Hypertension in pregnancy

Fergus P McCarthy
Louise C Kenny

Abstract
Hypertension is a common complication of pregnancy and remains a major cause of maternal and perinatal morbidity and mortality worldwide. Hypertensive disorders range from mild gestational hypertension to severe pre-eclampsia which remains one of the leading causes of maternal death in the UK. Although there have been major advances in understanding the pathophysiology of the disease in recent years, interventions to prevent hypertensive disorders in pregnancy have had disappointing results. Due to their unpredictable nature and potential poor outcomes, patients with hypertensive disorders of pregnancy warrant cautious care with consultant obstetric, neonatal and anaesthetic involvement to optimize both maternal and fetal outcomes.

Keywords eclampsia; hypertension; pre-eclampsia; pregnancy

Introduction
Hypertension is a frequently encountered complication of pregnancy and has a number of possible aetiologies. In the United Kingdom the number of maternal deaths from hypertension in pregnancy has fallen steadily over the past few decades, as have the complication rates. However hypertensive disorders remain a major cause of maternal and perinatal morbidity and mortality worldwide. Interventions to prevent hypertensive disorders in pregnancy including pre-eclampsia in the general population have been disappointing and the mainstay of treatment involves close antenatal supervision of mother and fetus and timely delivery to prevent deterioration of the condition and subsequent morbidity and mortality.

Hypertension in pregnancy
Classification and diagnosis of hypertension
The classification of hypertension in pregnancy by Davey et al. remains the most widely accepted and appropriate classification (Box 1).

Women who are hypertensive and pregnant must be subdivided into those with:

- chronic hypertension
- pregnancy-induced or gestational hypertension (PIH). Women with PIH are subdivided further:
  - the majority have non-proteinuric PIH, a condition associated with minimal maternal or perinatal mortality/morbidity
  - a minority have the major pregnancy complication of pre-eclampsia.

Pre-eclampsia is associated with significant maternal and perinatal morbidity and mortality. As such it is imperative that every effort is made to accurately classify women with hypertension in pregnancy as having chronic hypertension, non-proteinuric PIH or pre-eclampsia as the aetiology and management of the three conditions is very different.

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. It is imperative that an appropriately sized cuff should be used. To avoid incorrect measurement of blood pressure, if the mid-arm circumference is greater than 33 cm, a large cuff should be used. Korotkoff phase 1 should be used to measure systolic BP and Korotkoff 5 is the appropriate measurement of diastolic blood pressure. The method used to record blood pressure should be consistent and documented.

Pregnancy induced hypertension
Gestational or pregnancy induced hypertension is a rise in the blood pressure in the absence of proteinuria after 20 weeks’ gestation. True non-proteinuric pregnancy induced hypertension does not appear to be associated with an increase in maternal or fetal morbidity. However, the risk of progression from pregnancy induced hypertension to pre-eclampsia is approximately 20–30% and therefore vigilance is required. This rate increases...
to approximately 50% when pregnancy induced hypertension develops before 32 weeks’ gestation. As a result of this risk of progression to pre-eclampsia weekly urinalysis and BP checks are generally recommended in women with pregnancy induced hypertension.

**Chronic hypertension**

Chronic hypertension is defined as hypertension preceding pregnancy. Blood pressure falls in the first and second trimesters. Therefore women with high blood pressure before the 20th week of pregnancy are assumed to have pre existing or essential hypertension. As many women of reproductive age only present for the first time when pregnant, chronic hypertension is often revealed in the first half of pregnancy. Approximately 90—95% of cases of chronic hypertension are considered to be essential. Secondary causes which account for approximately 5—10% are listed in Table 1. In women presenting with hypertension in the first half of pregnancy it is important to look for an underlying cause. These investigations should at least include:

- urine analysis (looking for blood, protein or glucose)
- urea and electrolytes
- renal tract ultrasound.

Women with underlying renal disease are at significantly increased risk of poor pregnancy outcome and require multidisciplinary care.

