Queensland Clinical Guidelines

Translating evidence into best clinical practice

Maternity and Neonatal **Clinical Guideline**

Hypertensive disorders of pregnancy

Queensland Government

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- Advising consumers of their choices in an environment that is culturally appropriate and which enables comfortable and confidential discussion. This includes the use of interpreter services where necessary
- Ensuring informed consent is obtained prior to delivering care
- Meeting all legislative requirements and professional standards
- Applying standard precautions, and additional precautions as necessary, when delivering care
- Documenting all care in accordance with mandatory and local requirements

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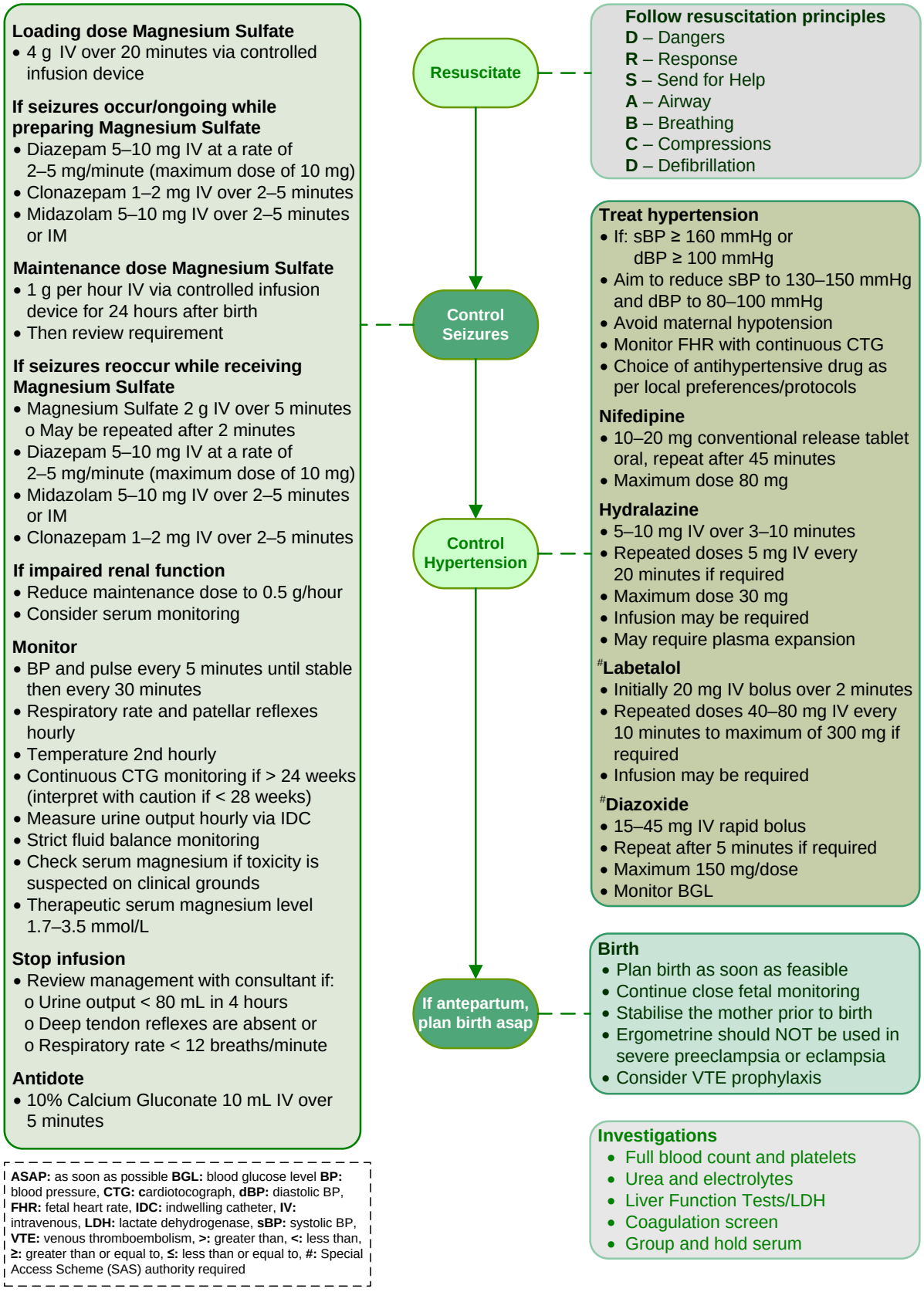
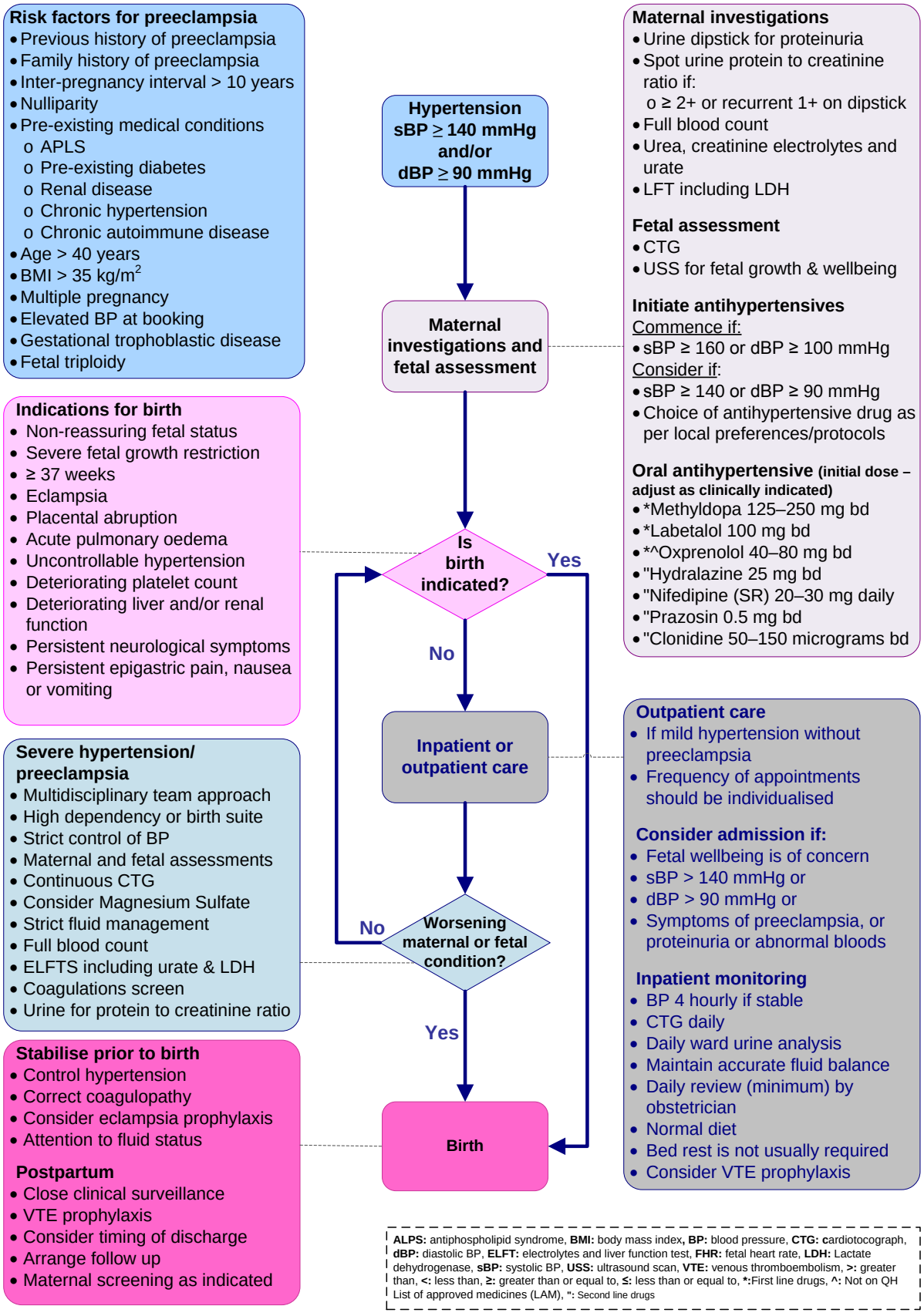
Flow Chart: Management of eclampsia



