1. Introduction to Hypertension

Definition: What is hypertension?

Normal vs. high blood pressure ranges (e.g., normal: <120/80 mmHg, high: ≥130/80 mmHg).

Importance of blood pressure in overall health.

2. Causes and Risk Factors

Primary (Essential) Hypertension – No identifiable cause, develops over time.

Secondary Hypertension – Due to underlying conditions (kidney disease, hormonal disorders, medications).

Risk factors:

Modifiable (diet, obesity, smoking, alcohol, stress, lack of exercise).

Non-modifiable (age, genetics, ethnicity, gender).

3. Symptoms and Diagnosis

Often called the "silent killer" (asymptomatic in many cases).

Symptoms (if present): headaches, dizziness, nosebleeds, vision problems, chest pain.

Diagnosis:

Blood pressure measurement (sphygmomanometer).

Ambulatory BP monitoring (24-hour monitoring).

Additional tests (blood tests, ECG, echocardiogram) if needed.

4. Complications of Uncontrolled Hypertension

Cardiovascular diseases (heart attack, stroke, heart failure).

Kidney damage (chronic kidney disease).

Vision problems (hypertensive retinopathy).

Cognitive issues (vascular dementia).

5. Prevention and Lifestyle Modifications

Healthy diet (DASH diet, low sodium, high potassium).

Regular physical activity (150 min/week of moderate exercise).

Weight management and BMI control.

Limiting alcohol and quitting smoking.

Stress management techniques (meditation, deep breathing, yoga).

6. Medical Management and Treatment

Classes of antihypertensive medications:

Diuretics

Beta-blockers

ACE inhibitors

alcium channel blockers

ARBs (Angiotensin II Receptor Blockers)

Importance of medication adherence.

7. Monitoring and Long-Term Management

Regular BP checks at home or clinic.

Maintaining a healthy lifestyle to prevent complications.

Importance of follow-ups with healthcare providers.

CARDIAC

CALCIUM CHANNEL BLOCKERS

Drugs
- Amlodipine
- Diltiazem
- Verapamil

Uses
- Hypertension
- Angina
- Arrhythmias

Side Effetcs
- Constipation
- Headache
- Peripheral Edema

Considerations
- Advise patients to avoid grapefruit juice, which can increase drug levels.
- May cause gingival hyperplasia; emphasize importance of good oral hygiene.

BETA BLOCKERS

Drugs
- Metoprolol
- Atenolol
- Carvedilol

Uses
- Hypertension
- Heart failure
- Arrhythmias

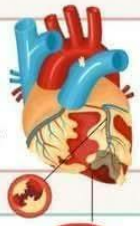
Side Effetcs
- Bradycardia
- Fatigue
- Bronchospasm

Considerations
- Monitor heart rate and blood pressure regularly. Gradual dose titration is often necessary.
- May mask hypoglycemia symptoms in diabetic patients; educate on the importance of blood glucose monitoring.

ACE INHIBITORS

Drugs
- Lisinopril
- Enalapril
- Ramipril

Uses
- Hypertension
- Heart failure
- Diabetic nephropathy



Side Effetcs
- Dry cough
- Angioedema
- Hyperkalemia

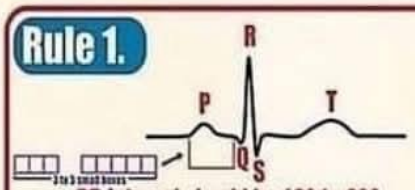
Considerations
- Monitor renal function and potassium levels, especially when initiating therapy or changing doses.
- Strictly contraindicated in pregnancy due to risk of fetal harm; counsel women of childbearing age.

Beta Blocker Approximate Dose Equivalents

Carvedilol 12.5 mg BID	Bisoprolol 5 mg daily
Labetalol 100 mg BID	Metoprolol 50 mg BID
Propranolol 40 mg BID	Propranolol LA 80 mg daily
Atenolol 50 mg daily	Metoprolol SR 100 mg daily

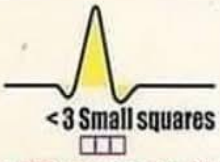
10 RULES OF A NORMAL ECG

Rule 1.



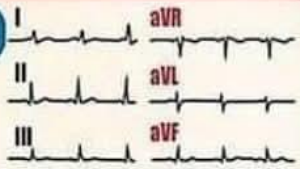
PR interval should be 120 to 200 milliseconds or 3 to 5 little squares.

Rule 2.



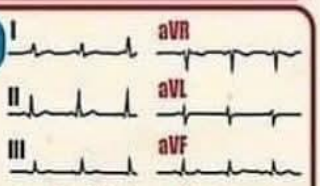
The width of the QRS complex should not exceed 110ms, less than 3 little squares.

