

Table 1. ESC 2024 GL on hypertension. Key illness representations and treatment beliefs: how these apply to communicating a hypertension diagnosis to the patient (note that gender influences these representations)

Illness representation	Example patient question	Application to a hypertension diagnosis conversation
Identity	What is the disease/illness label and the related symptoms?	The condition where your systolic BP is ≥ 140 and/or diastolic BP ≥ 90 mmHg is called hypertension. We classify systolic BP 120–139 or diastolic BP 70–89 mmHg as elevated BP. For most people, this has no noticeable signs or symptoms, therefore, we need to monitor your BP to assess how medications and behavioural changes are working.
Control	Is the illness controllable through medical intervention or behavioural change?	Hypertension can usually be controlled with medication and behavioural changes such as dietary changes and regular physical activity. For some people we need to try a few different options before we get BP under control.
Timeline	Is this an acute or chronic problem?	This is a serious long-term or chronic condition that will require long-term management. This means that it may need to be managed throughout life.
Consequences	What are the physical and psychosocial consequences?	If hypertension is not controlled, then there is a risk of a serious acute cardiovascular disease event such as a stroke or heart attack; however, if it is managed through the right medical intervention and behavioural changes, then this risk can be reduced and the condition will have less consequences for your life.
Causes	What caused the condition?	Multiple factors contribute to someone developing hypertension. These include both non-modifiable factors (e.g. genetics and age) and modifiable factors (e.g. diet, weight, and physical activity). We are best focusing on those things that we can control to reduce your BP.
Treatment beliefs	Example patient question	Application to a hypertension diagnosis communication
Necessity	To what extent is treatment necessary?	Taking BP-lowering medication every day is necessary to keep your BP under control and to help prevent a more serious health problem developing. Do you think that these medicines will help you?
Concerns	To what extent does treatment cause concern?	Some patients have concerns about taking daily medications throughout their life, e.g. about side effects. Do you have any concerns about taking your BP medications every day?

Table 2. Investigations

AHA/ACC 2025 GL on hypertension.

Patient Evaluation, Including Laboratory Tests and Other Diagnostic Procedures

1	C-EO	1. For adults who are diagnosed with hypertension, laboratory tests (ie, complete blood count, serum electrolytes, serum creatinine, lipid profile, glucose or hemoglobin A1c [HbA1c], thyroid-stimulating hormone, urinalysis, and urine albumin-to-creatinine ratio) and diagnostic procedures (12-lead ECG) should be performed to optimize management.
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Routine Laboratory Testing for New Diagnosis of Hypertension

Diagnostic Tests
Complete blood count
Serum sodium, potassium, calcium
Serum creatinine with estimation of glomerular filtration rate (based on the 2021 CKD-EPI Creatinine Equation)
Lipid profile
Fasting blood glucose or Hemoglobin A1c
Thyroid-stimulating hormone
Urinalysis
Urine albumin-to-creatinine ratio; urine protein-to-creatinine ratio
ECG

ESC 2024 GL on hypertension.

Routine tests recommended in the initial work-up of a patient with elevated blood pressure or hypertension

Routine test	Clinical utility
Fasting blood glucose (and HbA1c if fasting blood glucose is elevated)	Assessing CVD risk and comorbidities
Serum lipids: total cholesterol, LDL cholesterol, HDL and non-HDL cholesterol, triglycerides	Assessing CVD risk
Blood sodium and potassium, haemoglobin and/or haematocrit, calcium, and TSH	Screening secondary hypertension (primary aldosteronism, Cushing's disease, polycythaemia, hyperparathyroidism, and hyperthyroidism)
Blood creatinine and eGFR; urinalysis and urinary albumin-to-creatinine ratio	Assessing CVD risk and HMOD Guiding treatment choice Screening secondary hypertension (renoparenchymal and renovascular)
12-lead ECG	Assessing HMOD (left atrial enlargement, left ventricular hypertrophy) Assessing irregular pulse and other comorbidities (AF, previous acute myocardial infarction)

AF, atrial fibrillation; CVD, cardiovascular disease; ECG, electrocardiogram; eGFR, estimated glomerular filtration rate; HbA1c, glycated haemoglobin; HDL, high-density lipoprotein; HMOD, hypertension-mediated organ damage; LDL, low-density lipoprotein; TSH, thyroid-stimulating hormone.