**Treatment of chronic hypertension in pregnancy**

The use of antihypertensive drugs in the hypertensive women without renal impairment is considered by some to be beneficial in preventing sudden increases in blood pressure, cerebral haemorrhage or hypertensive encephalopathy. However, a clear benefit of antihypertensive agents in mild-to-moderate chronic hypertension remains unproven, as treatment does not prevent placental abruption or superimposed pre-eclampsia, or influence perinatal outcome. There are differing opinions regarding the timing of initiation of treatment in hypertensive disorders in pregnancy. This is compounded by the fact that a single blood pressure of 140/90 mmHg or above is not uncommon in pregnancy and was reported in nearly 40% of pregnant women in one study, while persistent high blood pressure occurs in approximately 12—22% of pregnancies. Until recently, the focus remained on treating elevated blood pressure based on the diastolic reading with groups recommending treatment for sustained diastolic blood pressures of greater than 105—110 mmHg. There is now however increasing awareness on the importance of increases in, as well as the absolute values of, systolic blood pressure. Generally, the aim of antihypertensive therapy in women without underlying medical problems is to keep the systolic blood pressure at 130—155 mmHg and diastolic blood pressure at 80—105 mmHg.

Both CMACE 2006—2008 and NICE Clinical Guideline on Hypertension in pregnancy recommend that all pregnant women with a systolic blood pressure of 150 mmHg or more require antihypertensive treatment. Consideration should also be given to initializing treatment at lower pressures if the overall clinical picture suggests rapid deterioration and/or where the development of severe hypertension can be anticipated.

In the 2006—2008 CMACE report, particular emphasis was placed on the implementation of effective anti-hypertensive treatment in women with systolic blood pressures greater than 150 mmHg. A systolic blood pressure greater than 180 mmHg should be considered a medical emergency and quick effective treatment is advocated to prevent haemorrhagic stroke.

Women with chronic hypertension taking angiotensin-converting enzyme (ACE) inhibitors or angiotensin II receptor blockers should be counselled that there is an increased risk of congenital abnormalities if these drugs are taken during pregnancy. There are multiple alternative antihypertensive agents available which may be used in pregnancy. These can be used independently or in conjunction with a second or third agent.

- **Labetolol** is a popular first-line antihypertensive of choice in the treatment of hypertension. Labetolol is a combined \(\alpha\)-adrenoceptor blocker that also blocks \(\beta\)-adrenoceptors. Ordinary \(\beta\)-adrenoceptor blockers are unsuitable for producing a quick antihypertensive effect because a quick fall in blood pressure triggers a compensatory sympathetic discharge that increases the peripheral vascular resistance via \(\alpha\)-adrenoceptors. Blocking the \(\beta\)-adrenoceptors alone cannot prevent this compensatory response, but the addition of an \(\alpha\)-adrenoceptor blocker can. It is this action that renders labetolol suitable for gaining quick control of the blood pressure. Labetolol, like all \(\beta\)-adrenoceptors, is contraindicated in women with a history of asthma.

- **Nifedipine** is a calcium channel blocker used in the treatment of chronic hypertension in pregnancy. Data suggest that it is safe, but cumulative evidence is not as extensive as with older drugs such as labetolol and methyldopa. The principal side effect is headache, which can be severe, lasts for several days after commencing treatment and may return after increasing the dose. Use of the long-acting once-daily preparation improves compliance. Nifedipine is a potent antihypertensive agent and should not be given

