*In the name of The Almighty*

# Hypertension

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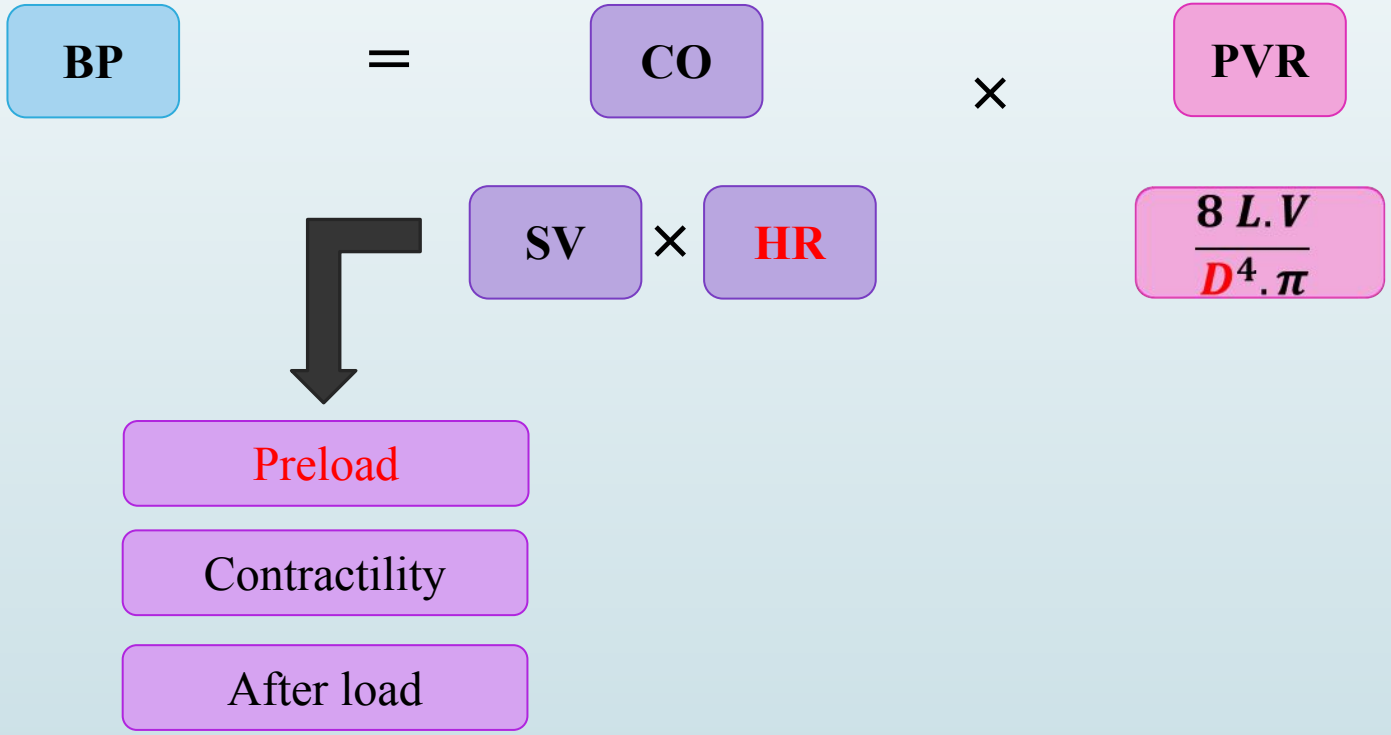
***Assistant professor of SUMS***

# We are going to learn….

- What is Blood Pressure?
- How does the body Regulate Blood Pressure?
- How should we measure Blood pressure?
- Who has HTN?
- What is masked HTN?
- What is White coat HTN?
- What should we do for management of patient?
- HTN Crisis.

# What is Blood Pressure?


BP
=
CO
×
PVR
SV
×
HR
$\frac{8\,L.V}{D^4.\pi}$
Preload
Contractility
After load

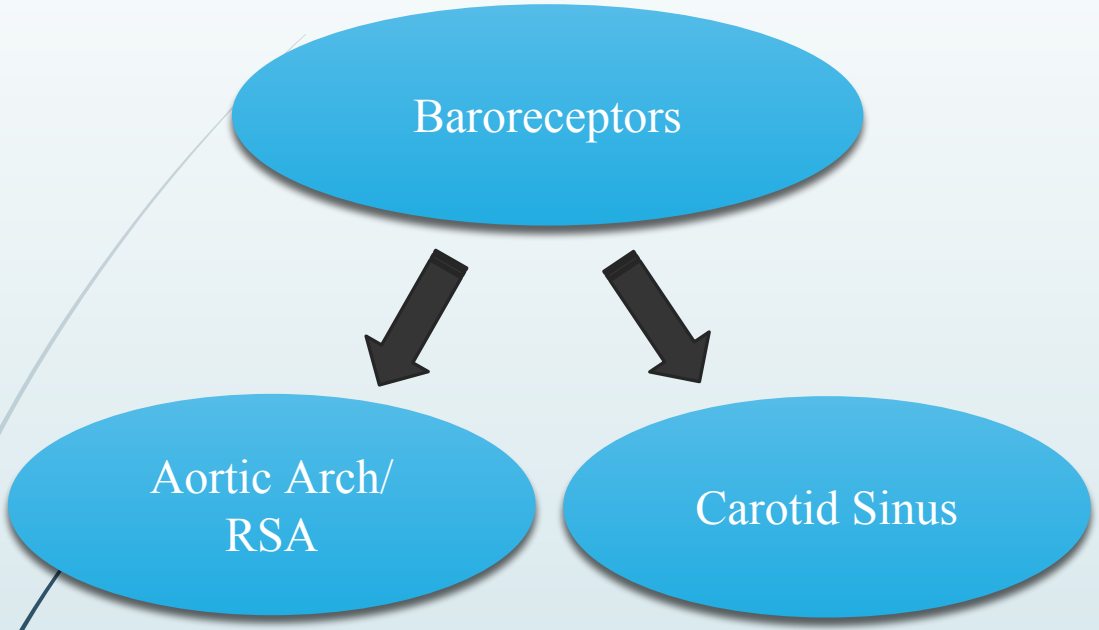
# How does the body Regulate Blood Pressure?

blood pressure modulators

AUTONOMIC NERVOUS SYSTEM

RENIN ANGIOTENSIN ALDOSTERONE SYSTEM

# Autonomic Nervous System



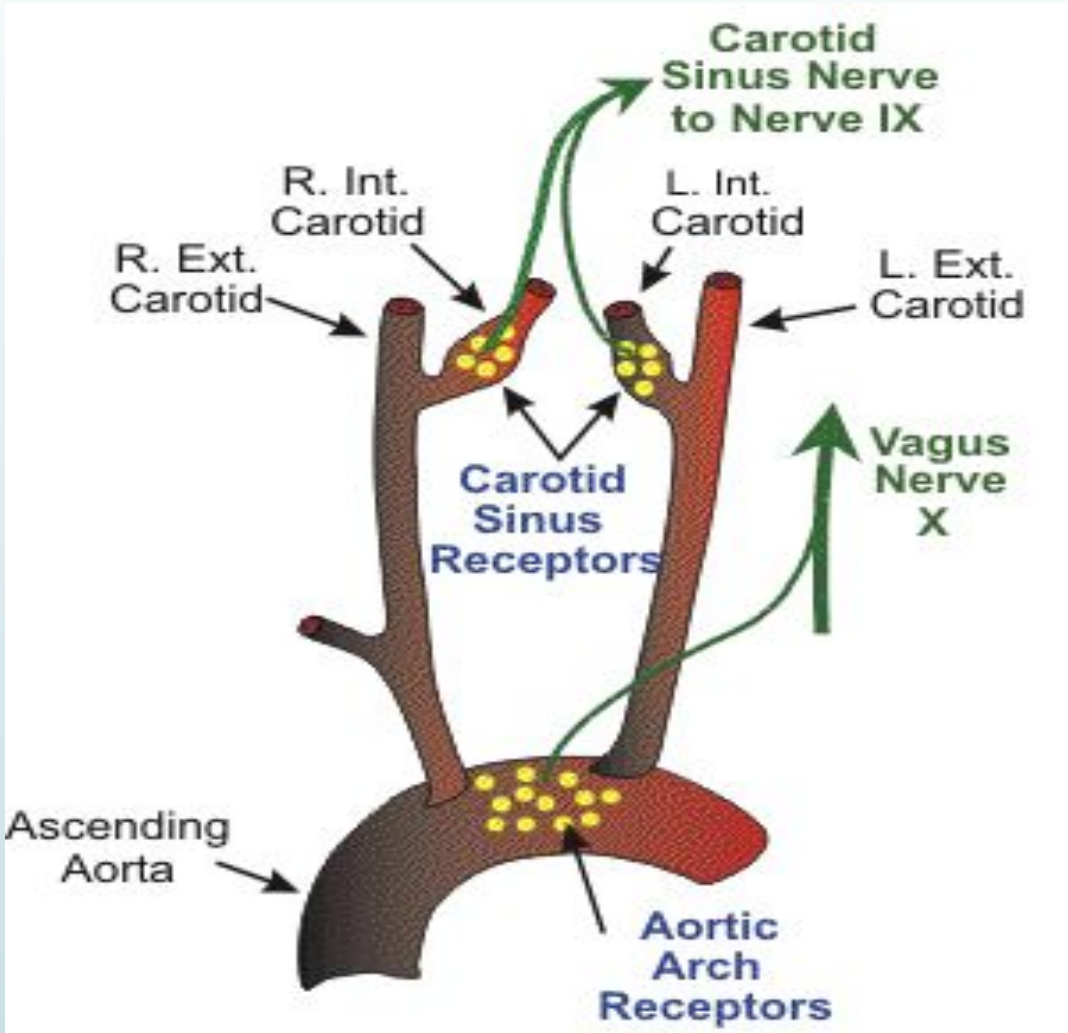
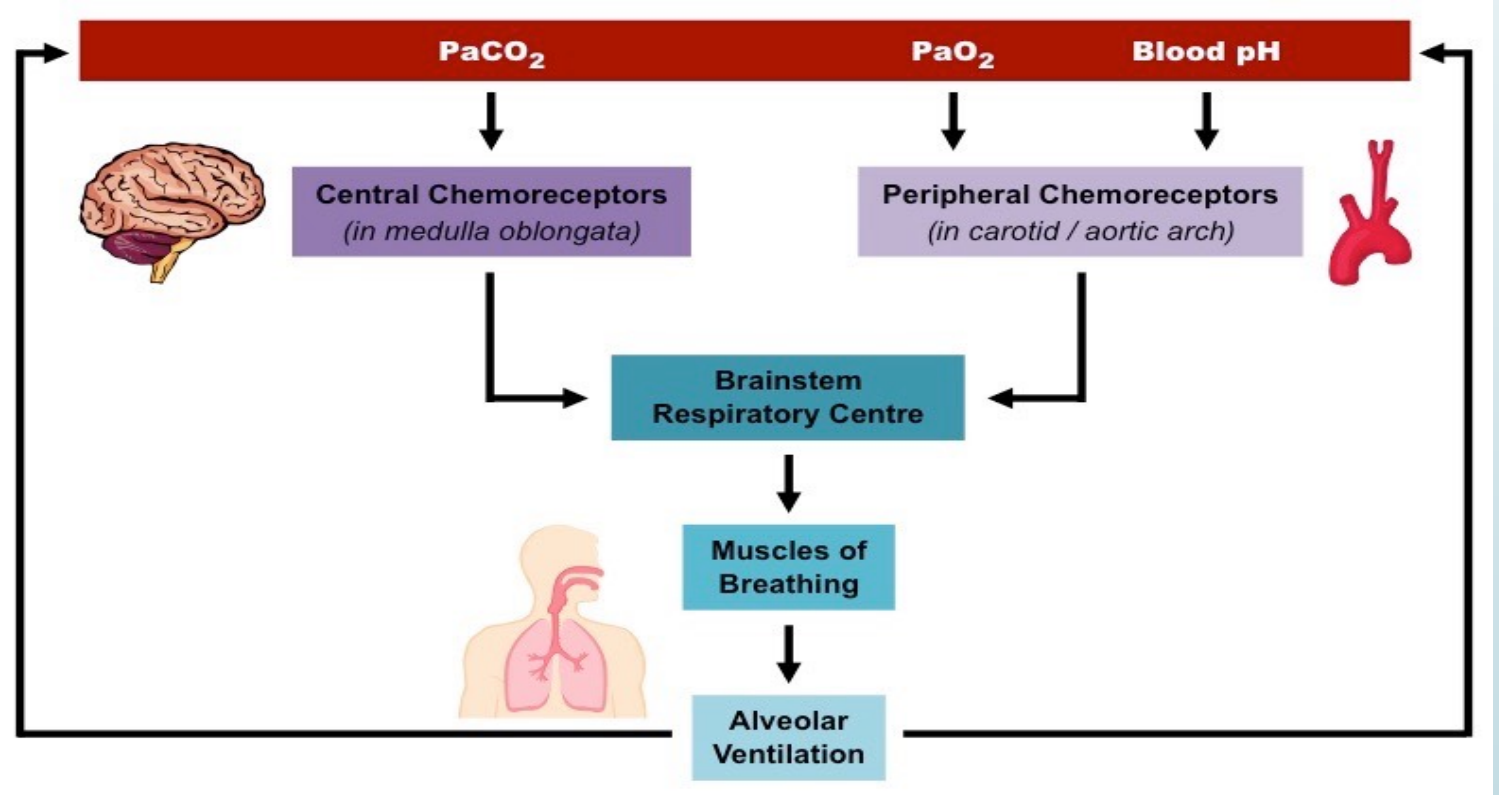




Figure 1. Location and innervation of arterial baroreceptors.