Rule 3.



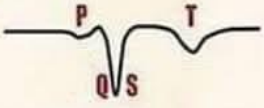
The QRS complex should be dominantly upright in leads I and II.

Rule 4.



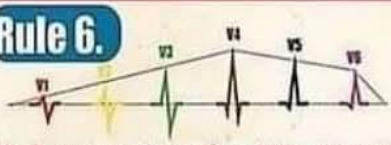
QRS and T waves tend to have the same direction in the limb leads.

Rule 5.



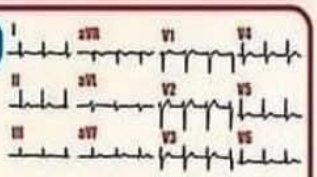
All waves are negative in lead aVR

Rule 6.



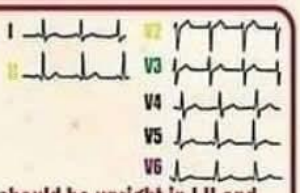
The R wave must grow from V1 to at least V4
The S wave must grow from V1 to at least V3 and disappear in V6

Rule 7.



The ST segment shouls start isoelectric except in V1 and V2 where it may be elevated.

Rule 8.

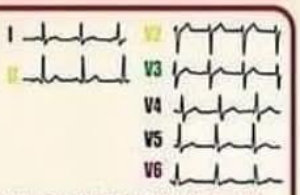


The P waves should be upright in I,II,and V2 to V6

Rule 9.

There should be no Q wave or only a small q less then 0.04 seconds in width in I,II,V2 to V6.

Rule 10.



The T wave must be upright in I,II, V2 to V6

II-Tips and Tricks in Use of Betablockers

1-All betablockers can cause reduction in HDL level except carvedilol.

2-All betablockers can cause hypertriglyceridemia except carvedilol.

3-The betablocker of the choice in renal patients on dialysis+ Heart failure is carvedilol.

4-Target dose of carvedilol is patients with heart failure with reduced ejection fraction (HFrEF) is 25mg twice (50mg twice) if body weight 85Kg or more.

5-The best antihypertensive effect among betablockers is observed with carvedilol and Nebivilol.

6-The best rate controlling effect among betablockers is observed with bisoprolol and metoprolol.

7-The most selective beta1 blocker is Nebivilol, so it the most suitable for patients with asthma or COPD.

8-The lowest incidence of erectile dysfunction among betablockers is observed with Nebivilol.

9-Betablocker can control heart rate in AF during rest and exercise (while digoxin control HR at rest only).

10-Betablockers are considered the fifth antihypertensive drug (after ACEI, ARBs, CCB, thiazide diuretics) except in pregnancy, Arrhythmias (AF), angina or Heart failure in these cases, Betablocker can be used as first line for hypertension.

Tips and Tricks in Use of Angiotensin-Converting Enzyme Inhibitors (ACE inhibitors) and Angiotensin II Receptor Blockers (ARBs)

ACE inhibitors and ARBs share most indications and contraindications:

Indications for ACE inhibitors/ARBs	Contra-indications for ACE inhibitors/ARBs
• Hypertension (HTN), alone or in combination with diuretic or calcium-channel blocker. • Heart failure or asymptomatic left ventricular dysfunction. • Secondary prevention of coronary artery disease. • Diabetes mellitus and diabetic nephropathy.	• Severe aortic stenosis. • Severe hyperkalaemia. • Symptomatic hypotension. • Renovascular hypertension (bilateral renal artery stenosis or stenosis of the artery to a single functioning kidney). • Pregnancy. • Angio-oedema.

ACE inhibitors/ARBs are not contraindicated, but should be used with caution for:

- Moderate renal insufficiency (serum creatinine <3 mg/dL).
- Mild hyperkalaemia (K^+ <5.5 mEq/L).
- Asymptomatic hypotension.

Practical tips & tricks on when and how to change from ACE inhibitors to ARBs

- When RAAS blockade is indicated, ACE inhibitors should be used as first-line treatment.
- There are currently no compelling indications for the use of ARBs routinely as first-line treatment.
- The combination of ACE inhibitors/ARBs is contraindicated in the vast majority of patients.
- When RAAS blockade is needed but ACE inhibitors are not well tolerated due to a persistent dry cough, ARBs can be considered as an alternative (ARBs should be avoided as an alternative to ACE inhibitors in patients who develop severe renal insufficiency or hyperkalaemia as adverse effects of this treatment).
- In case of a switch from ACE inhibitors to ARBs, it seems reasonable to stop ACE inhibitors and start ARBs the following day at an equivalent dose.

