMPSIA IS AN OBSTETRIC EMERGENCY**
- **Call for help using 2222 stating Obstetric emergency and identify where this is occurring**
- **Ensure resuscitation equipment is in the room- Emergency eclampsia tray and resuscitation trolley.**
- **Basic resuscitation using ABC approach**
    1. Maintain airway – oral suction if necessary.
    2. Left lateral position.
    3. Facial oxygen at 10L/minute.
    4. Oxygen saturation monitor (pulse oximeter).
- **Obtain IV access and** take blood for Full Blood Count, coagulation screen, Liver Function Tests, Urea & Electrolytes, Group and save
- **Control fit and reduce risk of further fits with magnesium sulfate (see appendix E)**
- Treat convulsions (eclamptic fits are usually self-limiting), control BP, stabilize the mother, monitor fetal wellbeing and plan to deliver the infant safely
- **Initial treatment:** Loading dose of 4g (20ml) of 20% Magnesium Sulfate (MgSO4) IV over 5 minutes
- A further 2g (10mls of 20% MgSO4 solution) IV may be given over 5 minutes for recurrent seizures
- **Maintenance Dose:** An infusion of 1g/hour of 20% MgSO4 (i.e. 5mls of a 20% solution) via a syringe pump should be given until 24 hours after the last seizure.
- Monitoring for toxicity as described in magnesium sulfate section

If repeated seizures occur despite $MgSO_4$

- Check serum magnesium levels – may be sub-therapeutic and warrant increasing the dose of MgSO4.
- Consider diazepam 10 mg IV over 5 minutes as a slow bolus.
- The Anaesthetist may choose to use thiopentone (50 mg IV).
- Intubation may become necessary to protect airway and ensure adequate oxygenation. Further seizures must be managed by intermittent positive pressure ventilation and muscle relaxation.
- **Note: Persistent convulsions may be the sign of serious intracranial lesions and an indication for emergency Computed Tomography (CT) scan or Magnetic Resonance Imaging (MRI) of the brain.**
- Once seizure is under control management as per "Severe Pre-eclampsia" although delivery will usually be expedited (decision on mode of delivery should be made by a senior Obstetrician, usually a Consultant)

16. References

1. Royal College of Obstetricians and Gynecologists (RCOG). New NICE guideline update on Hypertension in pregnancy https://www.rcog.org.uk/en/about-us/nga/nga-news/nice-guideline-hypertension-pregnancy-update/
2. National Institute for Clinical Excellence (2019) Hypertension in pregnancy: diagnosis and management NICE guideline [NG133] Published date: 25 June 2019 https://www.rcog.org.uk/en/about-us/nga/nga-news/nice-guideline-hypertension-pregnancy-update
3. Cathy Winter, Timothy Draycott, Neil Muchatuta, Jo Crofts. Practical Obstetric Multi Professional Training PROMPT Training Manual – Version 3 (2017)
4. Laura A Magee, Chris Cham, ElizabethJ Watermann, Arne Ohlsson, peter Von Dadelszen:vol 327, number7421>BMJ 2003;327;955 Hydralazine for treatment of severe hypertension in pregnancy: meta-analysis. BMJ. 2003;327(7421):955
5. Labetalol. In: Intravenous. In: Injectable Medicines Guide. Date of revision of text 03.12.2019. Cited July 23rd 2020. Available from http://medusa.wales.nhs.uk/

17. Annual Auditable Standards

The following standards will inform the annual record keeping audit plan:-

1. Evidence of MEOWS chart commenced
2. Evidence of magnesium sulfate administered with severe pre-eclampsia
3. Evidence of aspirin given antenatally from 12 weeks gestation to patients at risk of pre-eclampsia (PGD proforma for evidence)
4. Evidence of serial ultrasound growth scans from 28 weeks where risk of severe pre-eclampsia has been diagnosed or suspected

18. Appendix A – Community PET Proforma

Attach Patient ID:

ECLAMPSIA PROFORMA (COMMUNITY)



DATE: ..... TIME OF SEIZURE:..... DURATION .....

