THE DIAGNOSIS AND MANAGEMENT OF PRE-ECLAMPSIA AND ECLAMPSIA

CLINICAL PRACTICE GUIDELINE

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and

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3. Nifedipine is a potent antihypertensive and should never be given sublingually.
4. Cases of severe pre-eclampsia should be given magnesium sulphate to prevent seizures.
5. Following delivery the patient should be fluid restricted in order to wait for the natural diuresis.
6. Corticosteroids may be considered for patients with a platelet count of < 50 x 10^9 ml.
7. A platelet transfusion is recommended prior to caesarean section or vaginal delivery when the platelet count is < 20 x 10^9 ml.
8. Methyldopa should be avoided postnatally.
9. It is not necessary to perform a clotting profile in cases of non-severe pre-eclampsia and gestational hypertension if the platelet count is normal.

1.0 Purpose and Scope

The purpose of this guideline is to assist all healthcare professionals in the diagnosis and management of pre-eclampsia and eclampsia.

2.0 Background and Introduction

Pre-eclampsia complicates 2-3% of all pregnancies (5-7% in nulliparous women) and remains a leading cause of maternal and perinatal mortality and morbidity in Ireland and internationally.

This guideline provides information relating to the diagnosis of hypertensive disorders of pregnancy and offers a reasonable approach to the management of women with pregnancies complicated by pre-eclampsia.

3.0 Methodology

The literature reviewed during the development of this guideline included current local and national guidelines and their reference lists from the UK, Canada, USA, Australia and New Zealand. In addition, Medline and the Cochrane Library were searched for literature published between 2000 and 2010. Articles were restricted to those published in English.

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4.0 Clinical Guideline

4.1 Diagnosis and Classification

4.1.1 Classification of Hypertensive Disorders of Pregnancy

It is imperative that every effort is made to accurately classify women with hypertension in pregnancy as having chronic (or pre-existing hypertension) or gestational hypertension because the management and prognosis is very different. In particular, the presence or absence of pre-eclampsia in women with gestational hypertension must be ascertained as it has a clear association with adverse maternal and prenatal outcomes.

Chronic or pre-existing pregnancy hypertension predates the pregnancy or appears before 20 weeks' gestation. Approximately 95% of cases of chronic hypertension are considered to be essential. In women presenting with hypertension in the first half of pregnancy it is important to exclude an underlying secondary cause. Women with co-morbid conditions such as renal disease are at significantly increased risk of poor pregnancy outcome and require multidisciplinary care.

4.1.2 Measurement of Blood Pressure

Blood pressure should be measured with the woman rested and seated at a 45-degree angle with the arm at the level of the heart. **An appropriately sized cuff should be used. If the mid-arm circumference is greater than 33cm, a large cuff should be used** (Hogan et al, 2010).

Korotkoff phase 1 should be used to measure systolic BP and Korotokoff 5 is the appropriate measurement of diastolic blood pressure.

The method used should be consistent and documented. Automated methods need to be used with caution, as they may give inaccurate blood pressure readings in pre-eclampsia and a comparison using an anaeroid device is recommended.

4.1.3 Diagnosis of Hypertension

Hypertension in pregnancy should be defined as:

- a systolic blood pressure greater than or equal to 140 mmHg
- a diastolic blood pressure of greater then or equal to 90 mmHg

These measurements should be based on the average of at least two measurements, taken using the same arm, several hours apart.

Elevations of both systolic and diastolic blood pressures have been associated with adverse fetal outcome and therefore both are important.

Detecting a rise in blood pressure from 'booking' or preconception blood pressure, rather than relying on an absolute value, has in the past been considered useful in diagnosing pre-eclampsia in women who do not reach blood pressure of 140 or 90 mmHg. Available evidence does not suggest that these women have an increased risk of adverse outcome. However, such a rise may be significant in women with other complications such as proteinuria and closer monitoring of such women is recommended.

Severe hypertension should be defined as a systolic BP of >160 mmHg or a diastolic BP of >110 mmHg. For severe hypertension, a repeat measurement should be taken for confirmation no more than 15 minutes later.

- Measurement of Proteinuria

All pregnant women should be assessed for proteinuria.

Urinary dipstick testing may be used for screening for proteinuria when the suspicion of preeclampsia is low.

Approximate equivalence is:

- 1+ = 0.3 g/l
- 2+ = 1 g/l
- 3+ = 3 g/l

There is considerable observer error with visual dipstick assessment. This can be overcome by the use of automated dipstick readers, which significantly improve both false positive and negative rates.

In the presence of hypertension, a reading of 1+ or more should prompt further evaluation.

4.1.5 Diagnosis of Clinically Significant Proteinuria

The upper limit of a normal 24-hour urine protein excretion is 0.3g and is based on a 95% CI for urinary protein in pregnancy. However, there is considerable variation between laboratory assays for the quantification of proteinuria. This, combined with unknown errors and the delay associated with obtaining a 24-hour collection means that newer tests have potential advantages. An elevated protein creatinine ratio of greater than 30 mg/mmol correlates with a 24-hour urine excretion greater than 300mg and should be used to check for significant proteinuria.