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**Table 1**

<table>
<thead>
<tr>
<th>Causes of secondary chronic hypertension</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Idiopathic</strong></td>
<td><strong>Essential hypertension</strong></td>
</tr>
<tr>
<td>Vascular disorders</td>
<td>Renovascular hypertension</td>
</tr>
<tr>
<td>Endocrine disorders</td>
<td>Aortic coarctation</td>
</tr>
<tr>
<td>Endocrine disorders</td>
<td>Diabetes mellitus</td>
</tr>
<tr>
<td>Renal disorders</td>
<td>Hyperthyroidism</td>
</tr>
<tr>
<td>Renal disorders</td>
<td>Hypothyroidism</td>
</tr>
<tr>
<td>Renal disorders</td>
<td>Phaeochromocytoma</td>
</tr>
<tr>
<td>Renal disorders</td>
<td>Acromegaly</td>
</tr>
<tr>
<td>Renal disorders</td>
<td>Cushing’s syndrome</td>
</tr>
<tr>
<td>Renal disorders</td>
<td>Conn’s syndrome</td>
</tr>
<tr>
<td>Connective tissue disorders</td>
<td>Renal failure resulting from:</td>
</tr>
<tr>
<td>Connective tissue disorders</td>
<td>Diabetic nephropathy</td>
</tr>
<tr>
<td>Connective tissue disorders</td>
<td>Reflux nephropathy</td>
</tr>
<tr>
<td>Connective tissue disorders</td>
<td>Chronic glomerulonephritis</td>
</tr>
<tr>
<td>Connective tissue disorders</td>
<td>Nephritic and nephrotic syndrome</td>
</tr>
<tr>
<td>Connective tissue disorders</td>
<td>Polycystic kidney</td>
</tr>
<tr>
<td>Connective tissue disorders</td>
<td>Systemic lupus erythematosus</td>
</tr>
<tr>
<td>Connective tissue disorders</td>
<td>Systemic sclerosis</td>
</tr>
<tr>
<td>Connective tissue disorders</td>
<td>Polyarteritis nodosa</td>
</tr>
<tr>
<td>Connective tissue disorders</td>
<td>Rheumatoid disease</td>
</tr>
</tbody>
</table>

**Table 1**

- Women with underlying renal disease are at significantly increased risk of poor pregnancy outcome and require multidisciplinary care.

- Treatment of chronic hypertension in pregnancy

- The use of antihypertensive drugs in the hypertensive women without renal impairment is considered by some to be beneficial in preventing sudden increases in blood pressure, cerebral haemorrhage or hypertensive encephalopathy. However, a clear benefit of antihypertensive agents in mild-to-moderate chronic hypertension remains unproven, as treatment does not prevent placental abruption or superimposed pre-eclampsia, or influence perinatal outcome. There are differing opinions regarding the timing of initiation of treatment in hypertensive disorders in pregnancy. This is compounded by the fact that a single blood pressure of 140/90 mmHg or above is not uncommon in pregnancy and was reported in nearly 40% of pregnant women in one study, while persistent high blood pressure occurs in approximately 12—22% of pregnancies. Until recently, the focus remained on treating elevated blood pressure based on the diastolic reading with groups recommending treatment for sustained diastolic blood pressures of greater than 105—110 mmHg. There is now however increasing awareness on the importance of increases in, as well as the absolute values of, systolic blood pressure. Generally, the aim of antihypertensive therapy in women without underlying medical problems is to keep the systolic blood pressure at 130—155 mmHg and diastolic blood pressure at 80—105 mmHg.

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sublingually as it may cause a precipitate fall in blood pressure, which can lead to fetal distress.

- α-Methyldopa (a centrally acting α-adrenergic agonist that inhibits vasoconstricting impulses from the medulla oblongata) has traditionally been the most commonly used agent for the control of blood pressure during pregnancy. Its safety has been well established both in pregnancy and in the long-term follow-up of the infants. One of the most frequent side effects is sedation, which can be profound. This is often poorly tolerated and leads to unpredictable compliance. However, α-methyldopa remains the preferred agent of the National High Blood Pressure Education Programme. Angiotensin-converting enzyme (ACE) inhibitors and angiotensin receptor blockers (ARBs) and diuretics should be avoided in pregnancy. Diuretics may reduce uteroplacental perfusion.