EMERGENCY BELL ACTIVATED (FMU) YES / NO TIME.....

AMBULANCE CALLED YES / NO TIME.....

LABOUR WARD INFORMED YES / NO TIME.....

STAFF PRESENT	NAME	ALREADY PRESENT(✓)	TIME INFORMED	TIME ARRIVED

TREATMENT

LEFT LATERAL POSITION	YES / NO	TIME..... If no, other position .....
HIGH FLOW O_2	YES / NO	TIME..... If no, give reason .....
IV ACCESS	YES / NO	TIME..... If no, give reason .....
BLOODS – GROUP + SAVE FBC, CLOTTING, U+E's, LFT's URATE	YES / NO	TIME..... If no, give reason .....

INITIAL POST SEIZURE OBSERVATIONS TIME.....

RESP RATE ..... PULSE RATE ..... BP .....mm/Hg TEMP .....°C

FH.....

URINARY CATHETER INSERTED YES / NO TIME.....

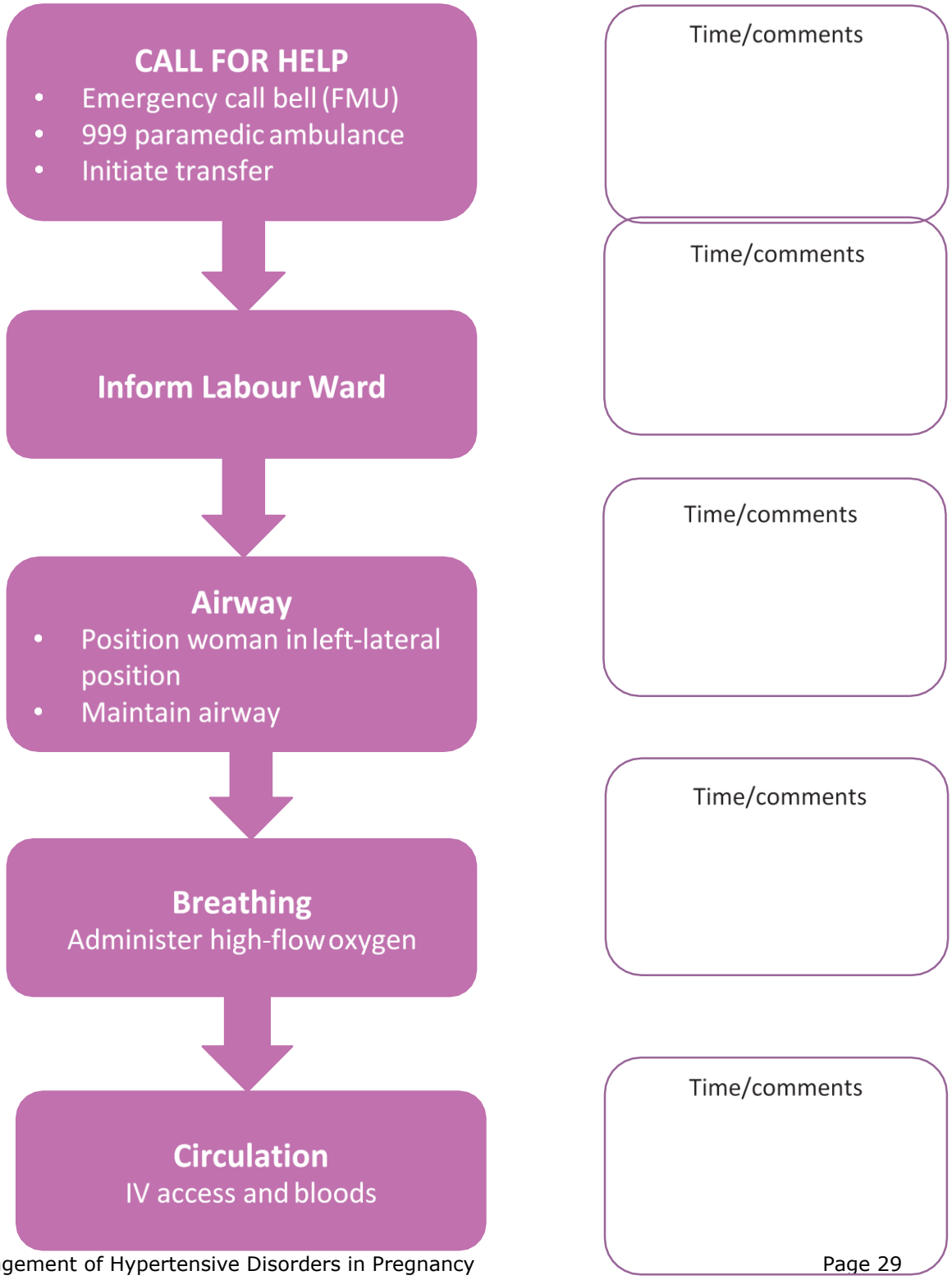
TIME PARAMEDIC ARRIVED AT .....