4.2 Management of non-severe pre-eclampsia

It is estimated that 15-25% of women with gestational hypertension will develop pre-eclampsia. There is a higher rate (approximately 50%) of progression in those that develop gestational hypertension prior to 32 weeks' gestation. Therefore, on-going management of gestational hypertension should focus on close maternal and fetal monitoring for the development of pre-eclampsia, severe hypertension, maternal end organ involvement and/or fetal compromise. There is no robust evidence to suggest the ideal interval between assessments. However, weekly blood pressure measurement and urine analysis should be performed as a minimum.

4.2.1 Place of Care

A component of care through hospital day units and general practice can be considered for women with non-severe pre-eclampsia and non-proteinuric gestational hypertension. Eligibility will depend on the distance from the hospital, patient compliance and lack of progression of pre-eclampsia.

4.2.2 Initial evaluation

Confirmation of sustained elevated blood pressures and quantification of urinary protein excretion is an essential part of the initial evaluation. Laboratory testing should be performed in women with a sustained blood pressure between 90-99 mmHg and should include:

- Renal function tests including uric acid test
- Serum electrolytes
- Liver function tests
- Full Blood count

It is not necessary to perform a clotting profile in cases of non-severe pre-eclampsia and gestational hypertension if the platelet count is normal.

Fetal assessment with sonography to evaluate fetal weight, progression of fetal growth, amniotic fluid index and umbilical artery Doppler velocimetry should be performed at diagnosis and once every 4 weeks thereafter with more frequent monitoring if any parameters are abnormal.

4.2.3 Treatment of non-proteinuric gestational hypertension and non-severe pre-eclampsia

Medical therapy of mild hypertension has not been shown to improve neonatal outcomes and may mask the diagnosis and recognition of progression to severe disease. Treatment should be reserved for moderate to severe hypertension, with the goal of reducing maternal complications such as cerebrovascular accidents.

For women without underlying medical problems, antihypertensive drug therapy should be used to keep systolic blood pressure at 130-155 mmHg and diastolic blood pressure at 80-105 mmHg. For women with underlying medical problems, such as diabetes or renal disease, there is some evidence that tighter control is beneficial and therapy should be used to keep systolic blood pressure at 130-139 mmHg and diastolic blood pressure at 80-89mmHg.

There are several medications currently used for the treatment of moderate to severe hypertension. A Cochrane review of pharmacological agents used in the treatment of gestational hypertension found insufficient evidence to recommend one agent over another and the selection of a drug of first choice is at the clinician's discretion (Duley et al. 2002).

- Labetalol is a mixed alpha- and beta-adrenergic antagonist that produces a significant reduction in maternal blood pressure without any pronounced fetal effects. Dosing is typically initiated at 100mg two to three times a day up to a maximum dose of 2.4g (i.e. 600mg four times daily). Labetalol is contraindicated in women with asthma.

- Methyldopa is a centrally acting antihypertensive which does not appear to have any adverse effect on the uteroplacental circulation. Methyldopa is given at a dose of 250mg three times per day increasing to a maximum of 1g three times a day. Methyldopa is not suitable for the rapid control of hypertension as it requires 24 hours to achieve therapeutic levels. As the dose of methyldopa increases the adverse effects, particularly sedation and depression increase.

- Nifedipine is a calcium channel antagonist. **It is a potent antihypertensive and should not be given sublingually** as it can cause a precipitate fall in blood pressure, which can lead to fetal distress. In contrast, long-acting nifedipine (Adalat LA) does not appear to have any adverse effect on the uteroplacental circulation. For the control of hypertension, nifedipine is usually commenced at a dose of 30mg a day, which can be increased to 120mg per day. There is no evidence to determine whether administration once daily or split between two doses is referable to control gestational hypertension.

If the initial dose of any antihypertensive drug fails to adequately control blood pressure, the dose should be increased incrementally until the maximum dose is reached. If adequate control of blood pressure has still not been achieved, a second antihypertensive agent may be introduced. This drug should be prescribed in addition to and not instead of the first agent.

4.2.4 Delivery

The ultimate treatment for pre-eclampsia is delivery of the baby. After 37 completed weeks gestation consideration should be given to induction of labour. A clinical assessment should include the woman's symptoms, the severity of the pre-eclampsia, the well-being of the fetus and the favourability of the cervix. If the cervix is unfavourable and the pre-eclampsia is mild, for example, induction of labour may be deferred especially in a woman with a single prior caesarean section. Particular caution is also required in the obese parturient. In some clinical circumstances it may be necessary to proceed to an elective caesarean section.

Evidence from the HYPITAT Trial (Koopmans et al. 2009) suggests that in women with gestational hypertension and non-severe pre-eclampsia, induction of labour after 37 weeks' gestation is associated with a significant reduction in adverse maternal outcome including progression to pre-eclampsia, without a difference in neonatal outcomes or an increase in Caesarean section rates. Consideration should be given to induction of labour in this situation.