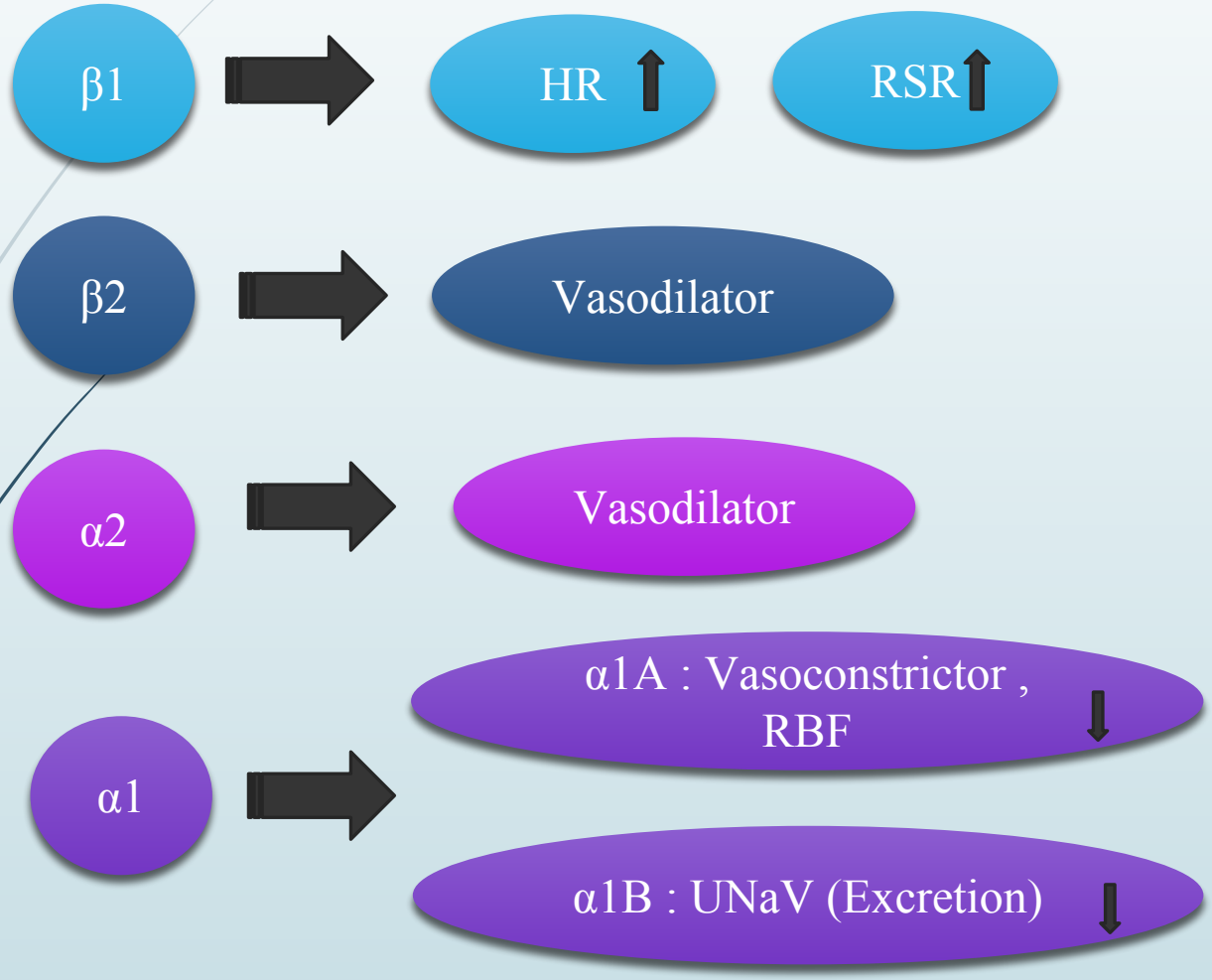
# Autonomic Nervous System

Chemoreceptors → Brain Stem

Carotid Sinus



# Autonomic Nervous System



# Renin Angiotensin Aldosterone System

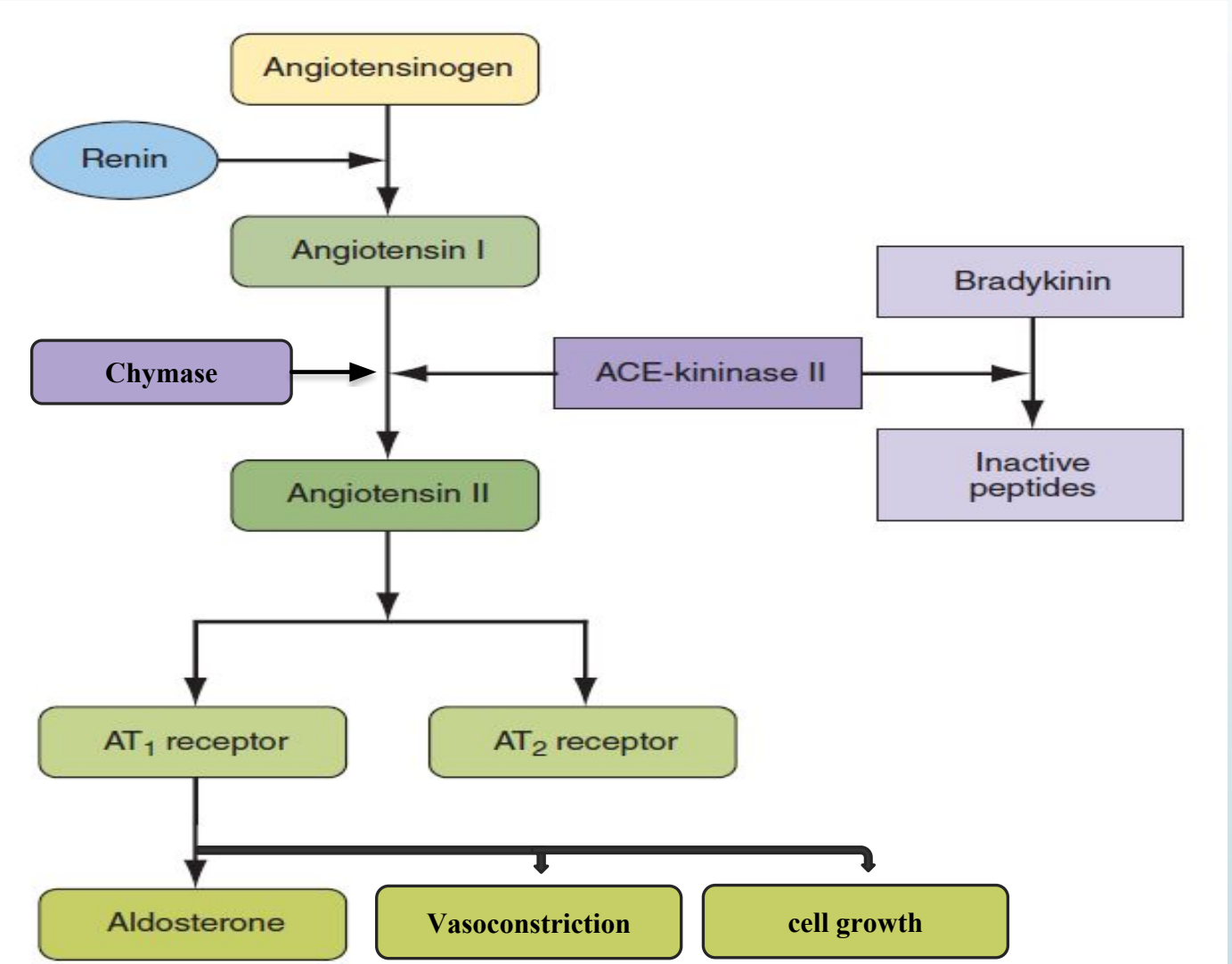



**FIGURE 271-2 Renin-angiotensin-aldosterone axis.** ACE, angiotensin-converting enzyme.

# How should we measure Blood pressure?

| Key Steps for Proper BP Measurements | Specific Instructions |
|---|---|
| Step 1: Properly prepare the patient | 1. Have the patient relax, sitting in a chair (feet on floor, back supported) for >5 min.<br>2. The patient should avoid caffeine, exercise, and smoking for at least 30 min before measurement.<br>3. Ensure patient has emptied his/her bladder.<br>4. Neither the patient nor the observer should talk during the rest period or during the measurement.<br>5. Remove all clothing covering the location of cuff placement.<br>6. Measurements made while the patient is sitting or lying on an examining table do not fulfill these criteria. |
| Step 2: Use proper technique for BP measurements | 1. Use a BP measurement device that has been validated, and ensure that the device is calibrated periodically.*<br>2. Support the patient's arm (e.g., resting on a desk).<br>3. Position the middle of the cuff on the patient's upper arm at the level of the right atrium (the midpoint of the sternum).<br>4. Use the correct cuff size, such that the bladder encircles 80% of the arm, and note if a larger- or smaller-than-normal cuff size is used (Table 9).<br>5. Either the stethoscope diaphragm or bell may be used for auscultatory readings (5, 6). |
| Step 3: Take the proper measurements needed for diagnosis and treatment of elevated BP/hypertension | 1. At the first visit, record BP in both arms. Use the arm that gives the higher reading for subsequent readings.<br>2. Separate repeated measurements by 1–2 min.<br>3. For auscultatory determinations, use a palpated estimate of radial pulse obliteration pressure to estimate SBP. Inflate the cuff 20–30 mm Hg above this level for an auscultatory determination of the BP level.<br>4. For auscultatory readings, deflate the cuff pressure 2 mm Hg per second, and listen for Korotkoff sounds. |
| Step 4: Properly document accurate BP readings | 1. Record SBP and DBP. If using the auscultatory technique, record SBP and DBP as onset of the first Korotkoff sound and disappearance of all Korotkoff sounds, respectively, using the nearest even number.<br>2. Note the time of most recent BP medication taken before measurements. |
| Step 5: Average the readings | Use an average of ≥2 readings obtained on ≥2 occasions to estimate the individual's level of BP. |
| Step 6: Provide BP readings to patient | Provide patients the SBP/DBP readings both verbally and in writing. |

*See Section 4.2 for additional guidance.

BP indicates blood pressure; DBP, diastolic blood pressure; and SBP, systolic blood pressure.

Adapted with permission from Mancia et al. (3) (Oxford University Press), Pickering et al. (2) (American Heart Association, Inc.), and Weir et al. (4) (American College of Physicians, Inc.).

**Table 4. BP Measurement Definitions**

| BP Measurement | Definition |
|---|---|
| SBP | First Korotkoff sound* |
| DBP | Fifth Korotkoff sound* |
| Pulse pressure | SBP minus DBP |
| Mean arterial pressure | DBP plus one third pulse pressure† |
| Mid-BP | Sum of SBP and DBP, divided by 2 |

*See Section 4 for a description of Korotkoff sounds.

†Calculation assumes normal heart rate.

BP indicates blood pressure; DBP, diastolic blood pressure; and SBP, systolic blood pressure.

# Who has HTN?

## TABLE 46.2 Staging of Office Blood Pressure*

| BP STAGE | SYSTOLIC (mm Hg) | DIASTOLIC (mm Hg) |
|---|---|---|
| Normal | <120 | <80 |
| Prehypertension (high-normal) | 120-139 | 80-89 |
| Stage 1 (mild) hypertension | 140-159 | 90-99 |
| Stage 2 (moderate) hypertension | 160-179 | |
| Stage 3 (severe) hypertension | ≥180 | ≥110 |
| Isolated systolic hypertension | ≥140 | <90 |

*Calculation of seated BP is based on the mean of two or more readings on two separate office visits.

*Modified from Gabb GM, Mangoni A, Anderson CS, et al. Guideline for the diagnosis and management of hypertension in adults—2016. Med J Aust 2016;205:85.*

**Table 6. Categories of BP in Adults***

| BP Category | SBP | | DBP |
|---|---|---|---|
| **Normal** | <120 mm Hg | and | <80 mm Hg |
| **Elevated** | 120–129 mm Hg | and | <80 mm Hg |
| **Hypertension** | | | |
| Stage 1 | 130–139 mm Hg | or | 80–89 mm Hg |
| Stage 2 | ≥140 mm Hg | or | ≥90 mm Hg |

*Individuals with SBP and DBP in 2 categories should be designated to the higher BP category.

BP indicates blood pressure (based on an average of ≥2 careful readings obtained on ≥2 occasions, as detailed in Section 4); DBP, diastolic blood pressure; and SBP systolic blood pressure.

**TABLE 46.1** Criteria for Diagnosis of Hypertension Using Different Methods of Blood Pressure (BP) Measurement (Systolic and/or Diastolic)

| METHOD | SYSTOLIC (mm Hg) | DIASTOLIC (mm Hg) |
|---|---|---|
| **Office** | | |
| Conventional office BP | ≥140 | ≥90 |
| Unattended automated office BP (AOBP) | ≥135 | ≥85 |
| **Home** | | |
| Home BP | ≥135 | ≥85 |
| **Ambulatory BP Monitoring (ABPM)** | | |
| Daytime (awake) | ≥135 | ≥85 |
| Nighttime (asleep) | ≥120 | ≥70 |
| 24 or 48 hour (average) | ≥130 | ≥80 |

*Modified from Gabb GM, Mangoni A, Anderson CS, et al. Guideline for the diagnosis and management of hypertension in adults—2016. Med J Aust 2016;205:85.*

# What is masked HTN?
# What is White coat HTN?

**Table 12. BP Patterns Based on Office and Out-of-Office Measurements**

| | Office/Clinic/Healthcare Setting | Home/Nonhealthcare/ABPM Setting |
|---|---|---|
| Normotensive | No hypertension | No hypertension |
| Sustained hypertension | Hypertension | Hypertension |
| Masked hypertension | No hypertension | Hypertension |
| White coat hypertension | Hypertension | No hypertension |

ABPM indicates ambulatory blood pressure monitoring; and BP, blood pressure.

# What should we do for management of patient?

**TABLE 271-6 Basic Laboratory Tests for Initial Evaluation**

| SYSTEM | TEST |
|---|---|
| Renal | Microscopic urinalysis, albumin excretion, serum BUN and/or creatinine |
| Endocrine | Serum sodium, potassium, calcium, TSH |
| Metabolic | Fasting blood glucose, total cholesterol, HDL and LDL (often computed) cholesterol, triglycerides |
| Other | Hematocrit, electrocardiogram |

*Abbreviations:* BUN, blood urea nitrogen; HDL, high-density lipoprotein; LDL, low-density lipoprotein; TSH, thyroid-stimulating hormone.