Important notes on use of ACE inhibitors/ARBs

- Check renal function, electrolytes and drug interactions.
- Potassium-sparing diuretics, potassium supplements or salt substitutes may lead to an increase in serum potassium and serum creatinine.
- Non-steroidal anti-inflammatory drugs use may lead to increased risk of renal impairment and loss of antihypertensive effect.
- Start at low doses and increase gradually (after at least 2 weeks) until the target dose is achieved.
- Monitor renal function and serum potassium closely.
- Common adverse effects: dry cough, hypotension, deterioration of renal function, hyperkalaemia.

Hypertension Management

Based on the 2017 ACC/AHA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults

Blood Pressure Categories

BP Category	Systolic BP (mmHg)		Diastolic BP (mmHg)
Normal Blood Pressure	<120	AND	<80
Elevated Blood Pressure	120-129	AND	<80
Stage 1 Hypertension	130-139	OR	80-89
Stage 2 Hypertension	≥140	OR	≥90

Use average of **≥2 BP readings** obtained on **≥2 occasions**

Hypertension Treatment Goals

Goal for all **ages <65 years** with hypertension, regardless of chronic comorbidities, if tolerated is **<130/80 mmHg**

BP goal for **ages ≥65 years** is **<130 mmHg** (SBP)

Reasonable to adjust BP goal based on patient factors including: high comorbidity burden, life expectancy, clinical judgment, patient preference,

Hypertension Treatment Algorithm

Normal BP
<120/<80 mmHg

- Promote healthy lifestyle habits
- Reassess Annually

Elevated BP
120-129/<80 mmHg

- Nonpharmacological interventions
- Reassess in 3-6 months

Stage 1 Hypertension
SBP 130-139 or DBP 80-89 mmHg

Clinical CVD, estimated 10-year ASCVD risk of ≥10%?

No

- Nonpharmacological interventions
- Reassess in 3-6 months

Yes

- Nonpharmacological interventions
- \+ Drug treatment for BP reduction
  - Ideally use first-line agents, otherwise those preferred for existing comorbidities, or based on tolerability
- Reassess BP & adherence in 1 month; assess tolerability sooner as needed

If BP is above goal

- Titrate dose as tolerated
- If dosing is optimized then add additional drug; first use either first-line agents, those preferred for existing comorbidities, or based on tolerability
- Do not combine ACEI, ARB, or aliskiren

Stage 2 Hypertension
SBP ≥140 or DBP ≥90 mmHg

- Nonpharmacological interventions
- \+ Drug treatment for BP reduction
  - Consider 2 agents from different drug classes, especially if BP >20/10 mmHg above goal
  - Use first-line agents, those preferred for existing comorbidities, or based on tolerability
  - Do not combine ACEI, ARB, or aliskiren
- Reassess BP & adherence in 1 month; assess tolerability sooner as needed

If BP is above goal

- Titrate dose as tolerated
- If dosing is optimized then add additional drug; first use either first-line agents, those preferred for existing comorbidities, or based on tolerability
- Do not combine ACEI, ARB, or aliskiren

Antihypertensive Medications

Primary Medications (Generally First-Line)

Thiazide diuretics e.g. chlorthalidone, indapamide, hydrochlorothiazide, metolazone	• Chlorthalidone preferred: long half-life, evidence for CVD benefit • HCTZ: may be cheaper, more widely available, more tolerable • Monitor electrolytes: hyponatremia, hypokalemia, uric acid, calcium
ACE inhibitors e.g. lisinopril, benazepril, enalapril, ramipril, etc.	• Do not combine with ARBs or aliskiren • Risk of hyperkalemia, esp. with CKD, K supplements, K-sparing drugs • Avoid in pregnancy
ARBs e.g. losartan, valsartan, olmesartan, etc.	• Do not combine with ACEIs or aliskiren • Risk of hyperkalemia, esp. with CKD, K supplements, K-sparing drugs • Avoid in pregnancy
CCBs, dihydropyridines e.g. amlodipine, felodipine, etc.	• Dose-related lower leg edema, more common in females • Avoid use with HFrEF; use amlodipine or felodipine if required
CCBs, non-dihydropyridines* e.g. diltiazem, verapamil	• *Generally less preferred than the dihydropyridine CCBs • Avoid regular use with BBs due to risk of bradycardia and heart block • Do not use with HFrEF • Drug interactions; both are CYP3A4 substrates, moderate inhibitors