4.3 Management of Severe Pre-eclampsia

4.3.1 Entry criteria

The criteria for managing a woman with these guidelines are subjective to a certain degree. However, the following are indicators of severe disease and justify close assessment and monitoring. They would not necessarily lead to delivery but assuming a diagnosis of pre-eclampsia, it is likely that maternal parameters will not improve until after delivery.

1. Eclampsia
2. Severe hypertension e.g. a systolic blood pressure over 160mmHg† with at least + proteinuria
3. Moderate hypertension e.g. a systolic blood pressure over 140 mmHg and/or diastolic blood pressure over 90 mmHg with significant proteinuria†† and any of:
    - severe headache with visual disturbance
    - epigastric pain
    - signs of clonus
    - liver tenderness
    - platelet count falling to below 100 x 10 9/l
    - alanine amino transferase rising to above 50iu/l
    - creatinine >100mmol/l

†average of 3 readings over 15 minutes
†† at least "++"proteinuria OR PCR ≥30mg/mmol or 0.3g in 24 hours

4.3.2 General Measures

The woman should be managed in a quiet, well lit room in a high dependency care type situation. Ideally there should be one to one midwifery care. After initial assessment, charts should be commenced to record all physiological monitoring and investigation results, preferably in a High Dependency Unit (HDU) booklet or using HDU charts. All treatments should be recorded.
The consultant obstetrician on duty should be informed, so that they can be involved at an early stage in management. This should be documented in the notes.
A large bore intravenous cannula for infusing drugs or fluid should be inserted, but not necessarily used until either an indication presents or a decision is made to deliver. If intravenous fluid is given, it should ideally be administered by controlled volumetric pump.

4.3.3 Basic Investigations

Blood should be sent for:

- Serum electrolytes
- Liver function tests
- Full Blood count
- Clotting
- Group and save serum

All tests should be checked daily or more frequently if abnormal.

4.3.4 Monitoring

- Blood pressure and pulse should be measured every 15 minutes until stabilised and then half hourly.
- An indwelling catheter should be inserted and urine output measured hourly whenever intravenous fluids are given.
- Oxygen saturation should be measured continuously and charted with the blood pressure. If saturation falls below 95% then medical review is essential.
- Fluid balance should be monitored very carefully. Detailed input and output recordings should be charted.
- Respiratory rate should be measured hourly.
- Temperature should be measured four hourly.
- When present, Central Venous Pressure (CVP) and arterial lines should be measured continuously and charted with the blood pressure.
- Neurological assessment should be performed hourly using either AVPU or GCS (see Appendix for details regarding these scales)
- Fetal well-being should be assessed carefully. In the initial stages this will be with a cardiotocograph but consideration should be given to assessing the fetus with a growth scan, liquor assessment and umbilical artery doppler flow velocity waveforms.
- Blood tests should be repeated every 12 hours whilst on the protocol. In the event of haemorrhage more frequent blood tests should be taken. In the presence of abnormal or deteriorating haematological and/or biochemical parameters, more frequent testing may be required e.g. every 4-8 hours.

4.3.5 Fluid Management

Antenatal Fluid Management

Careful fluid balance is aimed at avoiding fluid overload. Total input should be limited to 80ml/hour. If syntocinon is used it should be at high concentration (30IU in 500mls, as per NICE guidelines) and the volume of fluid included in the total input. Oliguria at this point should not precipitate any specific intervention except to encourage early delivery.

4.3.6 Thromboprophylaxis

Prior to delivery:

- Women with pre-eclampsia are at increased risk of thrombo emobolic disease. All patients should have anti-embolic stockings and/or flowtrons and/or heparin whilst immobile.

Following delivery:

- Low molecular weight heparin (dose adjusted on early pregnancy weight) should be given daily until the patient is fully mobile (7 days if delivered by Caesarean section).
- Low molecular weight heparin should not be given until 4-6 hours after spinal anaesthesia.
- An epidural catheter should be left in place for at least 12 hours after low molecular weight heparin administration. Following removal of an epidural catheter low molecular weight heparin should not be given for 4-6 hours.

4.3.7 The treatment of severe hypertension

Systolic blood pressure ≥160mm Hg requires prompt treatment

The aim of stabilisation of blood pressure is to reduce the blood pressure to <160/105 mmHg in the first instance mean arterial pressure (MAP)[†] <125 mmHg and maintain the blood pressure at or below that level. This will necessitate medical staff remaining in attendance. Blood pressure may suddenly drop in response to treatment, thus treatment should be titrated gradually by the obstetrician.

[†] MAP = diastolic pressure + 1/3 (systolic minus diastolic pressure)

FIRST CHOICE AGENT: LABETALOL

If the woman can tolerate oral therapy, an initial 200mg oral dose can be given. This can be done immediately before venous access is obtained and so can achieve as quick a result as an initial intravenous dose. This should lead to a reduction in blood pressure in about half an hour. A second oral dose can be given after 30 minutes if needed.

If there is no initial response to oral therapy or if it cannot be tolerated, control should be by repeated boluses of labetalol 50mg followed by a labetalol infusion.