Optional tests that may be used as clinically indicated in the initial work-up of a patient with elevated blood pressure or hypertension to assess hypertension-mediated organ damage or established cardiovascular disease

Optional test	Clinical utility
Echocardiography	Assessing HMOD (hypertensive heart disease) Assessing established CVD (previous acute myocardial infarction, heart failure) Assessing thoracic aorta dilation
CAC by cardiac CT or carotid or femoral artery ultrasound imaging	Assessing HMOD (atherosclerotic plaque)
Large artery stiffness (carotid–femoral or brachial–ankle PWV)	Assessing HMOD (arterial stiffness)
High-sensitivity cardiac troponin and/or NT-proBNP	Assessing HMOD
Ankle–brachial index	Assessing established CVD (lower-extremity arterial disease)
Abdominal ultrasound	Assessing established CVD (abdominal aneurysm)
Fundoscopy	Assessing HMOD (hypertensive retinopathy) Diagnosing hypertensive emergency/ malignant hypertension (haemorrhages and exudates, papilloedema)

CAC, coronary artery calcium; CT, computed tomography; CVD, cardiovascular disease; HMOD, hypertension-mediated organ damage; NT-proBNP, N-terminal pro-brain natriuretic peptide; PWV, pulse wave velocity.

Recommendations for assessing renal hypertension-mediated organ damage

It is recommended to measure serum creatinine, eGFR, and urine ACR in all patients with hypertension. ^{170,273}	I	A
If moderate-to-severe CKD is diagnosed, it is recommended to repeat measurements of serum creatinine, eGFR, and urine ACR at least annually. ²⁷⁶	I	C
Renal ultrasound and Doppler examination should be considered in hypertensive patients with CKD to assess kidney structure and determine causes of CKD and to exclude renoparenchymal and renovascular hypertension. ^{276,277} CT or magnetic resonance renal angiography are alternative testing options.	IIa	C

ACR, albumin:creatinine ratio; CKD, chronic kidney disease; CT, computed tomography; eGFR, estimated glomerular filtration rate.

Recommendations for assessing cardiac hypertension-mediated organ damage

A 12-lead ECG is recommended for all patients with hypertension. ^{31,281}	I	B
Echocardiography is recommended in patients with hypertension and ECG abnormalities, or signs or symptoms of cardiac disease. ^{14,31,292}	I	B
Echocardiography may be considered in patients with elevated BP, particularly when it is likely to change patient management. ^{31,291}	IIb	B

Recommendations for assessing vascular hypertension-mediated organ damage

Fundoscopy is recommended if BP >180/110 mmHg in the work-up of hypertensive emergency and malignant hypertension, as well as in hypertensive patients with diabetes.	I	C
Fundoscopy for detecting hypertensive retinopathy may be considered in patients with elevated BP or hypertension. ²⁹⁹	IIb	B
Ultrasound examination of the carotid or femoral arteries for detecting plaque may be considered in patients with elevated BP or hypertension when it is likely to change patient management. ²¹¹	IIb	B
Coronary artery calcium scoring may be considered in patients with elevated BP or hypertension when it is likely to change patient management. ^{127,211}	IIb	B
Measurement of PWV may be considered in patients with elevated BP or hypertension when it is likely to change patient management. ^{28,31,215,216}	IIb	B

BP, blood pressure; PWV, pulse wave velocity

Why measure?	Which organ?	What to measure?	How to diagnose HMOD?
 Support decision to start or intensify BP-lowering treatment for: - Individuals with elevated BP with SCORE2/SCORE2-OP risk of 5–<10% - Uncertain situations (i.e. BP or risk close to thresholds, masked or white-coat hypertension, non-traditional CVD risk factors) - Individuals <40 years old with elevated blood pressure - Assistance overcoming patient and physician inertia	Kidney	 eGFR ACR	Moderate-to-severe kidney disease - eGFR <60 mL/min/1.73 m² irrespective of albuminuria - Albuminuria ≥30 mg/g irrespective of eGFR
	Heart	ECG	LVH - Sokolow–Lyon: SV1+RV5 >35 mm - RaVL ≥11 mm - Cornell voltage: SV3+RaVL >28 mm (men) SV3+RaVL >20 mm (women)
		Echocardiography	LVH - LV mass/height^{2.7} (g/m^{2.7}): >50 (men) >47 (women) - LV mass/BSA (g/m²): >115 (men) >95 (women) - LV concentric geometry: RWT ≥0.43 Diastolic dysfunction - LA volume/height² (mL/m²): >18.5 (men) >16.5 (women) - LA volume index (mL/m²): 34 - e' <7cm; E/e' >14
		Cardiac biomarkers	- hs-cTnT or I >99th percentile upper reference limit - NT-proBNP >125 pg/mL if age <75 years or >450 pg/mL if ≥75 years
	Arteries	Carotid or femoral ultrasound	Plaque (focal wall thickening >1.5 mm)
		Pulse wave velocity	- Carotid-femoral PWV >10 m/s - Brachial-ankle PWV >14 m/s
		Cardiac CT	Coronary artery calcium score >100 Agatston units

Figure 1. ESC 2024 GL on hypertension Tests and criteria for defining hypertension-mediated organ damage and considerations for their use in clinical practice.