- Hypertension is an independent predisposing Factor for
  - Heart -> HF , LVH
  - Coronary artery disease
  - Brain -> Stroke , ICH , Encephalopathy
  - Renal disease -> ESRD , Albuminuria
  - peripheral arterial disease (PAD)

**TABLE 47.3 Risk for Hypertension According to Individual Factors Evaluated on the Basis of Estimated Population Attributed Risk**

| FACTOR | RISK (95% CI) |
|---|---|
| BMI ≥25 kg/m$^2$ | 50% (49-52%) |
| Non-narcotic analgesic use | 17% (15-19%) |
| No DASH diet | 14% (10-17%) |
| No vigorous exercise | 14% (10-19%) |
| No or excessive alcohol | 10% (8-12%) |
| Folic acid use ≤400 µg/day | 4% (1-7%) |

*BMI,* Body mass index; *CI,* confidence interval; *DASH,* Dietary Approaches to Stop Hypertension.

*Modified from Liebson PR. Diet, lifestyle, and hypertension and Mediterranean diet and risk of dementia. Prev Cardiol 2010;13:94.*

**TABLE 47.4 Diet and Physical Activity Recommendations for Lowering Blood Pressure (BP)**

| Dietary Recommendations |
|---|
| 1. Advise adults who would benefit from BP lowering to consume a dietary pattern that emphasizes intake of vegetables, fruits, and whole grains; includes low-fat dairy products, poultry, fish, legumes, nontropical vegetable oils, and nuts; and limits intake of sweets, SSBs, and red meat:<br>a. Adapt this dietary pattern to appropriate calorie requirements, personal and cultural food preferences, and nutrition therapy for other medical conditions (including diabetes mellitus).<br>b. Achieve this pattern by following plans such as the DASH dietary pattern, the U.S. Department of Agriculture (USDA) Food Pattern, or the AHA Diet. |
| *NHLBI grade: A (strong); ACC/AHA COR: I; LOE: A.* |
| 2. Advise adults who would benefit from BP lowering to lower sodium intake. |
| *NHLBI grade: A (strong); ACC/AHA COR: I; LOE: A.* |
| 3. Advise adults who would benefit from BP lowering to<br>a. Consume no more than 2400 mg/day of sodium.<br>b. Further reduce sodium intake to 1500 mg/day because it is associated with an even greater reduction in BP.<br>c. Reduce sodium intake by at least 1000 mg/day because this will lower BP even if the desired daily sodium intake is not yet achieved. |
| *NHLBI grade: B (moderate); ACC/AHA COR: IIa; LOE: B.* |
| 4. Advise adults who would benefit from BP lowering to combine the DASH dietary pattern with lower sodium intake. |
| *NHLBI grade: A (strong); ACC/AHA COR: I; LOE: A.* |
| **Physical Activity Recommendations** |
| In general, advise adults to engage in aerobic physical activity to lower BP: 3-4 sessions a week lasting on average 40 minutes per session and involving physical activity of moderate to vigorous intensity. |
| *NHLBI grade: B (moderate); ACC/AHA COR: IIa; LOE: A.* |

*COR,* Class of recommendation; *LOE,* level of evidence; *DASH,* Dietary Approaches to Stop Hypertension; *SSBs,* sugar-sweetened beverages.

*Modified from the Eckel RH, Jakicic JM, Ard JD, et al. 2013 AHA/ACC guideline on lifestyle management to reduce cardiovascular risk: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. J Am Clin Cardiol 2014;63(25 Pt B):2960-84.*

| TABLE 271-7 Lifestyle Modifications to Manage Hypertension | |
|---|---|
| Weight reduction | Attain and maintain BMI <25 kg/m$^2$ |
| Dietary salt reduction | <6 g NaCl/d |
| Adapt DASH-type dietary plan | Diet rich in fruits, vegetables, and low-fat dairy products with reduced content of saturated and total fat |
| Moderation of alcohol consumption | For those who drink alcohol, consume ≤2 drinks/d in men and ≤1 drink/d in women |
| Physical activity | Regular aerobic activity, e.g., brisk walking for 30 min/d |

*Abbreviations:* BMI, body mass index; DASH, Dietary Approaches to Stop Hypertension (trial).

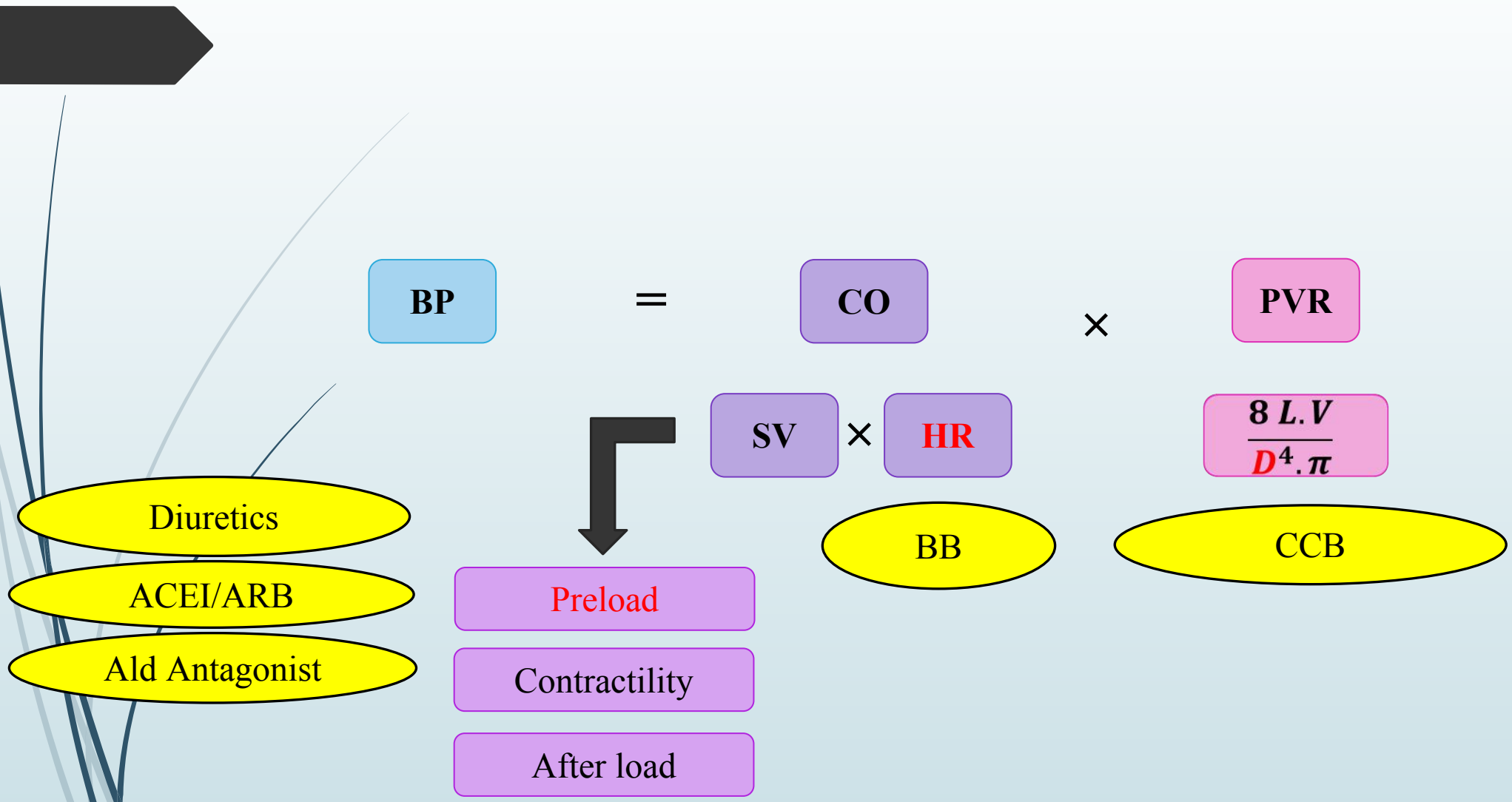

BP
=
CO
×
PVR
SV
×
HR
$\frac{8\,L.V}{D^4.\pi}$
Preload
Contractility
After load
BB
CCB
Diuretics
ACEI/ARB
Ald Antagonist

**TABLE 47.6 Contraindications to Use of Specific Antihypertensive Drugs**

| DRUG | COMPELLING | POSSIBLE |
|---|---|---|
| Diuretics (thiazides) | Gout | Metabolic syndrome<br>Glucose intolerance<br>Pregnancy<br>Hypercalcemia<br>Hypokalemia |
| Beta blockers | Asthma<br>Atrioventricular block (grade 2 or 3) | Metabolic syndrome<br>Glucose intolerance (except for vasodilating beta blockers)<br>Athletes and physically active patients<br>Chronic obstructive pulmonary disease |
| Dihydropyridine calcium channel blockers | | Tachyarrhythmia<br>Heart failure |
| Nondihydropyridine calcium channel blockers | Atrioventricular block (grade 2 or 3, trifascicular block)<br>Severe left ventricular heart dysfunction<br>Heart failure | |
| Angiotensin-converting enzyme inhibitors | Pregnancy<br>Angioedema<br>Hyperkalemia<br>Bilateral renal artery stenosis | Women with childbearing potential |
| Angiotensin receptor blockers | Pregnancy<br>Hyperkalemia<br>Bilateral renal artery stenosis | Women with childbearing potential |
| Aldosterone antagonists | Acute or severe renal failure (estimated glomerular filtration rate <30 mL/min)<br>Hyperkalemia | |

**TABLE 47.7 Preferred Antihypertensive Drugs for Specific Conditions**

| CONDITION | DRUG OR DRUGS |
|---|---|
| Patients with prehypertension | ARB? |
| Hypertensive patients in general | CCB, ARB or ACEI, D |
| Hypertension in older patients | CCB, ARB or ACEI, D |
| Hypertension with LVH | ARB, D, CCB |
| Hypertension in patients with diabetes mellitus | CCB, ACEI or ARB, D |
| Hypertension in patients with diabetic neuropathy | ARB, D |
| Hypertension in patients with nondiabetic chronic kidney disease | ACEI, BB, D |
| BP reduction for secondary prevention of coronary events | ACEI, CCB, BB, D |
| BP reduction for secondary prevention of stroke | ACEI + D, CCB |
| BP for patients with heart failure | D, BB, ACEI, ARB, MR antagonists |
| Pregnancy | BB (labetalol), CCB (nifedipine) |
| Aortic aneurysm | BB |
| Atrial fibrillation, ventricular rate control | BB, non-DHP CCB |

*ACEI,* Angiotensin-converting enzyme inhibitor; *ARB,* angiotension receptor blocker; *CCB,* calcium channel blocker; *BB,* beta blocker; *D,* diuretic; *LVH,* left ventricular hypertrophy; *MR,* mineralocorticoid receptor; *DHP,* dihydropyridine.

*Modified from Mancia G, Fagard R, Narkiewicz K, et al: 2013 ESH/ESC guidelines for the management of arterial hypertension: The Task Force for the Management of Arterial Hypertension of the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC). Eur Heart J 31:1281, 2013.*

# HTN Crisis.

- Malignant HTN = 220/130 +EOD
- HTN Urgency = 220/130 - EOD
- Severe HTN =180/110 < BP <220/130

**TABLE 47.14** Intravenous Drugs for Treatment of Hypertensive Emergencies

| DRUG | ONSET OF ACTION | HALF-LIFE | DOSE | CONTRAINDICATIONS AND SIDE EFFECTS |
|---|---|---|---|---|
| Labetalol | 5-10 min | 3-6 hr | 0.25-0.5 mg/kg; 2-4 mg/min until goal BP is reached, thereafter 5-20 mg/hr | Second- or third-degree AV block; systolic heart failure, COPD (relative); bradycardia |
| Nicardipine | 5-15 min | 30-40 min | 5-15 mg/hr as continuous infusion, starting dose of 5 mg/hr, increase q15-30 min with 2.5 mg until goal BP achieved, thereafter decrease to 3 mg/hr | Liver failure |
| Nitroprusside | Immediate | 1-2 min | 0.3-10 μg/kg/min, increase by 0.5 μg/kg/min q5min until goal BP achieved | Liver/kidney failure (relative), cyanide toxicity |
| Nitroglycerin | 1-5 min | 3-5 min | 5-200 μg/min, 5-μg/min increase q5min | |
| Urapidil | 3-5 min | 4-6 hr | 12.5-25 mg as bolus injections; 5-40 mg/hr as continuous infusion | |
| Esmolol | 1-2 min | 10-30 min | 0.5-1.0 mg/kg as bolus; 50-300 μg/kg/min as continuous infusion | Second- or third-degree AV block, systolic heart failure, COPD (relative); bradycardia |
| Phentolamine | 1-2 min | 3-5 min | 1-5 mg, repeat after 5-15 min until goal BP is reached; 0.5-1 mg/hr as continuous infusion | Tachyarrhythmia, angina pectoris |

*AV,* Atrioventricular; *COPD,* chronic obstructive pulmonary disease.
*Modified from van den Born BJ, Beutler JJ, Gaillard CA, et al. Dutch guideline for the management of hypertensive crisis—2010 revision. Neth J Med 2011;69:248.*