Bolus infusion is 50mg (= 10ml of labetalol 5mg/ml) given over at least 5 minutes. This should have an effect by 10 minutes and should be repeated if diastolic blood pressure has not been reduced (to <160/105). This can be repeated in doses of 50mg, to a maximum dose of 200mg, at 10 minute intervals.

Following a response to bolus doses, or as initial treatment in moderate hypertension, a labetalol infusion should be commenced. An infusion of labetalol 5mg/ml at a rate of 4ml/hour (20mg/hour) preferably via a syringe pump should be started. The infusion rate should be

doubled every half hour to a maximum of 32ml/hour (160mg)/hour until the blood pressure has dropped and then stabilised at an acceptable level.

Contraindication: severe asthma, use with caution in women with pre-existing cardiac disease. If intravenous labetalol has not reduced BP <160/105mmHg after 60-90 minutes or BP is >160mmHg despite a maximal labetalol infusion, then a second line agent should be considered. In such cases it is normally appropriate to continue the first drug i.e. labetalol while administering the second. The use of a second line antihypertensive should always be discussed with a senior obstetrician.

SECOND CHOICE AGENTS:

The choice of second line agent should be determined by the clinical situation (i.e. suitability of oral or IV therapy, proximity of delivery) and the preference of the senior obstetrician.
CAUTION: The use of a second line agent (hydralazine or nifedipine) can cause precipitate drops in blood pressure, particularly if magnesium sulphate therapy is also being administered.

HYDRALAZINE

If labetalol is contraindicated or fails to control the blood pressure then Hydralazine is an alternative agent.

Hydralazine is given as a bolus infusion 2.5 mg over 5 minutes measuring the blood pressure every 5 minutes. This can be repeated every 20 minutes to a maximum dose of 20 mgs. This may be followed by an infusion of 40mg of hydralazine in 40 mls of normal saline, which should run at 1-5ml/hr (1-5mg/hr). However, if the labetalol infusion is continued a hydralazine infusion may not be required as the blood pressure will probably settle with bolus doses.

NIFEDIPINE

Nifedipine should **NOT** be given sublingually to a woman with hypertension. **Profound hypotension can occur with concomitant use of nifedipine and parenteral magnesium sulphate and therefore nifedipine should be prescribed with caution in women with severe pre-eclampsia.**

Oral nifedipine is currently available in 3 different preparations; capsules, modified release (12 hour twice daily dose) and modified release (24 hours, once daily dose) tablets.

NB the proprietary brands of nifedipine vary, check the drug information carefully before prescribing.

Oral nifedipine can be considered if labetalol and/or hydrallazine has not adequately controlled blood pressure.

A modified release 12 hour preparation (e.g. Adalat® Retard) or 24 hour (e.g. Adalat® LA) may be considered in women where a more sustained preparation may be beneficial (such as women post delivery who have discontinued magnesium sulphate).

4.3.8 The Treatment and Prevention of Eclampsia

It is appropriate to treat cases of severe pre-eclampsia with Magnesium Sulphate to prevent seizures. No other agents are appropriate for prophylaxis (Duley et al, 2010).

MAGNESIUM SULPHATE PROTOCOL

Magnesium sulphate is given as a loading dose followed by a continuous infusion for 24 hours or until 24 hours after delivery - whichever is the later.

The loading dose is 4g magnesium sulphate i.v. over 5 -10 minutes.

The maintenance dose is 1g magnesium sulphate i.v per hour.

To avoid drug prescription and administration errors, magnesium sulphate should be administered in pre-mixed solutions. Pre-mixed magnesium sulphate is available in two preparations:

Magnesium sulphate 4g in 50ml. This should be administered intravenously over 10 minutes as a loading or bolus dose.

Magnesium sulphate 20g in 500ml. This should be administered via a volumetric pump at a rate of 25ml/hour (i.e. 1g/hour of magnesium sulphate).

There is no need to measure magnesium levels with the above protocol.

Side effects

Motor paralysis, absent tendon reflexes, respiratory depression and cardiac arrhythmia (increased conduction time) can all occur but will be at a minimum if magnesium is administered slowly and the woman is closed monitored.

Important observations

Formal clinical review should occur at least every 4 hours.

Hourly MEWS (Modified Early Warning Score) should be recorded with the following additional observations performed:

i) Continuous pulse oximetry (alert Anaesthetist if O_2 sat<95%) and three lead ECG monitoring if available

ii) hourly urine output
iv) deep tendon reflexes (every 4 hours)

Cessation/reduction of the magnesium sulphate infusion should be considered if:

i) The biceps reflex is not present.
ii) The respiratory rate is < 12/min.

The **antidote** is **10ml 10% calcium gluconate given slowly intravenously**.

97% of magnesium is excreted in the urine and therefore the presence of oliguria can lead to toxic levels (respiratory paralysis can be expected at 5-6.5mmol/l and cardiac conduction problems at levels >7.5mmol/l). In the presence of oliguria, further administration of magnesium sulphate should be reduced or withheld. If magnesium is not being excreted then the levels should not fall and no other anticonvulsant is needed. Magnesium should be re-introduced if urine output improves.

