Clinical Practice Guideline	**Hypertensive Disease in Pregnancy and the Postnatal Period**
Peninsula Care Goal	**Safe/Effective**

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Target Audience

Medical, Midwifery and Nursing Staff

Purpose

Severe hypertensive disorders of pregnancy are associated with high rates of maternal and fetal morbidity and mortality. Pre-eclampsia is a multi-system disorder with unpredictable presentation and progression. Although the clinical progression is usually slow, occurring over days and sometimes weeks, rapid deterioration may occur and occasionally result in multisystem failure within a few hours. There is no curative treatment apart from birth, and the best management is by the involvement of a multidisciplinary team.

Pre-eclampsia affects 2-8% of pregnancies. Eclampsia complicates 1 in 200-300 cases of pre-eclampsia in Australia. This guidelines outlines risk assessment, prevention, assessment and management of hypertensive disorders in pregnancy including hypertension, pre-eclampsia and eclampsia.

By convention, the term woman is used when describing pregnant individuals in this guideline. It is acknowledged that some may identify as other genders and prefer the use

other pronouns or titles. It is essential that all patients under our care are treated with respect and dignity irrespective of their gender or sexuality.

Definitions

Eclampsia	The occurrence of one or more convulsions after 20 weeks gestation in association with pre-eclampsia. Aetiology is likely to be associated with vasogenic brain oedema with a significant risk of cerebral haemorrhage or stroke. Seizures can occur antepartum, intrapartum or postpartum. About half of all eclamptic seizures occur postpartum.
Essential hypertension	Hypertension confirmed before pregnancy or before 20 weeks gestation, of unknown cause, which is a diagnosis of exclusion.
Gestational Hypertension	Characterised by a new onset raised blood pressure after 20 weeks' gestation, without maternal or fetal signs or symptoms of pre-eclampsia, followed by a return to normal within 3 months post-partum. Up to 25% of these women will progress to development of pre-eclampsia.
HELLP Syndrome	HELLP syndrome represents a subset of women with severe pre-eclampsia characterised by **H**aemolysis, raised **L**iver **E**nzymes (transaminases) and **L**ow **P**latelets. Often only two of the three components are visible. HELLP syndrome carries a mortality rate of 6.3% if managed expectantly and in increased risk of placental abruption and should be managed as severe pre-eclampsia. HELLP syndrome may present in the presence of an only mildly elevated blood pressure.
Hypertension - mild	140/90 to 149/99 mmHg
Hypertension - moderate	150/100 to 159/109 mmHg
Hypertension - severe	≥ 160/100 mmHg
Pre-eclampsia	A clinical diagnosis of pre-eclampsia can be made when the following criteria are fulfilled: **Hypertension after 20 weeks' gestation AND the onset of any one or more of the following:** **Renal:** • Proteinuria confirmed by laboratory testing of a spot urine protein/creatinine ratio (PCR) of ≥ 30mg/mmol • Oliguria i.e. <80mL/4hr • Serum or plasma creatinine > 0.09mmol/L or 90micromol/L **Haematological:** • Thrombocytopenia. platelet count < 100,000/microL • Haemolysis: schistocytes or red cell fragments on blood film, raised bilirubin, raised lactate dehydrogenase >600 IU/L, decreased haptoblobin • Coagulation profile derangement **(only taken if platelet count**

Pre-eclampsia (cont'd)	**is low)** • Disseminated intravascular coagulation (DIC) **Hepatic:** • Raised serum transaminase >70IU/L. • New onset nausea and/or vomiting • Severe epigastric / right upper quadrant pain **Neurological:** • Hyperreflexia • Persistent, new Headache • Persistent visual disturbances such as photopsia, scotomata, cortical blindness, retinal vasospasm • Convulsions (eclampsia) • Stroke **Pulmonary Oedema** **Fetal:** • Fetal growth restriction / evidence of placental compromise • Placental abruption **Notes:** • Oedema is not included in the diagnostic features of pre-eclampsia, occurring as commonly in normal pregnant women and those with pre-eclampsia. Severe pre-eclampsia may be present in the absence of any oedema. Rapid development of generalised oedema may be a marker of clinical deterioration in women with pre-eclampsia. • Other rare disorders may present with some of the features of pre-eclampsia. Disorders such as acute fatty liver of pregnancy, haemolytic uraemic syndrome, thrombotic thrombocytopenic purpura, exacerbation of SLE or cholecystitis may need to be excluded. • Pre-eclampsia presenting before 20 weeks may have a predisposing factor such as hydatidiform mole, multiple pregnancy, fetal triploidy, severe renal disease or antiphospholipid antibody syndrome. • Dipstick testing for proteinuria has a high false positive and negative rate. All women with hypertension should have a urine protein/creatinine ratio performed. • Hyperuricemia is a common but not diagnostic feature of pre-eclampsia. Degree of hyperuricemia may correlate with fetal risk. A rapidly rising plasma uric acid in the setting of hypertension may indicate worsening pre-eclampsia • Serum transaminases are reduced in normal pregnancy (by approximately 20%) and the upper limit of normal should be based on local reference ranges. • Microangiopathic haemolysis although rare may cause a sudden fall in haemoglobin and the appearance of fragmented