Second- and third-trimester exposure to angiotensin-converting enzyme inhibitors appears to be fetotoxic, producing fetal hypocalvaria and renal defects. The cause of these defects seems to be related to fetal hypotension and reduced renal blood flow. Anuria associated with oligohydramnios can produce fetal limb contractures, craniofacial deformations and pulmonary hypoplasia. Intrauterine growth restriction, prematurity, persistence of a patent ductus arteriosus, severe neonatal hypotension, neonatal anuria and neonatal or fetal death have all been observed with use of these drugs, and they should therefore be discontinued preconceptually or as early in the first trimester as possible. Angiotensin receptor blockers are newer agents that have not been formally studied in pregnancy; they are probably best avoided given their common pathway with ACE inhibitors.

### Pre-eclampsia

**Introduction**

Pre-eclampsia is a potentially life-threatening hypertensive disorder of pregnancy characterized by vascular dysfunction and systemic inflammation involving the brain, liver, and kidneys of the mother. The incidence of pre-eclampsia has risen in countries such as the United States of America but maternal mortality from pre-eclampsia has decreased significantly in the UK since 1992 (Table 2).

Pre-eclampsia is defined by the International Society for the Study of Hypertension in Pregnancy as gestational hypertension of at least 140/90 mmHg on two separate occasions measured at least 4 h apart accompanied by significant proteinuria of at least 300 mg in a 24 h collection of urine, arising de novo after the 20th week of gestation in a previously normotensive woman and resolving completely by the 6th postpartum week. It usually occurs during the second half of pregnancy and complicates 2–8% of pregnancies, depending on population studied. Pre-eclampsia is twice as common in primigravid women as in women having second or later pregnancies. Women who become pregnant with donor eggs are at increased risk of developing pre-eclampsia while particular men are at increased risk of fathering a pre-eclamptic pregnancy. Table 3 highlights other risk factors for pre-eclampsia.

Pre-eclampsia also carries implications in adult life, with offspring of affected pre-eclamptic pregnancies demonstrating poor growth in childhood and an increased risk of hypertension, heart disease and diabetes.

**Pathophysiology of pre-eclampsia**

Pre-eclampsia is thought to result from a combination of impaired trophoblast differentiation and invasion during the first trimester resulting in the failure of trophoblast cells to destroy the muscularis layer of the spiral arterioles resulting in the development of a poorly perfused placenta. However, this reduced placental perfusion alone is not sufficient to cause the maternal syndrome of pre-eclampsia and it is thought that this process requires the influence of additional maternal factors including genetic make-up and environmental factors (such as obesity and diet), which together results in widespread endothelial dysfunction and hypertension.

**Management of pre-eclampsia**

Ideally women at high risk of pre-eclampsia should be reviewed pre-conceptually and advised to take 75 mg of aspirin daily from 12 weeks’ gestation until the birth of their child. Women considered at high risk of pre-eclampsia include those with any of the following:

- hypertensive disease during a previous pregnancy
- chronic kidney disease
- autoimmune disease such as systemic lupus erythematosus or antiphospholipid syndrome

### Numbers of direct deaths attributed to eclampsia and pre-eclampsia and mortality rates per 100,000 maternities; United Kingdom: 1985–2008

<table>
<thead>
<tr>
<th>Triennium</th>
<th>Number</th>
<th>Rate</th>
<th>95 per cent CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985–87</td>
<td>27</td>
<td>1.19</td>
<td>0.82 1.73</td>
</tr>
<tr>
<td>1988–90</td>
<td>27</td>
<td>1.14</td>
<td>0.79 1.66</td>
</tr>
<tr>
<td>1991–93</td>
<td>20</td>
<td>0.86</td>
<td>0.56 1.33</td>
</tr>
<tr>
<td>1994–96</td>
<td>20</td>
<td>0.91</td>
<td>0.59 1.41</td>
</tr>
<tr>
<td>1997–99</td>
<td>16</td>
<td>0.75</td>
<td>0.46 1.22</td>
</tr>
<tr>
<td>2000–02</td>
<td>14</td>
<td>0.70</td>
<td>0.42 1.18</td>
</tr>
<tr>
<td>2003–05</td>
<td>18</td>
<td>0.85</td>
<td>0.54 1.35</td>
</tr>
<tr>
<td>2006–08</td>
<td>19</td>
<td>0.83</td>
<td>0.53 1.30</td>
</tr>
</tbody>
</table>