**TABLE 47.15** Recommended Treatment of Hypertensive Emergencies by End-Organ Involved

| TYPE OF EMERGENCY | TIMELINE, TARGET BLOOD PRESSURE | FIRST-LINE THERAPY | ALTERNATIVE THERAPY |
|---|---|---|---|
| Hypertensive crisis with retinopathy, microangiopathy, or acute renal insufficiency | Several hours, MAP –20% to –25% | Labetalol | Nitroprusside<br>Nicardipine<br>Urapidil |
| Hypertensive encephalopathy | Immediate, MAP –20% to –25% | Labetalol | Nicardipine<br>Nitroprusside |
| Acute aortic dissection | Immediate, SBP <110 mm Hg | Nitroprusside + metoprolol | Labetalol |
| Acute pulmonary edema | Immediate, MAP 60-100 mm Hg | Nitroprusside with loop diuretic | Nitroglycerin<br>Urapidil with loop diuretic |
| Acute coronary syndrome | Immediate, MAP 60-100 mm Hg | Nitroglycerin | Labetalol |
| Acute ischemic stroke and BP >220/120 mm Hg | 1 hour, MAP –15% | Labetalol | Nicardipine<br>Nitroprusside |
| Cerebral hemorrhage and SBP >180 mm Hg or MAP >130 mm Hg | 1 hour, SBP <180 mm Hg and MAP <130 mm Hg | Labetalol | Nicardipine<br>Nitroprusside |
| Acute ischemic stroke with indication for thrombolytic therapy and BP >185/110 mm Hg | 1 hour, MAP less than –15% | Labetalol | Nicardipine<br>Nitroprusside |
| Cocaine/XTC intoxication | Several hours, SBP <140 mm Hg | Phentolamine (after benzodiazepines) | Nitroprusside |
| Pheochromocytoma crisis | Immediate | Phentolamine | Nitroprusside<br>Urapidil |
| Perioperative hypertension during or after CABG | Immediate | Nicardipine | Urapidil<br>Nitroglycerin |
| During or after craniotomy | Immediate | Nicardipine | Labetalol |
| Severe preeclampsia/eclampsia | Immediate, BP <160/105 mm Hg | Labetalol (plus $MgSO_4$ and oral antihypertensives) | Ketanserin<br>Nicardipine |

*CABG*, Coronary artery bypass graft; *MAP*, mean arterial pressure; *$MgSO_4$*, magnesium sulfate; *XTC*, "Ecstasy" (3,4-methylenedioxymethamphetamine).
*Modified from van den Born BJ, Beutler JJ, Gaillard CA, et al: Dutch guideline for the management of hypertensive crisis—2010 revision. Neth J Med 69:248, 2011.*

| TABLE 271-9 Preferred Parenteral Drugs for Selected Hypertensive Emergencies | |
|---|---|
| Hypertensive encephalopathy | Nitroprusside, nicardipine, labetalol |
| Malignant hypertension (when IV therapy is indicated) | Labetalol, nicardipine, nitroprusside, enalaprilat |
| Stroke | Nicardipine, labetalol, nitroprusside |
| Myocardial infarction/unstable angina | Nitroglycerin, nicardipine, labetalol, esmolol |
| Acute left ventricular failure | Nitroglycerin, enalaprilat, loop diuretics |
| Aortic dissection | Nitroprusside, esmolol, labetalol |
| Adrenergic crisis | Phentolamine, nitroprusside |
| Postoperative hypertension | Nitroglycerin, nitroprusside, labetalol, nicardipine |
| Preeclampsia/eclampsia of pregnancy | Hydralazine, labetalol, nicardipine |

*Source:* Adapted from DG Vidt, in S Oparil, MA Weber (eds): *Hypertension*, 2nd ed. Philadelphia, Elsevier Saunders, 2005.

# 2020 International Society of Hypertension , Global Hypertension Practice Guidelines

# 2020 International Society of Hypertension Global Hypertension Practice Guidelines

Thomas Unger, Claudio Borghi, Fadi Charchar, Nadia A. Khan, Neil R. Poulter, Dorairaj Prabhakaran, Agustin Ramirez, Markus Schlaich, George S. Stergiou, Maciej Tomaszewski, Richard D. Wainford, Bryan Williams, Aletta E. Schutte

## Table of Contents



## Section 1: Introduction

### Context and Purpose of This Guideline

***Statement of Remit***

To align with its mission to reduce the global burden of raised blood pressure (BP), the International Society of Hypertension (ISH) has developed worldwide practice guidelines for the management of hypertension in adults, aged 18 years and older.

The ISH Guidelines Committee extracted evidence-based content presented in recently published extensively reviewed guidelines and tailored ESSENTIAL and OPTIMAL standards

ESSENTIAL

## Hypertension Diagnosis – Office BP Measurement

- The measurement of BP in the office or clinic is most commonly the basis for hypertension diagnosis and follow-up. Office BP should be measured according to recommendations shown in Table 3 and Figure 1.[1,2,17,18]
- Whenever possible, the diagnosis should not be made on a single office visit. Usually 2–3 office visits at 1–4-week intervals (depending on the BP level) are required to confirm the diagnosis of hypertension. The diagnosis might be made on a single visit, if BP is ≥180/110 mm Hg and there is evidence of cardiovascular disease (CVD).[1,2,17,18]
- The recommended patient management according to office BP levels is presented in Table 4.
- If possible and available, the diagnosis of hypertension should be confirmed by out-of-office BP measurement (see below).[1,2,19–21]

**Table 3. Recommendations for Office Blood Pressure Measurement**

| | |
|---|---|
| Conditions | • Quiet room with comfortable temperature. |
| | • Before measurements: Avoid smoking, caffeine and exercise for 30 min; empty bladder; remain seated and relaxed for 3–5 min. |
| | • Neither patient nor staff should talk before, during and between measurements. |
| Positions | • Sitting: Arm resting on table with mid-arm at heart level; back supported on chair; legs uncrossed and feet flat on floor (Figure 1). |
| Device | • Validated electronic (oscillometric) upper-arm cuff device. Lists of accurate electronic devices for office, home and ambulatory BP measurement in adults, children and pregnant women are available at www.stridebp.org.[22] (see also Section 11: Resources) |
| | • Alternatively use a calibrated auscultatory device, (aneroid, or hybrid as mercury sphygmomanometers are banned in most countries) with 1st Korotkoff sound for systolic blood pressure and 5th for diastolic with a low deflation rate.[22] |
| Cuff | • Size according to the individual's arm circumference (smaller cuff overestimates and larger cuff underestimates blood pressure). |
| | • For manual auscultatory devices the inflatable bladder of the cuff must cover 75%–100% of the individual's arm circumference. For electronic devices use cuffs according to device instructions. |
| Protocol | • At each visit take 3 measurements with 1 min between them. Calculate the average of the last 2 measurements. If BP of first reading is <130/85 mm Hg no further measurement is required. |
| Interpretation | • Blood pressure of 2–3 office visits ≥140/90 mm Hg indicates hypertension. |

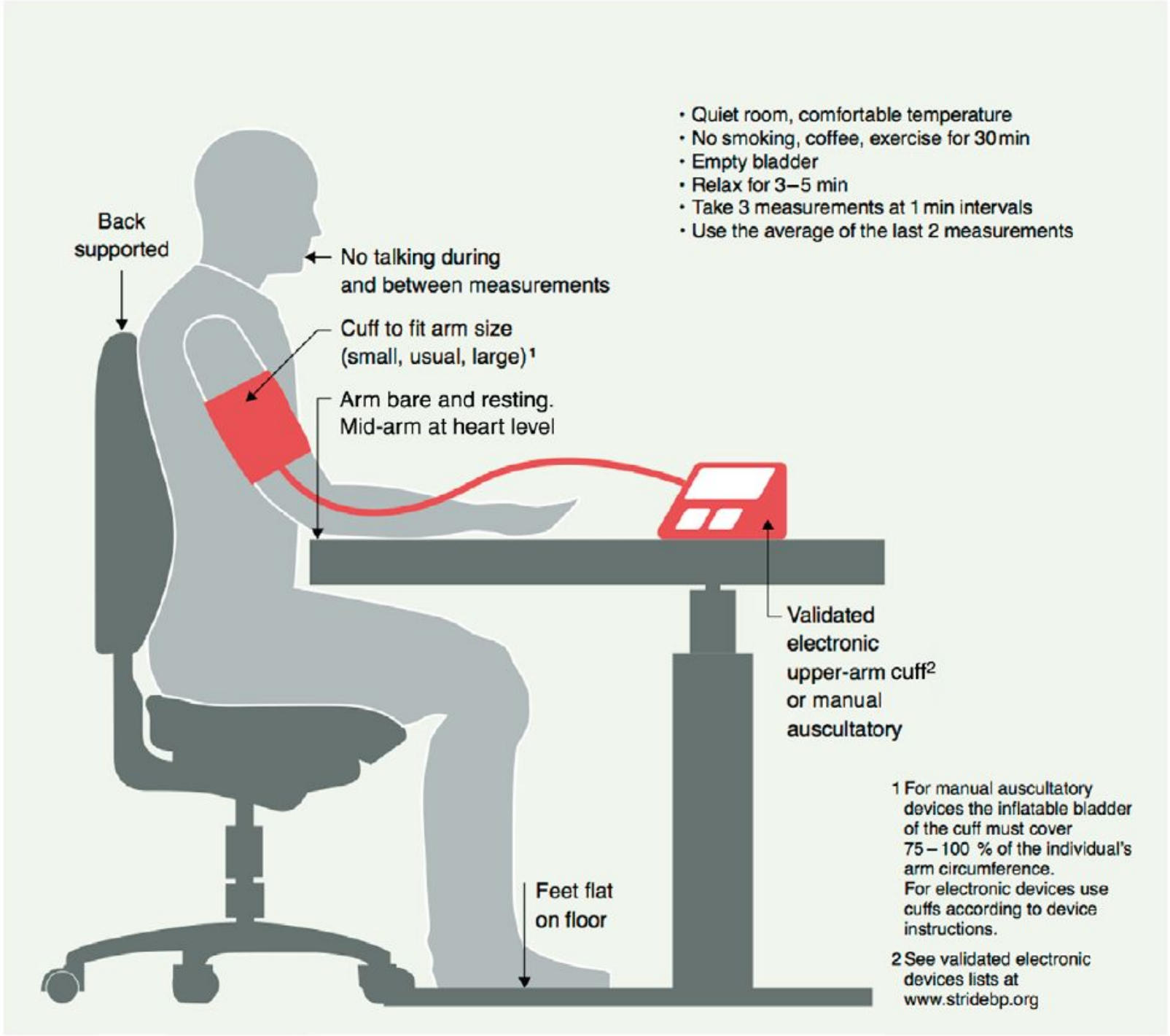
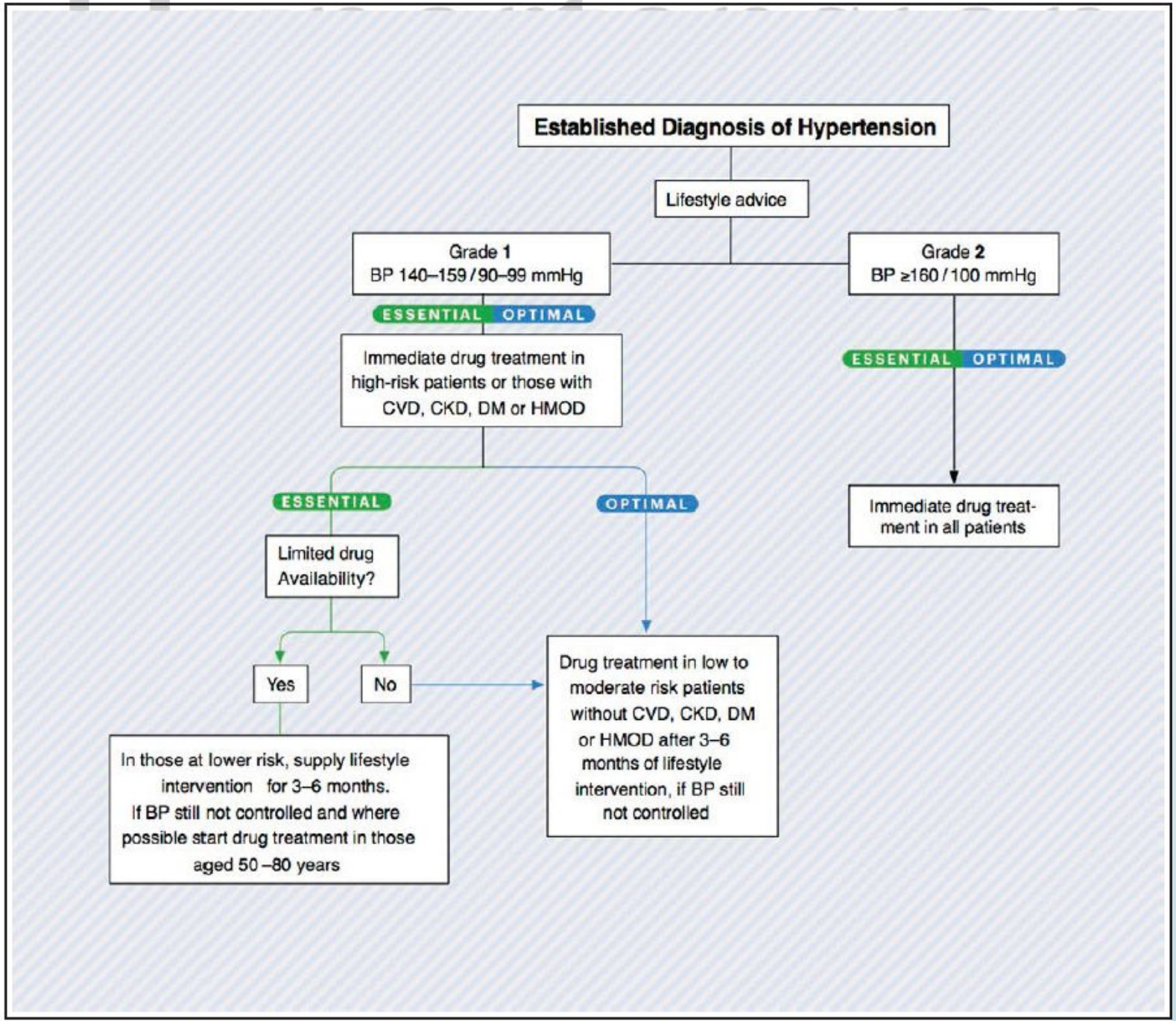