	red blood cells on the blood film. It is accompanied by a rise in bilirubin and lactate dehydrogenase, thrombocytopenia and elevated liver enzymes, sometimes with appearance of red or black urine. This diagnosis should be considered after a fall in haemoglobin when there has been insufficient revealed bleeding to account for anaemia. • Pre-existing hypertension is a strong risk factor for the development of pre-eclampsia.
Secondary hypertension	Raised blood pressure as above caused by known pre-existing medical conditions. Important causes of secondary hypertension in pregnancy include: • Chronic kidney disease e.g. glomerulonephritis, reflux nephropathy, adult polycystic kidney disease • Renal artery stenosis • Systemic disease with renal involvement e.g. diabetes mellitus, systemic lupus erythematosus • Endocrine disorders e.g. Pheochromocytoma, Cushing's syndrome, primary hyperaldosteronism

Risk Assessment

Women should be assessed early in pregnancy for risk factors that may precipitate the development of hypertensive disorders of pregnancy including pre-eclampsia and eclampsia

At the antenatal booking visit, women should be assessed for the following risk factors for preeclampsia and appropriate specialist referrals should be made. A pregnancy planning visit should be arranged with the obstetric team as early as possible for women with risk factors, with immediate escalation if women fulfil the fetal growth restriction (FGR) risk levels 2 or 3 to consider the use of prophylactic aspirin. See below and Risk Assessment for Model of Pregnancy Care CPG

Risk factors	Minimum Category for Model of Care
Pre-eclampsia in a previous pregnancy	C
Multiple pregnancy	C
Pre-existing hypertension	C
Pre-existing diabetes (type 1 or 2)	C
Antiphospholipid antibody syndrome	C
Renal disease	C
Systemic Lupus Erythematosus	C
Obesity BMI >40	C
Vascular and connective tissue disorders	C
Maternal age <18 or >35	B
Familial history pre-eclampsia	B
Low PAPP-A (<0.45 MoM)	B
New partner	A
Nulliparity	A

Aspirin Prophylaxis

NICE (2019) recommend that women with one major risk factor or two minor risk factors commence low dose aspirin. The risk factors are very similar to those listed for the prevention of fetal growth restriction as the pathophysiology is similar. It is therefore recommended that the same risk assessment tool is used (see Routine Pregnancy Care Guideline)

Aspirin regimen for women with risk factors: low dose aspirin (150mg oral nocte) before 16 weeks (ideally 10-12 weeks) until 36/40
Calcium supplementation (1.5g/day) is useful in women whose diet is deficient in calcium or women who have a high BMI.

Counselling Points:

- A review of studies showed women with risk factors who took aspirin in pregnancy had a lower rate of pre-eclampsia from 7.6% compared to 9.2% taking placebo (Duley 2019, Cochrane)
- Women with risk factors taking aspirin had a lower rate of preterm birth (15.9% compared to 17.5%)
- The same studies showed that aspirin was safe for the baby
- Aspirin can cause allergic reactions and gastric irritation in some women
- Rates of bleeding/ PPH are not increased in aspirin users.

