



## OFFICIAL

OBSTETRICS AND GYNAECOLOGY CLINICAL PRACTICE GUIDELINE	
Hypertension and Pregnancy	
<b>Scope (Staff):</b>	WNHS Obstetrics and Gynaecology Directorate staff
<b>Scope (Area):</b>	Obstetrics and Gynaecology Directorate clinical areas at KEMH, OPH and home visiting (e.g. Visiting Midwifery Services, Community Midwifery Program and Midwifery Group Practice)
This document should be read in conjunction with the <a href="#">Disclaimer</a> .	

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## Aim

The aim of the guideline is to standardise the definition, diagnosis, and management of HTN, severe pre-eclampsia toxemia (PET) and eclampsia in the antenatal, intrapartum and postnatal period, with the goal to improve outcomes for the mother and the neonate.

## Background

Hypertensive disorders during pregnancy occur in women with pre-existing primary or secondary chronic HTN, and in women who develop new onset HTN in the second half of pregnancy. Hypertensive disorders during pregnancy carry risks for the woman and baby. In Australia in 2021, 3.1% of women who gave birth had gestational hypertension (HTN) and an additional 0.9% had existing HTN<sup>1</sup>. This was higher among First Nations women with 3.2% and 1.2% respectively<sup>2</sup>.

## Abbreviations

ACE	Angiotensin converting enzyme
ASCU	Adult Special Care Unit
BD	Twice daily
BP	Blood pressure
CMP	Community Midwifery Program
CTG	Cardiotocography
DIC	Disseminated intravascular coagulopathy

DVT	Deep vein thrombosis
ECG	Electrocardiogram
FHR	Fetal Heart Rate
GP	General Practitioner
HELLP	Haemolysis, elevated liver enzymes and low platelets
HTN	Hypertension
IR	Immediate release
IV	Intravenous
LBS	Labour and Birth Suite
MVP	Maximum vertical pocket
Obs	Observations (vital signs)
PCR	Protein creatinine ratio
PEA	Pre-eclamptic angina
PET	Pre-eclampsia toxaemia
SCN	Special Care Nursery
SR	Senior Registrar
USS	Ultrasound scan

### Definition of HTN<sup>1</sup>

<b>Mild to moderate HTN</b>	<b>Systolic BP:</b> from 140 – 160 mmHg and/or <b>Diastolic BP:</b> from 90 – 110 mmHg
<b>Severe HTN in pregnancy</b>	<b>Systolic BP:</b> $\geq 160$ mmHg and/or <b>Diastolic BP:</b> $\geq 110$ mmHg

These values represent a level of blood pressure (BP) above which the risk of maternal morbidity and mortality is increased.

Hypertension should be lowered promptly, carefully, to prevent complications of intrauterine growth restriction, placental abruption, superimposed pre-eclampsia, and worsening HTN leading to severe HTN and risks of cerebral vascular accident and /or organ damage<sup>2</sup>.

### Classification of HTN in pregnancy<sup>1</sup>

Hypertensive disorders in pregnancy may be classified as:

- Pre-eclampsia
- Gestational HTN
- Chronic HTN – essential or secondary
- Superimposed pre-eclampsia on chronic HTN
- White coat HTN
- Masked HTN
- Severe (or acute) HTN

**Pre-eclampsia**

This is a multi-system disorder characterised as the new onset of HTN and involvement of one or more other organ systems and/or the fetus.

Diagnosis can be made when:

1. HTN arising after 20 weeks gestation.
2. Involvement of one or more organ systems and/or the fetus.

**Gestational HTN**

- New onset of HTN arising after 20 weeks gestation
- No additional maternal or fetal features of pre-eclampsia toxaemia (PET).
- Resolves within 3 months postpartum.
- The risk of transition from gestational HTN to pre-eclampsia or adverse pregnancy outcome is higher with the earlier onset of gestational HTN.

**Chronic HTN**

Pre-existing HTN is strong risk factor for the development of PET and requires close clinical surveillance.

**1. Essential HTN**

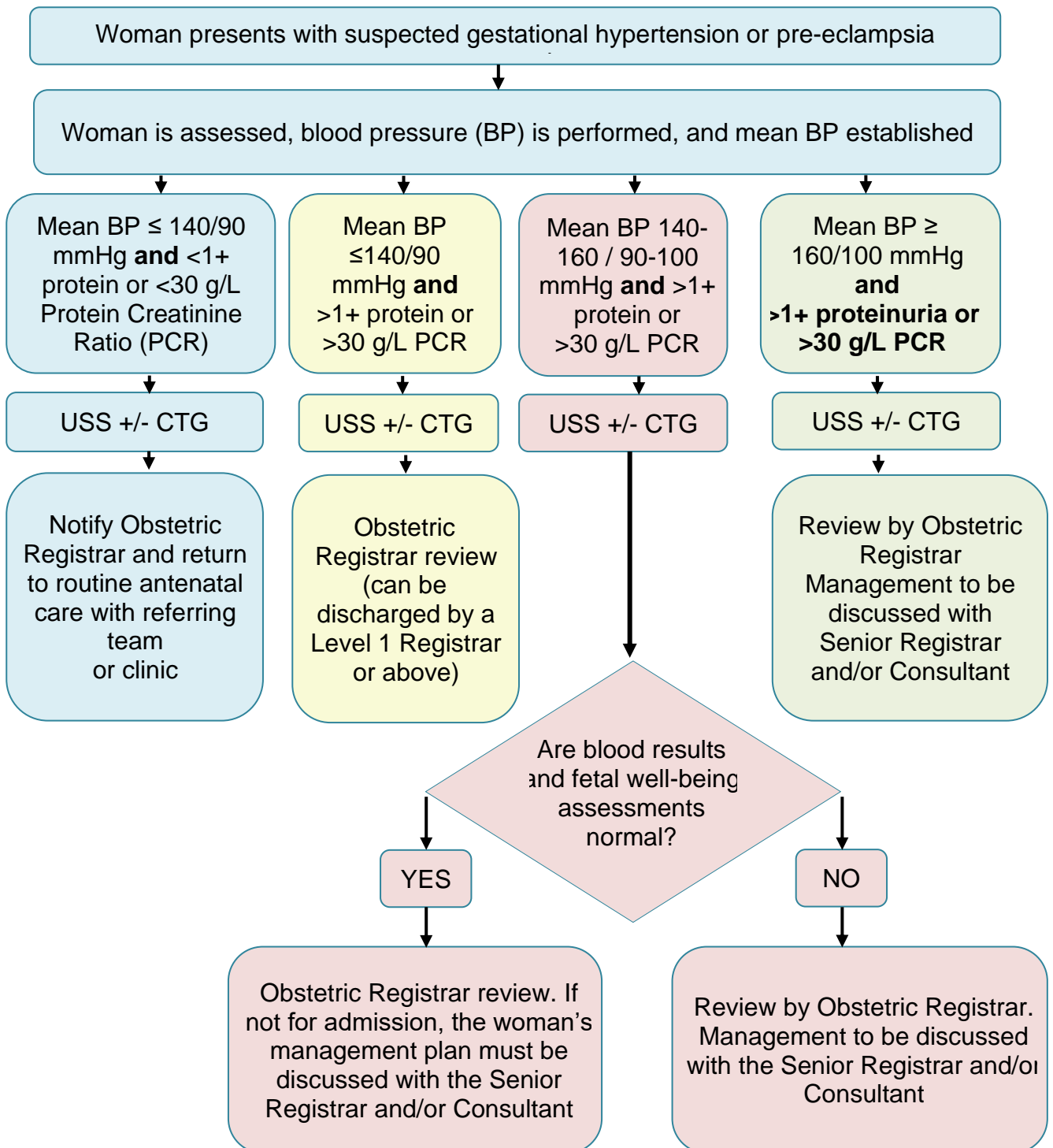
- BP greater than 140/90 mmHg preconception or prior to 20 weeks without an underlying cause OR
- BP less than 140/90 mmHg entering pregnancy on antihypertensives