• Quiet room, comfortable temperature
• No smoking, coffee, exercise for 30 min
• Empty bladder
• Relax for 3–5 min
• Take 3 measurements at 1 min intervals
• Use the average of the last 2 measurements
Back supported
No talking during and between measurements
Cuff to fit arm size (small, usual, large)[1]
Arm bare and resting. Mid-arm at heart level
Validated electronic upper-arm cuff[2] or manual auscultatory
Feet flat on floor
1 For manual auscultatory devices the inflatable bladder of the cuff must cover 75 – 100 % of the individual's arm circumference. For electronic devices use cuffs according to device instructions.
2 See validated electronic devices lists at www.stridebp.org

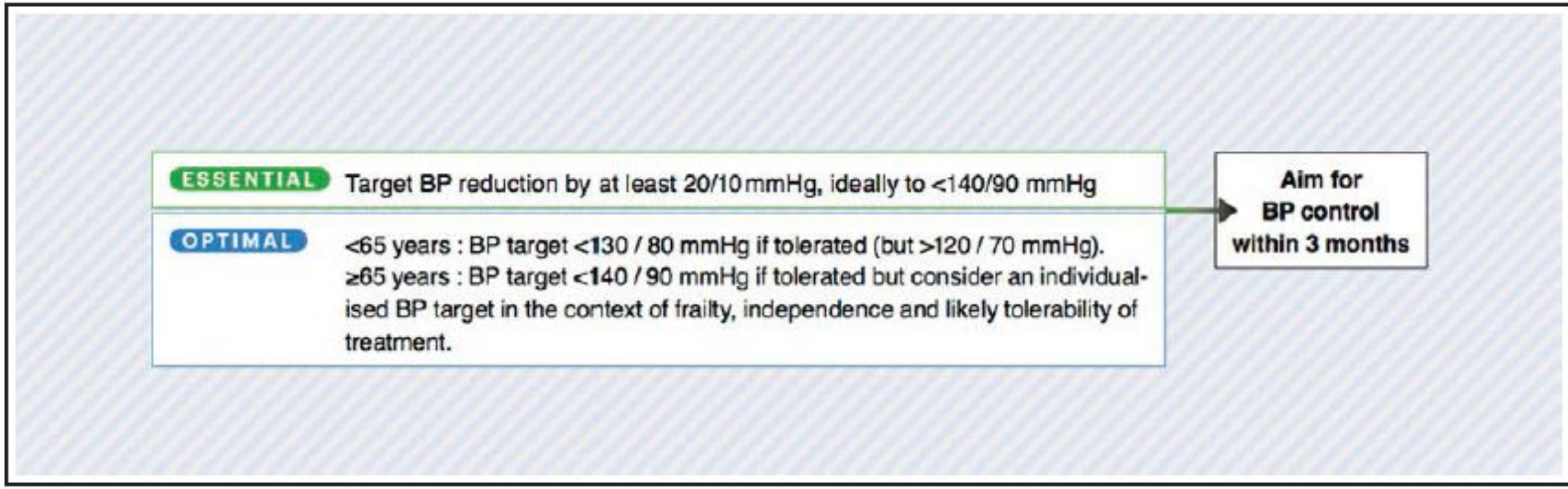
**Table 4. Blood Pressure Measurement Plan According to Office Blood Pressure Levels**

| Office Blood Pressure Levels (mm Hg) | | |
|---|---|---|
| <130/85 | 130–159/85–99 | >160/100 |
| Remeasure within 3 years (1 year in those with other risk factors) | If possible confirm with out-of-office blood pressure measurement (high possibility of white coat or masked hypertension). Alternatively confirm with repeated office visits. | Confirm within a few days or weeks |

**Table 8. Lifestyle Modifications**

| | |
|---|---|
| Salt reduction | There is strong evidence for a relationship between high salt intake and increased blood pressure.[47] Reduce salt added when preparing foods, and at the table. Avoid or limit consumption of high salt foods such as soy sauce, fast foods and processed food including breads and cereals high in salt. |
| Healthy diet | Eating a diet that is rich in whole grains, fruits, vegetables, polyunsaturated fats and dairy products and reducing food high in sugar, saturated fat and trans fats, such as the DASH diet (http://www.dashforhealth.com).[48] Increase intake of vegetables high in nitrates known to reduce BP, such as leafy vegetables and beetroot. Other beneficial foods and nutrients include those high in magnesium, calcium and potassium such as avocados, nuts, seeds, legumes and tofu.[49] |
| Healthy drinks | Moderate consumption of coffee, green and black tea.[50] Other beverages that can be beneficial include karkadé (hibiscus) tea, pomegranate juice, beetroot juice and cocoa.[49] |
| Moderation of alcohol consumption | Positive linear association exists between alcohol consumption, blood pressure, the prevalence of hypertension, and CVD risk.[51] The recommended daily limit for alcohol consumptions is 2 standard drinks for men and 1.5 for women (10 g alcohol/standard drink). Avoid binge drinking. |
| Weight reduction | Body weight control is indicated to avoid obesity. Particularly abdominal obesity should be managed. Ethnic-specific cut-offs for BMI and waist circumference should be used.[52] Alternatively, a waist-to-height ratio <0.5 is recommended for all populations.[53,54] |
| Smoking cessation | Smoking is a major risk factor for CVD, COPD and cancer. Smoking cessation and referral to smoking cessation programs are advised.[55] |
| Regular physical activity | Studies suggest that regular aerobic and resistance exercise may be beneficial for both the prevention and treatment of hypertension.[56–58] Moderate intensity aerobic exercise (walking, jogging, cycling, yoga, or swimming) for 30 minutes on 5–7 days per week or HIIT (high intensity interval training) which involves alternating short bursts of intense activity with subsequent recovery periods of lighter activity. Strength training also can help reduce blood pressure. Performance of resistance/strength exercises on 2–3 days per week. |
| Reduce stress and induce mindfulness | Chronic stress has been associated to high blood pressure later in life.[59] Although more research is needed to determine the effects of chronic stress on blood pressure, randomized clinical trials examining the effects of transcendental meditation/mindfulness on blood pressure suggest that this practice lowers blood pressure.[60] Stress should be reduced and mindfulness or meditation introduced into the daily routine. |
| Complementary, alternative or traditional medicines | Large proportions of hypertensive patients use complementary, alternative or traditional medicines (in regions such as Africa and China)[61,62] yet large-scale and appropriate clinical trials are required to evaluate the efficacy and safety of these medicines. Thus, use of such treatment is not yet supported. |
| Reduce exposure to air pollution and cold temperature | Evidence from studies support a negative effect of air pollution on blood pressure in the long-term.[63,64] |


Established Diagnosis of Hypertension
Lifestyle advice
Grade 1
BP 140–159 / 90–99 mmHg
Grade 2
BP ≥160 / 100 mmHg
ESSENTIAL
OPTIMAL
Immediate drug treatment in high-risk patients or those with CVD, CKD, DM or HMOD
ESSENTIAL
OPTIMAL
Immediate drug treatment in all patients
ESSENTIAL
OPTIMAL
Limited drug Availability?
Yes
No
Drug treatment in low to moderate risk patients without CVD, CKD, DM or HMOD after 3–6 months of lifestyle intervention, if BP still not controlled
In those at lower risk, supply lifestyle intervention for 3–6 months. If BP still not controlled and where possible start drug treatment in those aged 50 –80 years


ESSENTIAL
Target BP reduction by at least 20/10 mmHg, ideally to <140/90 mmHg
OPTIMAL
<65 years : BP target <130 / 80 mmHg if tolerated (but >120 / 70 mmHg).
≥65 years : BP target <140 / 90 mmHg if tolerated but consider an individualised BP target in the context of frailty, independence and likely tolerability of treatment.
Aim for BP control within 3 months

**ESSENTIAL**

- Use whatever drugs are available with as many of the ideal characteristics (see ***Table 9***) as possible.
- Use free combinations if SPCs are not available or unaffordable
- Use thiazide diuretics if thiazide-like diuretics are not available
- Use alternative to DHP-CCBs if these are not available or not tolerated (i.e. Non-DHP-CCBs: diltiazem or verapamil).

**OPTIMAL**

**Ideally Single Pill Combination Therapy (SPC)**

| | |
|---|---|
| **Step 1** Dual low-dose# combination | **A + C** [a, b, c] |
| **Step 2** Dual full-dose combination | **A + C** [a, b] |
| **Step 3** Triple combination | **A + C + D** |
| **Step 4** (Resistant Hypertension) Triple Combination + Spironolactone or other drug* | **A + C +D Add Spironolactone (12.5 – 50 mg o.d.)**[d] |

**ESSENTIAL** **OPTIMAL**

Consider beta-blockers at any treatment step when there is a specific indication for their use, e.g. heart failure, angina, post-MI, atrial fibrillation, or younger women with, or planning pregnancy.

a) Consider monotherapy in low risk grade 1 hypertension or in very old (≥80 yrs) or frailer patients.
b) Consider A + D in post-stroke, very elderly, incipient HF or CCB intolerance.
c) Consider A + C or C + D in black patients.
d) Caution with spironolactone or other potassium sparing diuretics when estimated GFR <45 ml/min/1.73m² or $K^+$ >4.5 mmol/L.

**A** = ACE-Inhibitor or ARB (Angiotensin Receptor Blocker)
**C** = DHP-CCB (Dihydropyridine -Calcium Channel Blocker)
**D** = Thiazide-like diuretic
**Supportive references:** A + C,[69,70] Spironolactone,[71] Alpha-blocker,[72] C + D[73].

* Alternatives include: Amiloride, doxazosin, eplerenone, clonidine or beta-blocker.

# low-dose generally refers to half of the maximum recommended dose

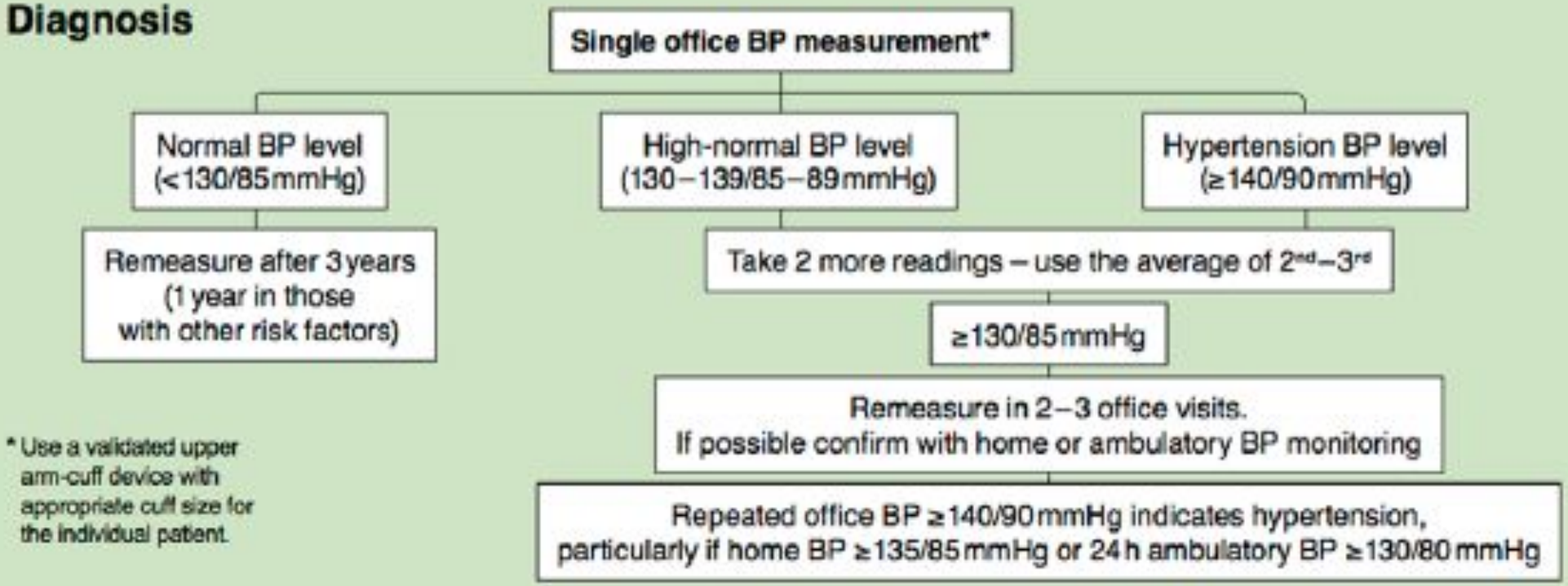
RCT-based benefits between ACE-I's and ARB's were not always identical in different patient populations. Choice between the two classes of RAS-Blockers will depend on patient characteristics, availability, costs and tolerability.

**Table 12. Hypertensive Emergencies Requiring Immediate BP Lowering**

| Clinical Presentation | Timeline and Target BP | First Line Treatment | Alternative |
|---|---|---|---|
| Malignant hypertension with or without TMA or acute renal failure | Several hours, MAP –20% to –25% | Labetalol<br>Nicardipine | Nitroprusside<br>Urapidil |
| Hypertensive encephalopathy | Immediate, MAP –20% to –25% | Labetalol<br>Nicardipine | Nitroprusside |
| Acute ischaemic stroke and SBP >220 mm Hg or DBP >120 mm Hg | 1 h, MAP –15% | Labetalol<br>Nicardipine | Nitroprusside |
| Acute ischaemic stroke with indication for thrombolytic therapy and SBP >185 mm Hg or DBP >110 mm Hg | 1 h, MAP –15% | Labetalol<br>Nicardipine | Nitroprusside |
| Acute hemorrhagic stroke and SBP >180 mm Hg | Immediate, 130<SBP<180 mm Hg | Labetalol<br>Nicardipine | Urapidil |
| Acute coronary event | Immediate, SBP <140 mm Hg | Nitroglycerine<br>Labetalol | Urapidil |
| Acute cardiogenic pulmonary edema | Immediate, SBP <140 mm Hg | Nitroprusside or nitroglycerine (with loop diuretic) | Urapidil (with loop diuretic) |
| Acute aortic disease | Immediate, SBP <120 mm Hg and heart rate <60 bpm | Esmolol and nitroprusside or nitroglycerine or nicardipine | Labetalol or metoprolol |
| Eclampsia and severe preeclampsia/ HELLP | Immediate, SBP <160 mm Hg and DBP <105 mm Hg | Labetalol or nicardipine and magnesium sulphate | |

Adapted from van den Born et al.[127]

## Diagnosis




* Use a validated upper arm-cuff device with appropriate cuff size for the individual patient.

