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Key Amendments

Date	Amendments	Approved by
21st August 2020	Updated guideline. LV to discuss the suggestion of putting Fresh Embryo Transfer as an independent risk for PET with regards to aspirin	Maternity Governance Meeting

Introduction

Hypertension complicates 6-8% of all pregnancies with around 5/1000 maternities in the UK suffering severe pre-eclampsia, and 5/10 000 maternities suffering eclampsia. In eclampsia, the case fatality rate has been reported as 1.8% and a further 35% of women experience a major complication.

This guideline aims to offer a clear but comprehensive plan for the management of hypertension in pregnancy by focusing on

- Antenatal, peripartum and postnatal management of hypertension
- Management of fluid balance
- Delivery and follow up

Guideline

- The definition and classification of the hypertensive disorders of pregnancy still lack universal agreement. For the purpose of this guideline we will use the classifications used by NICE.
- Not all pregnant women who have proteinuria and hypertension have diseases specific to pregnancy and groups have varying clinical outcomes.

  Women with hypertensive disorders of pregnancy have been subdivided as follows:

  a) Gestational hypertension (PIH) - new hypertension after twenty weeks of pregnancy

  b) Chronic hypertension - history of hypertension pre-conception / in the first half of pregnancy or de novo hypertension that fails to resolve postnatally

  c) Pre-eclampsia - de novo hypertension after twenty weeks of gestation, returning to normal postpartum AND proteinuria 3g/24hours or a PCR 30 mg/mmol ± oedema and virtually any organ system may be affected

  d) Pre-eclampsia superimposed on chronic hypertension - development of new signs and/or symptoms associated with pre-eclampsia after twenty weeks of gestation in a woman with chronic hypertension

- According to the NICE Guidelines, degree of hypertension can be defined as:
  - Hypertension: Blood pressure of 140-159/90-109 mmHg
  - Severe hypertension: Blood pressure >160/110 mmHg or greater
- It should be remembered that auto-regulation of the maternal cerebral circulation only breaks down at blood pressures of 170/110 mmHg. The evidence that antihypertensive drugs protect the mother from morbidity is most significant at these higher levels.
- Treatment of hypertension should be commenced when BP is >140/90 mmHg. Patients with chronic hypertension, pre-eclampsia and postpartum hypertension are managed in the same way.

Reducing the risk of PET

ASPIRIN

NICE recommends that Aspirin reduces the risk of pregnancy complications from placental disease, particularly pre-eclampsia. Therefore a full history at booking is essential.

Dosage is 150mg PO/OD from 12/40 until delivery and may be more effective if taken at night.

Contraindications include Aspirin allergy and a history of GI bleeding or ulceration.
Asthma is a relative contraindication and a careful history should be taken.
A reduced dose 75mg may be considered in cases of hepatic or renal impairment.

Risk level	Risk factors	Recommendation
High	Hypertensive disease in previous pregnancy Chronic renal disease Autoimmune disease such as SLE or APS Type 1 or 2 diabetes mellitus Essential hypertension Placental histology confirming placental dysfunction in a previous pregnancy	Low dose Aspirin for 1 or more high risk factors 150mg PO/OD/nocte from 12/40 until delivery.
Moderate	First pregnancy Maternal age (>40yrs at booking) Inter-pregnancy interval >10 years BMI >35 Family history of pre-eclampsia in first degree relative Multiple pregnancy	Low dose Aspirin if 2 or more moderate risk factors 150mg PO/OD/nocte from 12/40 until delivery

Assessment of Women with Hypertension in Pregnancy

How to measure BP?

It is important to standardise methods of blood pressure assessment with the woman appropriately positioned.

- The woman should be rested and sitting at a 45-degree angle.
- The cuff should be of an appropriate size and should be placed at the level of the heart.
- Multiple readings are required to accurately assess blood pressure because of natural variation. Korotkoff phase 5 is the appropriate method for diastolic blood pressure. Korotkoff phase 4 is used if there is no disappearance in sound. This must be documented in the woman's records.

Concerns have been raised about the use of automated methods. Automated methods can systematically underestimate, particularly the systolic blood pressure. It has been suggested that mercury sphygmomanometers should be used to establish baseline blood pressure as a reference unless the automated machine has been validated in pregnancy. When using an automated machine take the difference into account – observe for trends. The method used should be consistent and documented.

How should the woman be monitored?

Chronic hypertension

- Offer treatment to women with BP persistently 140/90 mmHg or higher aiming for a BP of 135/85 mmHg or less.
- If the BP is well controlled monitor it every 2-4 weeks, if it is poorly controlled consider weekly BP measurements.
- Offer PLGF-based testing between 20 and 35 weeks if it is felt the woman is developing pre-eclampsia

Gestational hypertension:

Do not routinely admit women with BP of 140/90 – 159/109 mmHg to hospital but initiate treatment if BP remains above 140/90mmHg to lower it to 135/85 mmHg or less.

- Check BP once or twice a week until it is less than 135/85 mmHg
- Check a urine dipstick for proteinuria once or twice a week
- Measure FBC, LFTs & U&Es at initial presentation and then as clinically indicated.