**2. Secondary HTN**

Secondary causes of chronic HTN include:

- Endocrine disorders (e.g. primary hyperaldosteronism pheochromocytoma, and Cushing's syndrome and)
- Chronic kidney disease
- Renal artery stenosis
- Systemic disease with renal involvement (e.g. diabetes mellitus, systemic lupus erythematosus)
- Coarctation of the aorta

## Flowchart: Management of suspected new onset HTN and / or PET



## Criteria for referral to Maternal Fetal Assessment Unit (MFAU)/ Assessment Unit (AU)

- BP  $\geq$  140/90 mmHg on 2 occasions +/- proteinuria on urine dipstick.

### Assessment

1. Assess for the following symptoms and/or signs. Arrange review by Obstetric Registrar or above if the following symptoms are present:

- Headache
- Visual disturbance
- Epigastric or right upper quadrant pain
- Significant oedema
- Hyper-reflexia / clonus
- Intrauterine growth restriction

2. Check the BP 4 times at 15-minute intervals (use K5 disappearance of sounds) and calculate the average BP.

**Note:** inform the Obstetric Registrar immediately if the woman has two BP recordings of  $\geq$ 160 mmHg systolic or  $\geq$ 110 mmHg diastolic.

3. Obtain a blood sample for:
  - Biochemistry – creatinine and electrolytes, uric acid, LDH, ALT, AST
  - FBP
  - Blood group and hold if symptomatic or BP  $\geq$ 160/110 mmHg
4. Obtain an MSU for urinalysis. If proteinuria  $\geq$ +1 protein, send urine sample for formal protein creatinine ratio (PCR).
5. If the woman is > 26 weeks pregnant, perform a CTG and USS.  
if the woman is < 26 weeks pregnant, perform an USS only.
6. Arrange an ultrasound assessment of fetal wellbeing as follows:
  - First presentation – fetal biometry, maximum vertical pocket (MVP) and umbilical artery (UA) Doppler studies.
  - Ongoing USS surveillance is as per Table *fetal surveillance LINK*
7. New proteinuria of > 2+ on dipstick with HTN in late pregnancy is a sign of severity requiring hospital admission for observation, irrespective of any other test results.
8. IUGR with new HTN is also an indication for hospital admission and usually reflects severe placenta vascular disease.

### Early onset pre-eclampsia

- Patients with severe early onset PET warrant investigation for associated conditions e.g. systemic lupus erythematosus, underlying renal disease, antiphospholipid syndrome, thrombophilia, acute fatty liver or undiagnosed pheochromocytoma.

- Subsequent management will be based on the results of ongoing BP measurement and the above investigations.
- Amongst women referred for assessment of new onset HTN, a number will have normal BP and investigations. These women are considered to have transient or labile HTN. Repeat assessment should be arranged within 3-7 days as many will subsequently develop PET.
- Consultation with obstetric physicians may be indicated for further management.

**Table 1 – Inpatient management of the antenatal patient with gestational HTN or PET**

<b>Maternal assessment</b>	On admission	Full set of observations
	4-hourly (or as per clinical condition)	Full set of observations
	Twice daily	Check for signs and symptoms of complications i.e. headaches, visual disturbances, epigastric pain, nausea, drowsiness and confusion
	Overnight	Continue 4 hourly observations Observe for Pre-eclamptic Angina (PEA) which is experienced typically at night
<b>Fetal assessment</b>	4-hourly	Fetal movement – report and escalate any decrease or change in fetal movement
	Twice daily	FHR – report any abnormalities promptly
	As ordered and / or if deterioration	*CTG – immediately if there is any deterioration in maternal condition, FHR or fetal movements

**\* Fetal Surveillance to always be determined by Senior Registrar and/or Consultant**

## Intrapartum management and birth

### Timing of birth

In severe PET, delivery must always be preceded by:

- Control of severe HTN
- Attention to fluid status
- Correction of coagulopathy (usually thrombocytopaenia)
- Control of eclampsia, or prophylaxis against eclampsia.

A team approach, involving obstetrician, midwife, neonatologist, anaesthetist and physician provides the best chance of achieving a successful outcome for mother and baby.

### Drug therapy

- Continue antihypertensive therapy throughout labour and birth<sup>4</sup>.

## Monitoring

- The frequencies of maternal observations are adjusted according to the maternal clinical condition and medication therapy guidelines.
- BP should be monitored continuously in labour<sup>1</sup>: every 30 minutes at a minimum and if unstable or hypertensive every 15 minutes.
- Continuous maternal oxygen saturation monitoring should be maintained during labour cares.
- Manual measurement of BP is considered gold standard. Automatic machines may be considered once the BP is stable.
- Ensure an appropriately sized cuff is used. It is better to use a cuff that is too big than a cuff that is too small.
- Monitor the fetal heart rate continuously with a CTG during labour. Refer to the [WNHS Fetal Heart Rate Monitoring Clinical Practice Guideline](#) for escalation.