Adapted from: Algorithm 16.1 Preeclampsia/eclampsia *in* The Moet course manual: managing obstetric emergencies and trauma (2007)

Queensland Clinical Guidelines: Hypertensive disorders in pregnancy. Flowchart version: F15.13-1-V7-R20

Flowchart: Management of hypertension in pregnancy



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Abbreviations

ACE	Angiotensin Converting Enzyme
AFI	Amniotic fluid index
APLS	Antiphospholipid syndrome
BMI	Body Mass Index
BP	Blood pressure
CI	Confidence Interval
CMACE	Centre for Maternal and Child Enquiries
CTG	Cardiotocograph
dBP	Diastolic blood pressure
DIC	Disseminated intravascular coagulation
DVP	Deepest vertical pocket
FBC	Full blood count
FHR	Fetal heart rate
GA	General anaesthesia
HDP	Hypertensive disorders of pregnancy
GP	General Practitioner
HELLP	**H**aemolysis, **E**levated **L**iver enzymes and **L**ow **P**latelet count
IUGR/FGR	Intrauterine growth restriction/Fetal growth restriction
LAM	List of approved medicines
LDH	Lactate dehydrogenase
LFT	Liver function test
sBP	Systolic blood pressure
SLE	Systemic lupus erythematosus
RR	Relative risk
SpO_2	Saturation of peripheral oxygen
USS	Ultrasound scan
VTE	Venous thromboembolism

Definition of terms

Expectant management	Refers to prolongation of the pregnancy beyond 48 hours with maternal and fetal monitoring.[1]
Multidisciplinary team	May include as relevant to the clinical circumstances obstetrician, midwives, obstetric physician, anaesthetist, neonatologist/paediatrician experienced in the care of women with hypertension in pregnancy.
Obstetrician	Local facilities may differentiate the roles and responsibilities assigned in this document to an "Obstetrician" according to their specific practitioner group requirements; for example to General Practitioner Obstetricians, Specialist Obstetricians, Consultants, Senior Registrars, Obstetric Fellows or other members of the team as required.
Woman centred care	Woman centred care includes the affordance of respect and dignity by supporting the woman to be central and active in her own care[2] through[3]: • Holistic care taking account of the woman's physical, psychosocial, cultural, emotional and spiritual needs • Focussing on the woman's expectations, aspirations and needs, rather than the institutional or professional needs • Recognising the woman's right to self-determination through choice, control and continuity of care from a known or known caregivers • Recognising the needs of the baby, the woman's family and significant others
Informed choice	When a woman has the autonomy and control to make decisions about her care after a process of information exchange that involves providing her with sufficient, evidence-based information about all options for her care, in the absence of coercion by any party and without withholding information about any options.[4]
Informed consent	When a woman consents to a recommendation about her care after a process of information exchange that involves providing her with sufficient, evidence-based information about all the options for her care so that she can make a decision, in the absence of coercion by any party, that reflects self-determination, autonomy and control.[4]

Table of Contents

List of Tables

1 Introduction

Hypertension is the most common medical problem encountered in pregnancy and is a leading cause of perinatal and maternal morbidity and mortality.[5] A rise in blood pressure (BP) during the peripartum period requires evaluation and review.[6]

1.1 Professional communication

The Centre for Maternal and Child Enquiries (CMACE) most recent report into maternal deaths[5] identified that in many cases of substandard care, there were major failures of communication between healthcare professionals, which in some cases may have contributed to the woman's death. Effective communication may be enhanced with:

- A multidisciplinary team approach that includes communication with the woman's General Practitioner (GP)
- Appropriate referral of high risk women and subsequent follow-up to ensure specialist input is achieved
- Use of early warning tools to monitor for and communicate clinical deterioration

1.2 Sharing information

Share and discuss information with the woman in a manner that enables informed choice and consent and supports woman centred care [Refer to definition of terms]. Discuss the woman's preferences for management. The BRAND acronym (Benefits, Risks, Alternatives, Do Nothing, Discuss) may be useful in communicating care options with woman and their families:

- What are the **B**enefits?
- What are the **R**isks?
- What are the **A**lternatives?
- What happens if we do **N**othing?
- **D**iscuss decisions

2 Definitions

The following definitions are used in this guideline.

Table 1. Definition

Term	Definition
Hypertension	• Systolic blood pressure (sBP) greater than or equal to 140 mmHg ***and/or*** • Diastolic blood pressure (dBP) greater than or equal to 90 mmHg • A rise in sBP greater than or equal to 30 mmHg and/or a rise in dBP greater than or equal to 15 mmHg may be significant in some women[1] but is not included in the definition. Assess these women for clinical and laboratory features of preeclampsia
Moderate hypertension	• sBP 141 mmHg to 159 mmHg and/or • dBP 91 mmHg to 109 mmHg
Severe hypertension	• sBP greater than or equal to 160 mmHg ***and/or*** • dBP greater than or equal to 110 mmHg • sBP greater than or equal to 170 mmHg with or without dBP greater than or equal to 110 mmHg is a medical emergency and requires urgent treatment
White coat hypertension	• Hypertension in a clinical setting with normal BP in a non-clinical setting when assessed by 24 hour ambulatory BP monitoring or home BP monitoring using an appropriately validated device

2.1 Classification

Table 2. Classification

Classification	Definition
Gestational hypertension	• New onset of hypertension arising after 20 weeks gestation • No additional features of preeclampsia • Resolves within 3 months postpartum
Preeclampsia	• A multi-system disorder characterised by hypertension and involvement of one or more other organ systems and/or the fetus
Chronic hypertension occurring in pregnancy *(Essential and Secondary)*	• Hypertension confirmed preconception ***or*** prior to 20 weeks without a known cause • May include women entering pregnancy on antihypertensive therapy with no secondary cause determined (and with lower sBP and/or dBP) • Secondary Hypertension may be due to: o Chronic kidney disease (e.g. glomerulonephritis, reflux nephropathy and adult polycystic kidney disease) o Renal artery stenosis o Systemic disease with renal involvement (e.g. diabetes mellitus, systemic lupus erythematosus) o Endocrine disorders (e.g. phaeochromocytoma, Cushing's syndrome and primary hyperaldosteronism, hyper or hypothryroidism, hyperparathyroidism, acromegaly) o Coarctation of the aorta o Medications or supplements (e.g. sympathomimetics in decongestants, steroids, liquorice, cocaine, methamphetamines)
Preeclampsia superimposed on chronic hypertension	• Where a woman with pre-existing hypertension develops systemic features of preeclampsia after 20 weeks gestation

2.2 Diagnosis of preeclampsia

Hypertension arising after 20 weeks gestation confirmed on 2 or more occasions and accompanied by ***one or more*** of the organ/systems features identified in Table 3. Diagnosis of preeclampsia.