Women with severe hypertension need to be admitted and have blood pressure checks at least 4 times a day. If a recording of systolic BP of 160mm Hg or more or a diastolic BP of 110mm Hg or more is made – the reading should be rechecked within 15 minutes and treatment should be instituted appropriately. (See below- Acute Treatment). BP should be checked every 15-30 minutes until it is less than 160/110mmHg

- The blood pressure should be checked closely as per the individual care plan. The blood pressure should be checked 4-hourly if a conservative management plan is in place and the woman is stable and asymptomatic.
- Close fluid balance record should be kept and charting of input and output is essential. A catheter with an hourly urometer is advisable in the acute situation, especially in the immediate postpartum period (See below).
- Bloods should be checked at presentation and then weekly.
- The urine should be dipped daily for proteinuria while an inpatient.

Women with severe hypertension must be reviewed by senior medical staff. Particular note should be made to the clinical features of severe pre-eclampsia:

Symptoms

- Severe headache
- Epigastric pain and/or vomiting.
- Visual disturbance
- Significant swelling of face, hands, feet
- Bleeding per vagina

Signs

- Clonus >1 beat
- Papilloedema on fundoscopy
- Fetal condition / (CTG)
- Liver tenderness

Investigations

- Full blood count, PET profile (See PET chart). These tests should be performed at presentation and then weekly.
- Clotting studies including fibrinogen levels are required if the platelet count is less than 100 x 10^6/l.
- Urinalysis – if 1+ proteinuria check PCR, if >30 mg/mmol inform medical staff (see below).

See Appendix 1 for further management of gestational hypertension

Pre-eclampsia:
Women with BP of 140/90 – 159/109 mmHg should be admitted if there are any concerns for the wellbeing of the woman or baby.

- Start treatment if the BP is 140/90 mmHg or higher aiming for a BP of 135/85 or less
- Check the BP every 48 hours or more frequently if the woman is admitted
- Perform blood tests twice a week
- Repeat the urine dipstick only if there is uncertainty in the diagnosis or it is clinically indicated

Women with BP of 160/110 mmHg need to be admitted and have blood pressure checks at least 4 times a day.

- Start treatment aiming for a BP of less than 135/85 mmHg
- Check BP every 15-30 minutes until it is less than 160/110 mmHg then at least four times a day
- Perform blood tests as indicated but at least twice a week.
- Repeat the urine dipstick only if there is uncertainty in the diagnosis or it is clinically indicated

See Appendix 2 for further information regarding the management of pre-eclampsia

How should proteinuria be measured?

The usual screening test is visual dipstick assessment.

While it has to be acknowledged that there is poor predictive value from urine dipstick testing, approximate equivalence is 1+ = 300mg/l, 2+ = 1000 mg/l and 3+ = 3000 mg/l. False negative as well as false positive rates are recorded with the use of visual dipstick assessment. Problems can be reduced by training.

In view of the high false positive rates with dipsticks, a quantitative test protein creatinine ratio (PCR) on urine is recommended for women with 1+ proteinuria or more on dipstick to confirm significant proteinuria unless the clinical urgency dictates immediate delivery.

PCR > 30 mg/mmol = significant proteinuria

The NICE Guidelines recommend spot protein: creatinine testing as an option for quantification of proteinuria after screening based on dipstick urinalysis.

The use of a spot protein: creatinine ratio is preferred to 24-hour urine collection for quantification of proteinuria since the results of spot protein: creatinine testing would be available within 2–4 hours.

Assessing proteinuria on the first morning urine void should be avoided.

How should the fetus be assessed?

- All women should have a symphysis fundal height plotted if not performed within the last 2 weeks.
- In the acute setting, an initial assessment with cardiotocography should be undertaken.
- Women in labour with severe pre-eclampsia should have continuous electronic fetal monitoring.
- If conservative management is planned then further assessment of the fetus with ultrasound measurements of fetal size, umbilical artery Doppler and liquor volume should be undertaken. Serial ultrasound assessment will allow timing of delivery to be optimised.

- UAD should be considered and serial growth scans performed (Fortnightly for women with PET or severe PIH) as the fetus is at high risk of FGR.

Treatment of hypertension in pregnancy

Acute Treatment

- NICE guideline Hypertension in pregnancy: diagnosis and management (NG133) (updated 2019) recommends treatment of hypertension >140/90mmHg.
- In women with other markers of potentially severe disease as mentioned in assessment of women above, treatment can be considered at lower degrees of hypertension.
- Blood pressure may suddenly drop in response to medication, thus treatment should be titrated gradually.
- Specialist advice needs to be sought if there is difficulty in controlling the BP.
- NICE recommend labetalol should be offered first line and for women in whom it is not suitable nifedipine should be given. Methyldpoa should be reserved for women unsuitable for labetalol or nifedipine.
- In WAHT the preferred therapeutic agents for acute management of severe hypertension in pregnancy are:

1st Line Treatment

- Labetalol, given orally or intravenously, (Appendix 3 & 4).

- Consider nifedipine and methyldopa as alternatives if there are contra indications to using labetalol like asthma (Appendix 3 &5).

2nd Line Treatment: If first line treatment is unsuccessful / contraindicated then

- Intravenous hydralazine (Appendix 3 & 6).

* Caution**:** All three drugs have cumulative effect and interact with magnesium sulphate. Nifedipine increases the muscular blockade of magnesium sulphate.