## Evaluation

**History & Physical Exam**
- Exclude drug-induced hypertension
- Evaluate for organ damage
- Assess total CV risk
- Search for symptoms/signs of secondary hypertension

**Lab Tests**
- Serum sodium, potassium & creatinine
- Lipid profile & glucose
- Urine dipstick
- 12 lead ECG

**Additional Tests**
- If necessary for suspected organ damage or secondary hypertension

## Treatment

**Grade 1 Hypertension:**
140–159/90–99 mmHg
1. Start lifestyle interventions
2. Start drug treatment in:
   – High-risk patients (CVD,CKD, diabetes, organ damage, or aged 50-80 years)
   – All others with persistent BP elevation after 3–6 months of lifestyle intervention

**Grade 2 Hypertension:**
≥160/100 mmHg
1. Start drug treatment immediately
2. Start lifestyle intervention

**Lifestyle Interventions**
- Stop smoking
- Regular exercise
- Lose weight
- Salt reduction
- Healthy diet and drinks
- Lower alcohol intake

**Drug Therapy Steps**

Use any drugs available and include as many of those below as possible. Consider monotherapy in low-risk grade 1 hypertension and in patients aged >80 years or frail. Simplify regimen with once daily dosing and single pill combinations.

***Non-Black Patients***
1. Low dose ACEI/ARB* + DHP-CCB
2. Increase to full dose
3. Add thiazide/thiazide-like diuretic
4. Add spironolactone or, if not tolerated or contraindicated, amiloride, doxazosin, eplerenone, clonidine or beta-blocker

***Black Patients***
1. Low dose ARB* + DHP-CCB or DHP-CCB + thiazide/thiazide-like diuretic
2. Increase to full dose
3. Add diuretic or ARB /ACEI
4. Add spironolactone or, if not tolerated or contraindicated, amiloride, doxazosin, eplerenone, clonidine or beta-blocker

* No ACEI/ARB in women with or planning pregnancy

## Monitoring

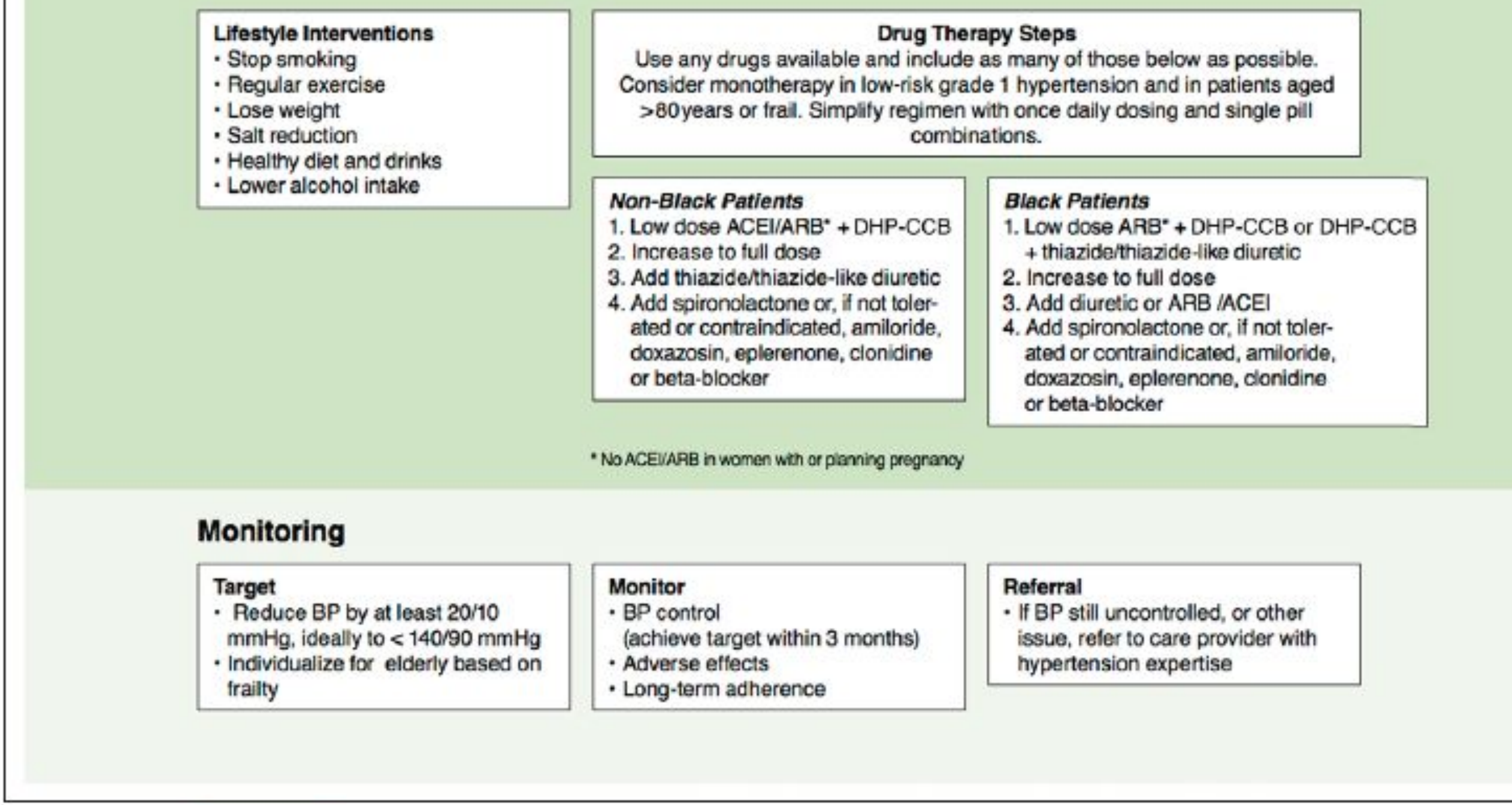
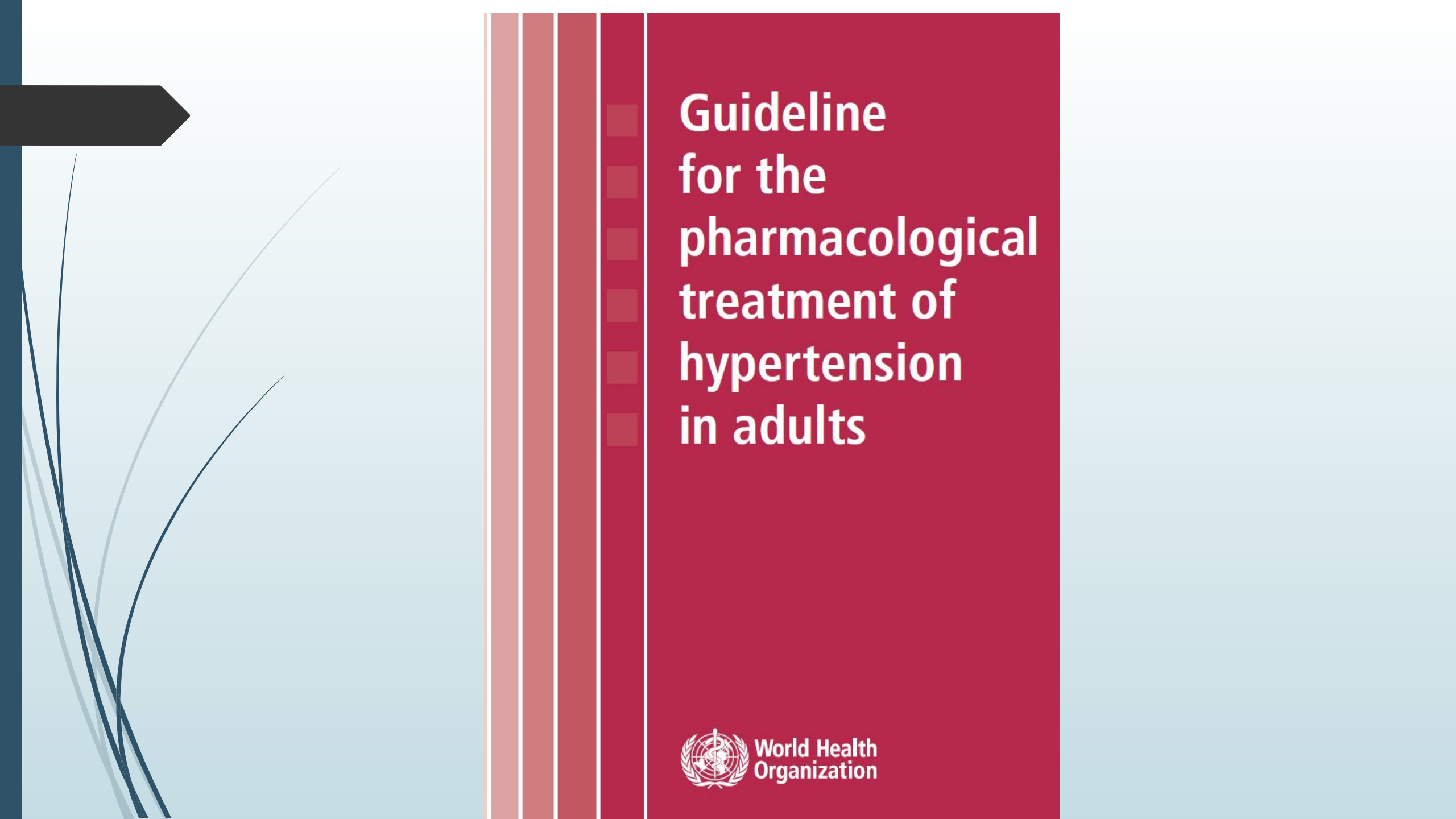



**Figure 5.** ISH 2020 ESSENTIAL recommendations (minimum standards of care).

# WHO Guideline for the pharmacological treatment of hypertension in adults


Guideline
for the
pharmacological
treatment of
hypertension
in adults
World Health
Organization

## 4. RECOMMENDATION ON DRUG CLASSES TO BE USED AS FIRST-LINE AGENTS

For adults with hypertension requiring pharmacological treatment, WHO recommends the use of drugs from any of the following three classes of pharmacological antihypertensive medications as an initial treatment:

1. thiazide and thiazide-like agents
2. angiotensin-converting enzyme inhibitors (ACEis)/angiotensin-receptor blockers (ARBs)
3. long-acting dihydropyridine calcium channel blockers (CCBs).

*Strong recommendation, high-certainty evidence*

Implementation remarks:

- Long-acting antihypertensives are preferred.
- Examples of indications to consider specific agents include diuretics or CCBs in patients over 65 years or those of African descent, beta-blockers in ischaemic heart disease, ACEis/ARBs in patients with severe proteinuria, diabetes mellitus, heart failure or kidney disease.

## 3. RECOMMENDATION ON CARDIOVASCULAR DISEASE RISK ASSESSMENT

WHO suggests cardiovascular risk assessment at or after the initiation of pharmacological treatment for hypertension, but only where this is feasible and does not delay treatment.

*Conditional recommendation, low-certainty evidence*

Implementation remarks:

- Most patients with SBP ≥140 or DBP ≥90 mmHg are high risk and indicated for pharmacological treatment; they do not require cardiovascular (CVD) risk assessment prior to initiating treatment. CVD risk assessment is most important for guiding decisions about initiating pharmacological treatment for hypertension (HTN) in those with lower SBP (130–139 mmHg). It is critical in those with HTN that other risk factors must be identified and treated appropriately to lower total cardiovascular risk.
- Many CVD risk-assessment systems are available. In the absence of a calibrated equation for the local population, the choice should depend on resources available, acceptability and feasibility of application.
- Whenever risk assessment may threaten timely initiation of HTN treatment and/or patient follow up, it should be postponed and included in the follow-up strategy, rather than taken as a first step to indicate treatment.

## 2. RECOMMENDATION ON LABORATORY TESTING

When starting pharmacological therapy for hypertension, WHO suggests obtaining tests to screen for comorbidities and secondary hypertension, but only when testing does not delay or impede starting treatment.

*Conditional recommendation, low-certainty evidence*

Implementation remarks:

- Suggested tests include serum electrolytes and creatinine, lipid panel, HbA1C or fasting glucose, urine dipstick, and electrocardiogram (ECG).
- In low-resourced areas or non-clinical settings, where testing may not be possible because of additional costs, and lack of access to laboratories and ECG, treatment should not be delayed, and testing can be done subsequently.
- Some medicines, such as long-acting dihydropyridine calcium-channel blockers (CCBs) are more suitable for initiation without testing, compared to diuretics or angiotensin-converting enzyme inhibitors (ACEi)/angiotensin-II receptor blockers (ARBs).