- Raised BP is common but not always the first manifestation
- Pre-existing hypertension is a strong risk factor for the development of preeclampsia[1] and requires close clinical surveillance
- Proteinuria is common but should not be considered mandatory to make the clinical diagnosis[1]

Table 3. Diagnosis of preeclampsia

Organ/System	Feature
Proteinuria	• Random urine protein to creatinine ratio greater than or equal to 30 mg/mmol
Renal	• Serum or plasma creatinine greater than or equal to 90 micromol/L or • Oliguria
Haematological	• Thrombocytopenia (platelets less than 100 x 10^9/L) • Haemolysis: schistocytes or red cell fragments on blood film, raised bilirubin, raised lactate dehydrogenase (LDH), decreased haptoglobin • Disseminated intravascular coagulation (DIC)
Liver	• Raised transaminases • Severe epigastric or right upper quadrant pain
Neurological	• Severe headache • Persistent visual disturbances (photopsia, scotomata, cortical blindness, retinal vasospasm) • Hyperreflexia with sustained clonus • Convulsions (eclampsia) • Stroke
Pulmonary	• Pulmonary oedema
Uteroplacental	• Fetal growth restriction (FGR)

3 Risk assessment

Assess all women presenting with new hypertension after 20 weeks gestation for signs and symptoms of preeclampsia. The earlier the gestation at presentation and the more severe the hypertension, the higher is the likelihood that the woman with gestational hypertension will progress to develop preeclampsia or an adverse pregnancy outcome.[1]

3.1 Risk factors for preeclampsia

The absolute risk for an individual woman is determined by the presence or absence of these and other predisposing or protective factors but to date no adequately accurate predictive tool, using either clinical or laboratory markers, has been developed.[1] The presence of multiple risk factors may have additive or synergistic effects but the combinations with the greatest risk are uncertain.

Table 4. Risk factors for preeclampsia

Risk factor	No. studies (No. women)	Relative Risk [95% CI]
Antiphospholipid antibodies (APLS)	2 (1802)	9.72 [4.34–21.75]
Previous history of preeclampsia	5 (24 620)	7.19 [5.85–8.83]
Pre-existing diabetes	3 (56 968)	3.56 [2.54–4.99]
Twin pregnancy (increased risk with multiples)	5 (53 028)	2.93 [2.04–4.21]
Nulliparity	3 (37 988)	2.91 [1.28–6.61]
Family history of preeclampsia	2 (692)	2.90 [1.70–4.93]
Raised Body Mass Index (BMI) before pregnancy	6 (64 789)	2.47 [1.66–3.67]
Raised BMI at booking	3 (4625)	1.55 [1.28–1.88]
Maternal age greater than or equal to 40 years (primipara)	1 (5242)	1.68 [1.23–2.29]
Maternal age greater than or equal to 40 years (multipara)	1 (3140)	1.96 [1.34–2.87]
sBP greater than or equal to 130 mmHg at booking	1 (906)	2.37 [1.78–3.15]
dBP greater than or equal to 80 mmHg at booking	1 (907)	1.38 [1.01–1.87]
Inter-pregnancy interval greater than 10 years	–	1.12 [1.11–1.13]
Renal disease	–	unavailable
Chronic autoimmune disease	–	unavailable
Chronic hypertension	–	unavailable

Adapted from: Lowe SA, Bowyer L, Lust K, McMahon LP, North RA, Paech M, et al[1]. and Duckitt K, Harrington D.[7]

3.2 Adverse perinatal outcomes with hypertension

Table 5. Adverse outcomes of hypertensive disorders

Aspect	Considerations
Cerebral injury	• Cerebral perfusion pressure is altered in pregnant women making them more susceptible to cerebral haemorrhage, posterior reversible encephalopathy syndrome and hypertensive encephalopathy[1] • sBP as opposed to dBP or relative increase or rate of increase of mean arterial pressure from baseline levels, may be the most important predictor of cerebral injury and infarction[5,8] • Preeclampsia/eclampsia was the second largest cause of maternal deaths in the most recent CMACE report[5] with 64% of these attributed to cerebral events
Other perinatal outcomes	• More likely to develop placental abruption[9], DIC, hepatic failure and acute renal failure[1] • Adverse neonatal outcomes may include prematurity, small for gestational age[9], admission to intensive care nursery • Refer to Appendix E: Longer term sequelae of hypertension in pregnancy

3.3 Risk reduction

No treatment to date can reliably prevent preeclampsia in all women.[10]

Table 6. Risk reduction

Aspect	Considerations
Assessment	• Assess all women for risk factors and consider risk reduction strategies, particularly if: o Previous early onset preeclampsia o Underlying maternal disease (e.g. APLS, pre-existing diabetes, renal or autoimmune disease) o Multiple risk factors present
Aspirin	• Low dose aspirin reduced the risk of preeclampsia (24%), preterm birth (14%) and intrauterine growth restriction (IUGR) (20%) in women at increased risk of preeclampsia without harmful effects[11] o Number needed to treat to prevent 1 diagnosis of preeclampsia is 42 [95% CI 26–200][11] • Advise women at moderate to high risk of preeclampsia to commence Aspirin 100 mg daily ideally before 16 weeks gestation and to continue it until 37 weeks or the birth of the baby[1]
Heparin	• Insufficient evidence to support routine use (other than in the specific case of APLS[1])
Calcium	• Calcium supplements may reduce the risk of preeclampsia in high risk women where there is deficient dietary calcium intake[12] • Insufficient evidence to recommend routine use for all women[13]
Advice if high risk of preeclampsia	• Advise women at high risk of hypertensive disorders of pregnancy (HDP) of the symptoms of preeclampsia and to seek immediate advice from a health care professional if symptoms present. • Symptoms include[13]: o Severe headache o Problems with vision (e.g. blurring or flashing before the eyes) o Severe pain just below the ribs on the right side o Vomiting o Sudden swelling of the face, hands or feet
Therapies unsupported by evidence	• There is insufficient evidence to support routine use (for prevention or risk reduction of hypertensive disorders of pregnancy) of the following: o Magnesium or zinc supplementation[14,15] o Bed rest[16] o Dietary salt restriction[17] o Antioxidants[13]

3.4 Initial investigations for new onset hypertension after 20 weeks

Table 7. Initial investigations

Investigation	Considerations
BP measurement	• Correct measurement techniques are critical to the correct diagnosis of HDP[18] • Confirm non-severe hypertension by measuring BP over several hours o Up to 70% of women with an office BP of 140/90 mmHg have normal BP on subsequent measurements on the same visit[17] • Refer to Appendix A: Measurement of blood pressure
Proteinuria	• Screen women for proteinuria with urinary dipstick at each visit[17 1] • Quantify by laboratory methods if: o Greater than or equal to 2+ proteinuria or o There is repeated 1+ proteinuria or o Preeclampsia is suspected • Spot urine protein to creatinine ratio greater than 30 mg/mmol is diagnostic of proteinuria in pregnancy[1,13,17] • 24 hour urine collection is not necessary in routine clinical management • Proteinuria testing does not need to be repeated once significant proteinuria in the setting of confirmed preeclampsia has been detected
Blood tests	• Tests may be abnormal even when BP elevation is minimal: o Full blood count (FBC)[1] o Urea, creatinine, electrolytes[1] and urate o Liver function tests (LFT)[1] including LDH
Preeclampsia investigations	• Urinalysis and microscopy on a carefully collected mid-stream urine sample • If there is thrombocytopenia or a falling haemoglobin, investigations for DIC and/or haemolysis including: o Coagulation studies o Blood film o LDH o Fibrinogen o Haemolytic studies • Refer to Appendix B: Maternal investigations • If severe or early onset preeclampsia consider investigation for associated conditions (e.g. systemic lupus erythematosus (SLE), APLS, chronic renal disease)
Fetal assessment	• Cardiotocograph (CTG) if greater than 24 weeks gestation • Ultrasound scan (USS) assessment of: o Fetal growth o Amniotic fluid volume (AFV) or deepest vertical pocket (DVP) o Umbilical artery flow (Doppler) o And follow-up to assess fetal growth velocity

4 Treatment of hypertension

There is no clear evidence to recommend one antihypertensive drug therapy over another.[19] Familiarity and experience with the chosen agent is the most important consideration[1]. Develop local protocols for administration and use. The goals of antenatal care in the presence of hypertension include control BP, recognise preeclampsia early[20], prevent eclampsia[20] and optimise birth for both the woman and her baby.