Screening tests for early-onset pre-eclampsia based on risk factors, mean arterial blood pressure, uterine artery pulsatility index, PAPP-A and Placental growth factor are becoming increasingly available in Victoria (vcgs.org.au). This technique will identify 75% of women at risk of preterm pre-eclampsia (before 34wks). The ASPRE study (Rolnik, 2017) found that high risk pregnant women treated with aspirin had a rate of preterm pre-eclampsia of 1.6% compared to 4.3%. A thousand pregnant women would need to be screened and 100 treated to prevent 2.7 cases of preterm pre-eclampsia. Term pre-eclampsia rates were not significantly different. There is not yet a consensus on the value of performing these tests routinely (ISSHP, 2018).

Blood Pressure Assessment

- A manual sphygmomanometer should be used in preference to an automated device as the latter can underestimate systolic pressures.
- An appropriately sized cuff for the arm should be selected.
- A large cuff should be used if the upper arm circumference is greater than 33 cm.
- The woman should be sitting comfortably or lying at a 45 degree angle
- The systolic blood pressure is accepted as the first sound heard (Korotkoff 1) and the diastolic blood pressure is the disappearance of sounds completely (Korotkoff 5). Where Korotkoff 5 does not occur, Korotkoff 4 (muffling) is accepted.
- Hypertension is confirmed by serial readings over several hours or at least on two readings a minimum of 4 hours apart.

Assessments and Investigations

Assessment and investigations in women with new onset hypertension and or pre-eclampsia will depend on the severity of the condition. Thorough maternal assessment should be aimed at detection and management of likely complications as listed above.

Maternal assessment

- Antenatal history
- Physical examination: general examination (e.g. facial oedema)
- Vital signs: blood pressure (frequency of recording dependent upon severity: from continuous in severe disease to 4 hourly in mild disease)
- Neurological (assess headache, visual disturbances, reflexes, clonus)
- Abdominal examination for the presence or absence of associated complications (e.g. FGR or hepatic pain).

Maternal investigations

Urine check:

- Urinalysis
- Mid-stream urine (MSU) to exclude infection
- Urine protein/creatinine ratio

Full blood examination (FBE) and blood film
Liver function tests (LFT)
Renal function tests + serum uric acid
Clotting studies if platelets < 100,000/microL

Notes:

- Blood test abnormalities should be interpreted using the pregnancy specific ranges, some of which are gestation dependent
- Women with severe early onset pre-eclampsia warrant investigations for associated conditions e.g. SLE, antiphospholipid syndrome or thrombophilias

Initial and ongoing fetal surveillance includes:

- Assessment of gestational age
- Increase the frequency of pregnancy care visits above routine care schedule in conjunction with senior obstetric staff
- Serial growth scans / AFI / dopplers
    - Gestational hypertension 3-4 weekly
    - Pre-eclampsia 2-3 weekly
    - Pre-eclampsia with FGR 2 weekly growth
weekly AFI and dopplers
(or more if abnormal dopplers)
    - See Indication for Antenatal Ultrasound CPG
- Cardiotocography (CTG) monitoring
    - Pre-eclampsia Twice weekly
    - Pre-eclampsia with FGR Twice weekly

Maternity staff should have access to and be familiar with:

- Adult resuscitation equipment
- Maternity eclampsia trolley – **IV labetalol, hydrALAZINe, magnesium sulfate and calcium gluconate can be found here together with drug administration instructions for use in an emergency.**

Management of Pre-Eclampsia & Gestational Hypertension

Management includes:

- Control of hypertension
- Seizure prophylaxis
- Management of eclampsia
- Fluid balance
- Fetal maturation and neuroprotection
- Birth timing and management in labour
- Post-partum Care

Classification and Control of Hypertension

Degree of hypertension	Mild	Moderate	Severe
Blood pressure range (mmHg)	140/90 to 149/99	150/100 to 159/109	160/110 or higher

Antihypertensive therapy does not prevent pre-eclampsia or the associated adverse perinatal outcomes, but it decreases the incidence of development of severe hypertension among women with mild hypertension by half. Uncontrolled hypertension is a frequent trigger for expediting birth and control of hypertension may allow prolongation of pregnancy.