Maintenance Treatment

Long-term treatment should be started at the same time:

- **Women already on treatment** may need an increment in existing doses or an addition of another antihypertensive. This should be discussed with the on-call consultant.
- In pregnant women with uncomplicated chronic hypertension treatment should be initiated if the BP is 140/90 mmHg or higher aiming for a BP of 135/85 mmHg or less. Do not offer pregnant women with uncomplicated chronic hypertension treatment to lower diastolic blood pressure below 80 mmHg.
- Offer pregnant women with secondary chronic hypertension referral to a specialist in hypertensive disorders.
- **Labetalol** can be increased to a maximum of 400mg QDS.
- **Nifedipine MR** Tablets (modified release) should be prescribed, to lower the BP in the short term and their current medication should be increased. Nifedipine MR may need to be added as a maintenance treatment (see appendix 5) and can be increased up to a maximum of 40mg BD.
- **Methyldopa** can be increased up to a maximum of 750mg QDS. More commonly Nifedipine is added if the BP is not adequately controlled on Methyldopa 500mg QDS, because of the sedative effects of higher doses of Methyldopa. This should be stopped postnatally due to the risk of depression.

Women not already on treatment

Labetalol and Nifedipine are the most commonly used therapies in the WAHT.

Labetalol - 200mg TDS PO, increased as above if necessary

Contraindications: asthma, heart failure. cardiogenic shock, hypotension, marked bradycardia, metabolic acidosis, phaeochromocytoma (apart from specific use with alpha-blockers), Prinzmetal's

angina, second-degree AV block, severe peripheral arterial disease, sick sinus syndrome, third-degree AV block

Side effects - Abdominal discomfort, bradycardia, confusion, depression, diarrhea, dizziness, dry eye (reversible on discontinuation), dyspnea, fatigue, headache, heart failure, n&v, paraesthesia, peripheral coldness, PVD, rash (reversible on discontinuation), sleep disorders, syncope, visual impairment

Or

Nifedipine MR – 10mg BD, increased as above if necessary

Contraindications: Acute attacks of angina, cardiogenic shock, significant aortic stenosis, unstable angina, within 1 month of an MI

Side effects – Constipation, malaise, oedema, and vasodilation are the commonest side effects but many women also report headaches

Antihypertensive drugs to avoid:

- **Atenolol** should be avoided, as there is some evidence that its use may be linked to fetal growth retardation when given in early pregnancy. Other beta-blockers are seldom used, as there is little data on their safety during pregnancy.
- **ACE inhibitors and angiotensin II receptor antagonists (ARB**) must not be used during pregnancy. There is an increased risk of congenital abnormalities if these drugs are taken during pregnancy. ACE inhibitors when taken during the second and third trimester cause fetal renal dysfunction, with oligohydramnios, intrauterine death, and neonatal death from renal failure. There is little data on the effects of ARB, but adverse effects are likely to be similar to those of ACE inhibitors. Accidental exposure of the fetus to ACE inhibitors or ARB in the *first trimester* is not grounds for termination of the pregnancy.
- **Diuretics** are relatively contraindicated in pregnancy. There may be an increased risk of congenital abnormalities and neonatal complications if they are taken. They should be reserved for the management of pulmonary oedema.

How should fluid balance be managed? (See appendix 7)

Fluid restriction is advisable to reduce the risk of fluid overload. Over the last 20 years, pulmonary oedema has been a significant cause of maternal death[3]. This has often been associated with inappropriate fluid management. There is no evidence of the benefit of fluid expansion and a fluid restriction regimen is associated with good maternal outcome (80mls/hr). There is no evidence that maintenance of a specific urine output is important to prevent renal failure, which is rare. Care should be taken with preloading patients who are receiving an epidural and close liaison with the anaesthetist is essential. The only indication for a fluid bolus is with the first dose of hydralazine antenatally.

Preventing problems associated with fluid balance & renal function

- Check that catheter is not blocked
- Timely delivery
- Strict charting of fluid intake and output
- Avoid sharp falls in BP (sublingual Nifedipine / large bolus of Oxytocin)
- Avoid betamimetic tocolysis
- Avoid Ergometrine
- Avoid unnecessary use of Postpartum Oxytocin Infusion
- Replace sudden blood losses promptly but precisely (volume replacement for volume loss)
- Use NSAIDs with caution and after a multi-disciplinary discussion

Suggested options for standard fluid management (involvement from anaesthetic team is vital)
In usual circumstances, total fluids should be – Hartmanns

- 1ml/kg/hour or Urine output + 40ml/ hour
- NICE recommends a fluid restriction of 80mls/hr

There are no trials to show differential benefit. Allow free oral fluids when possible and decrease intravenous fluid in line with this.

Standard monitoring of fluid balance
The duration and frequency of high dependency monitoring is not well defined and depends upon individual cases and their progress.

Monitoring of other characteristics

The frequency of monitoring of the following characteristics must be according to the individual management plan with regard to:
Clinical symptoms
BP, Pulse, respiration and temperature
Intake / Output charting
Oximetry
FBC+/- Clotting screen including fibrinogen, LFT, Renal functions
These should be plotted on a high dependency chart.