## Hydration and fluid management

- Monitor fluid input and output hourly. Aim to restrict the total fluid intake to 80 mL/hour during labour unless there are other ongoing fluid losses (e.g. haemorrhage) to reduce the risk of fluid overload<sup>5</sup>.
- Obtain IV access.
- Avoid pre-loading fluids prior to epidural analgesia<sup>1</sup>.
- Monitor urine output – if urine output is less than 25 mL/hour (indicating deteriorating renal function) report findings to the Registrar on duty. Oxytocin should be administered with caution as it has an anti-diuretic effect.

## Neurological assessment

- Monitor for any signs and symptoms of worsening HTN or impending eclampsia.
- Assess for the following signs and/or symptoms and arrange review by Obstetric Registrar or above if the following symptoms are present:

- |   |
|---|
| <ul style="list-style-type: none"> <li>• Headache</li> <li>• Visual disturbance</li> <li>• Epigastric or right upper quadrant pain</li> <li>• Significant oedema</li> <li>• Hyper-reflexia / clonus</li> <li>• Intrauterine growth restriction</li> </ul> |
|---|

## Analgesia

- Epidural analgesia is an effective analgesia options for use during labour. It assists with BP control, and the use is associated with improved renal and uteroplacental blood flow. It facilitates rapid caesarean section should the need arise.
- Confirm the platelet count is more than  $100 \times 10^9/\text{Litre}$  prior to epidural insertion. See [WNHS Anaesthesia and Pain Medicine](#): Neuraxial Analgesia (including epidural, intrathecal morphine) clinical guideline



- Consider arranging an early anaesthetic consultation regarding analgesia requirement for woman who may be suitable for epidurals.
- Notify theatre Coordinator and On-Call Anaesthetist when a woman with severe PET is in labour.

### Third stage management

- Patients with pre-eclampsia or gestational HTN are at increased risk of postpartum haemorrhage – see [WNHS Postpartum Complications Clinical Guideline](#) (WA Health staff access through HealthPoint)
- Administer oxytocin 10 units intramuscularly with the delivery of the anterior shoulder during the third stage of labour.
- Avoid the use of Ergometrine or Syntometrine® (Oxytocin and Ergometrine) as they can exacerbate HTN and are contraindicated in hypertensive women.

### Additional investigations

- Ensure clotting studies are performed when the platelet count is less than  $100 \times 10^9/\text{Litre}$ .

## Postpartum management

### Immediate post birth monitoring

- Consider transfer of care to ASCU or higher dependency unit for woman with severe PET until her condition is stable.
- The decision for postnatal transfer is made in liaison with the Obstetric and Anaesthetic consultants.

Any patient requiring Magnesium Sulfate anticonvulsant therapy in the antenatal and intrapartum period require admission to ASCU until therapy is ceased. See [Magnesium Anticonvulsant Therapy](#) section within this guideline.

### Ongoing postnatal care

In many women with chronic HTN or superimposed PET, BP is unstable for 1-2 weeks after delivery and may be difficult to control

- Will need follow-up after discharge.
- Offer pre-conception counselling.
- See [Postpartum Drug Therapy](#) section in this guideline, which includes:
  - Breastfeeding considerations, and
  - Discharge planning.

## Pre-eclampsia

### Diagnosis

A multisystem disorder; new onset HTN ( $\geq 140$  and/or  $\geq 90$  mmHg) after 20 weeks gestations<sup>1</sup> with one or more organ systems involvement (see below):

- **Renal involvement**
  - Significant proteinuria – a spot urine PCR  $\geq 30$  mg / mmol
  - Creatinine greater than or equal to 90 micromol/L
  - Oliguria ( $<0.5$  mL/kg/day)
- **Haematological involvement**
  - Thrombocytopaenia ( $<100,000/\mu\text{L}$ )
  - Haemolysis: schistocytes or red cell fragments on blood film, raised bilirubin, raised lactate dehydrogenase  $>600$  u/L, decreased haptoglobin
  - Disseminated intravascular coagulation
- **Liver involvement**
  - Raised transaminases
  - Severe epigastric or right upper quadrant pain
- **Neurological involvement**
  - Convulsions (eclampsia)
  - Persistent visual disturbances (photopsia, scotomata, cortical blindness, posterior reversible encephalopathy syndrome, retinal vasospasm)
  - Persistent, new headache
  - Stroke
- **Pulmonary oedema**
- **Fetal growth restriction (FGR)**

### Care of the woman with severe pre-eclampsia toxemia

1. Care should be provided in a high dependency unit i.e. Adult Special Care Unit (ASCU) or Labour Birth Suite (LBS).
2. Women should be nil by mouth due to the risk of aspiration due to eclampsia.
3. Insert intravenous (IV) line. Consider a second IV for antihypertensive or anticonvulsant medications.
4. Maintain close fluid balance with charting of hourly input and output. An indwelling catheter with an hourly urometer is advisable.
5. Complete maternal observations including vital signs every 15 minutes or until stable. Continue observations every 30 minutes.
6. Maintain continuous oxygen saturation with pulse oximetry.
7. Monitor deep tendon reflexes every 2 hours or more regularly if magnesium sulfate infusion in progress.
8. Assess for below symptoms and escalate to obstetric team immediately if present
  - Altered mental state

- Sudden sharp rise in BP or hyper tensive episodes ( $\geq 170/110$  mmHg)
  - Oliguria, increasing proteinuria ( $<0.5$  mL/ kg/ day)
  - Persistent frontal headache
  - Visual disturbances
  - Nausea or vomiting
  - Epigastric or right upper quadrant pain
  - Hyper-reflexia and / or sustained clonus
9. Fetal surveillance
- Maintain continuous FHR monitoring
  - Escalate FHR concerns as per [Fetal Heart Rate Monitoring Clinical Guideline](#)
10. Consider drug therapy for the acute management of BP. See [Drug Therapy](#) section within this guideline.
11. Consider the commencement of Magnesium Sulfate infusion – See [Magnesium Anticonvulsant Therapy](#) section within this guideline.
12. Consider whether antenatal corticosteroids are indicated.

