**Hypertension**

- **Hypertension** is a chronic medical condition in which arterial blood pressure is elevated
  - **Normal**: <130/85
  - **High normal**: 130-139/80-89
  - **Mild (grade 1)**: 140-159/90-99
  - **Moderate (grade 2)**: 160-179/100-109
  - **Severe (grade 3)**: >180/110

- **Epidemiology**: 30% of 45-54 year olds, 70% over 75s – commoner in men than in women

- **Causes**: 1° or “essential” hypertension (90-95% of cases)
  - Primary cause is unknown but risk factors include:
    - Age
    - Visceral obesity, sedentary lifestyle, insulin resistance, alcohol intake, stress/pain
    - Salt/sodium sensitivity
  - **Indications**: +BP/↑↑K, ↓↓BP/↑↑K
  - **Cautions**: atherosclerosis, renovascular disease, aortic stenosis, HCM
  - **Side effects**: hypotension, renal impairment, persistent dry cough, angioedema, rash/urticaria, GI upset, altered LFTs, cholestasis and hepatocellular necrosis, hyperkalaemia

- **Causes**: 2° hypertension
  - **Renal disease**
    - 75% intrinsic e.g. GN, chronic pyelonephritis, PCKD, systemic sclerosis, PAN
    - 25% renovascular e.g. atherosclerotic disease, fibromuscular dysplasia (young women)
  - **Endocrine disease**
    - Cushing’s syndrome (↑↑cortisol), Conn’s syndrome (↑↑aldosterone)
    - Hyperthyroidism, hyperparathyroidism
    - Phaeochromocytoma
    - Acromegaly
  - **Coarctation of the aorta**
  - **Pregnancy-induced hypertension and pre-eclampsia**
  - **Drugs**
    - Prescribed e.g. steroids, OCP/oestrogens, asthma drugs, decongestants/cold remedies, migraine drugs, EPO, ciclosporin, tacrolimus, TCAs
    - Recreational e.g. alcohol, nicotine, caffeine, cocaine, ecstasy, amphetamines, liquorice
  - **Symptoms**
    - Usually asymptomatic and detected on screening (adults should be checked every 5 years)
    - May cause headaches/palpitations or present with signs of underlying causative problem
  - **Investigations**
    - **History**: although patients may be asymptomatic, you need to elicit cardiovascular risk factors and symptoms of secondary causes, and find out more about the patient’s lifestyle
    - **Examination**: only really necessary if you wish to rule out secondary causes e.g. coarctation
    - **Measure BP in both arms**: lying, sitting and standing, “best of 3” BPs or arrange serial BP measurements at home (done by patient over a 5-day period using electronic BP monitor)
    - To identify persistent hypertension make two further appointments for BP assessment
    - **Routine**: U+E and eGFR, fasting cholesterol and lipid profile, fasting glucose, urine dipstick, ECG
    - **Tests for secondary causes** e.g. β-hcG, TFT, PTH, Ca++, IGF-1/GH/prolactin, tox screen, renal US/S/I+ arteriography, urinary free cortisol and 24-hour urinary VMAC (x3)

- **Complications of hypertension are due to end-organ damage:**
  - Cardiovascular disease → AF, MI, valvular disease, heart failure, dissecting aortic aneurysm
    - tests: ECG +/- echo, cardiac enzymes, fasting cholesterol and lipid profile
    - use cardiovascular risk calculators (Joint British Societies) to work out 10 year CV risk
  - Cerebrovascular disease → infarct, haemorrhage, vascular dementia
    - tests: neurological examination and CT/MRI head
  - Peripheral vascular disease
    - tests: PV exam, ABPI, arterial and venous Doppler
  - Renal damage → hypertensive nephrosclerosis
    - tests: U+E, urine for protein + glucose + microscopy, serum creatinine, renal USS
  - Retinal damage → hypertensive retinopathy
    - tests: fundoscopy, visual field testing
  - Progression to malignant hypertension

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**Drugs used to treat Hypertension**