Antihypertensive drugs are **essential** where:
Blood pressure ≥ 160/100 mmHg (with target BP in range of 130-140/80-90 mmHg). Pressures of these levels may lead to direct vascular damage associated with life-threatening sequelae

- Blood pressure < 160/100 mmHg associated with other organ markers of severe disease i.e. proteinuria or abnormal LFT or haematological changes, when expediting birth may also be indicated

Antihypertensive drugs are **optional** where:

- Systolic pressure 140-160 mmHg or diastolic pressure 90-100 mmHg

Table 1. Acute Treatment of Severe Hypertension

Drug	Dose/Route	Notes
niFEDIPine immediate release	**10 – 40 mg oral** (maximum dose) Repeat after 45 min if response inadequate up to maximum total 40 mg.	Onset within 30-45min Side effects: headache, flushing, dizziness. Impaired placental perfusion. **Immediate release niFEDIPine is not marketed in Australia, please complete Special Access Scheme form and return to Pharmacy**

Labetalol	• Refer to PH Labetalol Adult Drug Administration Guideline
	
	Intermittent IV 20 mg undiluted over 2 minutes
	• Draw up 5 doses of 20 mg (=4 mL) per syringe (undiluted) from ONE ampoule and **label syringes clearly**
	• Give by slow IV injection over 2 minutes:
	  • 20 mg (4 mL).
	  • 40 mg (8 mL) after 10 minutes if needed
	  • Repeat every 10 minutes with doses up to 80 mg (16 mL) until control is achieved or consider maintenance infusion.
	  • Maximum = 300 mg/24hr
	
	Maintenance infusion
	Labetalol 20-160 mg/hr (10-80 mL/hr once diluted) titrated to optimise blood pressure:
	  • Commence at 20 mg/hr
	  • Increase by 20 mg/hr every 20 min to a maximum rate of 160 mg/hr.
	  • Maximum (total including intermittent doses) = 300 mg/24hr
		Onset within 5min
		
		Side effects: bradycardia, bronchospasm, headache. Impaired placental perfusion.
		
		IV labetalol is not registered in Australia, please complete Special Access Scheme form and return to Pharmacy
		
		To be administered by obstetric medical staff during pregnancy

hydrALAZINe	• Refer to PH Hydralazine Adult Drug Administration Guideline **Intermittent IV 5 to 10 mg over 5 minutes** • Repeat 5-10 mg slow IV injection every 20 min as necessary; maximum = 15 mg or 3 doses • Consider need for continuous intravenous infusion **Maintenance infusion** 5-10 mg/hr (5-10mL/hr)	Onset within 20 min. Side effects: headache, Tachycardia, palpitations, oedema, flushing, hypotension. Impaired placental perfusion. To be administered by obstetric medical staff during pregnancy
IV fluid bolus	Consider 250-500mL of crystalloid IV over 15 min (0.9% sodium chloride) or compound sodium lactate (Hartmanns®) prior to first hydrALAZINe dose	May help reduce maternal hypotension but fetal benefit is unclear.

Observations During Treatment of Severe Hypertension:

- Hypotension is a risk of IV antihypertensives and can cause impaired placental flow resulting in CTG abnormalities and fetal compromise. Therefore, continuous electronic fetal surveillance (CTG) is required until the BP has stabilised.
- Avoid a precipitous fall in BP. The target blood pressure is 130-140/80-90 mmHg
- **During intermittent IV treatment,** record blood pressure and pulse every 5 minutes until BP stabilised.
- **During infusions,** record blood pressure every 15 minutes until BP stabilised, then record hourly.
- In addition record pulse and oxygen saturation every 30mins until stabilised

When Controlling Acute Severe hypertension:

- IV access x2 (18 g) IV cannula
  1. Medication administration and IV fluids to allow acute volume expansion
  2. Consideration for Magnesium Sulfate infusion for prevention of eclamptic seizure
- Monitor and reassess for signs of deterioration
- Urinary catheter - with hourly urine measurements

Table 2. Treatment and Maintenance of Moderate Hypertension

Drug	Dose/Route	Notes
Labetalol	**200 mg oral stat** Repeat 200 mg oral hourly until control is achieved. Maximum 3 doses. **Maintenance: 100 - 400mg 6-12 hourly** (max 1600 mg/day)	Side effects: bradycardia, sleep or gastrointestinal disturbance, bronchospasm. Fetal bradycardia and respiratory depression Avoid in asthmatics
Methyldopa	**Maintenance 250 - 750mg oral TDS**	Slow onset of action over 24 hrs. Side effects: Dry mouth, sedation, depression, blurred vision Withdrawal effects: rebound hypertension Avoid in depression
niFEDIPine	**30-60mg sustained release oral once daily**	Side Effects: Severe headache associated with flushing and tachycardia. Peripheral oedema and constipation. Avoid in aortic stenosis
Prazosin	**0.5 - 5mg TDS**	First dose = orthostatic hypotension
hydrALAZINe	**25 - 50mg TDS**	Flushing, headache, nausea, lupus-like syndrome (Maintenance doses >100 mg daily have an increased risk of lupus-like syndrome)

