Hypertension: Diagnosis and Management

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GPST2
Outline

• Diagnosis
• Staging
• Aetiology
• Guidelines
• Antihypertensives
Diagnosing hypertension

• In clinic
  – If a BP reading is $\geq 140/90$ mmHg
    • patients should be offered ABPM to confirm the diagnosis.

  – If a BP reading of $\geq 180/110$ mmHg
    • immediate treatment.
Ambulatory blood pressure monitoring (ABPM)

• at least 2 measurements per hour during the person's usual waking hours
  – (for example, between 08:00 and 22:00)

• use the average value of at least 14 measurements
If ABPM is not tolerated or declined .......

- HBPM should be offered.
  - BP should be recorded twice daily, ideally in the morning and evening
  - for each BP recording, two consecutive measurements need to be taken, at least 1 minute apart and with the person seated
  - BP should be recorded ideally for 7 days (Minimum 4 days)
  - Discard the measurements taken on the first day and use the average value of all the remaining measurements
# Blood pressure classification

<table>
<thead>
<tr>
<th>Stage</th>
<th>Criteria</th>
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<tbody>
<tr>
<td><strong>Stage 1 hypertension</strong></td>
<td>Clinic BP $\geq$ 140/90 mmHg and subsequent ABPM or HBPM average BP $\geq$ 135/85 mmHg</td>
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<tr>
<td><strong>Stage 2 hypertension</strong></td>
<td>Clinic BP $\geq$ 160/100 mmHg and subsequent ABPM or HBPM average BP $\geq$ 150/95 mmHg</td>
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<tr>
<td><strong>Severe hypertension</strong></td>
<td>Clinic systolic BP $\geq$ 180 mmHg, or clinic diastolic BP $\geq$ 110 mmHg</td>
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Managing hypertension

Lifestyle advice:
• a low salt diet is recommended, aiming for less than 6g/day, ideally 3g/day.
  – (The average adult in the UK consumes around 8-12g/day of salt.
  – A recent BMJ paper showed that lowering salt intake can have a significant effect on blood pressure. i.e. reducing salt intake by 6g/day can lower systolic blood pressure by 10mmHg
• caffeine intake should be reduced
• stop smoking,
• drink less alcohol,
• eat a balanced diet rich in fruit and vegetables,
• exercise more,
• lose weight
Managing hypertension

• If ABPM is normal - NICE recommend offering to measure the patient's blood pressure at least every 5 years.

• **Stage 1 hypertension** (ABPM/HBPM $\geq 135/85$ mmHg)
  - treat if:
  - < 80 years of age AND any of the following apply;
    • target organ damage,
    • established cardiovascular disease,
    • renal disease,
    • Diabetes
    • 10-year cardiovascular risk equivalent to 20% or greater.

Note: If >80 years of age - do not treat stage 1 hypertension
Managing hypertension

• Stage 2 Hypertension.
  – ABPM/HBPM $\geq$ 150/95 mmHg.

  – offer drug treatment regardless of age

• For patients $< 40$ years consider specialist referral to exclude secondary causes.
Hypertension: secondary causes

**Renal** - accounts for 80% of secondary hypertension
- glomerulonephritis
- pyelonephritis
- adult polycystic kidney disease
- renal artery stenosis

**Endocrine disorders**
- Cushing's syndrome
- primary hyperaldosteronism including Conn's syndrome
- congenital adrenal hyperplasia (11-beta hydroxylase deficiency)
- phaeochromocytoma
- acromegaly

**Others**
- NSAIDs
- pregnancy
- coarctation of the aorta
- the combined oral contraceptive pill
- steroids
- MAOI
## Blood pressure targets

<table>
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<tr>
<th>Age</th>
<th>Clinic BP</th>
<th>ABPM / HBPM</th>
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<tbody>
<tr>
<td>Age &lt; 80 years</td>
<td>140/90 mmHg</td>
<td>135/85 mmHg</td>
</tr>
<tr>
<td>Age &gt; 80 years</td>
<td>150/90 mmHg</td>
<td>145/85 mmHg</td>
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</tbody>
</table>
Summary of antihypertensive drug treatment

Aged under 55 years

Step 1
A

Step 2
A + C

Aged over 55 years or black person of African or Caribbean family origin of any age