Secondary Medications

Beta-blockers e.g. atenolol, metoprolol, carvedilol, bisoprolol, labetalol, nebivolol, etc.	• May be first-line with compelling indication (e.g. CHD, post-MI, HF) • HFrEF preferred agents: metoprolol succinate, carvedilol, bisoprolol • Bronchospastic airway disease preferred: atenolol, metoprolol, bisoprolol • Generally avoid use of BBs with intrinsic sympathomimetic activity (e.g. acebutolol, pindolol, penbutolol), especially with CHD or HF • Avoid abrupt cessation: risk of rebound tachycardia
Loop diuretics furosemide, torsemide, bumetanide	• Preferred diuretics with symptomatic HF • Preferred over thiazides with significant CKD (GFR <30 mL/min)
K-sparing diuretics triamterene, amiloride	• Minimal antihypertensive effect; used to protect from hypokalemia • Avoid in patients with significant CKD (GFR <45 mL/min)
Aldosterone antagonists spironolactone, eplerenone	• Preferred add-on with resistant HTN and in primary aldosteronism • K-sparing diuretic effect: avoid with K-sparing diuretics, or CKD • Spironolactone > risk of gynecomastia, impotence than eplerenone
Alpha-1 blockers doxazosin, prazosin, terazosin	• May be considered second-line in those with concomitant BPH • Risk for orthostatic hypotension, especially in older adults
Direct vasodilators hydralazine, minoxidil	• Use w/ a diuretic and BB: causes fluid retention and reflex tachycardia • Hydralazine has risk of drug-induced lupus-like syndrome • Minoxidil has risk of hirsutism and requires use with a loop diuretic
Central alpha-2 agonists clonidine, guanfacine, methyldopa	• Generally last-line due to CNS adverse effects, orthostatic hypotension • Avoid abrupt cessation: risk of rebound hypertension (esp. clonidine)

Reference: Whelton PK, Carey RM, Aronow WS, et al. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines [published correction appears in J Am Coll Cardiol. 2018 May 15;71(19):2275-2279]. J Am Coll Cardiol. 2018;71(19):e127-e248. doi:10.1016/j.jacc.2017.11.006

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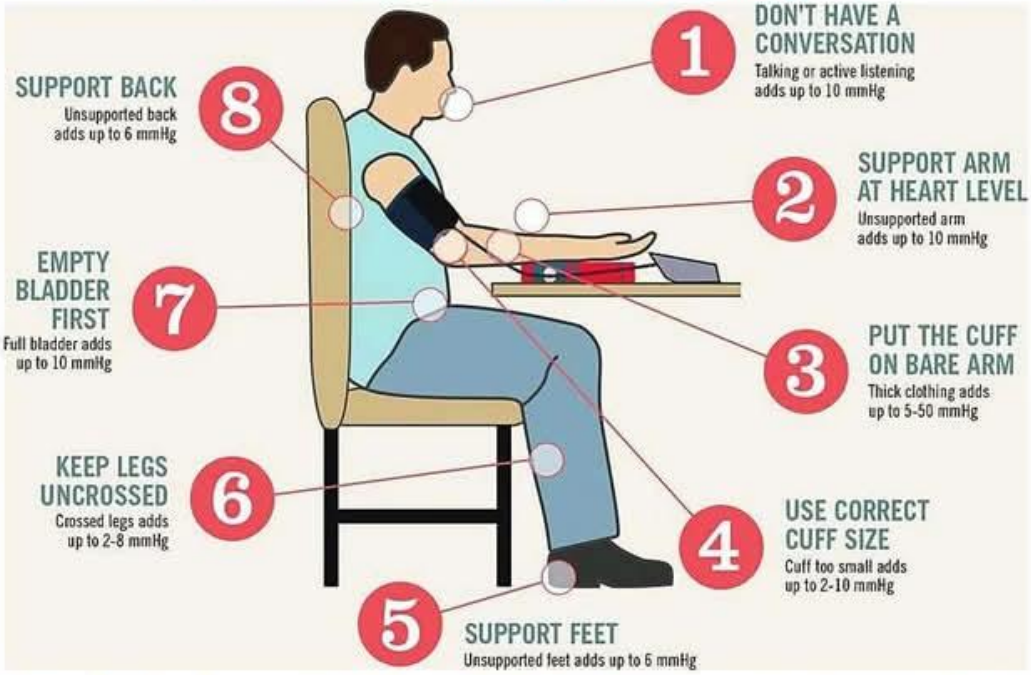
Requirements for Obtaining an Accurate Blood Pressure Reading



Source: The Pan American Health Organization (https://www.paho.org/en/hearts-americas/hearts-americas-blood-pressure-measurement).

Tsuyuki RT, Cloutier L, Gelfer M, Campbell NRC. The pharmacist's role in facilitating the accurate measurement of home blood pressure. Canadian Pharmacists Journal / Revue des Pharmaciens du Canada. 2023;156(4):175-176. doi:10.1177/17151635231178252