Prevention of eclamptic seizures

Refer to guideline on HELLP syndrome and Eclampsia

Good practice points

- **A prerequisite is a multi-professional team approach of a midwife, labour ward coordinator, obstetrician, anaesthetist and paediatrician.**
- Normal urine output should be greater than 0.5ml/kg body weight/ hour. This is usually between 25—100ml/hour. Oliguria can be simply defined as hourly urine output of <25ml/hour for two hours and severe oliguria as <10 ml for two hours.
- The primary purpose of urine output monitoring is not so that oliguria can be managed aggressively. Rather it is used as an indicator of worsening disease and particularly in case of anuria, as a sign that fluid overload might occur.
- Aim is to run woman dry, as she is more likely to die of fluid overload than renal failure.
- In women with severe PET fluids should be restricted to 80mls/hr unless there is on-going fluid loss.
- Invasive monitoring may be required to assist in intensive monitoring of these patients.
- Suggested indications for invasive monitoring i.e. Arterial line / CVP are refractory pulmonary oedema, refractory severe oliguria in presence of HELLP syndrome, severe haemorrhage and multi organ failure
- Consider CVP line if there is associated haemorrhage or difficulty in managing the fluid balance and urine output.
- CVP readings outside pregnancy should normally be 10-15mmHg. But in pre-eclampsia lower readings are needed to define when the vascular compartment is full (0-5mmHg); pulmonary oedema can develop at lower pressure because of increase permeability. The CVP response to fluid infusion is probably of more value than absolute level of single reading.
- Consider avoiding using high concentrations of epidural local anaesthetic boluses, which may require rapid fluid infusion.

Timing of delivery

Chronic and gestational hypertension

- Do not deliver before 37 weeks if the BP is lower than 160/110 mmHg, with or without anti hypertensive, unless there are medical indications or concerns about fetal wellbeing.
- If the BP is lower than 160/110 mmHg with or without antihypertensives after 37 weeks, the timing of delivery and maternal and fetal indications should be agreed between the woman and a senior obstetrician.
- Corticosteroids and magnesium sulphate should be given if indicated for planned early birth.

Pre-eclampsia

Depends on:

- Severity of the illness
- Condition of the fetus
- State of the cervix

Prolonging the pregnancy at very early gestations may improve the outcome for the premature infant but can only be considered if the mother remains stable.

- Prior to 34 weeks - conservative management should be performed unless there are maternal or fetal indications for delivery.
- From 34 – 36+6 weeks - surveillance should be continued unless there are indications for delivery.
- From 37 weeks birth should be initiated within 24-48 hours.
- Corticosteroids and magnesium sulphate should be given if indicated for planned early birth.

Delivery should be considered at any gestation for:

- Inability to control BP despite 3 antihypertensives
- O2 sats <90%
- Deterioration in LFTs, U&Es, platelets or haemolysis
- Development of neurological features
- Placental abruption
- Reversed EDF, non reassuring CTG or IUD

Mode of delivery

This should be determined after considering the presentation of the fetus and the fetal condition, together with the likelihood of success of induction of labour after assessment of the cervix.

- **Below 32 weeks** caesarean section is more likely as the success of induction is reduced.
- **After 34 weeks** with a cephalic presentation, vaginal delivery may be considered. The consultant obstetrician should discuss the mode of delivery with the mother.

Labour

- Do not routinely limit duration of second stage of labour if BP stable. Operative vaginal delivery should be considered if BP is very high in 2nd stage >160/110 mm of Hg.
- The third stage should be managed with 10 units intramuscular oxytocin or 5 units intravenous oxytocin given slowly.
- **Ergometrine or Syntometrine should be avoided** (in women with hypertension or if her blood pressure has not been checked in labour) for the management of third stage as this can further increase the blood pressure**.**

Postnatal Management & Follow up

Chronic hypertension

- Check BP daily for the first 2 days
- Check the BP at least once between days 3-5 days or as clinically indicated
- Aim to keep BP lower than 140/90 mmHg
- Offer a medication review with a GP or specialist at 2 weeks
- Offer women a medical review at 6-8 weeks with their GP or specialist

Gestational hypertension

- Check BP daily for the first 2 days
- Check the BP at least once between days 3-5 or as clinically indicated
- Reduce medication if BP falls below 130/80 mmHg
- Start antihypertensive treatment if the BP goes above 150/100 mmHg
- Offer women on medication a review at 2 weeks with either a GP or a specialist
- Offer all women a review at 6-8 weeks with their GP or a specialist