TIME ARRIVED AT LABOUR WARD ..... OBSTETRIC UNIT .....

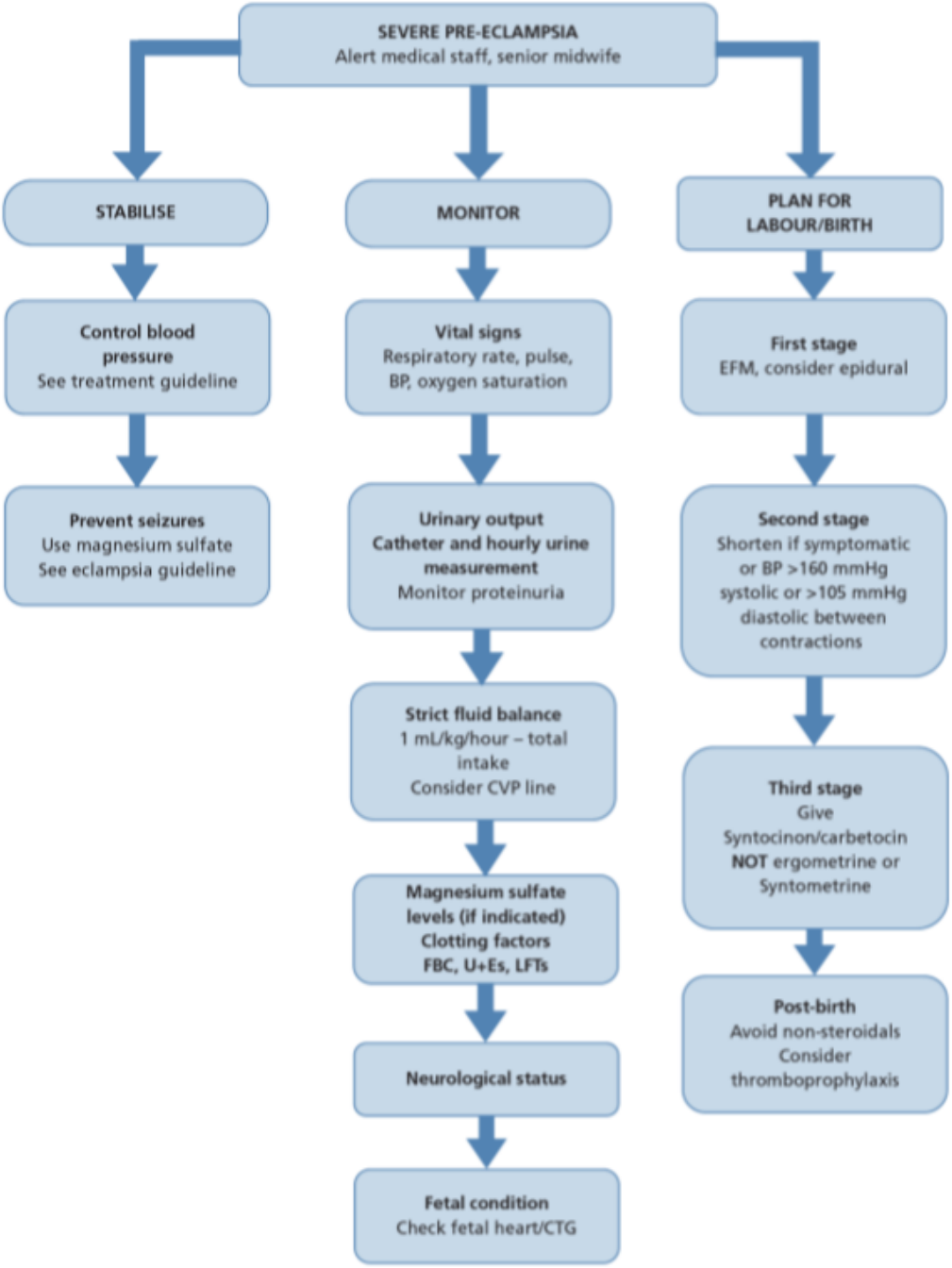
19. Appendix B – Community algorithm