Table 3. Postnatal treatment of moderate hypertension

Drug	Dose/Route	Notes
Labetalol	**200 mg oral stat** Repeat 200 mg oral hourly until control is achieved. Maximum 3 doses. **Maintenance: 100 - 400mg 6-12 hourly** (max 1600 mg/day)	**Side effects:** bradycardia, sleep or gastrointestinal disturbance, bronchospasm. Fetal bradycardia and respiratory depression Avoid in asthmatics
Nifedipine	**30-60mg sustained release oral once daily**	Severe headache associated with flushing and tachycardia. Peripheral oedema and constipation. Avoid in aortic stenosis
Enalapril	**5 - 10mg oral daily**	Not to be used in pregnancy but can be used for post-natal treatment Recommended by SCV as the preferred option; exercise caution with breastfeeding mothers of preterm infants.

Prevention and Treatment of Eclampsia

Impending eclampsia may be asymptomatic. Initial features may be non-specific and mild. Signs and symptoms may include:

- Persistent, severe frontal or occipital headache
- Visual disturbances (blurred vision/photophobia) papilloedema
- Right upper quadrant or epigastric pain, nausea and/or vomiting
- Sudden rise in blood pressure (BP). In about 20% of women with eclampsia BP may be normal
- Diminished urine output. Oliguria (<500mL/24 hours or <20mL/hr)
- Increasing proteinuria
- Hyper-reflexes and clonus
- Altered level of consciousness
- Mental state/restlessness

Prophylaxis with magnesium sulfate should be considered when:

- Warning signs of eclampsia e.g. neurological irritability
- All women with severe pre-eclampsia during labour, birth and immediate postpartum period
- Persistently elevated BP despite adequate treatment

Table 4. Seizure Prophylaxis & Treatment

Drug	Dose/Route	Action	Comments
Magnesium Sulfate	• Refer to PH Magnesium Sulfate Adult Drug Administration Guideline **Loading dose** **4 g IV undiluted given over 20 minutes.** **Maintenance dose** **1 g/hr** for at least 24 hours post birth **or** post last seizure **Secondary dose** if seizure occurs whilst on treatment 2 g IV over 10 minutes (With renal impairment, use 2 g loading dose and 0.5 g/hr maintenance)	Prevents maternal cerebral vasospasm Also used for Neuroprotection of the preterm fetus up to 30wks gestation	Administer slowly via a **syringe driver** using a dedicated peripheral intravenous line (not CVP line). **Therapeutic range:** 1.7-3.5 mmol/L. **Maternal side effects:** Local burning and pain at injection site; nausea. **Caution:** Excreted by kidneys therefore toxicity likely if urine output poor. **Contraindications:** Heart block or myocardial damage.

Preparing Magnesium Sulfate

Loading dose **4 grams over 20 min**

- Draw up 2 ampoules of magnesium sulfate (2.5 g in 5 mL), prime the extension tubing leaving **8 mL (= 4 g) in a 10 mL syringe**.
- Do not dilute
- Set rate at 24 mL/hr to infuse over 20 min
- Pump will alarm and stop after 8 mL infused

Maintenance dose **1 gram per hour**

- Once the loading dose is complete replace syringe with the magnesium sulfate maintenance dose 24.7g (100 mmol) in 50 mL (49.3%) pre-loaded syringe
- Infusion rate set at 1 g/hr (2 mL/hr)

Secondary dose **2 grams over 10 min**

If seizure occurs whilst on treatment (see eclampsia below)

- Draw up 1 ampoule of magnesium sulfate (2.5 g in 5mL). Prime the infusion tubing leaving **4 mL (= 2 g) in a 5 mL syringe**
- Set rate at 24 mL/hr to infuse over 10min

Observations

Continuous oxygen saturation monitoring is required and consideration should be given to cardiac monitoring with the commencement of magnesium sulfate