ACR, albumin: creatinine ratio; BP, blood pressure; BSA, body surface area; CT, computed tomography; CVD, cardiovascular disease; ECG, electrocardiogram; eGFR, estimated glomerular filtration rate; HMOD, hypertension-mediated organ damage; hs-cTnT, high-sensitivity cardiac troponin T; LA, left atrial; LV, left ventricular; LVH, left ventricular hypertrophy; NT-proBNP, N-terminal pro-brain natriuretic peptide; PWV, pulse wave velocity; RWT, relative wall thickness; SCORE2, Systematic COronary Risk Evaluation 2; SCORE2-OP, Systematic COronary Risk Evaluation 2–Older Persons.

Table 3. ESC 2024GL on hypertension. Recommendations for genetic testing in hypertension management

Genetic testing should be considered in specialist centres for patients suspected to have rare monogenic causes of secondary hypertension or for those with pheochromocytoma/paranglioma. ^{302,305}	IIa	B
Routine genetic testing for hypertension is not recommended.	III	C

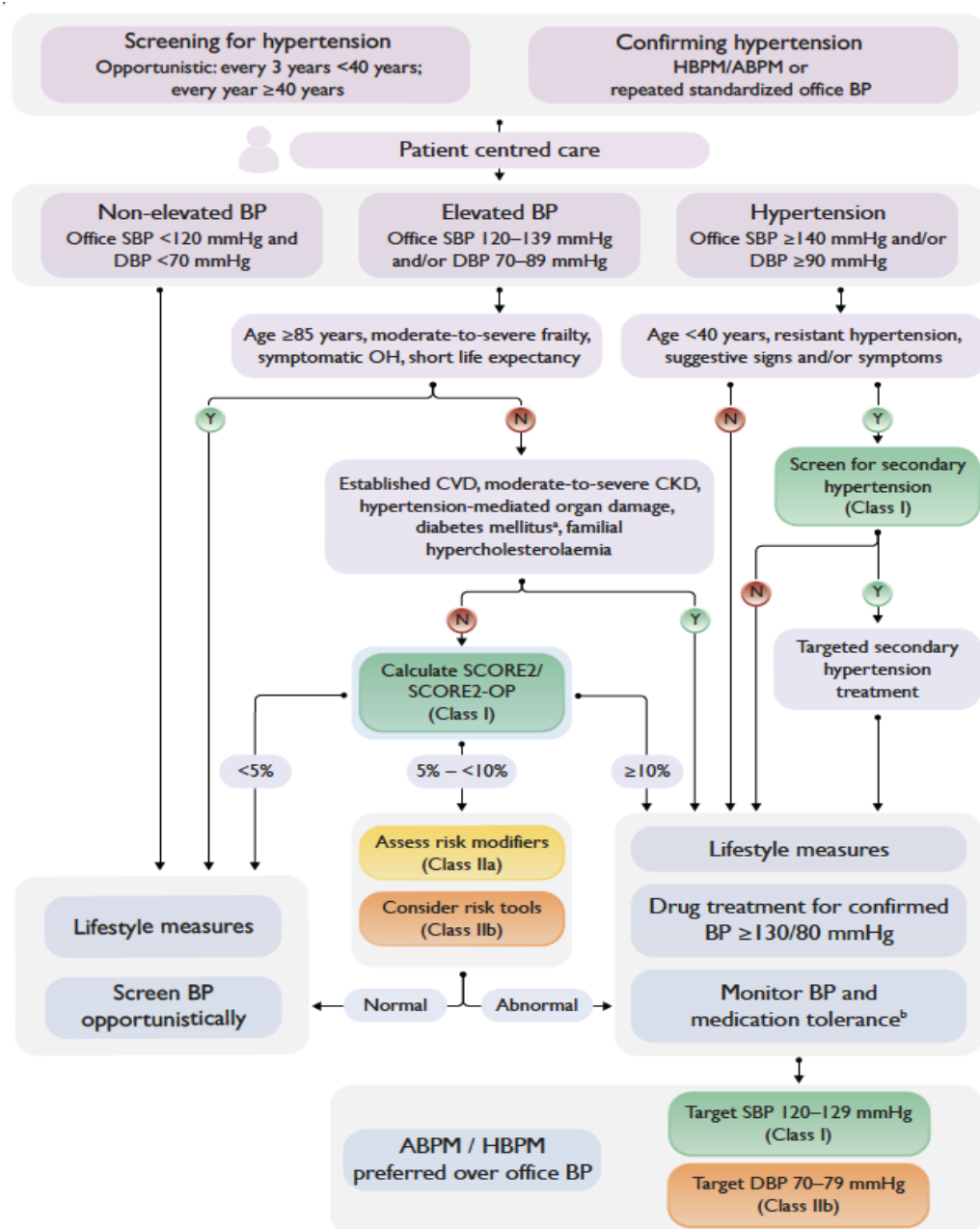


Figure 2. ESC 2024 GL on hypertension. Central Illustration

ABPM, ambulatory blood pressure monitoring; BP, blood pressure; CVD, cardiovascular disease; CKD, chronic kidney disease; DBP, diastolic blood pressure; HBPM, home blood pressure monitoring; OH, orthostatic hypotension; SBP, systolic blood pressure; SCORE2, Systematic COronary Risk Evaluation 2; SCORE2-OP, Systematic COronary Risk Evaluation 2–Older Persons. Summary algorithm for BP classification and management. See Section 5 for recommendations on out-of-office confirmation of the three BP categories.

^a Adults with type 2 diabetes mellitus

only and younger than 60 years should be considered for SCORE2-Diabetes assessment.

^b Though scientific data demonstrate that, under research conditions, the optimal target BP is $\leq 120/70$ mmHg, the target BP recommended by these guidelines in routine practice is 120–129/70–79 mmHg.

If achieving this target is not possible, or if treatment is not well tolerated, then BP should be treated to as low as reasonably achievable. For persons with elevated BP, treatment with lifestyle measures for 3 months is first recommended, prior to considering medications.

Table 4. AHA/ACC 2025 GL on hypertension.

Lifestyle and Psychosocial Approaches