Pre-eclampsia

- A woman who delivers with severe pre-eclampsia (or eclampsia) should have continued close observation postnatally and be managed in Delivery Suite initially. When stable can be transferred to postnatal ward.
- Anti-hypertensive medication may need to be continued after delivery as dictated by the blood pressure. Although, initially, blood pressure may fall, it usually rises again at around 24 hours postpartum. A reduction in anti-hypertensive therapy should be made in a stepwise fashion. There is no reason why the woman cannot go home on treatment, to be weaned off therapy as an outpatient.
- PET can worsen postnatally and there is still a risk of eclampsia developing in the postnatal period. Women should therefore be advised to stay in the hospital for 72–96 hours after delivery. Most women with severe pre-eclampsia or eclampsia will need inpatient care for 4 days or more following delivery. Careful review to ensure improving clinical signs is needed before discharge. This should be done by a Consultant or Registrar.
- PET Bloods should be repeated 48-72 hours after birth or earlier if indicated. If normal there is no need to repeat them again. If abnormal repeat as clinically indicated until they become normal.
- Women who develop hypertension or symptoms of pre-eclampsia in the postnatal period (headaches, visual disturbances, nausea and vomiting or epigastric pain) should be referred to a consultant or middle grade Obstetrician for a specialist opinion and investigation to exclude pre-eclampsia, and to advise on the appropriate hypertensive therapy. The decision about discharge from hospital needs to take account of the risk of late seizures. Up to 44% of eclampsia has been reported to occur in the postnatal period, especially in women presenting at term.
- After pre-eclampsia, blood pressure can take up to 3 months to return to normal. During this time, systolic blood pressure should be kept below 160/110 mmHg.
- If **not on antihypertensive treatment** the BP should be monitored at least 4 times a day while an inpatient and then at least once between days 3-5. If it is abnormal between days 3-5 it should be repeated on alternate days until it is normal.
- Antihypertensive treatment should be started if BP is 150/100 mm Hg or higher.
- If **on antihypertensive treatment** at the time of birth BP should be monitored at least 4 times a day while an inpatient and then every 1-2 days for up to 2 weeks after transfer to the community until the woman is off treatment and has no hypertension.
- Consider reducing antihypertensives if BP falls below 140/90 mmHg.
- Reduce antihypertensives if BP falls below 130/80 mmHg.
- Offer medical review if still taking antihypertensive treatment 2 weeks after transfer to the community.
- Offer all women who have had PET a medical review with their GP or specialist 6-8 weeks postnatally. If hypertension persists consider further investigation. A urinary dipstick should also be carried out at this visit. If proteinuria is still present repeat 3 months and refer to a renal specialist if required.
- All women whose pregnancies have been complicated by severe PET should have a **formal postnatal review in 6-18 weeks with the consultant and be counselled about future pregnancies.**

For all cases of hypertension:

- Stop methyldopa within 2 days of delivery and switch to an alternative.
- Provide a detailed discharge summary including who will provide follow up, requirements for BP monitoring, indications for reducing medication and the referral criteria back into secondary care or for review by a GP. Patients should also be advised to self-monitor for symptoms.

Postnatal Antihypertensives – Aim to use a medication that is only required once a day

- Offer Enalapril with appropriate monitoring of U&Es
- For women of black or Caribbean family origin consider nifedipine or Amlodipine if the woman has successfully used this before to control her BP. Amlodipine has a long half-life and increases the risk of accumulation in breastfed infants, Caution is therefore required and the infant should be monitored for adverse effects.
- If more than one antihypertensive is required consider combining enalapril and nifedipine (or amlodipine if used before). If this does not work or is not tolerated consider:

  Adding atenolol or labetalol

  Or

  Swapping one of the medication already being used to atenolol or labetalol

- If women are not planning to breastfeed treat their hypertension in line with the NICE guideline on hypertension in adults.

In breastfeeding women explain:

- Medications can pass into milk however most medications only lead to low quantities within the milk.
- When discharged home advise women to monitor their babies for drowsiness, lethargy, pallor, cold peripheries or poor feeding.
- Aim to avoid diuretics or ARBs.
- Further information on the safety of medications in breastfeeding is available from Medicines Information: Ext 45776

Future pregnancies

- Evidence suggests that up to 13% of women with pre-eclampsia will have underlying chronic or essential hypertension that was not suspected antenatally.
- Women should be counselled about the risk of recurrence of pre-eclampsia in subsequent pregnancy. These women should be aware that:
  - The risk of developing Gestational hypertension in a future pregnancy ranges from about 1 in 8 (6-12%)
  - The risk of developing pre-eclampsia in a future pregnancy is up to about 1 in 6 (16%)
  - If birth was at 28-34 weeks this is 1 in 3 women (33%)
  - If birth was 34-37 weeks 1 in 4 women (23%)

Pre conceptual counselling

This should be offered where the events that occurred, any risk factors and any preventative therapies can be discussed. It is particularly important for those women in whom their hypertension led to a birth at less than 34 weeks gestation.

Low-dose aspirin have moderate benefits when used for prevention of pre-eclampsia and its consequences. Antiplatelets are associated with an 8% reduction in the relative risk of preterm birth, a 14% reduction in fetal or neonatal deaths and a 10% reduction in small-for-gestational age babies. Women who take angiotensin-converting enzyme (ACE) inhibitors and angiotensin II receptor blockers (ARBs) must be advised that there is an increased risk of congenital abnormalities if these drugs are taken during pregnancy.

Appendix 1: Management of pregnancy with gestational hypertension (NICE guideline NG133)

	Degree of hypertension	
	Hypertension: blood pressure of 140/90–159/ 109 mmHg	Severe hypertension: blood pressure of 160/110 mmHg or more
Admission to hospital	Do not routinely admit to hospital	Admit, but if BP falls below 160/ 110 mmHg then manage as for hypertension
Antihypertensive pharmacological treatment	Offer pharmacological treatment if BP remains above 140/90 mmHg	Offer pharmacological treatment to all women
Target blood pressure once on antihypertensive treatment	Aim for BP of 135/85 mmHg or less	Aim for BP of 135/85 mmHg or less
Blood pressure measurement	Once or twice a week (depending on BP) until BP is 135/85 mmHg or less	Every 15–30 minutes until BP is less than 160/110 mmHg
Dipstick proteinuria testing	Once or twice a week (with BP measurement)	Daily while admitted
Blood tests	Measure full blood count, liver function and renal function at presentation and then weekly	Measure full blood count, liver function and renal function at presentation and then weekly
PlGF-based testing	Carry out PlGF-based testing on 1 occasion (in accordance with NICE guidance, see recommendation 1.4.4) if there is suspicion of pre-eclampsia	Carry out PlGF-based testing on 1 occasion (in accordance with NICE guidance, see recommendation 1.4.4) if there is suspicion of pre-eclampsia
Fetal assessment	Offer fetal heart auscultation at every antenatal appointment Carry out ultrasound assessment of the fetus at diagnosis and, if normal, repeat every 2 to 4 weeks, if clinically indicated Carry out a CTG only if clinically indicated	Offer fetal heart auscultation at every antenatal appointment Carry out ultrasound assessment of the fetus at diagnosis and, if normal, repeat every 2 weeks, if severe hypertension persists Carry out a CTG at diagnosis and then only if clinically indicated