Eclampsia

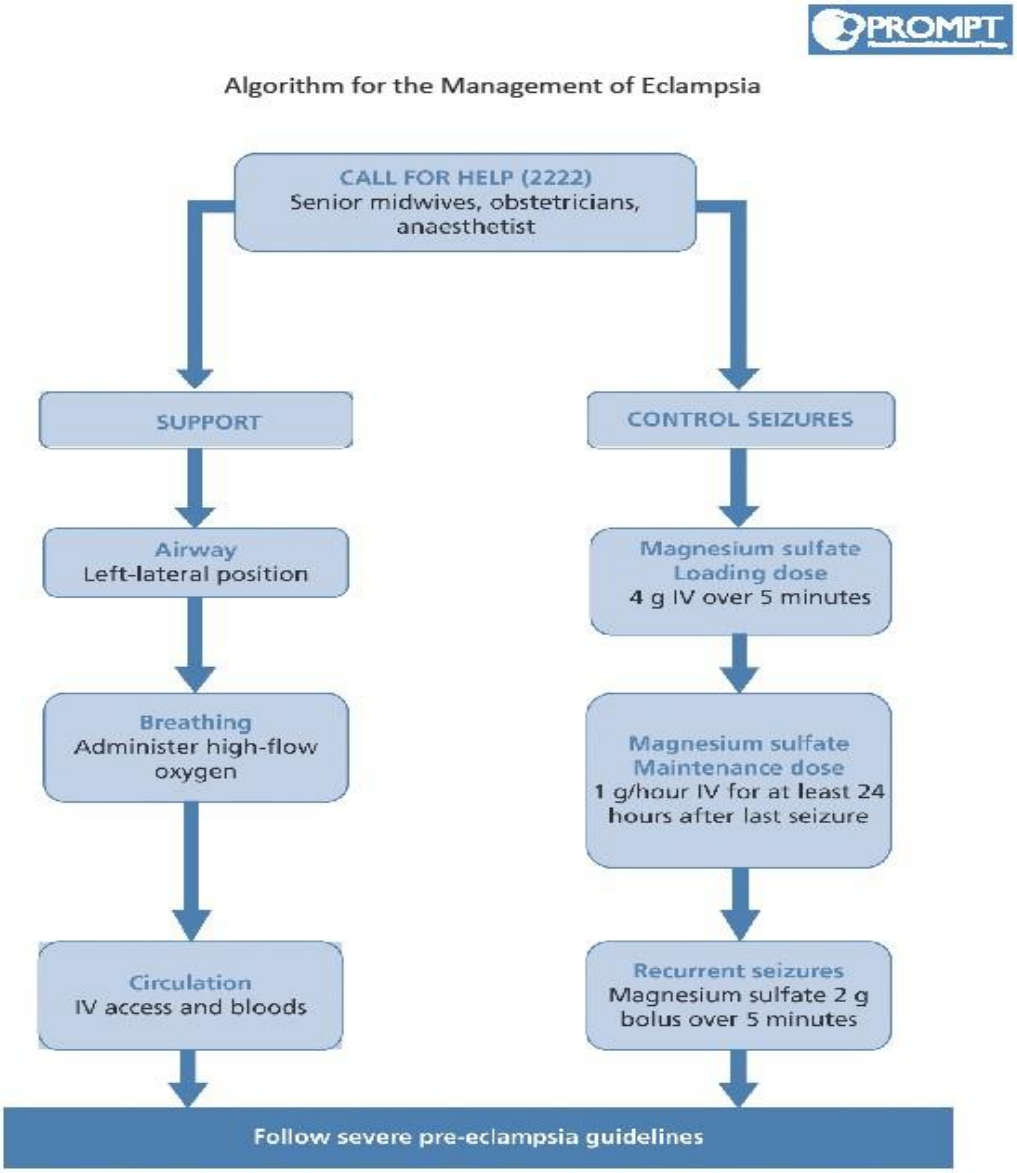
Community Algorithm for Management of Eclampsia