Observations required during 4 g magnesium sulfate loading dose

- 5 minutely vital signs (BP, pulse, respiratory rate, oxygen saturation)
- At completion of loading dose, record BP, PR, RR and deep tendon reflexes
- Observe for adverse effects

Observations required during magnesium sulfate infusion

- Half hourly vital signs (BP, pulse, respiratory rate, oxygen saturation)
- Continuous electronic fetal surveillance (CTG)
- Strict fluid balance including:
    - Fluid input restricted to 80mLs hour
    - Urinary output hourly
- Neurological:
    - Hourly patella reflexes
    - A=Absent N=Normal B=Brisk
    - Restlessness or twitching may indicate seizure risk
- Check pump and IV site hourly to ensure dose correct
- Monitor serum levels of magnesium in women with oliguria (< 120 ml in 4 hrs) or where signs of toxicity are suspected. Therapeutic range 1.7- 3.5 mmol/L.

Signs of magnesium sulfate Toxicity

- Loss of patellar reflexes
- Respiratory rate < 12 breaths/minute
- Nausea, vomiting
- Slurred speech, weakness, extreme sleepiness

- Double vision
- Muscle paralysis
- Respiratory/cardiac arrest

If signs of toxicity, cease magnesium infusion, call registrar and consultant, consider MET call if within criteria. Administer calcium gluconate. Send bloods for renal function and magnesium.

Table 5. Antidote to reverse magnesium sulfate toxicity

Drug	Dose/Route	Action	Comments
Calcium gluconate 10%	**2.2 mmol (1 g) IV** slow injection over 10 minutes	Antidote for magnesium sulfate toxicity	Refer to PH Calcium gluconate Adult Drug Administration Guideline

Duration of Magnesium Therapy:

- Generally magnesium is continued for 24hrs after the birth or the last seizure
- Signs of reducing risk of eclampsia are:
  - Blood pressure is stable
  - Diuresis
  - Clinical improvement of symptoms

Management of Eclampsia

Eclampsia presents as a tonic/clonic seizure. It is usually self-limiting but is indicative of severe disease with high levels of morbidity and mortality.

- Press the emergency buzzer on the Women's Health Unit
- Call a respond blue (dial 2222, ask for 'respond blue, room xx, Women's Health Unit')
- Ensure a patent airway
- Optimally position the woman with a left lateral tilt
- Administer 10L/min O2 by mask
- Obtain IV access
- Administer magnesium sulfate as per the above protocol (4g over 20mins then 1g/hr)
- **Generally IV sedation is not required** and can then make subsequent communication and consent more challenging, however,
- Prolonged seizure activity may be due to other intracerebral pathology (such as an intracerebral bleed)
- In the case of prolonged seizure activity, consider benzodiazepine e.g. Midazolam (0.1 - 0.2 mg/kg IV or IM) – refer to Status Epilepticus Management for Adults CPG
- Control hypertension (see above)
- Monitor for further seizure activity of neurological deterioration (higher cerebral haemorrhage risk)
- Nil by mouth
- Fluid management (see below)

- Delivery once stable (commonly by caesarean section, although other obstetric circumstances will influence decision, such as progress in labour)

Management of Recurrent seizures:
- Give a further intravenous bolus of 2 g magnesium sulfate undiluted over 10 minutes.
- Consider increasing the infusion rate to 2-3 g/hr = 4-6 mL/hr.
- Check serum magnesium levels

Differential Diagnosis of Eclampsia
- Epilepsy
- Intracerebral or subarachnoid haemorrhage
- Meningitis
- Drug or alcohol related
- Head trauma
- Metabolic disorders
- Persistent seizures/neurological symptoms merit a CT brain scan and referral to an appropriate medical specialty team

Fluid Balance

Careful maternal fluid balance is required in all women with pre-eclampsia
In severe pre-eclampsia maternal fluid retention can lead to severe acute pulmonary oedema
- Total fluid input should be restricted to 80ml/hr or 1ml/kg/hr
- Monitor output: hourly urine measurements with indwelling urinary catheter (IDC) and urometer

Where urine output is less than 20mls per hour for 3 consecutive hours immediate management includes:
- Review by medical staff
- Assessment of renal function
- In presence of sustained oliguria and renal impairment consider transfer to an Intensive Care Unit (ICU) for more intensive haemodynamic monitoring
- As oliguria is usually due to central vascular depletion, diuretics should not be used routinely unless there is evidence of fluid overload.