## HELLP Syndrome

Haemolysis, elevated liver enzymes and low platelets (HELLP) syndrome is a variant of severe PET<sup>1</sup>. Maternal mortality is reported to be as high as 1-2%.

The elements of this variety of severe PET are:

- Thrombocytopenia (common)
- Haemolysis (rare)
- Elevated liver enzymes (ALT, LDH – common)

[Refer to SOMANZ Hypertension in Pregnancy Guideline \(2023\) for further details \(external website, PDF 7.6MB\).](#)

## Antenatal / intrapartum management

If the platelet count is sufficiently low to present a hazard for operative delivery, a platelet transfusion should be considered<sup>3</sup> (consult with Consultant Haematologist).

## Postpartum management

- If there is significant bleeding attributed to pre-eclamptic thrombocytopenia at any time in the puerperium, a platelet transfusion should be given. Consult with the Consultant Haematologist.
- In the absence of bleeding, consider a platelet transfusion in the first 72 hours only if the count falls below 40,000 platelets per microlitre of blood, and there is concern of possible bleeding.
- If the count remains below 40,000 platelets per microlitre of blood after 72 hours from delivery without significant bleeding and without signs of impending recovery, consultation with the Consultant Haematologist is indicated. Differential diagnoses, such as thrombotic thrombocytopenia purpura or antiphospholipid syndrome should be considered<sup>3</sup>.

## Eclampsia

Eclampsia remains rare in Australia. There are no reliable clinical marker to predict eclampsia and conversely, the presence of neurological symptoms and / or signs is rarely associated with seizures. Seizures may occur antenatally, intra-partum or postnatally, usually within the first 24 hours post birth but occasionally later. Hypertension and proteinuria may be absent prior to the seizure<sup>3</sup>.

The further from delivery that the seizure occurs, the more carefully should other diagnoses be considered. It should be remembered that eclampsia is not the commonest cause of seizures in pregnancy and the differential diagnosis includes epilepsy, cerebral vein thrombosis and other medical problems that must be considered carefully, particularly when typical features of severe PET are lacking<sup>3</sup>.

## Prevention of eclampsia in the woman with PET

The drug of choice for the prevention of eclampsia is magnesium sulfate. Although there is good evidence for the efficacy of this therapy, the case for its routine administration in women with PET in countries with low maternal and perinatal mortality rates is less than compelling<sup>3</sup>.

## Management of eclampsia<sup>3</sup>

There are four main aspects to care of the woman who sustains eclampsia.

### 1. Resuscitation

Resuscitation requires a patent airway, oxygen by mask and intravenous access. Intravenous diazepam or clonazepam may be given while the magnesium sulfate is being prepared if the seizure is long.

### 2. Prevention of further seizures

Following appropriate resuscitation, treatment should be commenced with intravenous Magnesium Sulfate.

- Loading dose – 4 g Magnesium sulfate infused over 15-20 minutes
- Followed by – Magnesium sulfate infusion equivalent to 1-2 g/ hour

Refer to [Magnesium Anticonvulsant Therapy](#) and WNHS Pharmacy Adult Medication Monograph [Magnesium](#).

### 3. Control of HTN

After eclampsia, controlling severe HTN to below 160/100 mmHg is vital as the threshold for further seizures is lowered and there is serious risk of cerebral haemorrhage.

### 4. Delivery

Once the women's condition is stable, arrangements for birth should be made. In the interim, maintain close fetal monitoring (continuous CTG). There is no role for continuation of the pregnancy after eclampsia has occurred.

## Drug therapy

### Acute treatment of severe HTN

Antihypertensive treatment should be commenced for the management of stable HTN<sup>1</sup>, to reduce the risk of complications<sup>2</sup>. It is recommended that treatment be administered promptly aiming for a gradual and sustained lowering of BP.

- The agent of choice for the **acute treatment of HTN is oral nifedipine**.  
**This is administered as a 10 mg dose oral dose initially, with a repeat dose of 10 mg if there is inadequate response after 30 minutes. Headache is frequently a side effect.**
- [Intravenous Labetalol](#) is the agent of choice for IV administration. This is administered as a 20-80 mg bolus over 2 minutes. Associated side effects may be bradycardia, bronchospasm and headache.
  - Increase IV bolus dose incrementally as described in the WNHS Pharmacy Medication Monograph [Labetalol Injection](#).
- The third agent of choice is hydralazine. This is administered as an IV or IM dose of 5-10 mg every 20-30 minutes to control HTN  $\geq 160$  mmHg systolic and / or  $\geq 110$  mmHg diastolic.

**Note:** BP should not be allowed to fall below a level of 140/80 mmHg

**Table 2 – Acute BP management for severe HTN <sup>1,6</sup>**

Medication	Dose (start from low dose and titrate as required)	Route	Onset of Action	Adverse effects
IV <a href="#">Labetalol</a>	20 – 80 mg Max: 80 mg	IV bolus over 2 minutes. Repeat every 10 minutes PRN.	Maximal effect usually occurs within 5 minutes of each dose	Bradycardia (maternal and fetal), hypotension
Oral <a href="#">Nifedipine</a>	10 – 20 mg IR tablet/capsule Max: 40 mg	Oral. Repeat dose after 30 – 45 minutes if response inadequate.	30 – 45 minutes	Headache, flushing
IV <a href="#">Hydralazine</a>	5 – 10 mg (first dose 5 mg if fetal compromise) Max: 30 mg	IV bolus over 2 minutes. Repeat every 20 – 30 minutes PRN.	15 – 20 minutes	Flushing, headache, nausea, hypotension, tachycardia

## Treatment for HTN

Treatment of mild-moderate HTN should be considered an option and will reflect local practice. Above these levels, treatment should be considered mandatory.

In women with severe PET, or those who have received treatment for hypertensive crisis, maintenance control of BP is essential to reduce the risk of cerebral events and to prolong the pregnancy for fetal benefit where possible. However, the maternal BP must not be lowered too drastically because inadequate placental perfusion may occur where placental circulation has adapted to a higher BP.

It is important to control severe HTN at any gestation and postpartum. Induction of labour or caesarean section does not control HTN even though delivery begins the resolution of PET, with antihypertensive medication usually required even when delivery has been arranged.