Step 1
C

Step 2
C + D

Step 3

Resistant hypertension

A + C + D + consider further diuretic or alpha-blocker or beta-blocker
Consider seeking expert advice

I.e. Amlodipine, Diltiazem
Note: If cant tolerate CCB – Consider Thiazide-like diuretic. (chlorthalidone or indapamide)

I.e. Low dose spironolactone or high dose thiazide-like diuretic.
Renin-angiotensin-aldosterone system

Water and salt retention. Effective circulating volume increases. Perfusion of the juxtaglomerular apparatus increases.
Angiotensin-converting enzyme inhibitors

• First-line treatment in younger patients with hypertension and are also extensively used to treat heart failure.

• Less effective in treating hypertensive Afro-Caribbean patients.

• Also used to treat diabetic nephropathy and have a role in secondary prevention of ischaemic heart disease.

Mechanism of action:
• inhibit the conversion angiotensin I to angiotensin II
Angiotensin-converting enzyme inhibitors

Side-effects:
- cough: occurs in around 15% of patients and may occur up to a year after starting treatment.
  - Thought to be due to increased bradykinin levels
- angioedema: may occur up to a year after starting treatment
- hyperkalaemia

Cautions and contraindications
- pregnancy and breastfeeding - avoid
- renovascular disease - significant renal impairment may occur in patients who have undiagnosed bilateral renal artery stenosis
- aortic stenosis - may result in hypotension
- Hereditary idiopathic angioedema
Angiotensin-converting enzyme inhibitors

Monitoring

• U+E’s should be checked before treatment is initiated and after increasing the dose.

• a rise in the creatinine and potassium may be expected after starting ACE inhibitors.
  – Acceptable changes are an increase in serum creatinine, up to 30%* from baseline and an increase in potassium up to 5.5 mmol/l*.

• The NICE CKD guidelines suggest that a decrease in eGFR of up to 25% or a rise in creatinine of up to 30% is acceptable.
Angiotensin II receptor blockers

• Generally used in situations where patients have not tolerated an ACE inhibitor, usually due to the development of a cough.

Examples
- Candesartan 8-32mg OD
- Losartan 50-100mg OD
- Irbesartan 75-300mg OD

Like ACE inhibitors they should be used with caution in patients with renovascular disease.

Side-effects include hypotension and hyperkalaemia.

Mechanism
• block effects of angiotensin II at the AT1 receptor
# Calcium channel blockers

<table>
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<tr>
<th>Examples</th>
<th>Indications &amp; notes</th>
<th>Side-effects and cautions</th>
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</table>
| **Verapamil**         | Angina, Hypertension, Arrhythmias  
Highly negatively inotropic  
**Should not be given with beta-blockers as may cause heart block** | Heart failure, constipation, hypotension, bradycardia, flushing |
| **Diltiazem**         | Angina, Hypertension  
Less negatively inotropic than verapamil but caution should still be exercised when patients have heart failure or are taking beta-blockers | Hypotension, bradycardia, heart failure, ankle swelling        |
| **Dihydropyridines**  | Hypertension, Angina, Raynaud's  
Affects the peripheral vascular smooth muscle more than the myocardium and therefore do not result in worsening of heart failure | Flushing, headache, ankle swelling                            |
| *(Nifedipine, amlodipine, felodipine)* |                                                                                 |                                                               |
Thiazide-like diuretics

• NICE now advocate using either chlorthalidone (12.5-25.0 mg once daily) or indapamide (1.5 mg modified-release once daily or 2.5 mg once daily) in preference to a conventional thiazide diuretic such as bendroflumethiazide

• Inhibit reabsorption of Na\(^+\) and Cl\(^-\) ions from the distal convoluted tubules by blocking the Na\(^+\)-Cl\(^-\) cotransporter.

• Adverse effects-glucose intolerance, hypokalaemia, metabolic acidosis a 1% increase in cholesterol, gout, impotence
Spironolactone

• Step 4 treatment
  – consider further diuretic treatment
  – if potassium < 4.5 mmol/l and no other contraindications add spironolactone 25mg OD

• Aldosterone antagonist

• Contraindications-Hyperkalaemia, severe renal impairment, pregnancy, breast feeding, Addison’s and porphyria
Alpha Blockers

• **Step 4 treatment**
  – if further diuretic therapy is not tolerated, or is contraindicated or ineffective, consider an alpha- or beta-blocker

• The Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial was a large randomised controlled trial that was started in 1994 and reported in 2002.