Fetal Maturation and Neuroprotection

Corticosteroids
- Corticosteroids: Betamethasone (Celestone Chronodose®) 11.4 mg IM x 2 doses 24 hours apart) for promotion of fetal lung maturation should be administered if preterm birth is likely, or under 39 weeks if caesarean is required (see Antenatal Steroids in Pregnancy CPG).

Magnesium Sulfate
- Between 24-30 weeks gestation, a magnesium sulfate infusion for a minimum 4hrs pre-birth reduces the risk of neurological injury from preterm birth.
- The regime is per the eclampsia protocol above (4 g loading dose followed by 1 g/hr infusion). Discuss the initiation of magnesium sulfate with PIPER before transfer.

Birth Timing and Management in Labour

Pre-eclampsia is a progressive disorder and will inevitably worsen if pregnancy continues. Current therapy does not improve placental pathology nor alter the pathophysiology or natural history or progression of pre-eclampsia. Birth of the baby is the definitive management and is followed by resolution, generally over a few days but sometimes longer. At mature gestational age delivery should not be delayed. Even so, it is important to stabilize maternal condition before planning the birth.

Table 6. Timing of Birth

Gestation at onset	Pre-viable <23 weeks	23-31+6 weeks	32-36+6 weeks	37+0 onwards
Pre-eclampsia	Consult with tertiary service possible outcomes: termination of pregnancy or extreme preterm birth	Consult and transfer to tertiary service: likely to need preterm birth Aim to prolong pregnancy where possible	Aim to prolong pregnancy where safe to do so	Delivery recommended
Eclampsia		Stabilise and discuss either transfer, or delivery with neonatal retrieval with PIPER	Stabilise and deliver	Stabilise and deliver
Gestational Hypertension			BP≥160/110: Plan for birth if uncontrolled BP<160/110 Aim to prolong pregnancy where safe to do so	BP≥160/110 Immediate delivery BP<160/110 Shared decision making based on maternal and fetal condition. 38-39+6 reasonable if well controlled

23-31+6/40: Transfer to level 6 facilities (tertiary level) for specialised neonatal care. For emergency births between 23-30 weeks gestation consideration of Magnesium Sulfate administration for a minimum of 4 hrs for fetal neuroprotection should occur.

32-36+6/40: If maternal and fetal status permit, birth should be delayed for at least 24-48 hours to allow antenatal corticosteroids administered for fetal lung maturation. The HYPITAT II study suggested that women managed with early delivery at 34-37 weeks had a lower risk of adverse maternal outcomes (1.1% vs 3.1%) but a higher rate of neonatal admission (7.4% vs 3.7%) and neonatal respiratory distress syndrome (5.7% vs 1.7%). At 2 years of age, a childhood development questionnaire showed more children in the early delivery group had an abnormal score than the expectant group (28% vs 18%), mainly affecting fine motor skills. Advice from SOMANZ and FIGO suggest it is reasonable to manage expectantly unless there is evidence of maternal or fetal compromise (see below). Delaying the pregnancy does not increase the likelihood of a vaginal birth.

37/40 onwards: Pre-eclampsia: Induction of labour is associated with improved maternal outcome and is advised for women with pre-eclampsia beyond 37 weeks' gestation with no increase in caesarean section rates. Delivery from 37/40 is recommended by all international guidelines (FIGO, SOMANZ 2015, NICE 2019).

For women with gestational hypertension (BP <160/110) timing of birth should be discussed between the woman and a consultant obstetrician balancing the risk of early term birth on neonatal development against the risk of hypertensive disease in the woman (NICE 2019). Labour induction at 38-39+6/40 appeared to optimise this trade off (FIGO 2016)

Timing of Birth Summary

Expediting birth is indicated if:

- ≥37/40 with pre-eclampsia
- ≥37/40 if gestational hypertension ≥160/110
- <40/40 if well controlled gestational hypertension

And should be considered at any gestational age in the presence of one or more of the following:

- Uncontrolled BP despite maximum anti-hypertensive therapy, or rapidly increasing hypertension
- Deteriorating liver function e.g. persistent epigastric pain, nausea or vomiting, worsening liver function tests
- Deteriorating renal function
- Progressive thrombocytopenia
- Persistent neurological symptoms
- Eclampsia
- Neurological complications
- Pulmonary oedema
- Placental abruption
- Concern for fetal wellbeing (severe FGR, non-reassuring CTG)