In some cases of severe HTN, it is necessary to add a second or even third agent. Consider consultation with Obstetric Physician.

Antihypertensive therapy should be considered in the following situations:

- When the systolic BP is  $\geq 150$  mmHg at least twice in a 24-hour period separated by four hours.
- When the diastolic BP is  $\geq 95$  mmHg at least twice in a 24-hour period separated by four hours
- Following the acute treatment of severe HTN ( $\geq 160/110$  mmHg)

**When using medicines to treat HTN in pregnancy, aim for a target blood pressure of 135/85 mmHg.**

A number of drugs have demonstrated safety and efficacy when used to maintain BP within normal limits in PET. First line drugs include oral methyldopa and labetalol. Second line agents are oral hydralazine, nifedipine and prazosin. The choice of antihypertensive (beta-blockers, methyldopa, hydralazine, nifedipine, enalapril, clonidine) should be made through a shared decision-making process, particularly in breastfeeding/lactating women<sup>1</sup>.

**Table 3 – Drug therapy for HTN**

Drug	Dose	Action	Caution (avoid use)	Practice points
Oral <a href="#">Methyldopa</a>	250 – 750 mg TDS	Central alpha blocker	Depression, anxiety	Slow onset of action over 24 hours. Dry mouth, sedation, depression, blurred vision  Withdrawal effects: rebound HTN
Oral <a href="#">Labetalol</a>	100 – 400 mg TDS – QID	B blocker with mild alpha vasodilator effect	Asthma, chronic airways limitation	Bradycardia, bronchospasm, headache, nausea, scalp tingling which

				usually resolves within 24-48 hours <sup>2</sup>
Oral <a href="#">Nifedipine</a> (slow release)	30 – 60 mg slow release once daily to BD	Calcium channel antagonist	Aortic stenosis	Severe headache in first 24 hours, flushing, tachycardia, peripheral oedema, constipation <sup>2</sup>
Oral <a href="#">Prazosin</a>	0.5 – 5 mg TDS-QID	Alpha blocker	Aortic stenosis	Orthostatic hypotension especially after first dose
Oral <a href="#">Hydralazine</a>	25 – 50 mg TDS	Vasodilator	Idiopathic systemic lupus erythematosus or related diseases (contraindicated)	Flushing, headache, nausea, lupus-like syndrome

Atenolol and other highly selective beta blocker drugs are not recommended for prolonged use in pregnancy as they have been associated with fetal growth restriction.

The use of ACE-inhibitors and angiotensin receptor blockers is contraindicated in pregnancy. They have been associated with an increased risk of fetal, particularly cardiovascular, malformations in early pregnancy in one study and are known to cause adverse sequelae for the fetus in late pregnancy. Their use in the third trimester has been associated with severe fetal growth restriction, fetal or neonatal death and renal failure.

Diuretics, although not teratogenic, may restrict the natural plasma volume expansion of pregnancy and are not recommended for the treatment of HTN.

## Magnesium anticonvulsant therapy

### Aim

To prevent and treat eclamptic seizures.

### Key points

- Magnesium sulfate ( $\text{MgSO}_4$ ) should be considered for women with PET for whom there is concern about the risk of eclampsia<sup>1, 2</sup>. This is usually in the context of severe PET once a delivery decision has been made and in the immediate postpartum period<sup>1</sup>. In women with less severe disease the decision is less clear and will depend on individual care assessment. Magnesium sulfate shouldn't be prescribed for the prevention of eclampsia without discussion with the Consultant Obstetrician on call, unless in an urgent situation of imminent eclampsia.
- Use caution when a woman who has been treated with Nifedipine requires a  $\text{MgSO}_4$  bolus.



- $\text{MgSO}_4$  has been demonstrated to reduce the risk of eclamptic seizures and is also the medication of choice to control eclamptic seizures.
- When  $\text{MgSO}_4$  is administered it should be continued for 24 hours following birth, or for 24 hours after the last seizure.
- During use of  $\text{MgSO}_4$ , Calcium Gluconate 1 g (2.2 mmol) in 10 mL should be available to give as an antidote for magnesium toxicity, which can produce respiratory depression.
- Regular assessment of BP, urine output, maternal deep tendon reflexes, respiratory rate and oxygen saturation may indicate the development of  $\text{MgSO}_4$  toxicity.
- Serum magnesium levels are not routinely measured unless renal function is compromised<sup>2</sup>. Monitoring of plasma concentrations becomes important when tendon reflexes are absent or in the presence of renal dysfunction<sup>65</sup>. However, if the woman has reduced renal function then plasma magnesium should be closely monitored 6 hourly (or more frequently if signs of oliguria).
- If deep tendon reflexes are diminished or absent, the infusion must be stopped and a Magnesium level performed.
- All  $\text{MgSO}_4$  solutions **must** be given via an infusion pump.
- Use a dedicated intravenous line to infuse the  $\text{MgSO}_4$ . Do not use the same IV line to administer other drugs.

### Side effects of magnesium sulfate

Approximately 25% of women experience side effects from  $\text{MgSO}_4$ . There may include:

- Sensation of pain and warmth in arms
- Disruption to sensation, particularly in extremities
- Flushing of face, neck and hands
- Thirst, headache, dizziness, itching
- Nausea and vomiting
- Loss of patellar reflexes – will be absent well before toxic serum levels are reached
- Muscle weakness, slurring of speech, drowsiness and visual disturbances
- Irritation at the injection sites

Major side effects include:

- Respiratory depression which may lead to respiratory/cardiac arrest

### Contraindications

The use of  $\text{MgSO}_4$  is contraindicated and should be avoided in women with:

- Heart block
- Hypermagnesaemia
- Renal failure



## Magnesium sulfate infusion

The Consultant Obstetrician must be consulted before prescribing and commencing MgSO<sub>4</sub> therapy.

### Solution used at the WNHS

- The solution used at WNHS is **8 g of MgSO<sub>4</sub> in 100 mL Normal Saline in a pre-packaged solution.**
- This must be given via a controlled infusion device/pump.
- The regime for administration is to be read in conjunction with the [KEMH Magnesium Adult Medication Monograph](#).
- Infusion rates must be checked and confirmed by 2 Midwives when commencing and changing rates.
- See [Appendix 1 – Intravenous order form for Magnesium Sulfate](#) as example of how to prescribe.