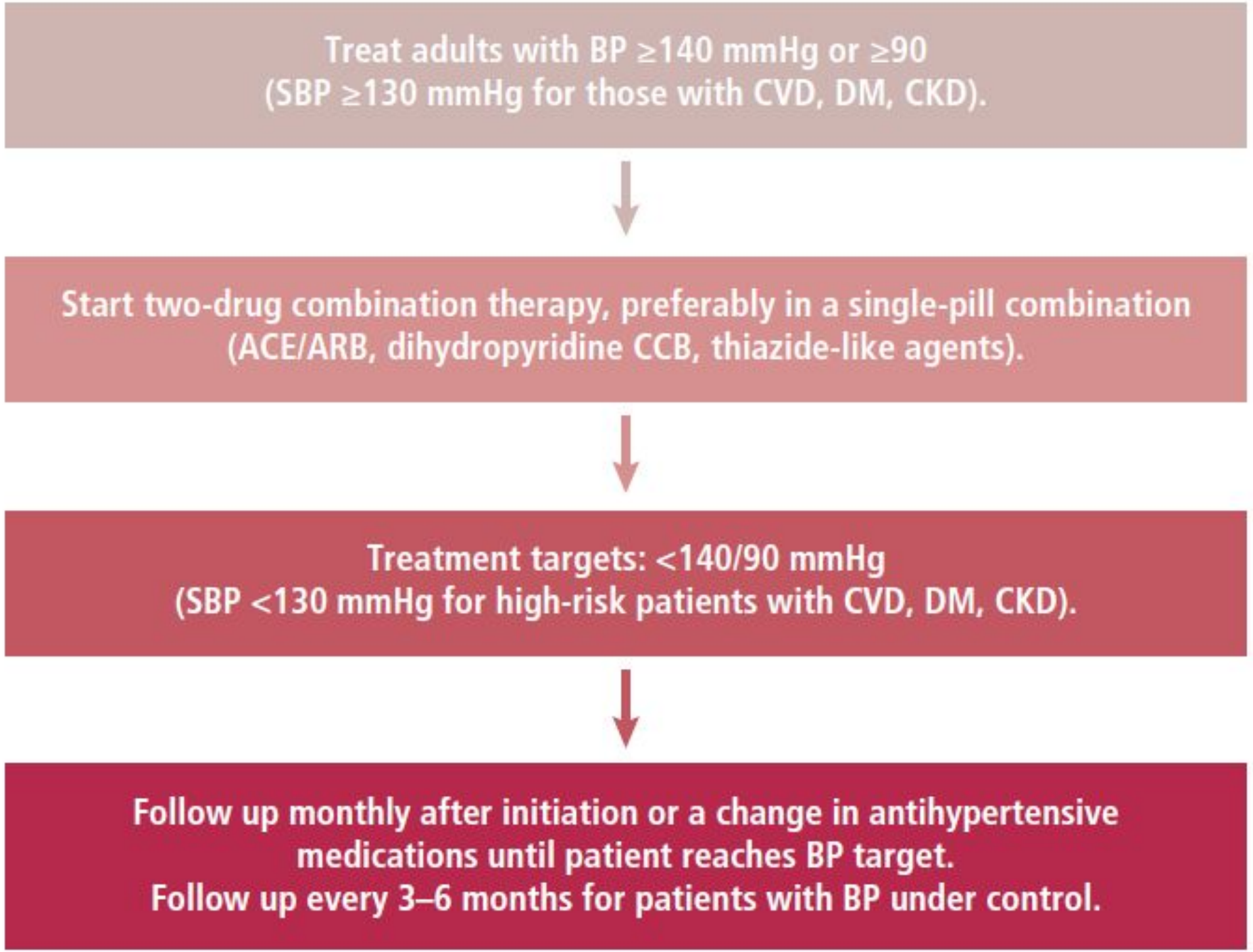
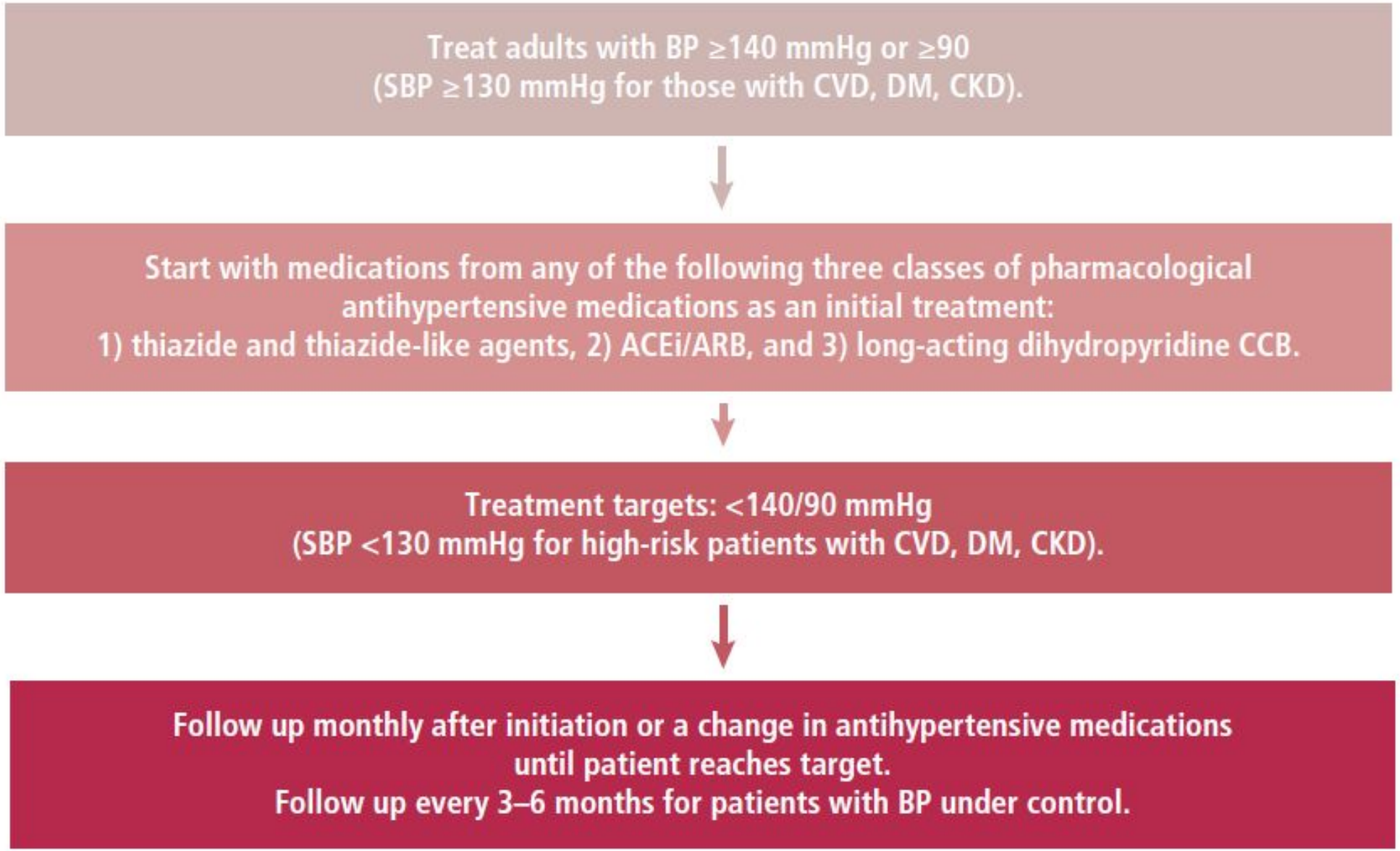
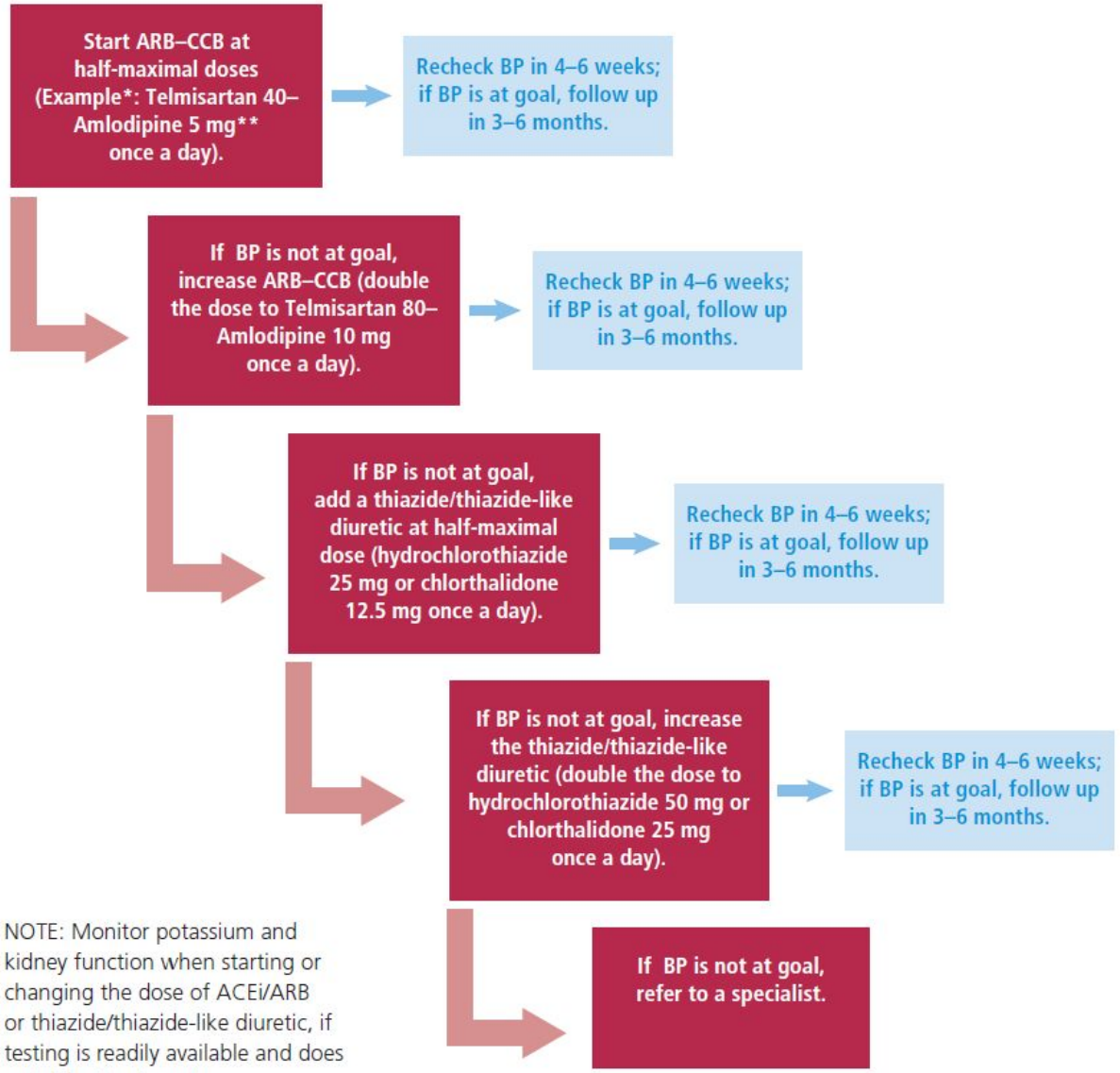

Treat adults with BP ≥140 mmHg or ≥90
(SBP ≥130 mmHg for those with CVD, DM, CKD).
Start two-drug combination therapy, preferably in a single-pill combination
(ACE/ARB, dihydropyridine CCB, thiazide-like agents).
Treatment targets: <140/90 mmHg
(SBP <130 mmHg for high-risk patients with CVD, DM, CKD).
Follow up monthly after initiation or a change in antihypertensive
medications until patient reaches BP target.
Follow up every 3–6 months for patients with BP under control.

Fig. 4 An approach for starting treatment not using a single-pill combination (i.e. with monotherapy or free combination therapy)



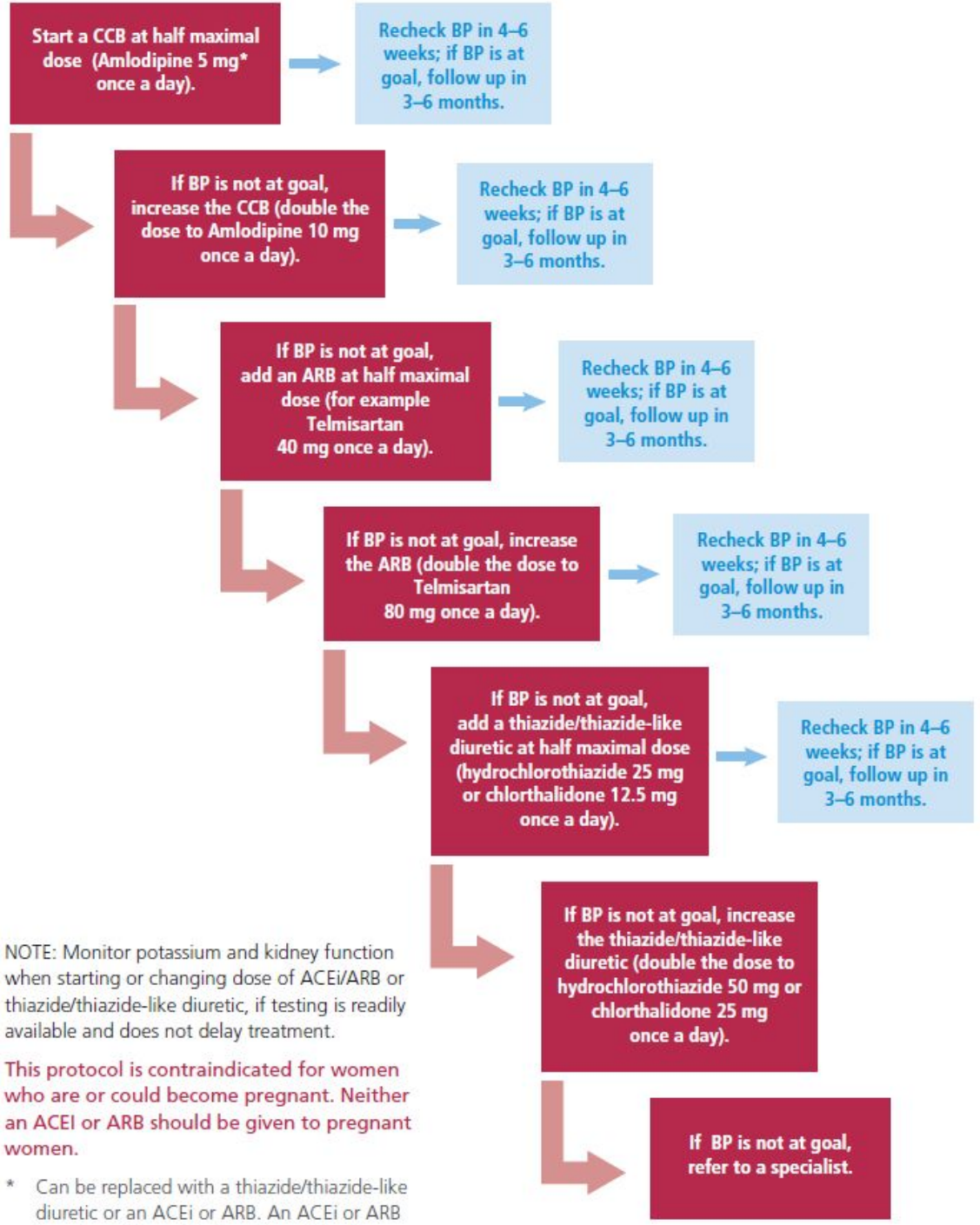



NOTE: Monitor potassium and kidney function when starting or changing the dose of ACEi/ARB or thiazide/thiazide-like diuretic, if testing is readily available and does not delay treatment.