1) **Angiotensin converting enzyme inhibitors: enalapril, lisinopril, ramipril**
   - Inhibit angiotensin converting enzyme to prevent angiotensin-II mediated vasoconstriction and aldosterone production
   - **Indications**: heart failure, LV dysfunction, established IHD, post-MI, diabetic nephropathy
   - **Significant drug interactions**: diuretics → ↓↓BP/↑↑K, ciclosporin →↑↑K, ↑↑ lithium levels
   - **Cautions**: diuretics, atherosclerosis, renovascular disease, aortic stenosis, HCM
   - **Contraindications**: renal disease, hypersensitivity to ACEIs, ↑↑K, pregnancy, breastfeeding
   - **Side effects**: profound hypotension, renal impairment, persistent dry cough, angioedema, rash/urticaria, GI upset, altered LFTs, cholestasis and hepatocellular necrosis, hyperkalaemia

2) **Angiotensin-II receptor antagonists: valsartan, irbesartan, candesartan, losartan**
   - Same effect as above by directly blocking a-II instead of inhibiting its production
   - **Indications**: as above, those who can’t tolerate ACEIs
   - **Contraindications**: as above, plus valve disease and cardiomyopathy
   - **Side effects**: renal failure, others much less than ACEs due to ↓ interference with bradykinins

3) **Beta adrenoceptor blockers: atenolol, metoprolol**
   - Block beta adrenoceptors to induce vasodilation, reduce cardiac output and alter baroreceptors
   - Effective at reducing BP, but other antihypertensives are better for reducing CV mortality, and there are also concerns that beta-blockers increase risk of diabetes
   - **Indications**: angina, post-MI, tachycardia, heart failure, young women, sympathetic drive
   - **Contraindications**: asthma, COPD, heart block, hyperlipidaemia, physically active
   - **Side effects**: fatigue, cold extremities, sleep disturbance, bronchospasm, arrhythmias, hypotension, sexual dysfunction, exacerbation of Raynaud’s and intermittent claudication

4) **Calcium channel blockers: amlodipine, nifedipine, diltiazem**
   - Effective at reducing BP, but other antihypertensives are better for reducing CV mortality, and there are also concerns that beta-blockers increase risk of diabetes
   - **Indications**: angina, post-MI, tachycardia, heart failure, young women, sympathetic drive
   - **Contraindications**: asthma, COPD, heart block, hyperlipidaemia, physically active
   - **Side effects**: flushing, headache, ankle swelling, bradycardia, heart block

5) **Diuretics**: frusemide, bendroflumethiazide, spironolactone, eplerenone
   - Increase kidney diuresis and eliminate excess salt and water from blood
   - **Indications**: heart failure, hypertension, edema, obesity
   - **Contraindications**: pregnancy, lactation, hyperkalaemia, hypotension, renal impairment
   - **Side effects**: hypotension, electrolyte disturbances e.g. hypokalaemia, hyperglycaemia, gout, dyslipidaemias, incontinence, sexual dysfunction, myalgias, increased calcium levels

6) **Alpha adrenoceptor blockers: prazosin, doxazosin, terazosin, alfuzosin**
   - Act to block post-synaptic alpha adrenoceptors and reduce blood pressure
   - **Indications**: hypertension, benign prostatic hyperplasia, hypertension in pregnancy
   - **Contraindications**: pregnancy, lactation, hypotension, renal impairment
   - **Side effects**: hypotension, dizziness, postural hypotension

7) **Centrally acting antisympathetics: methyldopa, clonidine, moxonidine**
   - Inhibit dopa-decarboxylase to reduce dopaminergic and adrenergic neurotransmission in the peripheral nervous system, and also inhibits sympathetic output
   - **Indications**: hypertension, Parkinsonism, bradycardia, oedema, sedation
   - **Contraindications**: postural hypotension, severe hypotension, diabetes
   - **Side effects**: postural hypotension, sedation

8) **Smooth muscle relaxants: hydralazine**
   - **Indications**: hypertension, failure, heart failure, renal failure
   - **Contraindications**: pregnancy, breastfeeding, lactation
   - **Side effects**: hypotension, vasodilatation

9) **Renin inhibitors: aliskiren**
   - **Indications**: hypertension, hyperkalaemia, renal impairment
   - **Contraindications**: pregnancy, breastfeeding, lactation
   - **Side effects**: hypotension, renal impairment

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**Treatment Strategies**

- **Lifestyle modifications are very important and can reduce systolic BP by up to 10mmHg**
  - Reduce alcohol and caffeine intake, stop smoking (may need nicotine replacement therapy)
  - Low fat, low salt diet
  - Low GI diet (i.e. complex slow-release carbohydrates) with plenty of fruit and vegetables (5-a-day)
  - Regular exercise and weight loss
  - Relaxation therapy if stress is a contributing factor
  - Patients need support and regular follow-up to monitor the effect of changes on their BP