Appendix 2: Management of pregnancy with pre-eclampsia (NICE guideline NG133)

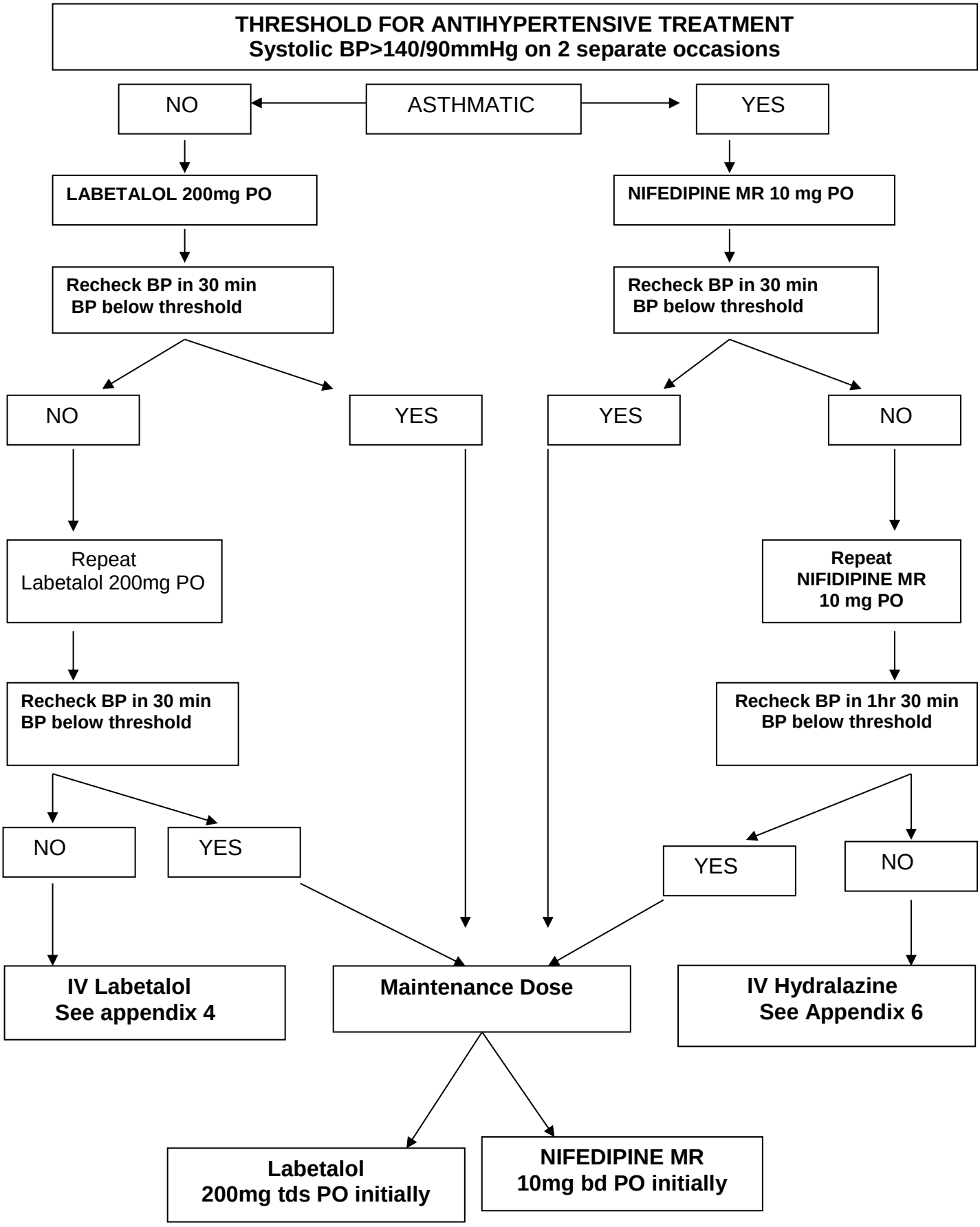
	Degree of hypertension	
	Hypertension: **blood pressure of 140/90–159/ 109 mmHg**	**Severe hypertension:** **blood pressure of 160/ 110 mmHg or more**
Admission to hospital	Admit if any clinical concerns for the wellbeing of the woman or baby (see recommendation 1.5.2) or if high risk of adverse events suggested by the fullPIERS or PREP-S risk prediction models	Admit, but if BP falls below 160/ 110 mmHg then manage as for hypertension
Antihypertensive pharmacological treatment	Offer pharmacological treatment if BP remains above 140/90 mmHg	Offer pharmacological treatment to all women
Target blood pressure once on antihypertensive treatment	Aim for BP of 135/85 mmHg or less	Aim for BP of 135/85 mmHg or less
Blood pressure measurement	At least every 48 hours, and more frequently if the woman is admitted to hospital	Every 15–30 minutes until BP is less than 160/110 mmHg, then at least 4 times daily while the woman is an inpatient, depending on clinical circumstances
Dipstick proteinuria testing[a]	Only repeat if clinically indicated, for example, if new symptoms and signs develop or if there is uncertainty over diagnosis	Only repeat if clinically indicated, for example, if new symptoms and signs develop or if there is uncertainty over diagnosis
Blood tests	Measure full blood count, liver function and renal function twice a week	Measure full blood count, liver function and renal function 3 times a week