4.1 Moderate hypertension

Table 8. Moderate hypertension

Aspect	Considerations
Context	• No difference identified in the risk of pregnancy loss, high-level neonatal care, or overall maternal complications between "less tight control" (dBP target 100 mmHg) and "tight control" (dBP target 85 mmHg) in women 14–36 weeks gestation who had non-proteinuric pre-existing or gestational hypertension and dBP 90–100 mmHg. Less-tight control was associated with significantly higher frequency of severe maternal hypertension[21] • Antihypertensive therapy halves the risk of developing severe hypertension (20 trials, 2558 women; RR 0.49; 95%,CI 0.40–0.60) but has no clear effect on other outcomes (e.g. preeclampsia, perinatal mortality)[9] • Concerns exist about the potential for decreased placental perfusion from aggressive BP lowering that might jeopardize fetal well-being[10]
Indications for drug therapy:	• Consider drug therapy if: o sBP is 140–160 mmHg and/or o dBP is 90–100 mmHg and/or o There are associated signs and symptoms of preeclampsia
Target BP	• There is no clear evidence about the optimal target BP for moderate hypertension in pregnancy[19] • Lower end targets *may be* appropriate if there are comorbidities[19] • Consider individual circumstances • Suggested targets[19]: o sBP less than 140 mmHg o dBP less than 90 mmHg

4.2 Oral antihypertensive drug therapy

Refer to an Australian pharmacopeia for full details of all drugs. Angiotensin Converting Enzyme (ACE) inhibitors and angiotensin receptor blockers are contraindicated in pregnancy.[19]

Table 9. Oral antihypertensive drug therapy

Drug[22,23]	Oral dose	Adjust frequency and dose as clinically indicated	
*Methyldopa	250–500 mg	Initially: 125–250 mg BD Maximum: 2 g	Up to: 500 mg QID
*Labetalol	100–400 mg	Initially: 100 mg BD Maximum: 2.4 g	Up to: 200–400 mg QID
^*Oxprenolol	20–160 mg	Initially: 40–80 mg BD Maximum: 320 mg	Up to: 60–160 mg BD
"Hydralazine	25–50 mg	Initially:25 mg BD Maximum: 200 mg	Up to: 50–100 mg BD
"Nifedipine (SR)	20 mg	Initially: 20–30 mg daily Maximum: 120 mg	Up to: 60–120 mg daily
"Nifedipine (immediate release)	10–20 mg	Initially:10–20 mg BD Maximum: 80 mg	Up to: 40 mg BD
"Prazosin	0.5–5 mg	Initially:0.5 mg BD Maximum: 20 mg	Up to: 1 mg TDS
"Clonidine	75–300 mcg	Initially:50–150 mcg BD Maximum: 600 mcg	Up to: 150–300 mcg BD

* First line drugs: " Second line drugs: ^Not on QH LAM:

4.3 Severe hypertension

The most recent CMACE report[5] identified failure to treat severe (particularly systolic) hypertension as the single most serious failing in the clinical care of women who died.

Table 10. Severe hypertension

Aspect	Considerations
Context	• The antihypertensive agent of choice for acute control has not been established and initial therapy can be with one of a variety of antihypertensive agents[24] • Persistent or refractory severe hypertension may require repeated doses[1] • The concurrent administration of longer acting oral agents will achieve a more sustained BP lowering effect[1]
Indications for drug therapy	• Commence pharmacological treatment if[1]: o sBP is greater than or equal to 160 mmHg and/or o dBP is greater than or equal to 100 mmHg • sBP greater than or equal to 170 mmHg with or without dBP greater than or equal to 110 mmHg is a medical emergency and requires urgent treatment
Target BP	• Target sBP range of 130 to 150 mmHg • Target dBP range 80 to 90 mmHg • Aim for gradual and sustained lowering of BP[24] so blood flow to the fetus is not compromised
Management	• A multidisciplinary team approach is required • Provide care in a high dependency unit[1] or birth suite • Strict control of BP is required • Monitor BP 15–30 minutes until stable and then at a minimum 4 hourly • Perform a thorough assessment of maternal and fetal condition[8] • Continuous fetal heart rate (FHR) monitoring is recommended[8]
Drugs not recommended	• Not generally recommended for treatment of hypertension[24]: Magnesium Sulfate (although may be indicated for prevention of eclampsia)[8], high dose Diazoxide, Nimodipine, Chlorpromazine • Infusions of Sodium Nitroprusside or Glyceryl Trinitrate are recommended only when other treatments have failed and birth is imminent[1,8]

4.3.1 Antihypertensive drug choices for treatment of acute severe hypertension

Refer to an Australian pharmacopeia for full details of all drugs.

Table 11. Antihypertensive drug choices for treatment of acute severe hypertension

Drug[22,25]	Dose	Route	Comment
*Nifedipine	10–20 mg conventional release tablet	Oral	Onset: 30–45 minutes Repeat: after 45 minutes Maximum: 80 mg
#*Labetalol	Initially 20 mg Repeat with 40–80 mg	IV bolus over 2 minutes	Onset: 5 minutes Repeat: every 10 minutes
	20–160 mg/hour	Infusion	Titrate to BP response to a maximum of 300 mg
*Hydralazine	5–10 mg (5 mg if fetal compromise)	IV bolus over 3–10 minutes	Onset: 20 minutes Repeat: every 20 minutes Maximum: 30 mg
	10–20 mg/hour	Infusion	Titrate to BP response Refer to Appendix C: Hydralazine protocol
#*Diazoxide[1]	15–45 mg	IV rapid bolus	Onset: 3–5 minutes Repeat: after 5 minutes Maximum 150 mg/dose Monitor Blood Glucose Levels

Note: *Refer to the Queensland Health List of Approved Medicines (LAM) for prescribing restrictions
Special Access Scheme (SAS) authority required

5 Preeclampsia

Severe hypertension, headache, epigastric pain, oliguria or nausea and vomiting are ominous signs requiring urgent admission and management, as does any concern about fetal wellbeing.[1]

Table 12. Preeclampsia

Aspect	Considerations
Context	• Severity, timing, progression and onset of clinical features are unpredictable[1] • Hypertension and proteinuria may be late or mild features of preeclampsia[1] • Birth is the definitive management and is followed by resolution, generally over a few days but sometimes much longer
Antihypertensive therapy	• Refer to Section 4.1 Moderate hypertension and Section 4.3 Severe hypertension
Progression	• Clinical progression is unpredictable, therefore close clinical surveillance is required for all women with preeclampsia[1] • Increasing severity may be indicated by difficulty in controlling BP and deteriorating clinical condition including[26]: o HELLP syndrome o Impending eclampsia o Worsening thrombocytopenia o Worsening fetal growth and wellbeing o The definitive treatment is always birth of the fetus and placenta
VTE	• Preeclampsia is an independent risk factor for venous thromboembolism (VTE) occurring in pregnancy or the puerperium[1] • Refer to the Queensland Clinical Guideline *VTE prophylaxis in pregnancy and the puerperium*[27]
Fluid management	• Administration of large volumes of intravenous fluids before or after birth may cause pulmonary oedema or worsen peripheral oedema[1] • In the immediate postpartum period, oliguria is common and physiological and does not require fluid therapy unless the serum plasma creatinine is rising • Strict fluid balance monitoring • If no other complications, restrict post-birth intravenous crystalloids to 1500 mL in the first 24 hours • An indwelling urinary catheter for hourly measurements may be required • Diuretics are usually inappropriate unless there is fluid overload or pulmonary oedema[19] • For oliguria (less than 80 mL/4 hour) o Oliguria generally defined as urine output less than 500 mL/24 hours. In preeclamptic women, significant renal impairment may occur within 24 hours and therefore this guideline recommends observation of urine output over 4 hours o Obstetric and medical review is required