- **Drug treatment (new NICE guidelines for hypertension released August 2011) is indicated in:**
  - All patients with persistent hypertension >160/100
  - Hypertension >140/90 with CV disease, end organ damage, diabetes, or 10yr CV risk of >20%
  - Target BP of ≤140/90, except in diabetes/renal disease where target is ≤130/80

**Malignant/Accelerated Hypertension**

- **This is severe hypertension (>180/110) resulting end-organ damage e.g. encephalopathy, nephropathy, retinopathy with papilloedema, exudates and haemorrhages, and angiopathic haemolytic anaemia**

- **Epidemiology:** approximately 1% of patients with essential hypertension, men>women, average age 40

- **Risk factors:** black ethnic origin, cigarette smokers, secondary hypertension e.g. phaeo, renal disease

- **May be secondary to raised renin levels** e.g. renal disease, phaeo, Conn’s, renin tumours, PIH

- **May present with:**
  - Severe headache and visual disturbance
  - Seizures
  - Nausea and vomiting
  - Oliguria and renal failure
  - Palpitations and chest pains/MI
  - Haemolysis and DIC (may present with haemorrhage)
  - Encephalopathy and confusion
  - Haemorrhagic stroke, subarachnoid haemorrhage

- **Urgent referral and investigation**
  - Full history including PMHx, FHx and DHx, full systemic enquiry
  - Full examination including detailed BP assessment, fundoscopy and neurological assessment
  - Bloods: FBC, clotting, U+E, creatinine, LFT, TFT, fasting glucose, fasting lipid profile, troponins, plasma renin, aldosterone and catecholamines, +/- autoantibodies e.g. anti-nuclear factor
  - Urine: dipstick, pregnancy test, renal function e.g. eGFR or creatinine clearance, 24hr VMAC
  - ECG, CXR, CT/MRI of head, kidneys or adrenals if indicated

- **Beta blockers** are used less now due to their limited reduction of CV events and risk of T2DM
  - Use in younger patients, those who cannot tolerate ACEIs/ARBs, and those with compelling indications or comorbidities e.g. angina, post-MI, tachyarrhythmias, increased sympathetic drive

- **Follow-up**
  - Patients require regular assessments of BP control, cardiovascular risk and end organ status
  - Also need to monitor for drug complications e.g. ACEIs/ARBs → renal impairment → monitor U+E
  - Routine tests include urine dipstick, U+E, creatinine, fasting glucose and lipid profile, and ECG

- **Reduction of cardiovascular risk**
  - All patients should have their 10 year cardiovascular risk calculated
  - Hypertension is only one of the risk factors for cardiovascular disease; others also need tackling
  - Primary prevention (if end organ damage, diabetes or CV risk >20%): aspirin 75mg daily, statin
  - Secondary prevention (if already had MI); aspirin +/- clopidogrel, statin, beta-blocker, ACEI
  - No benefits have been shown from vitamin supplementation or antioxidant therapy

**Hypertension in Pregnancy**

- **Patients may have pre-existing hypertension or pregnancy-induced hypertension (PIH)**
  - Many antihypertensive drugs are contraindicated in pregnancy:
    - ACEIs/ARBs → teratogenic skull defects, oligohydramnios, intrauterine death
    - BBs → IUGR
    - CCBs → generally considered safe ∅
    - Diuretics → neonatal thrombocytopenia (considered safe at low doses if patient already on them)

- There are well-defined management strategies using different drugs:
  - Treat if BP >160/100 or >140/90 with risk factors (same as essential hypertension)
  - **First line:** methyldopa +/- hydralazine
  - **Second line:** labetolol/nifedipine

- **It is also important to think holistically about the impact of hypertension on the pregnancy:**
  - Increased risk of placental abruption
  - Increased risk of pre-eclampsia
  - Monitor BP closely and refer if >160/100 for secondary antenatal care
  - Monitor urine for protein
  - Monitor foetal: regular CTG, USS +/- uterine artery Doppler
  - Look out for epigastric pain, vomiting, headaches, visual disturbance, increasing oedema, hypertension, seizures

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