**Table 2**

**Risk factors for pre-eclampsia**

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Unadjusted relative risk (95% confidence interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age ≥ 40 years, primiparae</td>
<td>1.68 (1.23–2.29)</td>
</tr>
<tr>
<td>Age ≥ 40 years, multiparae</td>
<td>1.96 (1.34–2.87)</td>
</tr>
<tr>
<td>Family history</td>
<td>2.90 (1.70–4.93)</td>
</tr>
<tr>
<td>Nulliparity</td>
<td>2.91 (1.28–6.61)</td>
</tr>
<tr>
<td>Multiple pregnancy</td>
<td>2.93 (2.04–4.21)</td>
</tr>
<tr>
<td>Pre-existing diabetes</td>
<td>3.56 (2.54–4.99)</td>
</tr>
<tr>
<td>Pre-pregnancy body mass index ≥ 35</td>
<td>4.29 (3.52–5.49)</td>
</tr>
<tr>
<td>Previous pre-eclampsia</td>
<td>7.19 (5.85–8.83)</td>
</tr>
<tr>
<td>Antiphospholipid syndrome</td>
<td>9.72 (4.34–21.75)</td>
</tr>
</tbody>
</table>

**Table 3**
• type 1 or type 2 diabetes
• chronic hypertension.

Investigations and monitoring of the suspected pre-eclamptic patient should include:

• Full blood count: this may demonstrate a raised haematocrit (indicating haemoconcentration) and thrombocytopenia (which is an indicator of severe pre-eclampsia). Thrombocytopenia may also occur as a result of HELLP syndrome. (haemolysis, elevated liver enzymes and low platelets).
• Urea and electrolytes: uric acid is a particularly sensitive measure of pre-eclampsia and perinatal outcome, but it is only of clinical significance if the levels are increasing or are very high.
• If the platelet count is normal it is not necessary to perform a coagulation screen (PT, APTT and INR) in cases of non-severe pre-eclampsia and gestational hypertension.
• Urine analysis with a 24 h urine collection or protein creatinine ratio. Significant proteinuria is the most important clinical variable predicting both maternal and perinatal outcome. All pregnant women should be assessed for proteinuria. Urinary dipstick testing may be used for screening for proteinuria when the suspicion of pre-eclampsia is low. The degree of positivity on urine dipstick correlates with the quantity of proteinuria as follows: 1 + = 0.3 g/l, 2 + = 1 g/l and 3 + = 3 g/l.

Considerable observer error may occur with visual dipstick assessment and this may be overcome by the use of automated dipstick readers, which significantly improve both false positive and negative rates. A reading of 1+ or more should prompt further evaluation. Clinically significant proteinuria is defined as a 24-h urine protein excretion of ≥0.3 g and is based on a 95% CI for urinary protein in pregnancy. An elevated protein creatinine ratio of greater than 30 mg/mmol correlates with a 24-h urine excretion greater than 300 mg and may be used to check for significant proteinuria.
• Ultrasound: increased fetal surveillance with ultrasound assessment to evaluate fetal weight, progression of fetal growth, amniotic fluid index and umbilical artery Doppler velocimetry should be performed at the time of diagnosis of pre-eclampsia once every 4 weeks thereafter with more frequent monitoring if any parameters are abnormal.