The Management of Eclampsia

- Call appropriate personnel - including the resident Anesthetist.
- Remember ABC.
- Give the loading dose of Magnesium Sulphate 4g over 5-10 minutes intravenously and start an infusion of Magnesium Sulphate (see above).
- Diazepam may be administered if the fitting continues at the discretion of the Anesthetist 5-10 mg intravenously.
- Once stabilised the woman should be delivered.
- Oximetry should be instituted if not already in place.

Management of recurrent fits

Give a further bolus dose of Magnesium of 2g and increase the rate of infusion of Magnesium to 1.5g / hour. Continue observations and consider the need for ventilation. If two such boluses do not control seizures, then other methods should be instituted such as the administration of conventional anticonvulsants.

Send blood for magnesium levels aiming for a level of 1.97-3.28 mmol/l (4.8-8.4mg/dl). Hospitals use different units for measuring magnesium. Check which units your hospital uses.

It is essential to consider other causes of seizures. It may be appropriate to organise cranial imaging scan when the woman is stabilised.

4.3.9 The Timing and Mode of Delivery of Women with Pre-eclampsia

"PLANNED DELIVERY ON THE BEST DAY IN THE BEST WAY"

The delivery should be well planned, done on the best day, performed in the best place, by the best route and with the best support team. Timing affects the outcome for both mother and baby. If the mother is unstable then delivery is inappropriate and increases risk. Once stabilised with antihypertensive and possibly anticonvulsant drugs then a decision should be made. In the absence of convulsions, prolonging the pregnancy may be possible to improve the outcome of a premature fetus, but only if the mother remains stable. Continued close monitoring of mother and baby is needed. It seems ideal to achieve delivery, particularly of premature infants, during normal working hours.
For pregnancies less than 34 weeks' gestation, steroids should be given. The benefits of steroid administration to the fetus peak between 48 hours and 6 days. However, even if delivery is planned for within 24 hours, steroids may still be of benefit and should be given. After 48 hours, further consideration should be given to delivery, as further delay may not be advantageous to the baby or mother. In all situations a planned elective delivery suiting all professionals is appropriate.

The mode of delivery should be discussed with the consultant obstetrician. If gestation is under 34 weeks, induction of labour is unlikely to be successful and consideration should be given to delivery by Caesarean section. After 34 weeks' gestation, vaginal delivery should be considered in a cephalic presentation. Vaginal prostaglandins will increase the chance of success. Anti hypertensive treatment should be continued throughout assessment and labour. In cases where delivery does not occur vaginally within 12-24 hours, the mode of delivery should be reconsidered by a senior obstetrician. In cases of severe pre-eclampsia even when the baby has died or is not viable, it may be appropriate to expedite delivery by caesarean section in the mother's interests if induction of labour is prolonged.

If blood pressure is controlled (150/80-100 mmHg), the second stage should not be limited routinely. An epidural will normally be used. The third stage should be managed with 5 units of i.v. syntocinon **NOT** ergometrine or syntometrine.

4.3.10 Stabilisation before Transfer

If the mother is very ill and requires a bed in a tertiary unit or the fetus is very premature or potentially compromised (and therefore also needs a tertiary cot) transfer is often considered. In all cases, the decision to transfer an antenatal patient must be made by the consultant obstetrician in the referring centre after discussion with the consultant obstetrician and neonatologist in the receiving centre.

If the woman requires transfer for delivery, it is of paramount importance that her condition is stabilised before transfer. The following are therefore recommended as a minimum requirement before transfer.

1. When the woman is ventilated it is important to ensure ventilatory requirements are stable and oxygen saturations are being maintained.
2. Blood pressure should be stabilised at <160/105 according to the above protocol.
3. Appropriate personnel are available to transfer the woman. This will normally mean at least a senior midwife and an anaesthetist if the woman is ventilated.
4. All basic investigations should have been performed and the results clearly recorded in the accompanying notes or telephoned through as soon as available.

4.3.11 Anaesthesia and fluid administration

Regional blockade and fluids

Women with genuine pre-eclampsia tend to maintain their blood pressure, despite regional blockade. When this happens, fluid load is unnecessary and may complicate fluid balance. For this reason, fluid loading in pre-eclampsia should always be controlled and should never be done prophylactically or routinely. Hypotension, when it occurs, can be easily controlled with very small doses of ephedrine. General Anaesthesia can add to the risks of delivery since intubation and extubation can lead to increases in systolic and diastolic blood pressure, as well as heart rate, so should be avoided where possible. Caution is needed when removing an epidural in the post-natal period as rebound hypertension can occur.

Arterial line insertion

Invasive blood pressure monitoring may be considered to aid intravenous antihypertensive therapy.

An intra-arterial pressure monitor may be indicated if:
i) the woman is unstable
ii) the blood pressure is very high
iii) the woman is obese, when non-invasive measurements are unreliable
iv) there is a hemorrhage of >1000 mls

Indications for central venous pressure monitoring

CVP lines can be misleading in women with pre-eclampsia as they often have a constricted vasculature with altered venous pressures which do not accurately reflect intravascular fluid status. However, a CVP line may be indicated if blood loss is excessive:

i) particularly at Caesarean section
ii) or if delivery is complicated by other factors such as abruptio placentae.