There should be a multidisciplinary consultation between the woman, obstetric, midwifery, paediatric, and anaesthetic staff. Consultation with neonatal services regarding bed availability should occur prior to determination of a date of birth

Mode of birth

Mode of birth depends on:

- Fetal presentation
- Maternal and fetal well-being and degree of urgency
- Bishops score
- If caesarean section is required, epidural or spinal anaesthesia is preferred over general anaesthetic (GA) providing clotting profile and platelet count are satisfactory

Intrapartum care

- Continuous electronic fetal monitoring is required and maternal observations will be dependent on the severity of the disease but at minimum 2hrly blood pressure and oxygen saturation monitoring should occur.
- Epidural analgesia is encouraged as this may improve blood pressure control and support urgent expediting of birth provided the clotting profile and platelet count are

satisfactory

Third stage management

- **Active management of third stage is recommended**
- 10 units IM oxytocin (Syntocinon / Oxytocin ®) or 5 units IV given slowly
- Avoid ergometrine or Syntometrine® for third stage

The placenta is to be sent for histopathology

Post-Partum Care

Almost half of all eclampsia occurs in the postnatal period, therefore ongoing monitoring is required. While it is expected that the woman's condition will steadily improve management includes:

- High dependency care is required for severe pre-eclampsia for at least 24hrs or until signs of recovery (diuresis, blood pressure controlled, symptoms resolved). This may be on the birth suite or with birth suite level of staffing allocation.
- Eclampsia recovery is commonly managed on ICU for 24hrs – discuss with ICU liaison and the ICU medical staff.
- Daily obstetric team review
- 4 hourly observations for 48hours
    - Vital signs
    - Reflexes
    - Clonus
- Seizure prophylaxis
    - See above for indications.
    - Magnesium Sulfate to run for 24hrs following birth or from the last seizure.
    - Specialised observations required when magnesium running (see above)
    - 4 hourly medical review when magnesium running
- Blood pressure control
    - Cease methyl-dopa due to its depressive effects
    - See Table 3 (above) for postnatal antihypertensives
    - Labetolol, nifedipine slow release, or enalapril are advised
    - Enalapril is recommended as the preferred option by SCV Maternity eHandbook
    - Gradual withdrawal will be possible when the blood pressure normalises.
    - Hypertension may last up to 3 months and will need to followed up by the GP.
- Fluid balance
    - Hourly fluid balance monitoring whilst magnesium is running
    - Thereafter fluid balance chart to continue minimum 4 hourly until diuresis observed and decision to cease discussed with obstetric team.
- Bloods
    - Every 24hrs if derangement of renal, liver or haematological function until improvement observed, then as per obstetric decision
- Debriefing of the mother, family or other support people
    - Offer support, debriefing and counselling. Pre-eclampsia and hypertensive disease can be traumatic.
    - Information is available from Australian Action on Pre-Eclampsia www.aapec.org.au

- Emotional support is available from www.panda.org.au that runs a national helpline on 1300 726306 for perinatal mental health support.
- Consider social work review
- Discuss the potential risk of hypertension disorders in a future pregnancy. Recommend low dose Aspirin from 12 to 36 weeks of pregnancy.
- Recommend ongoing review of blood pressure in later life (higher risk of late onset hypertension).

Discharge and Follow Up

- Decision and timing of discharge to be made in consultation with obstetric consultant
- Consideration should be given to the risk of late seizures or hypertension
- Encourage early contact with GP and consider postnatal obstetric clinic review/debrief

Key Aligned Documents

- Maternity Emergency Call
- Code Blue
- Hand Hygiene & Aseptic Technique
- Resuscitation of the Newborn
- Intrauterine Resuscitation
- Instrumental Vaginal Birth
- Classification of Urgency for Caesarean Section
- Blood and Body Substance Exposure Prevention and Management of Exposure
- Induction of Labour- Indications and Booking Process
- Routine Pregnancy Care Guideline
- Risk Assessment for Model of Pregnancy Care CPG
- Peninsula Care Clinical Governance Framework

Evaluation

- VHIMS will be followed up as per Peninsula Health Policy.
- Ongoing evaluation of care is reported on at monthly Maternal Mortality and Morbidity meetings

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