Fetal assessment	Offer fetal heart auscultation at every antenatal appointment Carry out ultrasound assessment of the fetus at diagnosis and, if normal, repeat every 2 weeks Carry out a CTG at diagnosis and then only if clinically indicated (See section 1.6 for advice on fetal monitoring)	Offer fetal heart auscultation at every antenatal appointment Carry out ultrasound assessment of the fetus at diagnosis and, if normal, repeat every 2 weeks Carry out a CTG at diagnosis and then only if clinically indicated (See section 1.6 for advice on fetal monitoring)

Use an automated reagent-strip reading device for dipstick screening for proteinuria in a secondary care setting.
Abbreviations: BP, Blood Pressure; CTG, Cardiotocograph; PLGF, Placental Growth Factor

Worcestershire Acute Hospitals NHS Trust

Appendix 3:



Appendix 4:

IV Drug protocol for Labetalol

Labetalol regime on Delivery Suite

Oral therapy 200mg stat with further 200mg after 1 hr

Acute Treatment (IV)	Maintenance Treatment (IV)
• 50mg IV Bolus over 1 min (10mL labetalol 5mg/mL) • Can be repeated every 5 min to a **maximum** of 200mg • Can cause excessive bradycardia reversed by giving IV atropine sulphate 600 micrograms – 2.4mg in divided doses (max per dose 600 micrograms)	• Where continuous IV doses required, consider insertion of arterial line in discussion with anaesthetist • Neat labetolol 5mg/mL at a rate of 4ml/hr via syringe driver • Set target BP and record • Start infusion at 4 mL/hr and double every 30 min to maximum 32 mL/hr (160mg) until BP lowered and stabilised at acceptable level • Start at • 4 mL/hr (double every 30 min if necessary) • 8 mL/hr • 16 mL/hr • 32 mL/hr (maximum) • Convert to oral therapy – dose dependant on IV dose that was required

Infusion

Prepare a syringe containing **200mg Labetalol** in 40ml syringe.

Commence infusion via syringe driver at 4ml/hr (20mg / hr) and double rate of infusion every 30 mins to a maximum dose of 32ml/hr (160mg) until required BP achieved.

Aim to keep systolic BP below 160mm Hg and diastolic BP at 90 - 95 mm Hg.

- Monitor BP and Pulse as per individual management plan

If this fails to control BP, or there are any other concerns, inform Consultant Obstetrician for advice regarding further management.

- An IV drug additive label must be completed and attached to the syringe, not obscuring the scale. This label must be visible at all times.

Clinical monitoring

Continuous	BP Pulse 0_2 saturation CTG
Hourly	Urine output

Bradycardia induced by Labetalol can be treated with 0.6mg Atropine IV up to a maximum of 4 doses.

Appendix 5:

Drug protocol NIFEDIPINE

- Nifedipine is the most extensively used calcium-channel blocker in pregnancy.
- Nifedipine should be given orally not sublingually.
- Nifedipine MR 10mg tablets PO should be prescribed stat.
- Nifedipine MR 10mg can be repeated once if no response after 1hr 30mins after initial dose.
- Maintenance dose; starting dose of 10mg bd increasing by 10mg bd up to 40mg bd if needed

Side Effects

- Headaches
- Flushing
- Tachycardia
- Do not use with aortic stenosis
- May act as tocolytic

There is no evidence of harm to the fetus from Nifedipine, but in view of limited safety data it is recommended as an alternative to more established treatments only if these are ineffective or contraindicated.

NB Women on Nifedipine should be warned not to take grapefruit or grapefruit juice

Appendix 6:

Drug protocol for Hydralazine

Bolus

Reconstitute a 20mg ampoule with 1ml of water for injection and make up to 10ml with normal saline 0.9% to give 2mg/1mL. G ive 5mg (2.5ml) Hydralazine as slow intravenous injection over 3-5mins check BP every 5mins for 30mins the dose can be repeated once again if the required BP is not achieved within 30 mins (Total 1 hour)

Consideration should be given to administering 500mL crystalloid fluid before or at the same time as the first dose of hydralazine IV due to the potential it has for causing maternal hypotension.

Infusion

Prepare 40mg Hydralazine in 40ml of sodium chloride 0.9%. Reconstitute each 20mg ampoule with 1ml of water for injection then make the 2ml (40mg) up to 40ml with sodium chloride 0.9% in a 50ml syringe to give a concentration of 1mg/mL

Commence infusion via syringe driver at 4ml/hr (4mg/hr) and increase rate by 4ml/hr at 30 minute intervals to a maximum rate of infusion of 20ml/hr (20mg/hr) until satisfactory response obtained i.e. systolic BP <160mmHg / diastolic BP of 90 – 95mmHg.

If this fails to control BP, or there are any other concerns, inform Consultant Obstetrician for advice regarding further management.