### Prior to commencement of magnesium sulfate infusion

Ensure:

- Deep tendon reflexes are present<sup>1</sup>, respirations are more than 12 per minute, and the urine output is >100 mL in the last 4 hours.<sup>3</sup>
- Ensure these values are documented on the appropriate Observation and Response Chart.
- The six (6) rights of medication safety are adhered to.

#### Loading dose regimen

Administer intravenous loading dose of 4 g of MgSO<sub>4</sub> over 20 minutes via a controlled infusion device.

This equates to an infusion rate of 150 mL/hr for 20 minutes (i.e. the woman only receives 50 mL)

#### Maintenance dose regimen

The loading dose is followed by a maintenance dose of 1 g MgSO<sub>4</sub> per hour. This equates to an infusion rate of 12.5 mL per hour. This is continued for at least 24 hours after the last seizure or birth of the neonate.

#### Treatment for recurrent seizures

If recurrent seizures occur, a further 2 – 4 g of MgSO<sub>4</sub> is given over 10 minutes.

This equates to :

- 2g MgSO<sub>4</sub> = 300 mL/hour for 5 minutes (i. e. the woman receives 25 mL of MgSO<sub>4</sub>)
- 4g MgSO<sub>4</sub> = 300 mL/hour for 10 minutes (i. e. the woman receives 50 mL of MgSO<sub>4</sub>)

## Calcium gluconate

- Calcium gluconate 1 g in 10 mL (2.2 mmol Calcium in 10 mL) must be available at all times for treatment of MgSO<sub>4</sub> toxicity.

- If indicated, administer Calcium Gluconate 1 g in 10 mL via intravenous push slowly over 3 to 10 minutes into a large vein.
- ECG monitoring is recommended if Calcium Gluconate is given.

### Signs of magnesium sulfate toxicity

- Nausea, hot flushes, weakness
- Slurred speech, confusion, blurred vision
- Loss of deep tendon reflexes, absent patellar reflexes
- Hypotension, pulse oximetry < 95%
- Respiratory depression (<12 breaths/min)
- Respiratory arrest
- Cardiac arrhythmia, ECG changes (e.g. widened QRS complex, increased PR interval, prolonged QT interval, heart block)
- Chest pains
- Oliguria, Urine output less than 25 mL/hour

### Maternal and fetal observations during MgSO<sub>4</sub> infusion

Document observations on the Obstetric Acute Care Observation and Response Chart MR731.01 (KEMH) or Maternal Observation and Response Chart MR140B (OPH).

#### Fetal observations

- Apply continuous fetal monitoring – cardiotocography where appropriate
- Ongoing monitoring in the following 24 hours will depend on the maternal and fetal clinical condition.
- The decision regarding fetal surveillance should be made in liaison with the Consultant Obstetrician.

#### Maternal observations

##### Patella reflexes

- Perform every 15 minutes for the first 2 hours, then hourly thereafter.
- If deep tendon reflexes are absent:
  - Cease the infusion<sup>1</sup>
  - Notify the medical officer
  - Collect blood for serum magnesium levels – therapeutic magnesium concentration range is 1.7 – 3.5 mmol/L

##### Deep tendon reflex grading scale:

- 4+ Hyperactive; very brisk, jerky, includes clonus if present; abnormal
- 3+ Brisker than average; may not be abnormal
- 2+ Average response; normal
- 1+ Diminished response; low normal
- 0 No response; abnormal

**Respiratory rate and oxygen saturations**

- Monitor respirations 15 minutely for the first 2 hours, then hourly thereafter.
- If respirations are less than 12 breaths/min – or – if signs of magnesium toxicity:
  - Notify the Medical Officer
  - Cease the infusion until medical review
- If respiratory arrest occurs:
  - Stop the infusion
  - Call Code Blue Medical
  - Initiate respiratory support until the woman is intubated and ventilated
- Place the woman in the recovery position
  - Maintain the airway and administer oxygen at 6-8 L/min via Hudson mask
  - Administer intravenous Calcium Gluconate 1 g in 10 mL (2.2 mmol in 10 mL) slowly. Monitor heart rate with an ECG if available.
  - Collect blood for serum magnesium levels
- Apply continuous pulse oximetry. Record O<sub>2</sub> saturation levels hourly

**Fluid balance**

- Maintain a strict fluid balance chart.
- Fluid restriction is advisable to reduce the risk of fluid overload in the intrapartum and postpartum periods. In usual circumstances, total fluids should be limited to 80 mL/ hour or 1 mL/ kg/ hour.
- The regime of fluid restriction should be maintained until there is a postpartum diuresis, as oliguria is common with severe PET.
  - If there is associated maternal haemorrhage, fluid balance is more difficult and fluid restriction is inappropriate.

**Monitor urine output**

- Measure and record urine output via IDC urometer bag hourly.
- If urine output is <25 mL/hour notify the medical staff. The MgSO<sub>4</sub> therapy may need to be reduced or ceased if there is less than 25 mL of urine output in 1-hour.

**Blood pressure**

- Monitor BP 15 minutely during the infusion for the first 2 hours then hourly thereafter.

**Review of magnesium sulfate infusion**

- Report any side effects of MgSO<sub>4</sub> to the Medical Officer
- Notify the obstetric staff of any signs of ongoing seizure activity despite MgSO<sub>4</sub>

**Ongoing management**

- All women undergoing MgSO<sub>4</sub> must be cared for in either LBS or ASCU at a 1:1 midwife/nurse to patient ratio until therapy has ceased, which is normally 24-hours following the last seizure or after the birth.