This protocol is contraindicated for women who are or could become pregnant. Neither an ACEI or ARB should be given to pregnant women.

* The medications mentioned serve as examples and can be replaced with any two medications from any of the three drug classes (ACEis/ARBs, CCBs or thiazide/thiazide-like diuretics). Start two individual pills or, if available, both in a single-pill combination (fixed-dose combination).

** Can be replaced with other individual pills or, if available, other single-pill combinations (fixed-dose combinations).




NOTE: Monitor potassium and kidney function when starting or changing dose of ACEi/ARB or thiazide/thiazide-like diuretic, if testing is readily available and does not delay treatment.

This protocol is contraindicated for women who are or could become pregnant. Neither an ACEI or ARB should be given to pregnant women.

* Can be replaced with a thiazide/thiazide-like diuretic or an ACEi or ARB. An ACEi or ARB is preferred for patients with proteinuria

# 2021 European Society of Hypertension practice guidelines

# 2021 European Society of Hypertension practice guidelines for office and out-of-office blood pressure measurement

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**Keywords:** ambulatory, clinic, diagnosis, home, hypertension, kiosk, monitoring, office, pharmacy, self-measurement

**Abbreviations:** ABPM, ambulatory blood pressure monitoring; BP, blood pressure; CVD, cardiovascular disease; HBPM, home blood pressure monitoring; MH; masked hypertension; OBP, office blood pressure; WCH, white-coat hypertension

## SECTION 1: INTRODUCTION [1–4]

High blood pressure (BP) is the leading modifiable risk factor for morbidity and mortality worldwide. The basis for diagnosing and managing hypertension is the measurement of BP, which is routinely used to initiate or rule out costly investigations and long-term therapeutic interventions. Inadequate measurement methodology or use of inaccurate BP measuring devices can lead to overdiagnosis and unnecessary treatment, or underdiagnosis and exposure to preventable cardiovascular disease (CVD).

Office BP (OBP) is measured using different methods monitoring (ABPM), or home BP monitoring (HBPM), along with measurements in other settings (pharmacies, public spaces). With lower BP targets currently recommended by hypertension guidelines, the accuracy in BP measurement has become even more important to achieve optimal control and prevent adverse effects of over-treatment. Current guidelines recommend widespread use of ABPM and HBPM for detecting white-coat hypertension (WCH), masked hypertension (MH), resistant hypertension and other clinically important conditions. However, to date the classification of BP, as well as the threshold and target for treatment, are still based on conventional OBP measurements.

This European Society of Hypertension (ESH) statement aims to summarise essential recommendations for BP measurements for clinical practice in and out of the office. Members of the ESH Working Group on Blood Pressure Monitoring and Cardiovascular Variability prepared the first draft, which was reviewed by ESH Council members to formulate a draft statement. This document was then reviewed by external international experts, including general practitioners, and a final statement was developed.

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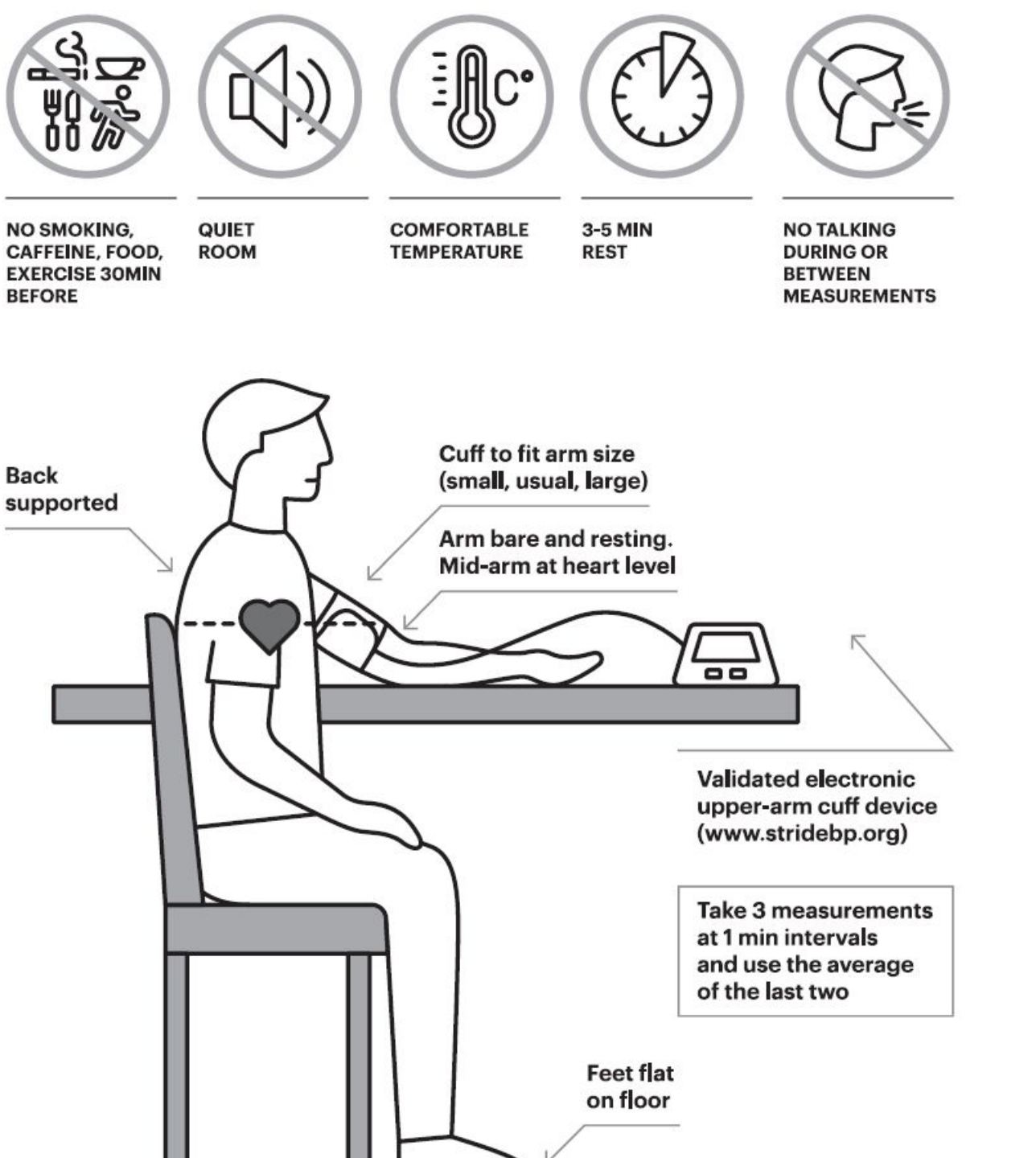
NO SMOKING, CAFFEINE, FOOD, EXERCISE 30MIN BEFORE
QUIET ROOM
COMFORTABLE TEMPERATURE
3-5 MIN REST
NO TALKING DURING OR BETWEEN MEASUREMENTS
Back supported
Cuff to fit arm size (small, usual, large)
Arm bare and resting. Mid-arm at heart level
Validated electronic upper-arm cuff device (www.stridebp.org)
Take 3 measurements at 1 min intervals and use the average of the last two
Feet flat on floor

**TABLE 4. Interpretation of average OBP (at least 2-3 visits with 2-3 measurements per visit)**

| | Normal-optimal BP (<130/85 mmHg) | High-normal BP (130–139/85–89 mmHg) | Hypertension Grade 1 (140–159/90–99 mmHg) | Hypertension Grade 2 and 3 (≥160/100 mmHg) |
|---|---|---|---|---|
| **Diagnosis** | Normotension highly probable | Consider MH | Consider WCH | Sustained hypertension highly probable |
| **Action** | Remeasure after 1 year (6 months in those with other risk factors) | Perform HBPM and/or ABPM. If not available confirm with repeated office visits | | Confirm within a few days or weeks[a]. Ideally use HBPM or ABPM |

[a]Treat immediately if OBP is very high (e.g. ≥180/110 mmHg) and there is evidence of target organ damage or CVD.

**Box 3 ABPM INTERPRETATION (Fig. 3)**

**ABPM thresholds of hypertension**

| | | |
|---|---|---|
| 24 h average: | ≥130/80 mmHg | Primary criterion |
| Daytime (awake) average: | ≥135/85 mmHg | Daytime hypertension[a] |
| Night-time (asleep) average: | ≥120/70 mmHg | Night-time hypertension[b] |

**Asleep BP dip compared with awake BP** (systolic and/or diastolic)

| | |
|---|---|
| Asleep BP fall ≥10%: | Dipper[a,b] |
| Asleep BP fall <10%: | Non-dipper[a,b] |

[a]Apply only if day/night BP is calculated using the individuals' sleeping times.
[b]The diagnosis must be confirmed with repeat ABPM.

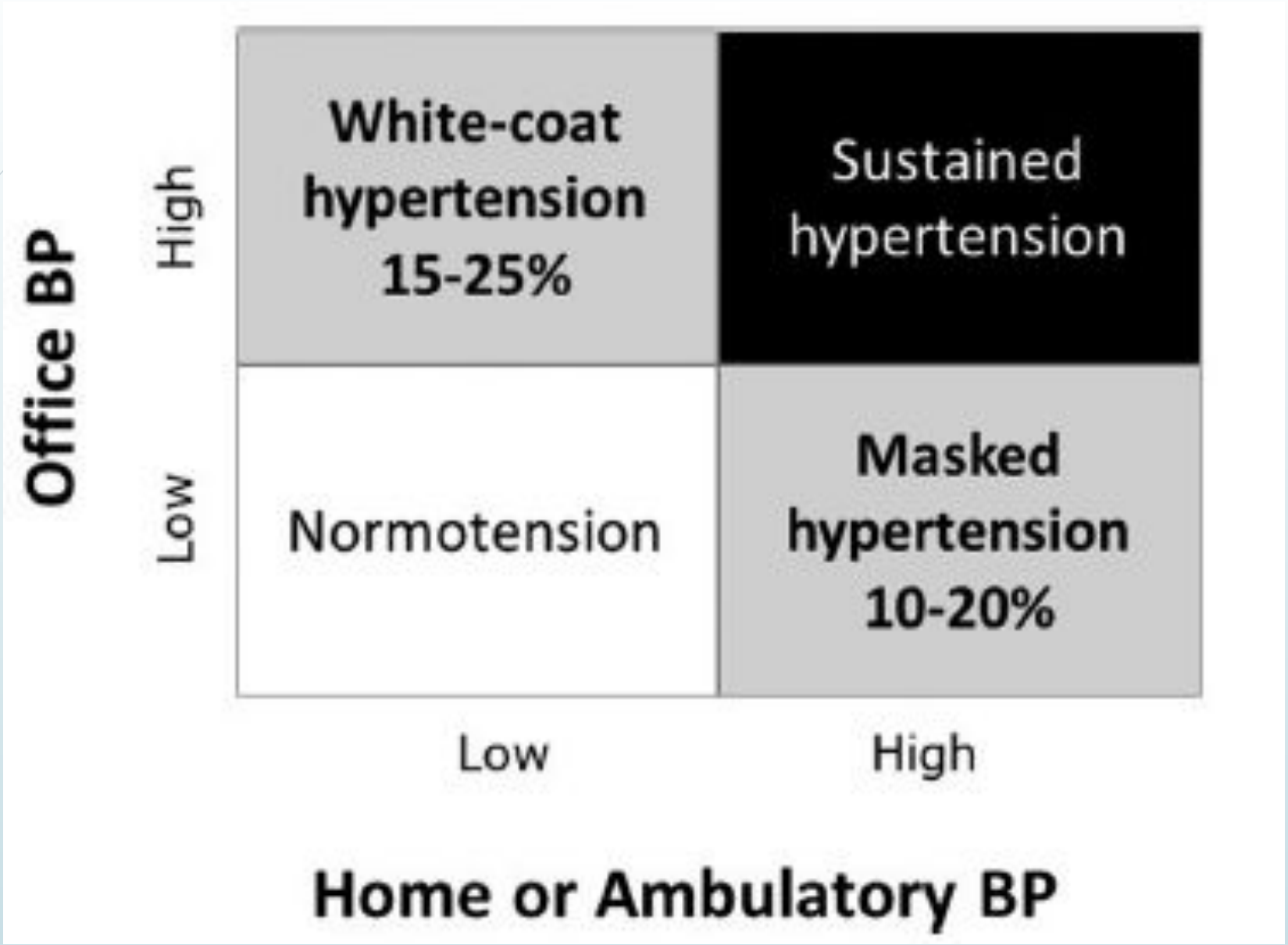
Office BP
High
Low
White-coat hypertension 15-25%
Sustained hypertension
Normotension
Masked hypertension 10-20%
Low
High
Home or Ambulatory BP

**TABLE 2. Diagnosis and management of white-coat and masked hypertension phenomena (in untreated or treated individuals)**

| | White-coat hypertension[a] | Masked hypertension[a] |
|---|---|---|
| Diagnosis | Elevated OBP, but not 24 h ambulatory and/or home BP[b] | Elevated 24 h ambulatory and/or home BP, but not OBP[b] |
| Management | Lifestyle changes and annual follow-up.<br>Consider drug treatment in patients with high or very-high CVD risk | Lifestyle changes and consider drug treatment |

[a]These diagnoses require confirmation with repeat OBP and out-of-office BP measurements.
[b]'Elevated' based on OBP threshold ≥140/90 mmHg, 24 h ambulatory BP ≥130/80 mmHg, home BP ≥135/85 mmHg.


thank
you