• **ALLHAT** compared amlodipine, chlorthalidone, lisinopril and doxazosin. Over 40,000 patients aged 55 years or older who had hypertension with one other risk factor (for example diabetes) were included in the trial.

• Landmark trial due to the large size and inclusion of minority groups such as people of Afro-Caribbean descent.

• **Results**
  – Chlorthalidone outperformed lisinopril in preventing cardiovascular disease, a surprising finding which has been debated since (particularly in relation to the large number of black patients in the trial (ACE inhibitors are known to be less effective in this group)
  – Doxazosin arm was stopped prematurely due to a higher incidence of heart failure
  – 60% of patients reached the target blood pressure of 140/90 mmHg (it was generally thought prior to the trial that blood pressure targets were more difficult to achieve)
Beta blockers

• **ASCOT trial 2003**
  • The 2003 Anglo-Scandinavian Cardiac Outcomes Trial - Blood Pressure Lowering Arm was a double-blinded, randomised controlled trial of around 20,000 patients with hypertension and other risk factors. Patients were randomised to either atenolol (with the addition of bendroflumethiazide if needed) or amlodipine (with the addition perindopril if needed). The primary outcome was non-fatal myocardial infarction (MI) and fatal ischaemic heart disease (IHD).
  • Results
    – the study was stopped prematurely because of a higher death rate in the atenolol assigned group
    – the group receiving amlodipine-based regimes had a non-significant 10% reduction in primary outcomes (non-fatal MI plus fatal IHD) and significant reductions in nearly all secondary cardiovascular endpoints and new-onset diabetes
  • The trial resulted in a major shift away from the use of beta-blockers in the management of hypertension
Newer drugs

• Direct renin inhibitors
  — e.g. Aliskiren (branded as Rasilez)
• Inhibiting renin blocks the conversion of angiotensinogen to angiotensin I
• no trials have looked at mortality data yet. Trials have only investigated fall in blood pressure. Initial trials suggest aliskiren reduces blood pressure to a similar extent as angiotensin converting enzyme (ACE) inhibitors or angiotensin-II receptor antagonists
• adverse effects were uncommon in trials although diarrhoea was occasionally seen.
• Risk of angioedema and renal dysfunction
• Contraindicated in combination with ACEi or ARBs in patients with diabetes and patients with eGFR<60. Not recommended in combination with ACEi and ARB or patients with a eGFR<30
• only current role would seem to be in patients who are intolerant of more established antihypertensive drugs
Summary

- Diagnosis clinic $\geq 140/90$ and subsequent ABPM or HBPM average BP $\geq 135/85$
- Lifestyle, lifestyle, lifestyle!
- Treat stage 1 if high risk
- Offer drug treatment in stage 2
- Consider immediate treatment for stage 3 hypertension
- A or C, A+C, A+C+D approach
Thank you
HTN in Diabetes

Shiv Sriranjan
Tina Swampillai
• Measure BP at least annually in those with DM.
• However, every
  – 1 month if BP is higher than 150/90 mmHg
  – 2 months if BP is higher than 140/80 mmHg
  – 2 months if BP is higher than 130/80 mmHg and there is kidney, eye or cerebrovascular damage.
• Offer lifestyle advice (diet and exercise) at the same time.
• Add medication if lifestyle does not bring BP <140/80 (or 130/80 if end organ damage)

• Monitor 1-2 monthly and intensify treatment to bring BP persistently under 140/80 or 130/80 with renal disease etc

• 1st line medication is ACEi/ARBs
  – (unless afro-caribbean- or woman of child bearing age)
  – In Afrocarribean population – first line is ACE Inhibitor + diuretic / or CCB
  – In woman of child bearing age –first line is CCB

• CHECKING BP every 4-6 months recommended for those who have achieved/maintained their target BP level.
### Functional Categories of Older People with Diabetes