- Transfer to the postnatal ward will be dependent on the women's condition and in discussion with the Obstetric Consultant

## Postpartum drug therapy<sup>9</sup>

- Hypertension, proteinuria, eclampsia and other adverse conditions of pre-eclampsia may develop for the first time during the postpartum period
- After birth, clinical and laboratory derangements of pre-eclampsia improve over several days but may take up to 3 months for complete resolution<sup>9</sup>
- Liver enzyme elevations and thrombocytopenia will often worsen in the first few days after birth before they improve
- De novo postpartum HTN is most common on days 3–6<sup>9</sup>
- Hypertension may persist for several days<sup>6</sup> with peak postpartum BP occurring on days 3–6<sup>9</sup>
- 32–44% of eclampsia occurs in the postpartum period<sup>5</sup>

## Drug therapy

- Continue use of antenatal antihypertensive drug therapy
  - If prescribing antihypertensives that require frequent administration on discharge, consider risk of non-adherence to drug therapy
  - If methyldopa commenced during pregnancy, consider ceasing postpartum and commence alternative therapy as it is associated with increased risk of clinical depression<sup>9</sup>
- Reduce or cease when hypertensive changes are resolving
  - Avoid abrupt withdrawal to reduce risk of rebound HTN
- If persistently hypertensive (systolic BP greater than or equal to 140 mmHg or diastolic BP greater than or equal to 90 mmHg), start antihypertensive drug therapy (if not commenced prior to birth)
  - If severe HTN, refer to [Table 2 – Acute BP management for severe HTN](#)

**Table 4 – Drug therapy for postpartum HTN**

Drug	Dose	Action	Caution (avoid use)	Practice points
<a href="#">Nifedipine</a>	30-120 mg XR daily	Calcium channel blockade	Tachycardia	Can cause severe headache Shown to reduce risk of readmission with severe HTN compared with labetalol <sup>10</sup>
<a href="#">Diltiazem</a> (external website)	180-360 mg XR slow	Calcium channel blockade	Severe bradycardia,	Can use if nifedipine not tolerated or tachycardia present

	release daily		hypotension or AF	
<a href="#">Labetalol</a>	100-400 mg tds	Alpha and beta blockade	Asthma	Dosing schedule more difficult whilst breastfeeding May cause severe nipple pain
<a href="#">Methyldopa</a>	250mg to 1g tds	Central	Depression	Switch to alternative agent if possible within first few weeks postpartum
<a href="#">Metoprolol</a>	12.5-25 mg bd	Beta blocker	Bradycardia, asthma	Concentrated in breast milk but no adverse effects documented

NB: Enalapril has shown to be ineffective in immediate postpartum period and is not recommended for treatment of postpartum HTN.

### Breastfeeding considerations

- First and second line drugs are considered compatible with breastfeeding<sup>1</sup>
- Advise women that antihypertensive medications can pass into breast milk however unlikely to have any significant clinical impact on the newborn<sup>5</sup>
- Antihypertensive drugs without reported adverse reactions in breastfed infants include:
  - Nifedipine<sup>9</sup>
  - Metoprolol<sup>9</sup>
  - Labetalol<sup>9</sup>
  - Atenolol (other agents may be preferred if breastfeeding a preterm infant or baby less than 3 months)<sup>9</sup>

### Discharge planning<sup>9</sup>

Following a pregnancy complicated by hypertensive disorders of pregnancy, the woman has an increased risk of cardiovascular and medical conditions in future pregnancies of gestational HTN and pre-eclampsia as well as an increased risk of longer term cardiovascular and medical conditions.

BP surveillance post discharge consider:

- Preferred first BP check within 7–10 days after discharge (earlier if symptomatic), to determine need for further evaluation or treatment
- Consider weekly follow up for women discharged on antihypertensives to monitor compliance and to facilitate tapering of medication.
  - May be done with GP or at specialist clinics.
- Recommend comprehensive follow-up after 12 weeks to ensure resolution of hypertensive disorder related changes, check serum lipids and ascertain the need for further investigation and management.

- Inform the GP and/or other relevant healthcare providers about the events of the pregnancy.
- Provide advice regarding:
  - Future pregnancy risk reduction
  - Management (e.g. prophylaxis with aspirin)
  - Contraceptive options

## Preconception counselling

For women with a history of, or significant risk factors for PET.

### Background

Pre-eclampsia complicates 2-3% of all pregnancies and the risk of recurrent PET in a second pregnancy was found to vary according to the gestational age at delivery in the first pregnancy. The risk is progressive, with the greatest risk attributed to those women who were delivered earliest in the previous pregnancy.

### Key points

1. All women with significant risk factors for developing PET who are planning a future pregnancy should be counselled appropriately about risk factors, symptoms and management<sup>2</sup>.
2. Women at significant risk of developing PET should be offered calcium and low dose Aspirin supplements.
3. Women planning a pregnancy who are at significant risk of developing PET should receive preconception counselling by an appropriate obstetrician and / or obstetric physician.

### Women recommended to attend preconception counselling (or as early as possible if pregnant)

Preconception counselling and early pregnancy referral<sup>35</sup> to KEMH is recommended for women with:

- A history of PET prior to 34 weeks gestation or severe early onset PET < 28 weeks gestation
- Thrombophilias (acquired or congenital)
- Severe pre-gestational diabetes (Type 1 or Type 2)
- Connective tissue disease e.g. systemic lupus erythematosus (SLE), rheumatoid arthritis
- Chronic renal disease

### Management strategies for prevention of PET

#### Calcium supplementation

- Calcium supplementation appears to significantly reduce the risk of PET and has been shown to reduce the risk of preterm birth.<sup>2</sup>

- Offer all women at increased risk of PET (particularly women with a low dietary calcium intake) calcium supplements of 1.5 g daily.<sup>1,2</sup>

### Low dose aspirin

- Commence low dose aspirin on or before 16 weeks gestation<sup>4</sup>. **[RCA recommendation]**
- Low dose aspirin (100 mg) has moderate benefits when used for prevention of PET and its consequences and is safe to use in pregnancy at this dose. In view of this potential benefit, and the relative absence of maternal or neonatal complications, low dose aspirin is indicated for the secondary prevention of PET in women at increased.
- For the majority of women, aspirin may be ceased at 37 weeks gestation although continuation beyond this period is not unsafe.

### Use of Enoxaparin (Clexane®) with aspirin

- Enoxaparin is used with aspirin **only** for patients with antiphospholipid syndrome, **after** consultation with the Maternal Fetal Medicine specialist or the Obstetric Physician.