5.1 Magnesium Sulfate

Table 13. Magnesium Sulfate

Aspect	Consideration
Context	• Magnesium Sulfate is the anticonvulsant drug of choice for the prevention and treatment of eclampsia[20] • Do not prescribe Magnesium Sulfate for the prevention of eclampsia without discussion with a consultant obstetrician • Treatment is recommended during the antepartum, intrapartum and within the first 24 hours postpartum for preeclampsia with evidence of central nervous system dysfunction • Symptoms or signs have poor positive and negative predictability for eclampsia • Refer to Appendix D: Magnesium Sulfate protocol
Suggested indications to commence	• Eclampsia • Severe preeclampsia, defined in the Magpie Trial[28] as: o sBP greater than or equal to 170 mmHg or dBP greater than or equal to 110 mmHg and at least 3+ of proteinuria *or* o sBP greater than or equal to 150 mmHg or dBP greater than or equal to 100 mmHg on two occasions and at least 2+ of proteinuria in the presence of at least two signs or symptoms of ‘‘imminent eclampsia’’ [refer to Section 6 Eclampsia] • Preeclampsia with at least one sign of central nervous system irritability [refer to Section 2.2 Diagnosis of preeclampsia] • Transfer to higher level service for preeclampsia management
Local protocols	• Develop local protocols that include recognition of the risks of Magnesium Sulfate and assessment of maternal and fetal outcomes • If not using standard pre-mixed 20% Magnesium Sulfate preparations, develop local dilution/preparation protocols

5.2 HELLP Syndrome

Table 14. HELLP syndrome

Aspect	Considerations
HELLP syndrome	• A variant of severe preeclampsia (**H**aemolysis, **E**levated **L**iver enzymes and **L**ow **P**latelet count). Elements include: o Thrombocytopenia (common) o Haemolysis (rare) and o Elevated liver enzymes (common) • In a woman with preeclampsia, the presence of any of the following is an indicator of severe disease[13]: o Maternal platelet count of less than 100 x 10^9/L o Elevated transaminases o Microangiopathic haemolytic anaemia with fragments/schistocytes on blood film
Management	• Liaise with consultant obstetrician, obstetric physician, physician haematologist or anaesthetist o Contact other facilities/services if necessary • If greater than 34 weeks gestation and/or condition deteriorating, plan birth • Magnesium Sulfate infusion may be indicated [refer to Section 5] • Consider platelet transfusion if: o Thrombocytopenia presents a hazard to operative birth or o There is significant bleeding postpartum attributable to preeclamptic thrombocytopenia

6 Eclampsia

Defined as the occurrence of one or more seizures superimposed on preeclampsia.

Table 15. Eclampsia

Aspect	Considerations
Goals of treatment[1]	• Terminate the seizure • Prevent recurrence • Control hypertension • Prevent maternal and fetal hypoxia
Context	• There are no reliable clinical markers that predict eclampsia • Hypertension and proteinuria may be absent prior to the seizure[1] • Seizures may occur antepartum, intrapartum or postpartum usually within 24 hours of birth[1] • Reported incidence of eclampsia varies. In Australia in singleton pregnancies, the incidence of eclampsia is reported as 8.6/10,000 births 2.6% of preeclampsia cases[29]
Imminent eclampsia	• Defined in the Magpie trial as at least two of the following symptoms[28] o Frontal headache o Visual disturbance o Altered level of consciousness o Hyperreflexia o Epigastric tenderness
Treatment	• Follow the basic principles of resuscitation[1] • Magnesium Sulfate is the anticonvulsant drug of choice for the prevention and treatment of eclampsia[20,28] o Refer to Appendix D: Magnesium Sulfate protocol • If the seizure is ongoing or prolonged[1] while initiating Magnesium Sulfate infusion or reoccurs during administration of Magnesium Sulfate give : o Diazepam 5–10 mg IV at a rate of 2–5 mg/minute (maximum dose of 10 mg) or o Midazalam 5–10 mg IV over 2–5 minutes or IM o Clonazepam 1–2 mg IV over 2–5 minutes • Do not use Phenytoin for eclampsia prophylaxis or treatment unless there is a contraindication to Magnesium Sulfate or it is ineffective • Aim for BP below 160/100 mmHg • Refer to the flow chart “Management of Eclampsia” on page 3 of this guideline
Post seizure care	• If birth has not occurred, plan as soon as feasible and when the woman’s condition is stable[1,13] • Close clinical surveillance is required in an appropriately staffed area

7 Antenatal surveillance

At each assessment following the detection of hypertension in pregnancy systematically review the woman's symptoms, examination, laboratory investigations and fetal wellbeing. Base further laboratory assessment on the recommendations contained in Table 17. Maternal and fetal surveillance.[1]

7.1 Model of care

Table 16. Model of care

Type	Considerations
Outpatient care	• Suitable for women with moderate hypertension without evidence of preeclampsia and where there are no geographic contraindications • Consider combined obstetric and physician outpatient management if there is: o Previous pregnancy complicated by preeclampsia o Known essential hypertension on drug therapy o Known renal disease or recurrent urinary tract infection o Other disease associated with hypertension (e.g. SLE) • Frequency of appointments is based on the individual clinical requirements of the woman o Suggested review is initially weekly to fortnightly at a minimum
Day stay	• An alternative to inpatient stay or an adjunct to close antenatal surveillance in selected patients • Frequent maternal and fetal surveillance is required with: o Regular (daily) review by an obstetrician and o When there is a change to maternal or fetal condition
Inpatient	• Consider admission to hospital where[1]: o There is concern for fetal wellbeing and/or o sBP is greater than 140 mmHg or dBP greater than 90 mmHg or signs or symptoms of preeclampsia are present
Inpatient monitoring	• BP 4 hourly if stable • CTG daily (from 28 weeks gestation) • Daily ward urine analysis if proteinuria not previously confirmed • Maintain accurate fluid balance record • Daily review (minimum) by obstetrician • Normal diet • Actively consider thromboprophylaxis o Refer to Queensland Clinical Guideline: *Venous thromboembolic prophylaxis in pregnancy and the puerperium*[27]
Transfer of Care	• Care options will depend on the services available at each facility[30] • Consultation with and/or transfer to a higher level service may be indicated for: o Preterm pregnancies (24–32 weeks gestation)[1] with preeclampsia, severe preeclampsia, eclampsia or HELLP syndrome o Term pregnancies complicated by eclampsia or HELLP syndrome o Any pregnancy in which the health care provider believes the health care facility will be unable to manage the complications of hypertension of pregnancy • Consider Magnesium Sulfate therapy prior to transfer in women with severe preeclampsia, eclampsia or HELLP syndrome • If transfer is indicated, contact Retrieval Services Queensland (RSQ) on 1300 799 127

7.2 Maternal and fetal surveillance

Adverse perinatal outcome is increased in women with all subcategories of hypertensive disease in pregnancy as compared to normotensive women.