20. Appendix C - Algorithm for the Management of Severe pre-eclampsia



21. Appendix D – Algorithm for the Management of Eclampsia



22. Appendix E - Eclampsia Documentation Proforma

Attach Patient ID:

PROMPT

ECLAMPSIA DOCUMENTATION PRO FORMA

DATE: ..... TIME OF SEIZURE: ..... DURATION OF SEIZURE: .....

PERSONS PRESENT AT ONSET OF SEIZURE.....

.....

EMERGENCY BELL ACTIVATED YES / NO TIME.....

If emergency bell not activated, please give reason.....

	NAME	ALREADY PRESENT (✓)	TIME INFORMED	TIME ARRIVED
EXPERIENCED OBSTETRICIAN				
MIDWIFE COORDINATOR				
ANAESTHETIST				
JUNIOR OBSTETRICIAN				
MATERNITY HEALTH CARE ASSISTANT				
OTHER PERSONS ASSISTING				

CONSULTANT OBSTETRICIAN INFORMED YES / NO Name.....

If no, give reason.....

Time attended (if attended).....

TREATMENT

LEFT LATERAL POSITION YES / NO TIME..... If no, other position.....

HIGH FLOW O_2 YES / NO TIME..... If no, give reason.....

IV ACCESS YES / NO TIME..... If no, give reason.....

BLOODS – GROUP + SAVE FBC, CLOTTING, U+E's, LFT's URATE YES / NO TIME..... If no, give reason.....

MAGNESIUM SULPHATE INFUSION (see laminated regimen for dosages)	TIME COMMENCED
LOADING DOSE	
MAINTENANCE DOSE	

INITIAL POST SEIZURE OBSERVATIONS TIME.....

RESP RATE..... PULSE RATE..... BP.....mm/Hg 02 sats.....% TEMP.....°C

URINARY CATHETER INSERTED YES / NO TIME..... If no, give reason.....

(Commence Maternity Critical Care Chart)

HYPERTENSIVE TREATMENT ADMINISTERED YES/NO TIME.....

If yes, please document medication given and dosage .....

.....

FETAL WELLBEING (if appropriate) FETAL HEART RATE.....bpm TIME.....

POST SEIZURE CTG PERFORMED YES / NO NORMAL / SUSPICIOUS / PATHOLOGICAL

If CTG not performed, give reason.....

Please complete Risk Management Reporting Form and attach copy of this pro forma – Thank you.

23. Appendix F - Magnesium Sulfate Regime – Grab Box preparation support

Magnesium sulfate dosage-
Loading dose: 4 g IV over 5 min:

a) Prefilled syringe, if available
b) Draw up two 2g/10mls ampoules of 20% magnesium sulfate to make 4g/20mls for loading dose.

Maintenance dose: 1g/hr IV for 24 hrs:

a) Prefilled syringe if available
b) Draw up five ampoules of 2g/10mls 20% magnesium sulfate for maintenance dose of 10g/50mls to be run at 1g/hr for 24hrs.

24. Appendix G - Fluid Flowchart for Management of Severe or Fulminating Pre-eclampsia