The pharmacological treatment of pre-eclampsia focuses on controlling maternal hypertension. No drugs in current clinical use beneficially affect the human placenta. As a result, management involves treatment of maternal hypertension and close antenatal supervision of the mother and fetus with timely delivery to prevent deterioration of the mother and fetus. Pre-eclampsia can occasionally be managed conservatively. Maternal and fetal monitoring should continue until fetal maturity has been achieved, at which stage the cervix is assessed with Bishops scoring and, if favourable, induction of labour is carried out.

Patients with pregnancy induced hypertension may be monitored through a combination of general practitioners and hospital day care units. Severe pre-eclampsia necessitates inpatient care with a close monitoring of the symptoms, signs and biochemical parameters. No one definition defines "severe" pre-eclampsia. However, the following features generally indicate the development of severe pre-eclampsia.

• Eclampsia
• Severe hypertension e.g. a systolic blood pressure over 160 mmHg with at least 2+ proteinuria
• Moderate hypertension associated with any of:
  - severe headache with visual disturbance
  - epigastric pain
  - signs of clonus
  - liver tenderness
  - platelet count falling to below 100 × 10⁹/L
  - creatinine 100 mmol/l
  - alanine aminotransferase rising to above 50 iu/L.

In extreme prematurity, transfer to hospital with adequate neonatal facilities (with steroid administration to enhance lung maturity) is indicated. Severe pre-eclampsia presenting prior to fetal viability is an indication for termination of pregnancy.

The optimum time of delivery is of crucial importance and remains a balance between the risks of major complications to the mother and intrauterine growth retardation in the fetus against the risks of delivery and prematurity to the fetus. The mode of delivery is a balance between caesarean section and vaginal delivery. Caesarean section is a better option for rapid deteriorating maternal and fetal condition, or alternatively for those remote from term with an unfavourable cervix. Epidural analgesia may be beneficial by preventing the increase of catecholamine release, in order to prevent further elevations of blood pressure during uterine contractions. It may also allow a more controlled second stage. Evidence from the HYPTITAT Trial suggests that women with gestational hypertension and non-severe pre-eclampsia, should be induced after 37 weeks’ gestation. This was associated with a significant reduction in adverse maternal outcome including progression to pre-eclampsia. Furthermore, no differences were observed in neonatal outcomes or Caesarean section rates.

Oral antihypertensive are discussed above. In severe pre-eclampsia, there are two antihypertensive regimens to choose from:

• Labetolol (200 mg) can be given orally prior to or in the absence of intravenous access; if there is no response within 30 min, a second oral dose can be given. If there is no initial response to oral therapy or if it is not tolerated, a bolus of 50 mg given intravenously over at least 5 min can be administered, repeated to a maximum of 200 mg, at 10-min intervals. Following this, or as treatment for moderate hypertension, a labetolol infusion can be commenced (5 mg/ml at 4 ml/h via a syringe pump, the infusion rate being doubled every 30 min to a maximum of 32 ml (160 mg)/h until the blood pressure has dropped and stabilized at an acceptable level). Labetolol is contraindicated in women with asthma and should be used with caution in cardiac disease.
• Hydralazine is given by bolus infusion (10–20 mg over 10–20 min measuring the blood pressure every 5 min). This may be followed by an infusion (40 mg hydralazine in 40 ml normal saline, which should run at 1–5 ml/h (1–5 mg/h)). Management of hypertension is summarized in Box 2.

In pre-eclampsia, magnesium sulphate is indicated as the first line anticonvulsant. Formal clinical review should occur every 4 h, observing for side effects (motor paralysis, absent reflexes, respiratory depression and cardiac arrhythmia). The antidote is
Management of hypertension in pregnancy

- Screening
  - Women should be screened for signs of hypertension using blood-pressure checks and urinalysis monthly until 30 weeks’ gestation, fortnightly from 30 weeks’ gestation and weekly from 36 weeks’ gestation
  - If elevated BP +/− proteinuria refer for admission or monitoring in antenatal day unit