4.3.12 Postpartum fluid management

Following delivery, the woman should be fluid restricted in order to wait for the natural diuresis which usually occurs sometime around 36-48 hours post delivery. The total amount of fluid (the total of intravenous and oral fluids) should be restricted to **80 ml/hour.** Fluid

restriction will usually be continued for the duration of magnesium sulphate treatment; however, increased fluid intake may be allowed by a consultant obstetrician at an earlier time point in the presence of significant diuresis.

Urine output should be recorded hourly and each 4 hour block should be summated and recorded on the chart. Each 4 hour block should total in excess of 80 ml. If two consecutive blocks fail to achieve 80 ml then further action is appropriate:

A. If total input is more than 750 ml in excess of output in the last 24 hours (or since starting the regime) then 20 mg of iv furosemide should be given. Colloid should then be given as below if a diuresis of >200mls in the next hour occurs.

or

B. If total input is less than 750 ml in excess of output in the last 24 hours (or since starting the regime) then an infusion of 250ml of colloid over 20 minutes should be given. The urine output should then be watched until the end of the next four hour block. If the urine output is still low then 20mg of iv furosemide - furosemide should be given. If a diuresis in excess of 200 ml occurs in the next hour the fluid should be replaced with 250ml of colloid over 1 hour in addition to baseline fluids.

If the urine output fails to respond to furosemide in either situation then a discussion with a Renal Physician or a recognized specialist would be appropriate.

If persisting oliguria requiring fluid challenge or frusemide occurs then the electrolytes need to be carefully assessed and checked six hourly. If there is concern over a rising creatinine and or potassium the case should be discussed with a Renal Physician or a recognized specialist.
If the woman has a falling oxygen saturation, this is most likely to be due to fluid overload. Input and output should be assessed together with either clinical or invasive assessment of the fluid balance. However the most appropriate treatment is likely to be furosemide and oxygen. If there is no diuresis and the oxygen saturation does not rise, then renal referral should be considered.

4.3.13 HELLP syndrome

Prophylactic transfusion of platelets is not recommended, even prior to Caesarean section, when platelet count >50 x 10^9/L and there is no excessive bleeding or platelet dysfunction.

Consideration should be given to ordering blood products, including platelets, when the platelet count is <50 x 10^9/L, when the platelet count is falling, and/or there is coagulopathy.

Platelet transfusion is recommended prior to Caesarean section or vaginal delivery when platelet count is <20 x 10^9/L.

Corticosteroids may be considered for women with a platelet count <50 x 10^9/L. Dexamethasone intravenously at 12 hourly intervals over 36 hours [10 mg, 10 mg, 5 mg, 5 mg] may expedite improvement of laboratory parameters.

4.3.14 Immediate post natal care

Women who have received treatment for severe pre-eclampsia should be monitored in hospital until at least the 3rd postnatal day and have 4 hourly blood pressure measurements.
It is important to predict and anticipate the need for antihypertensives in order to avoid delaying discharge and to prevent severe hypertension

- Beta blockers (eg. Atenolol, labetalol), alpha-adrenergic blockers (eg. doxazocin), angiotensin converting enzyme (ACE) inhibitors (enalapril, captopril) and calcium antagonists (e.g. nifedipine, amlodopine) are all safe to use in a woman who is breast feeding. Diuretic treatment is safe but should be avoided in breastfeeding women. **Methyldopa should not be prescribed post natally.**
- After day 3-4 women may be discharged when asymptomatic, provided the haematology and biochemistry results are normal or improving and the blood pressure is < 150/100
- Those on treatment should have follow up arranged either for their GP or for a hospital clinic within 2 weeks.
- There should be direct communication with the GP via a phone call or discharge note. This should include:
    - who will provide follow-up care, including medical review if needed (GP or secondary care)
    - frequency of blood pressure monitoring
    - thresholds for reducing or stopping treatment (e.g. BP130/80 reduce treatment, <120/70 stop treatment)
    - indications for referral to primary care for blood pressure review
- Measure BP every 1–2 days for up to 2 weeks after transfer to community care, until antihypertensive treatment stopped and no hypertension. Blood pressure can take up to 3 months to return to normal. During this time, blood pressure should not be allowed to exceed 160/110 mmHg.

4.3.15 Postnatal review

All patients with severe pre-eclampsia should attend their general practitioner and be offered a hospital appointment within 8 weeks after delivery. Blood pressure and proteinuria assessment should be carried out and appropriate referral made if antihypertensive treatment is still required and/or significant proteinuria confirmed.

Post natal review should allow an opportunity for a full debriefing of the events surrounding delivery, a review of ongoing antihypertensive treatment and any further investigations or medical referral which may be necessary. An opportunity for pre-conceptual counselling should also be available for these patients as there are an albeit limited number of modifiable

risk factors such as obesity and limited interventions such as aspirin therapy which may improve outcomes in subsequent pregnancies.