Table 17. Maternal and fetal surveillance

Aspect	Considerations
Plan of care	• Discuss and agree a plan with each woman about antenatal surveillance and birth that takes into account: o Maternal preferences o Previous history, risk factors for preeclampsia and gestational age at presentation[13] o Risks and benefits of care options o Indications for elective birth including maternal and fetal thresholds (biochemical, haematological and clinical) o Timing and mode of birth o The most appropriate care setting for the birth taking into account the potential for preterm birth and acuity o If, and when, antenatal steroids are to be administered • Document the plan clearly in the health record(s)
Maternal surveillance	• Assess women at each consultation[13] • If less than 32 weeks gestation, women with preeclampsia require care at centres with facilities for preterm birth[1] • Serial surveillance of maternal and fetal wellbeing is recommended • Frequency, intensity and modality of maternal and fetal surveillance will depend on individual maternal and fetal characteristics[13] • Suggested surveillance protocols are outlined in Table 17[1] • Refer to Appendix B: Maternal investigations
Fetal surveillance	• Incorporate holistic review (especially with fetal growth restriction) that includes USS, CTG, and maternal wellbeing • Assessment of growth trends by serial USS is recommended[1] • Symphysio-fundal height measurement is a poor screening tool for detection of fetal growth restriction (FGR)[1]

7.3 Type and frequency of ongoing surveillance

Common protocols are based on expert opinion and have not been tested in prospective randomised trials.[1]

Table 18. Type and frequency of ongoing surveillance

Classification	Surveillance type[1]		Frequency[1]
Gestational hypertension	Maternal	• Urinalysis for protein • Preeclampsia bloods	• 1–2 per week • Weekly
	Fetal	• USS	• At diagnosis and 2–4 weekly
Preeclampsia	Maternal	• Urinalysis for protein (quantify if 1+) • Preeclampsia bloods	• At diagnosis and if non-proteinuric, repeat daily • Twice weekly (or more if unstable)
	Fetal	• USS • CTG	• At diagnosis and 2–3 weekly • Twice weekly (or more if indicated)
Preeclampsia with FGR	Maternal	• As for maternal preeclampsia	
	Fetal	• USS • CTG	• *On admission and weekly (or more if indicated) • Twice weekly (or more if indicated)
Chronic hypertension	Maternal	• Urinalysis for protein • Preeclampsia bloods	• Each visit • If sudden increase in BP or new proteinuria
	Fetal	• Early dating USS	• First trimester
		• USS	• In 3rd trimester repeat as indicated

*Weekly: Amniotic Fluid Index (AFI) and Doppler, Fortnightly: growth and wellbeing, AFI and Doppler

7.4 Signs of fetal compromise

Currently, there is no single fetal monitoring test to accurately predict fetal compromise in women with preeclampsia. A combination of tests, with emphasis on umbilical artery Doppler when there is FGR is generally recommended.[17]

Table 19. Signs of fetal compromise

Fetal investigation	Description
Fetal movement perception	• Decreased
Fetal monitoring	• Abnormal FHR tracing (e.g. decreased variability)
Deepest amniotic fluid pocket	• AFI 5 cm or less • DVP 2 cm or less • Oligohydramnios associated with adverse perinatal outcomes
USS assessment of fetal growth	• Usually asymmetrical intrauterine fetal growth
Umbilical artery flow Doppler	• Increased resistance, absent or reversed end diastolic flow
Ductus venosus Doppler	• Absent or reversed “a” wave
Middle cerebral artery Doppler	• Cerebral redistribution (decreased resistance or ‘brain sparing effect’) • Paradoxically the flow can revert back to a high resistance pattern when the pathology has not yet resolved - this is a very poor prognostic sign

8 Birth

Consider the entire clinical circumstances when recommending care about birth.

Table 20. Planning birth

Aspect	Considerations
Multidisciplinary approach	• Consult early with an anaesthetist, obstetrician, and obstetric physician[1], or physician where feasible • Inform the anaesthetist when a woman with preeclampsia is admitted to birth suite
Indications for birth[1]	• Non-reassuring fetal status • Severe FGR • Gestational age greater than or equal to 37 weeks • Eclampsia • Placental abruption • Acute pulmonary oedema • Inability to control hypertension despite adequate antihypertensive therapy • Deteriorating platelet count • Deteriorating liver function • Deteriorating renal function • Persistent neurological symptoms • Persistent epigastric pain, nausea or vomiting with abnormal liver function tests
Stabilisation prior to birth	• Except where there is acute fetal compromise, stabilise the woman before birth including[13] o Control of eclampsia or prophylaxis against eclampsia if indicated o Control of severe hypertension[1] o Correction of coagulopathy o Attention to fluid status
Mode of birth	• Recommend vaginal birth unless a caesarean section is required for other obstetric indications[17] • If vaginal birth is planned and the cervix is unfavourable, recommend cervical ripening to increase the chance of successful vaginal birth[17]
Caesarean Section	• In the absence of contraindications, all of the following are acceptable methods of anaesthesia: epidural, spinal, combined spinal-epidural, and general anaesthesia (GA)[17] • When clinically appropriate, spinal is preferred to epidural (because of more rapid onset) and to GA (because it avoids hypertensive response to intubation)[17]

8.1 Timing of birth

There is limited high quality evidence to inform decisions about optimal timing of birth.[31] Individualise care and take into account relative maternal and fetal risks.[32]

Table 21. Timing of birth

Aspect	Considerations
Moderate hypertension	• For women at low risk of adverse outcomes, consider expectant management beyond 37 weeks • Induction of labour from 37 weeks has been associated with a reduction in the incidence of severe hypertension, without an increase in the CS rate[33] but it may also constitute unnecessary intervention in women and babies with generally good outcomes[1]
Preeclampsia	• Timing of birth is dependent on the severity of the disease and the gestational age at which it presents • Prolongation of pregnancy carries no benefit for the mother but may be desirable at early gestations to improve the fetal prognosis[31,34]
Less than 34 weeks	• Aim to prolong pregnancy where possible to improve fetal prognosis • Refer to the Queensland clinical guideline *Preterm labour and birth*[35] regarding: o Antenatal corticosteroids for fetal lung maturity o Magnesium Sulfate for neuroprotection if less than 30 weeks gestation o Retrieval and transfer
34–36+6 weeks	• For women with moderate HDP, immediate birth might reduce the already small risk of adverse maternal outcomes but the risk of neonatal respiratory distress syndrome is significantly increased • Consider expectant monitoring until the clinical situation deteriorates[36] • Consult with higher level services as appropriate
37+0 weeks onwards	• Plan birth taking into consideration resourcing requirements and available maternity and neonatal services • If severe preeclampsia, do not delay birth (except to achieve stabilisation if possible) [refer to Table 20. Planning birth]
HELLP	• Expectant management is harmful with a 6.3% incidence of maternal death and an increased risk of placental abruption[1] • Plan birth as soon as feasible

8.2 Intrapartum

Table 22. Intrapartum

Aspect	Considerations
Drug therapy	• Continue antihypertensive drug therapy throughout labour and birth[13]
Monitoring	• Close clinical surveillance is required • Monitor BP ½ hourly as a minimum • Continuous CTG is recommended • IV access is required • An epidural (in the absence of contraindications) is a useful adjunct therapy for BP control[1] o Discuss with anaesthetist
Second stage	• There is no evidence to guide management of second stage[13] • Assistance is not routinely required but may be necessary if: o BP is poorly controlled o Progress is inadequate o There are premonitory signs of eclampsia • If BP is within target range, refer to Queensland Clinical Guideline *Normal birth*[37] for management of second stage • If BP does not respond to initial drug therapy, advise assisted/operative birth[13]
Third Stage	• Active management of third stage is recommended due to the increased risk of postpartum haemorrhage[5] • **DO NOT GIVE** Ergometrine or Syntometrine as it may produce an acute rise in BP • Refer to Queensland Clinical Guideline: *Primary postpartum haemorrhage*[38]

9 Postpartum

Hypertension, proteinuria, eclampsia and other adverse conditions of preeclampsia may develop for the first time during the postpartum period.