- Maternal assessment
  - Repeat (at least 4 hourly) blood-pressure measurement
  - Quantitative measurement of protein in urine. (Pre-eclampsia = 0.3 g protein 24 h urine collection)
  - Platelet count, serum uric acid concentration, and tests of liver function (alanine and aspartate aminotransferase levels)
  - Coagulation screen if altered liver function

- Antihypertensive therapy
  - Consider admission, monitor closely and treat if blood pressure is persistently above 160/100 mmHg

- Anticonvulsant therapy
  - If convulsions occur, use magnesium sulphate, intravenously or intramuscularly
  - In cases of severe pre-eclampsia, consider prophylactic magnesium sulphate

- Fetal management
  - Give prophylactic steroids if the duration of gestation is less than 34 weeks
  - Perform an ultrasound assessment of fetal weight on initial presentation and repeat fortnightly
  - Doppler ultrasonographic assessment of umbilical blood-flow velocity if evidence of growth restriction
  - Regular cardiotocography (CTG/non-stress tests)
  - Ultrasonography at least twice a week for liquor volume
  - Multidisciplinary approach regarding timing and mode of delivery

- Postpartum care
  - Continued close monitoring of the mother by experienced carers
  - If on magnesium therapy, continue for at least 24 h postpartum until stable
  - Careful fluid balance (total 80 ml/h intake) and early use of diuretics if pulmonary oedema secondary to fluid overload is suspected
  - Decrease dose of antihypertensive agents as indicated. Avoid sudden cessation immediately postpartum as rebound hypertension likely

- Follow-up
  - Long-term follow-up to make sure that the blood pressure falls (within 6 weeks postpartum), and suitable referral if it does not
  - Discussion about the illness and the significance for the future

Key points in the management of the severe pre-eclamptic patient

- Insert an indwelling catheter and measure hourly urine output until stable
- Record blood pressure and pulse every 15 min until stable and then half hourly
- Oxygen saturation should be measured continuously and charted with the blood pressure. If saturation falls below 95% then medical review is essential to rule out pulmonary oedema and other complications
- Strict fluid balance should be recorded with detailed input and output measurements
- Respiratory rate should be measured hourly. A reducing respiratory rate may indicate magnesium toxicity
- 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 the AVPU or GCS scales
- Fetal well-being should be monitored using a cardiotocography
- Blood tests should be repeated at least every 12 h whilst on the magnesium sulphate protocol. In the event of complications such as haemorrhage or abnormal or deteriorating haematological and/or biochemical parameters more frequent blood tests should be taken e.g. every 4–8 h

Box 3

10 ml 10% calcium gluconate given slowly intravenously. Of the magnesium sulphate, 97% is excreted in the urine. Oliguria (<80 ml/24 h) can thus lead to toxicity. Therefore, in the presence of oliguria, magnesium sulphate should be reduced or withheld. If magnesium is not excreted, levels should not fall. Box 3 highlights key management steps in the treatment of patients with severe pre-eclampsia.

Eclampsia

Eclampsia refers to the occurrence of one or more generalized convulsions and/or coma in the setting of pre-eclampsia and in the absence of other neurological conditions. The UK Obstetric Surveillance System (UKOSS) report gives an estimated incidence of 27.5 cases per 100,000 maternities with a case fatality rate estimated to be 3.1%. This was almost a halving of the incidence of eclampsia since 1992. Eclampsia remains to be associated with significant maternal morbidity, in particular cerebrovascular events (2.3%). The benefit of magnesium sulphate in the prevention of eclampsia has been well demonstrated and...
magnesium sulphate has been shown to halve the risk of eclampsia among women with pre-eclampsia. Box 4 indicates the diagnostic criteria for eclampsia. Cerebral haemorrhage has been reported to be the most common cause of death in patients with eclampsia and stroke is known to be the most common cause of death (45%) in women with HELLP syndrome.