5.0 References and further reading

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6.0 Implementation Strategy

- Distribution of guideline to all members of the Institute and to all maternity units.
- Implementation through HSE Obstetrics and Gynaecology programme local implementation boards.
- Distribution to other interested parties and professional bodies.

7.0 Key Performance Indicators

1. No of women experiencing eclamptic seizures per delivery.
2. No of primigravidas and multigravidas who develop pre-eclampsia.
3. No of cardiovascular accidents.
4. Eclampsia and when eclamptic fit occurred
5. Instance of post partum pregnancy induced
6. Neonatal – survival / death
7. Maternal death

8.0 Qualifying Statement

These guidelines have been prepared to promote and facilitate standardisation and consistency of practice, using a multidisciplinary approach. Clinical material offered in this guideline does not replace or remove clinical judgment or the professional care and duty necessary for each pregnant woman. Clinical care carried out in accordance with this guideline should be provided within the context of locally available resources and expertise.

This Guideline does not address all elements of standard practice and assumes that individual clinicians are responsible to:

- Discuss care with women in an environment that is appropriate and which enables respectful confidential discussion.
- Advise women of their choices and ensure informed consent is obtained.
- Meet all legislative requirements and maintain standards of professional conduct.
- Apply standard precautions and additional precautions as necessary, when delivering care.
- Document all care in accordance with local and mandatory requirements.

Appendix 1

Neurological monitoring

The Glasgow coma score is a quantitative assessment of the level of consciousness. It is the sum of the three responses of eye opening, verbal response and motor response:

Response	Points
Eye opening	
Spontaneous	4
Eye opening to speech on request	3
Eye opening to painful stimulus	2
No eye opening	1
Verbal response	
Orientated	5
Confused	4
Inappropriate words	3
Incomprehensible sounds	2
No verbal response	1
Motor response	
Obeys commands	6
Localises to pain	5
Withdraws fro painful stimulus	4
Abnormal flexion, decorticate posture	3
Extensor response, decerebrate posture	2
No movement to stimulus	1

The AVPU score is a simplified and quick neurological assessment where the patient can be

A Alert
V Responds to voice
P Responds to pain
U Unresponsive

Appendix 2

Ospidéal Máithreachais na hOllscoile Corcaigh
Cork University Maternity Hospital

24HR HIGH DEPENDENCY UNIT CARE PLAN
CORK UNIVERSITY MATERNITY HOSPITAL

Name: | DOB: | Age: | Hospital No: | Weight: | Height: | Consultant: | Parity: | EDD: | Date of Admission:

Diagnosis:

Past Medical/Surgical History:

Allergies: | Blood Group: | Serology: | Anti D: | Date: | Antenatal Steroids 1st Dose: | 2nd Dose:

DELIVERY DETAILS
Date: | Mode: | Sex: M/F: | Birth Weight: | Outcome:

CONTACT DOCTOR FOR EARLY INTERVENTION IF PATIENT TRIGGERS ONE RED OR TWO YELLOW SCORES AT ANY ONE TIME

Date: / Time:

RESP (write rate in corresp. box): >30 | 21-30 | 11-20 | 0-10
Saturations: 90-100% | <90%
O2 Conc: %
Temp: 39 | 38 | 37 | 36 | 35
HEART RATE: 170 | 160 | 150 | 140 | 130 | 120 | 110 | 100 | 90 | 80 | 70 | 60 | 50 | 40
Systolic Blood Pressure: 200 | 190 | 180 | 170 | 160 | 150 | 140 | 130 | 120 | 110 | 100 | 90 | 80 | 70 | 60 | 50
Diastolic Blood Pressure: 130 | 120 | 110 | 100 | 90 | 80 | 70 | 60 | 50 | 40
Passed Urine: Y or N
Lochia: Normal | Heavy/Foul
Proteinuria: 2+ | >2+
Liquor: Clear/Pink | Green
NEURO RESPONSE (✓): Alert | Voice | Pain | Unresponsive
Pain Score (n/a): 2-3 | 0-1
Nausea (✓): YES (✓) | NO (✓)
Looks unwell: YES (✓) | NO (✓)
Total Yellow Scores
Total Red Scores

FHR
Uterus
Reflexes

Drug Infusions - Dose Given - ie Indicate mgs/hr / iu/hr / mcg/hr / mcg/kg/hr / mcg/kg/min

Blood Glucose
Actrapid iu/hr

INPUT									OUTPUT				
Time	PO	Maintenance Fluid Rate/Hr	RCC	Other Blood Products	MgSo4			HOURLY TOTAL	Urine	Drains		HOURLY TOTAL	HOURLY BALANCE