## References and resources

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## Related WNHS procedures and guidelines

### WNHS [Obstetrics and Gynaecology Clinical Practice Guidelines](#):

- Fetal Heart Rate Monitoring
- **Preterm Labour:** Magnesium Sulfate for Neuroprotection of the Fetus
- Postpartum Complications [WA Health staff access through [HealthPoint](#)]

**[Anaesthesia and Pain Medicine](#):** Neuraxial Analgesia (including epidural, intrathecal morphine)

### WNHS Pharmacy medication monographs:

- [Hydralazine Adult Medication Monograph](#)
- [Labetalol Adult Medication Monograph](#)
- [Magnesium Adult Medication Monograph](#)
- [Methyldopa Adult Medication Monograph](#)
- [Nifedipine Adult Medication Monograph](#)
- [Prazosin Adult Medication Monograph](#)









## Useful resources

### WNHS Forms:

- Intravenous Fluid & Additive Order form MR740 (KEMH) / MR176.1 (OPH)
- Obstetric Acute Care Observation and Response Chart MR731.01 (KEMH)
- Maternal Observation and Response Chart MR140B (OPH)

Keywords:	Hypertension, HTN, pre-eclampsia, PE, PET, eclampsia, severe pre-eclampsia, eclampsia hypertension, blood pressure, urinalysis, fetal, maternal, HELLP, thrombocytopenia, platelets, hydralazine, labetalol, nifedipine, methyldopa, gestational, fetal, chronic hypertension, hypertension in pregnancy, preconception counselling, magnesium sulfate, MgSO <sub>4</sub> , seizure, convulsions, anticonvulsant therapy, deep tendon reflexes		
Document owner:	Co-Directors, Obstetrics and Gynaecology Directorate		
Author / Reviewer:	Obstetrics Medical Co-Director; Pharmacy		
Date first issued:	May 2025 [see version history below]	Version	1.1
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Endorsed by:	Midwifery and Obstetrics Clinical Practice Outcome Committee	Date:	21/05/2025



NSQHS Standards (v2) applicable:	<input checked="" type="checkbox"/>  1: Clinical Governance <input type="checkbox"/>  2: Partnering with Consumers <input type="checkbox"/>  3: Preventing and Controlling Healthcare Associated Infection <input checked="" type="checkbox"/>  4: Medication Safety	<input type="checkbox"/>  5: Comprehensive Care <input checked="" type="checkbox"/>  6: Communicating for Safety <input type="checkbox"/>  7: Blood Management <input checked="" type="checkbox"/>  8: Recognising and Responding to Acute Deterioration
<b>Printed or personally saved electronic copies of this document are considered uncontrolled.</b> <b>Access the current version from WNHS HealthPoint.</b>		

### Version history

Version number	Date	Summary
1	May 2025	First version <b>History:</b> In May 2025 amalgamated three individual guidelines on HTN in obstetrics dating from Aug 2002. <b>Supersedes:</b> <ol style="list-style-type: none"> <li>1. Hypertension: Medical Management (dated Dec 2020)</li> <li>2. Hypertension in Pregnancy- Midwifery Care (date amended Jan 2019)</li> <li>3. Hypertension in Pregnancy: Magnesium Anticonvulsant Therapy (dated Jun 2019)</li> </ol> <b>Changes</b> <ul style="list-style-type: none"> <li>• Updated and condensed content, streamlined with contemporary information specific to WNHS care models. Read guideline.</li> <li>• Inclusion of a 'Postpartum Drug Therapy' section to provide further guidance for prescribers, should patients return/re-present for blood pressure control postpartum.</li> </ul>
1.1	28/5/2025	Amended typo- Magnesium sulfate shouldn't be prescribed for the prevention of eclampsia without discussion with the Consultant Obstetrician on call, unless in an urgent situation of imminent eclampsia

This document can be made available in alternative formats on request for a person with a disability.

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[www.nmhs.health.wa.gov.au](http://www.nmhs.health.wa.gov.au)

## Appendix 1 – Example IV order form for Magnesium Sulfate

KE011  
11/22

+ DO NOT WRITE IN BINDING MARGIN +

  
 EMR305620

Women and Newborn Health Service <b>INTRAVENOUS FLUID &amp; ADDITIVE ORDER FORM</b> Year: 20____ Chart ____ of ____ Site: KEMH <input type="checkbox"/> OPH <input type="checkbox"/>					<b>ALLERGIES AND ADVERSE DRUG REACTIONS</b> Nil known    Unknown    Yes – Refer to WA HMC <div style="border: 1px solid red; padding: 2px; margin: 5px 0;">Attached ADR Sticker</div>			Med Rec. No: ..... Surname: ..... Forename: ..... Gender: ..... D.O.B. ....			
					Ward: _____		Weight: _____				

Date	Type of Fluid	Volume (mL)	Rate (mL/hr)	Additive & Dose	To start	Prescriber	Started	Finished	Administered by:	Checked by:
Date	Water for injection	50 mL	150 mL/hr	Magnesium sulfate 4 g	Date: Date Time: Time	Name: A.Doctor Sign: AD	Date: Time:	Date: Time:	Name: Sign:	Name: Sign:
Date	Water for injection	50 mL	12.5 mL/hr	Magnesium sulfate 4 g	Date: Date Time: Time	Name: A.Doctor Sign: AD	Date: Time:	Date: Time:	Name: Sign:	Name: Sign:
Date	Water for injection	100 mL	12.5 mL/hr	Magnesium sulfate 8g	Date: Date Time: Time	Name: A.Doctor Sign: AD	Date: Time:	Date: Time:	Name: Sign:	Name: Sign:
Date	Water for injection	100 mL	12.5 mL/hr	Magnesium sulfate 8g	Date: Date Time: Time	Name: A.Doctor Sign: AD	Date: Time:	Date: Time:	Name: Sign:	Name: Sign:
Date	Water for injection	100 mL	12.5 mL/hr	Magnesium sulfate 8g	Date: Date Time: Time	Name: A.Doctor Sign: AD	Date: Time:	Date: Time:	Name: Sign:	Name: Sign:
Date	Water for injection	100 mL	12.5 mL/hr	Magnesium sulfate 8g	Date: Date Time: Time	Name: A.Doctor Sign: AD	Date: Time:	Date: Time:	Name: Sign:	Name: Sign:
Date	Water for injection	100 mL	12.5 mL/hr	Magnesium sulfate 8g	Date: Date Time: Time	Name: A.Doctor Sign: AD	Date: Time:	Date: Time:	Name: Sign:	Name: Sign:
Date	Water for injection	100 mL	12.5 mL/hr	Magnesium sulfate 8g	Date: Date Time: Time	Name: A.Doctor Sign: AD	Date: Time:	Date: Time:	Name: Sign:	Name: Sign:

Page 1 of 1

**MR740 (KEMH) / MR176.1 (OPH) INTRAVENOUS FLUID & ADDITIVE ORDER FORM**