Postpartum management of hypertension in pregnancy

Blood pressure rises progressively over the first 5 postnatal days, peaking on days 3–6 after delivery. Research has focused on the antenatal complications, for both mother and baby, and the risks and benefits of administering antihypertensive therapy prior to delivery. There is very little information on how best to manage postpartum hypertension, regardless of type or severity, to optimize maternal safety and minimize hospital stay. Women with postpartum hypertension may also experience longer hospital stays and possibly, heightened anxiety about their recovery. General NICE recommendations for postnatal care of women with hypertension in pregnancy include stopping methyldopa within 2 days of birth and asking the woman about severe headache and epigastric pain every time BP is measured. In cases of mild or moderate pre-eclampsia platelet count, transaminases and serum creatinine should be measured 48–72 h after birth or step-down. These do not need to be repeated if results are normal. In most cases of gestational hypertension and pre-eclampsia there is a rapid and complete resolution within 6 weeks of delivery of the fetus. Patients requiring antihypertensives can be weaned off slowly and medications should not be stopped suddenly as there may often be a rebound hypertension.

Postnatal follow-up

All women who have had pre-eclampsia should be offered a medical review at the postnatal review (6–8 weeks) after the birth. Women who have had pre-eclampsia should be educated regarding their increased risk of development of cardiovascular disease, renal disease and cardiovascular risk factors for several years following pregnancy and regular blood pressure checks with their general practitioner should be recommended. Women with severe pre-eclampsia have an increased risk of recurrence in their next pregnancy (about 1 in 6 (16%) pregnancies) but the disorder is generally less severe and manifests 2–3 weeks later than in the first pregnancy. This risk increases to about 1 in 4 (25%) pregnancies if the pre-eclampsia was complicated by severe pre-eclampsia, HELLP syndrome or eclampsia and led to birth before 34 weeks. The risk of recurrence is about 1 in 2 (55%) pregnancies if the pre-eclampsia led to birth before 28 weeks’ gestation.

Women with essential hypertension should be encouraged to present for pre-conceptual counselling as antihypertensive medications such as ACE inhibitors are contraindicated in pregnancy and should be changed pre-conceptually. The use of low-dose aspirin in women with chronic hypertension moderately reduces the risk of developing superimposed pre-eclampsia, intrauterine growth retardation and perinatal death, and should be offered to all women at an early booking visit. The findings from the CLASP trial do not support routine treatment with aspirin of all women at risk of pre-eclampsia.

Conclusion

Hypertensive disorders are one of the commonest complications of pregnancy and may be associated with significant maternal and fetal morbidity and mortality. Although the aetiology of these disorders is becoming increasingly better understood interventions to prevent hypertensive disorders of pregnancy have had poor results. The mainstay of treatment remains the use of antihypertensive medications, the use of magnesium sulphate in the prevention of eclampsia and multidisciplinary input to ensure a timely delivery.

FURTHER READING


### Practice points

- Automated blood pressure devices may underestimate the blood pressure in pregnancy and therefore caution should be exercised in their use.
- An appropriately sized blood pressure cuff should be used. If the mid-arm circumference is >33 cm, a large cuff should be used.
- Labetolol remains the antihypertensive of choice. Methyldopa and nifedipine may be used as second or third line agents.

- Systolic blood pressures over 150 mm/Hg should be treated.
- Anaesthetists should anticipate an additional rise in blood pressure at intubation in women with severe pre-eclampsia who are undergoing caesarean section under general anaesthesia and take measures to avoid a speed that compromises maternal wellbeing, even when there are concerns about fetal wellbeing.
- If the platelet count is <20 × 10⁹/L, a platelet transfusion is recommended prior to caesarean section or vaginal delivery.
- Following delivery the patient should be fluid restricted to ≤80 ml total fluid/h until a natural diuresis occurs.
- Syntometrine should not be given for the active management of the third stage if the mother is hypertensive, or her blood pressure has not been checked.
- Postpartum, women should be counselled appropriately regarding their risk of recurrence of pre-eclampsia as well as their increased risk of developing cardiovascular and renal disease.