**Category 1: Functionally Independent**
- Living independently and have no impairments of ADL

**Category 2: Functionally Dependent**
- Have impairments of ADL and at risk of admission to a care home
  - **Subcategory A: Frail**
    - Severe restriction in mobility & strength and high falls risk
  - **Subcategory B: Dementia**
    - Cognitive impairment, disorientation, personality change & unable to self-care

**Category 3: End of Life Care**
- Significant medical illness or malignancy and have a life expectancy of less than 1 year

### Functional Category | Usual HbA1C Target (%) | Usual BP Target (mmHg) | Management of Lipids
--- | --- | --- | ---
Functionally Independent | 7.0-7.5 | <140/90 | Actively manage to reduce CV risk
Functionally Dependent | 7.0-8.0 | <140/90 | Actively manage to reduce CV risk
Frail | Up to 8.5 | <150/90 | Statin use as clinically indicated
Dementia | Up to 8.5 | <140/90 should be attempted | Consider appropriateness of statin in non-atherosclerotic dementia
End of Life Care | Avoid symptomatic hyperglycaemia | Strict BP control not necessary; consider stopping therapy | Lipid control not necessary; consider stopping therapy
Current evidence suggests a target of \(<140/80\text{mmHg}\) is generally more effective than less intensive treatment. More aggressive BP targets are associated with adverse cardiovascular outcomes.

All drug classes can be used, however drug regimen should encompass \textbf{ACEI} or \textbf{ARB}; current evidence suggests that ACEI/ARB use in normoalbuminuric patients with T2DM slows development of microalbuminuria ([Kidney Int 2012;81:674-683 (Ia)])
Management of Diabetic Nephropathy

Microalbuminuria – earliest sign of diabetic renal disease which then can progress to proteinuria and end stage renal failure.

30% of type 1 diabetics develop diabetic nephropathy

25% of type 2 diabetics develop CRF

90% of patients with diabetic nephropathy have diabetic retinopathy.

Current evidence suggests that using ACE/ARB in T2DM patients with normal Albumin slows the development of microalbuminuria

Kidney International 2012;81) 674-683
Hyperglycemia → Retinopathy → Increased glomerular filtration rate → Microalbuminuria → Frank proteinuria → Decreased glomerular filtration rate → Possible development of nephrotic syndrome → Endstage renal disease
• Check annual urinary Albumin: creatinine (ACR)

• Ask all patients to bring in a first pass morning pass urine sample –
  * excludes orthostatic hypotension
  * theoretically more accurate 24hr albumin collection

• White top bottle

• Annual serum creatinine (eGFR) around the same time

**MICROALBUMINURIA**
two samples needed

> 2.5mg/mmol  - abnormal in men
> 3.5 mg/mmol - abnormal in women

If abnormal 1\textsuperscript{st} ACR repeat 2 further times in the next 3-4 months this is to avoid is to avoid irreversible nephropathy
False +ves of ACR consider

- UTI
- strenuous exercise
- Glomerulonephritis

If persistently high ACR – check for retinopathy

If no evidence of retinopathy then – look to see if elevated BP/persistently high despite maximum treatment, or microscopic haematuria

If this is the case, consider other causes of proteinuria and renal referral
If there is an **abnormal ACR start ACE Inhibitors** at the maximum dose tolerated:

**Step 1:** Start Ramipril 2.5mg od (if creatinine < 150 and Na > 130)

**Step 2:** check U&Es one week later

**Step 3:** increase to 5mg od then recheck U&Es in 3 weeks

**Step 5:** increase to 10mg and check U&Es annually thereafter

**Target blood pressure is < 130/80 mmHg with evidence of diabetic nephropathy**

or lower (<125/75 mmHg) when there is proteinuria >= 1g/24h

BP reduction and ACE inhibitors/ARBs lead to a reduction in the rate of renal decline.

*From Hope Study Heart Outcomes Prevention Evaluation Evaluation Jensen 2000 & BNF*
Diabetic Retinopathy

Examine patients eyes of T1/T2 DM at time of diagnosis

Then annually thereafter, includes those registered as partially sighted.

Key points..

good glycaemic control , target HBA1c – 53mmol

Tight BP control < 130/80

NICE (February 2002). Management of type 2 diabetes - Retinopathy - screening and early management.