Blood Results							
FBC	WBC						
	RCC						
	HB						
	HCT						
	Platelets						
	Neutrophils						
	Reticulocytes						
U+E	Na+						
	K+						
	Chloride						
Renal	Urea						
	Urates						
	Creatinine						
	Albumin						
	Uric Acid						
LFTS	ALT						
	AST						
	Alk. Phosphate						
	Albumin						
	Total Bilirubin						
	Direct Bilirubin						
	LDH						
	FDPS						
	Gamma GT						
COAG	INR						
	APTT						
	Fibrinogen						
OTHERS	Mg++						
	Ionised CA++						
	Total CA++						
	Phosphate						
	Pre-Gent						
	Post-Gent						
	Lab Glucose						
	Blood Group CUH						
	Direct Coombs CUH						
	Other						
	Signature						

CVP / Arterial Line		
Date of Insertion		
Site Check	8am	8pm

Arterial Blood Gas Results						
Time						
PH						
PC02						
P02						
Lactate						
HB						
Bicarbonate						
TC02						
Beecf						
HCT						
HC03						

Appendix 3

Affix Patient's Label

PRESCRIPTION DOCUMENT FOR INTRAVENOUS LABETALOL

Date _____

Bolus doses

Yes □ **No**□

- Give bolus dose of 50mg (10ml of labetalol 5mg/ml) over at least 5 minutes.
- Can be repeated in doses of 50mg at 10 minute intervals up to a maximum dose of 200mg.

Prescribed by _____

Dose	_____	***Dose***	_____
Time	_____	***Time***	_____
Administered by	_____	***Administered by***	_____
Dose	_____	***Dose***	_____
Time	_____	***Time***	_____
Administered by	_____	***Administered by***	_____

Maintenance dose

Following a response to bolus doses, or as initial treatment in moderate hypertension, a labetalol infusion should be commenced:

- Draw up 300mg of labetalol in 60ml from three 20 ml ampoules containing 100 mg of labetalol each (5mg/ml).
- Start an infusion of labetalol 5mg/ml at a rate of 4ml/hour (20mg/hour) preferably via a syringe pump.
- The infusion rate should be doubled every half hour to a maximum of 32ml/hour (160mg)/hour until the blood pressure has dropped and then stabilised at an acceptable level.

Prescribed by _____

Prepared by _____

Checked by _____

Commenced by _____

Time commenced _____

Date commenced _____

Time discontinued _____

Date discontinued _____

Discontinued by _____

Appendix 4

Affix Patient's Label

PRESCRIPTION DOCUMENT
FOR INTRAVENOUS HYDRALAZINE

Date _____

Bolus doses

- Reconstitute 1 ampoule (20mg) with 1ml of water for injections.
- Draw this into a syringe containing 9ml of sodium chloride 0.9%, resulting in a 2mg/ml solution.
- Give a bolus dose of 2.5mg (1.25ml of hydralazine 2mg/ml) over at least 5 minutes.
- Repeat in doses of 2.5mg at 20 minute intervals to a maximum dose of 20mg.

Prescribed by _____

Dose		***Dose***	
Time		***Time***	
Administered by		***Administered by***	
Dose		***Dose***	
Time		***Time***	
Administered by		***Administered by***	
Dose		***Dose***	
Time		***Time***	
Administered by		***Administered by***	
Dose		***Dose***	
Time		***Time***	
Administered by		***Administered by***	

Maintenance dose

Administration of intravenous maintenance hydralazine.

- Reconstitute 2 ampoules (40mg) with 1ml of water for injections each.
- Add 40 mg of reconstituted hydralazine solution in 2 ml of water of injection to 38 ml of 0.9% normal saline (1mg/ml).
- Administer infusion at a rate of 1-5 mg/hour (i.e. 1-5 ml/hour).

Prescribed by _____

Prepared by _____

Checked by _____

Commenced by _____

Time commenced _____

Date commenced _____

Time discontinued _____

Date discontinued _____

Discontinued by _____

Affix Patient's Label

Appendix 5

PRESCRIPTION DOCUMENT FOR THE ADMINISTRATION OF INTRAVENOUS (PRE-MIXED) MAGNESIUM SULPHATE

Loading dose

- **Magnesium sulphate pre-mixed loading dose bag.** Each bag contains 4g of magnesium sulphate in 50ml of water of injection (i.e. 80mg per ml).
- Infuse pre-mixed loading dose bag over ten minutes (i.e. at a rate of 300ml per hour) followed by maintenance infusion.

Time _____ **Date** _____

Prescribed by _____ **Administered by** _____

Maintenance dose

- **Magnesium sulphate pre-mixed maintenance dose bag.** Each bag contains 20g of magnesium sulphate in 500ml of water of injection (i.e. 40mg per ml).
- Infuse pre-mixed maintenance dose bag at 1g per hour (i.e. at a rate of 25ml per hour).

Time _____ **Date** _____
Prescribed by _____

Bag #1

Prepared by _____
Checked by _____ **Commenced by** _____
Time commenced _____ **Date commenced** _____

Bag #2

Prepared by _____
Checked by _____ **Commenced by** _____
Time commenced _____ **Date commenced** _____

Bag #3

Prepared by _____
Checked by _____ **Commenced by** _____
Time commenced _____ **Date commenced** _____

Subsequent bags should be recorded on a second administration sheet

Time discontinued _____ **Date discontinued** _____