Table 23. Postpartum

Aspect	Considerations
Context	• After birth, clinical and laboratory derangements of preeclampsia recover, often taking several days[1] • Liver enzyme elevations and thrombocytopenia will often worsen in the first few days after birth before they improve • De novo postpartum hypertension is most common on days 3–6[17] • Peak postpartum BP occurs on days 3–6[39] • 44% of eclampsia occurs in the postpartum period, usually in the first 48 hours after birth[39]
Target BP	• sBP less than or equal to 140 mmHg • dBP les than or equal to 90 mmHg
Monitoring	• Continue close monitoring (4 hourly or more frequently) including BP, pulse rate, respiratory rate and oxygen saturation until: o BP is stable o Urine output has normalised o Blood investigations are stable or improving • Reduce frequency of monitoring only after discussion with the treating obstetric/medical team • Use Queensland Maternity Early Warning Tools (Q-MEWT) as indicated • Ask women about severe headache and epigastric pain each time BP is measured[13]
VTE prophylaxis	• Actively consider VTE prophylaxis • Refer to the Queensland clinical guideline *VTE prophylaxis in pregnancy and the puerperium*[27]
Drug therapy	• Continue use of antenatal antihypertensive drug therapy • Cease or reduce when hypertensive changes are resolving o Avoid abrupt withdrawal to avoid rebound hypertension • If persistently hypertensive (sBP greater than or equal to 140 mmHg or dBP greater than or equal to 90 mmHg), start antihypertensive drug therapy (if not commenced prior to birth) o If severe hypertension refer to Section 4.3 Severe hypertension • If Methyldopa commenced during pregnancy, cease postpartum and commence alternative therapy as it is associated with clinical depression[13] • For women prescribed beta blockers refer to Queensland Clinical Guideline *Newborn hypoglycaemia* for BGL monitoring[40]
NSAID	• Non-steroidal anti-inflammatory drugs (NSAIDS) are not generally recommended because of the risk of worsening hypertension and renal impairment, especially in volume depleted women
Breastfeeding	• First and second line drugs are considered compatible with breast feeding[1] • Antihypertensive drugs without reported adverse reactions in breastfed infants include: o Nifedipine o Enalapril o Captopril o Metoprolol o Atenolol (other agents may be preferred if nursing a preterm infant or baby less than 3 months[41]) o Labetalol (other agents may be preferred if nursing a preterm infant)[41] • Refer to Queensland Clinical Guideline *Breast feeding initiation*[42]
Psychological support	• Offer postnatal counselling regarding the pregnancy and birth experience[13] including formal postnatal review to discuss the events of the pregnancy if required

9.1 Discharge and follow-up

Following a pregnancy complicated by hypertensive disorders of pregnancy, the woman has an increased risk in future pregnancies of gestational hypertension and preeclampsia as well as an increased risk of longer term cardiovascular and medical conditions.[19] Refer to Appendix E: Longer term sequelae.

Table 24. Discharge and follow-up

Aspect	Considerations
Discharge	• Take into account the risk of late seizures and the peak postpartum BP when timing discharge • Recommend follow-up after 6 weeks to ensure resolution of pregnancy-related changes and ascertain the need for ongoing care • Inform the GP and/or other relevant medical specialists about the events of the pregnancy • Provide advice regarding future pregnancy risk reduction (e.g. Aspirin) and management
ACE inhibitors	• If taking ACE inhibitors o Discuss the importance of contraception as contraindicated in pregnancy[22] o Advise to discuss alternative antihypertensive treatment with their healthcare provider(s) if considering pregnancy[19]
Follow-up screening	• Offer screening for pre-existing hypertension and underlying renal disease to women with a history of early onset preeclampsia, or antiphospholipid antibodies • Ongoing assessment of traditional cardiovascular risk markers is of benefit to women who are normotensive but who had a hypertensive disorder of pregnancy[43] (e.g. annual BP check, serum lipids and blood glucose) • Offer pre-conceptual counselling for discussion of risk factors and preventative therapies (e.g. calcium supplementation, low dose aspirin)
Lifestyle advice	• Advise women that they will benefit from avoiding smoking, maintaining a healthy weight, exercising regularly and eating a healthy diet[1] • Encourage overweight women to attain a healthy BMI for long term health and to decrease risk in future pregnancy • Advise obese women of the benefits of weight loss before each pregnancy o Refer to Queensland Clinical Guideline *Obesity in pregnancy*[44]

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Appendix A: Blood pressure measurement

Technique	Procedure[18]	Rationale
Position of woman	• Seated • Feet supported on a flat surface • Arm supported horizontally at the level of the heart • Allow to rest for 5 minutes prior to measurement • Avoid supine posture • In labour, use left arm in lateral recumbency • Measure using both arms at initial visit • If BP consistently higher in one arm, use the arm with the higher values for all BP measurements	• Different arm positions can produce significantly different measurements • A rise in BP may occur in the first few minutes of a medical encounter • Avoids supine hypotension syndrome • Excludes rare vascular abnormalities
Cuff size	• Cuff length 1.5 times the circumference of the arm • If arm circumference greater than 33 cm use large cuff or extra-large cuff	• Correct sized cuff is necessary for correct measurement and hence diagnosis
Cuff position	• Place lower edge of cuff 2–3 cm above the point of brachial artery pulsation • Place rubber tubes from cuff bladder superiorly	• Allows easy access to the antecubital fossa for auscultation
Measurement device	• Calibrate and maintain device as per manufacturer's instructions • Use an aneroid device that is validated for use in pregnancy	• All devices require regular servicing and calibrating[23] • Mercury devices considered the gold standard but use not supported in Queensland Health due to occupational health and safety concerns
sBP measurement	• Palpate BP at the brachial artery • Inflate cuff to 30 mmHg above where pulse disappears • Deflate cuff slowly at approximately 2 mmHg per second • Use Korotkoff phase I (first sound heard) • Take readings to the nearest 2 mmHg (not nearest 0 or 5 mmHg)	• Palpation of the brachial artery is required to ensure correct placement of the stethoscope • Necessary for accurate systolic and diastolic estimation • Avoids bias through digit preference (i.e. observers estimating BP to nearest 0 or 5 mmHg)
dBP measurement	• Record dBP using Korotkoff phase V (i.e. when sounds disappear) • If phase V cannot be detected use Korotkoff phase IV (i.e. when sounds muffle)	• Korotkoff phase V is detected with greater reliability than Korotkoff phase IV and is a better estimation of true diastolic pressure
Documentation	• Record site and position of the BP reading at the booking visit • Be consistent at future antenatal visits	• Facilitates detection of true BP changes (i.e. not related to maternal position or site changes)
Other factors affecting BP readings	• Stress and anxiety • Talking while BP taken • *Tobacco products (containing Nicotine) • *Alcohol/Caffeine • Temperature • Full bladder	• Increase BP • *Avoid for 30 minutes prior to measurement