- An IV drug additive label must be completed and attached to the syringe, not obscuring the scale. This label must be visible at all times.

Clinical Monitoring

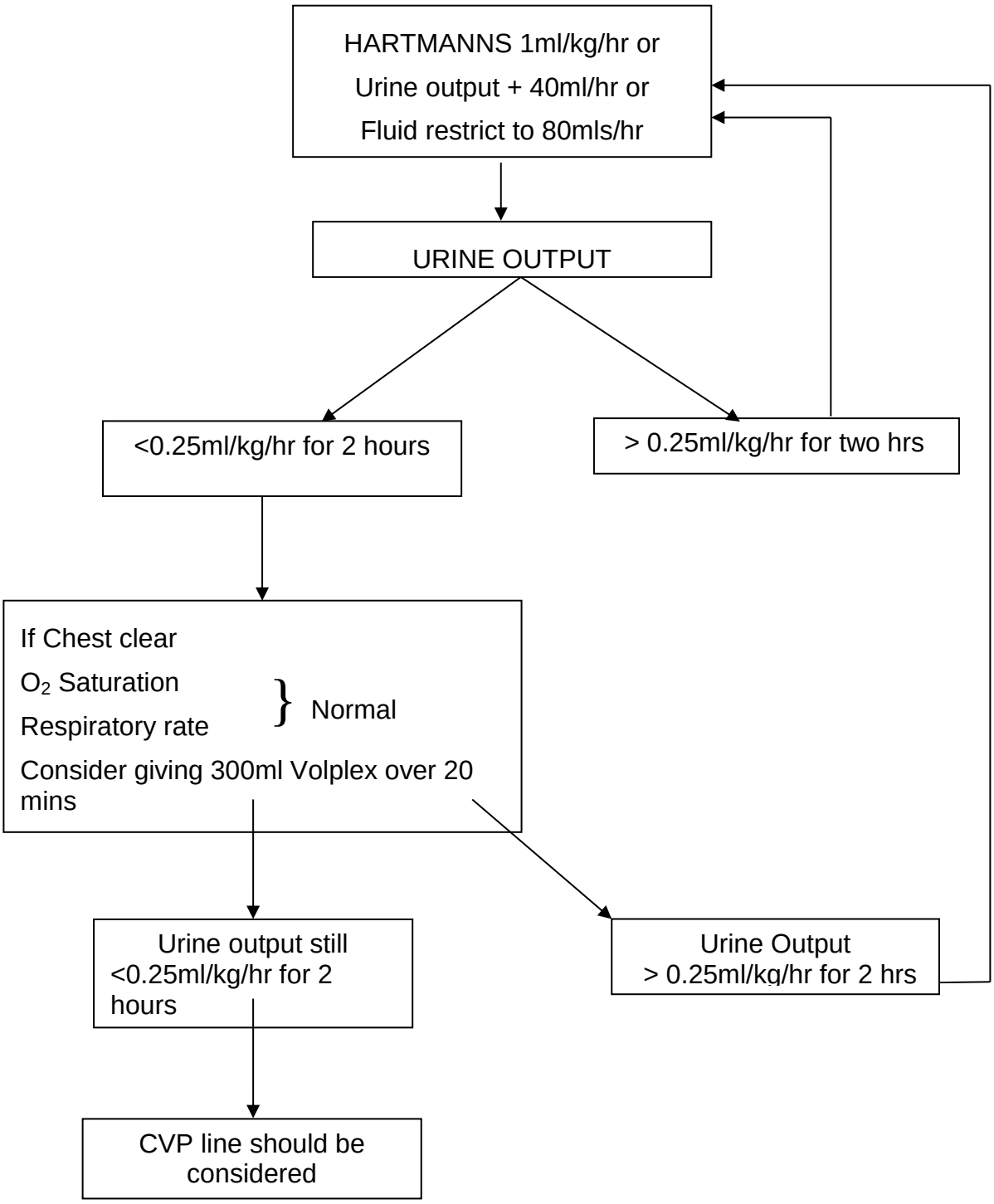
Continuous	BP Pulse 0_2 saturation Fetal Monitoring by CTG
Hourly	Urine output

Side Effects

- Tachycardia
- Hyper–reflexia
- Nausea
- Vomiting
- Headaches
- Flushing
- Diarrhoea
- Joint pain

Appendix 7:

FLUID BALANCE IN SEVERE PRE-ECLAMPSIA / ECLAMPSIA



Appendix 8

Please attach patient sticker here or record: *Name:……* *Unit No:* *NHS No:* *D.O.B: ……/……/……* *Gender: Female/Male Cons: ……*

Worcestershire NHS
Acute Hospitals NHS Trust

TESTS	Reference values in pregnancy (3rd trimester)								
Hb	11 – 14 g/dl								
WCC	6 – 16 $X10^9$/l								
Platelets	150 - 400 $X10^9$/l								
Urea	0 – 8.3 mmol/l								
Creatinine	44 – 80 µmol/l								
Potassium	3.5 – 5.3mmol/l								
Sodium	132-148 mmol/l								
Uric acid	140-360 µmol/l								
PCR	<30 mg/mmol/l								
ALT	0 – 40 iu/l								
Alk phos	133 – 418 iu/l								
Bilirubin	0 – 17 mmol/l								
T.Protein	60 – 80 g/l								
Albumin	35 - 50 g/l								
LDH	200-520iu/L								
OTHERS									

To be filed in Intrapartum section