Appendix B: Interpretation of preeclampsia investigations

Investigation	Gestation (weeks)	Reference range*	Units	Description if preeclampsia
WBC	1–12	5.7–13.6	$x10^9$/L	**Higher** Largely due to exaggerated neutrophilia
	13–24	6.2–14.8		
	25–42	5.9–16.9		
	Greater than 42	5.7–16.9		
Haemoglobin (Hb)	1–12	110–143	g/L	**Higher** Due to haemoconcentration unless there is microangiopathic haemolytic anaemia
	13–24	100–137		
	25–42	98–137		
	Greater than 42	98–143		
Platelets	1–12	170–390	$x10^9$/L	**Lower** Less than 100 x 10^9/L may be associated with coagulation abnormalities. Falling platelet count associated with worsening disease
	13–24	170–410		
	25–42	150–430		
	Greater than 42	150–430		
Haptoglobin (Hp)	1–42	0.36–1.95	g/L	**Lower** Suggests haemolysis
aPTT	0–42	26–41	seconds	**Higher** with DIC
INR	0–42	0.9–1.3		**Higher** with DIC
Fibrinogen	0–42	1.7–4.5	g/L	**Lower**
Glucose	0–42	3.0–7.8	mmol/L	**Low** in acute fatty liver of pregnancy
Serum Creatinine	0–42 (15–<19 years)	38–82	µmol/L	**Higher** Due to haemoconcentration and/or renal failure.
	0–42 (19–60 years)	45–90	µmol/L	
Bilirubin (Total)	0–42	Less than 20	µmol/L	**Higher** Unconjugated from haemolysis or conjugated from liver dysfunction
Albumin	0–26	35–50	g/L	**Lower**
	27–40	33–40		
AST	0–42	Less than 31	U/L	**Higher**
ALT	0–42	Less than 34	U/L	**Higher**
LDH	0–42	120–250	U/L	**Higher**
Random protein to creatinine ratio	0–42	Less than 30	mg/mmol	**Higher**

Appendix C: Hydralazine protocol

Caution: refer to the Australian product information for complete drug information	
Hydralazine	
Indications	• Acute control of severe hypertension
Contraindications	• Known hypersensitivity • SLE • Severe tachycardia • Myocardial insufficiency • Right ventricular heart failure
Precautions	• Suspected/confirmed coronary artery disease • Renal impairment • Hepatic impairment • Cerebrovascular disease
Route	• Intravenous
Intermittent bolus	• 5–10 mg IV over 3–10 minutes (5 mg if fetal compromise) • Repeated doses 5 mg IV 20 minutes apart if required • If maternal pulse greater than 125 beats/minute, then cease • If 20 mg total given or longer term BP control required consider an infusion • Maximum dose 30 mg
Infusion	• Commence at 10–20 mg/hour IV via controlled infusion device and titrate to BP • If maternal pulse greater than 125 beats/minute consider ceasing infusion
Side effects	• Tachycardia • Headache • Flushing • Palpitations
Monitoring during bolus doses	• Monitor BP and pulse o Every 5 minutes during administration and until stable, then o Hourly for 4 hours • Continuous CTG if ante/intrapartum
Monitoring during infusion	• Monitor BP every 15 minutes until stable then hourly • Continuous CTG if ante/intrapartum • FBC, LFT, coagulation profile, Group and hold • Strict fluid balance monitoring

Appendix D: Magnesium Sulfate protocol

Caution: refer to the Australian product information for complete drug information	
Magnesium Sulfate	
Resources required	• One to one midwifery care in birth suite or high dependency unit for the duration of therapy • Dedicated IV line for Magnesium Sulfate • Resuscitation and ventilator support immediately available • Calcium Gluconate 1 g available in case of respiratory depression/overdose
Contraindications	• Maternal cardiac conduction defects (heart block) • Hypermagnesaemia
Precautions	• Myasthenia gravis • Reduced renal function monitor plasma magnesium level/urine output
Loading dose	• 4 g IV infusion over 20 minutes via controlled infusion device
Seizures	• If new onset seizure or persistent seizures whilst on Magnesium Sulfate o Give a further 2 g IV over 5 minutes o May be repeated in a further 2 minutes if seizures persist
Maintenance dose	• 1 g/hour for 24 hours after last seizure or birth (whichever is latest), then review for continuation/cessation • If impaired renal function: o Reduce maintenance dose to 0.5 g/hour o Discuss serum monitoring requirements with an obstetrician
Side effects	• Related to hypermagnesaemia • Common (greater than 1%): nausea and vomiting, flushing • Infrequent (0.1–1%): headache, dizziness
Baseline observations	• BP, pulse, respiratory rate, level of consciousness • Oxygen saturation (SpO_2) • Patellar reflex • If antepartum, abdominal palpation, FHR/CTG
Monitoring during loading dose	• BP, pulse and respiratory rate every 5 minutes (for minimum 20 minutes) until stable • SpO_2 continuously • If in labour monitor contractions for 10 minutes every 30 minutes • Continuous CTG if greater than 24 weeks gestation o Interpret CTG relevant to gestational age if less than 28 weeks o Document reason if CTG not able to be performed • Auscultate FHR every 15–30 minutes if less than 24 weeks gestation • Observe for side effects • Check deep tendon reflexes (patellar or, if epidural insitu, biceps) after completion of loading dose o Notify obstetrician if absent and do not commence maintenance dose
Monitoring during maintenance infusion	• BP, pulse, respiratory rate and SpO_2 every 30 minutes • Temperature every 2 hours • If in labour, monitor contractions for 10 mins every 30 mins • Continuous CTG if greater than or equal to 24 weeks gestation o Interpret CTG relevant to gestational age if less than 28 weeks o Auscultate FHR every 15–30 minutes if less than 24 weeks gestation • Strict fluid balance monitoring and documentation o Notify medical officer if urine output less than 25 mL/hour o Indwelling urinary catheter is recommended • Deep tendon reflexes hourly o Record as A=Absent, N=Normal, B=Brisk • Serum monitoring is not required if renal function normal o Therapeutic serum magnesium levels are 1.7–3.5 mmol/L
Discontinuation and urgent medical review	• Respiratory rate less than 12 breaths/minute or more than 4 breaths/minute below baseline • Diastolic BP decreases more than 15 mmHg below baseline • Absent deep tendon reflexes • Urine output less than 80 mL/4 hours • Magnesium serum levels greater than 3.5 mmol/L
Ceasing therapy	• Before discontinuing therapy ensure o Clinical improvement evident (absence of headache, epigastric pain) and condition stable

Appendix E: Longer term sequelae of hypertension in pregnancy

If pregnancy complicated by:	Recurrence risk in future pregnancy of	
	Gestational hypertension	*Preeclampsia*
• Gestational hypertension	16–47%	2–7%
• Proteinuric preeclampsia	13–53%	16%
• Severe preeclampsia		
o Less than 34 weeks		25%
o Less than 28 weeks		55%

After preeclampsia, relative risk of:	Relative Risk [95% CI]
• End stage renal disease	4.30 [3.3–5.6]
• Chronic hypertension	3.70 [2.70–5.05]
• Ischaemic heart disease	2.16 [1.86–2.52]
• Peripheral vascular disease	1.87 [0.94–3.73]
• Type II diabetes	1.86 [1.22–2.84]
• Cerebrovascular disease	1.81 [1.45–2.27]
• Deep vein thrombosis	1.79 [1.37–2.33]
• Elevated thyroid-stimulating hormone (TSH)	1.70 [1.1–1.7]
• All cancers	0.96 [0.73–1.27]

Other reported sequelae
• If severe preeclampsia/eclampsia o Impaired cognitive function and memory at 3–8 months postpartum unrelated to scores of depression, anxiety or attention • If eclampsia o Increased self-reporting of cognitive failures and impaired vision several years after pregnancy compared to women with normal BP or women with preeclampsia • For the infant, increased cardiovascular risk factors from an early age o Increased sBP and dBP o Increased BMI

Source: Lowe SA, Bowyer L, Lust K, McMahon LP, North RA, Paech M, et al. The SOMANZ guideline for the management of hypertensive disorders of pregnancy. 2014

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