Weight		
1	A	1. In adults who have overweight or obesity, weight loss is recommended with a goal of at least 5% of body weight reduction to prevent or treat elevated BP and hypertension. ¹⁻⁹
Diet and Nutrients		
1	A	2. In adults with or without hypertension, a heart-healthy eating pattern, such as the DASH eating plan, is recommended to prevent or treat elevated BP and hypertension. ⁹⁻¹⁵
1	A	3. In adults with or without hypertension, reduction of dietary sodium intake* is recommended to <2300 mg/d, moving toward an ideal limit of <1500 mg/d to prevent or treat elevated BP and hypertension. ^{4,12,16-19}

2a	A	4. In adults with or without hypertension, potassium-based salt substitutes [†] can be useful to prevent or treat elevated BP and hypertension, particularly for patients in whom salt intake is related mostly to food preparation or flavoring at home, except in the presence of CKD or use of drugs that reduce potassium excretion where monitoring of serum potassium levels is indicated. ^{‡20–24}
1	A	5. In adults with elevated BP or hypertension, moderate potassium supplementation, [§] ideally from dietary sources, is recommended to prevent or treat elevated BP and hypertension, except in the presence of CKD or use of drugs that reduce potassium excretion where monitoring of serum potassium levels is indicated. ^{‡ 25–27}
Alcohol		
1	A	6. Adults with or without hypertension who currently consume alcohol should be advised to pursue a recommended goal of abstinence, or at least to reduce alcohol intake to ≤1 drink/d for women and ≤2 drinks/d for men to prevent or treat elevated BP and hypertension. ^{‡ 28–31}
Physical Activity		
1	A	7. In adults with or without hypertension, increasing physical activity, through a structured exercise program that includes aerobic exercise and/or resistance training, is recommended to prevent or treat elevated BP and hypertension. ^{1,3,4,14,32–39}
Stress Reduction		
2b	B-R	8. In adults with or without hypertension, stress reduction through transcendental meditation may be reasonable to prevent or treat elevated BP and hypertension, as an adjunct to lifestyle or medication interventions. ^{7,8,14,40}
2b	B-R	9. In adults with or without hypertension, other forms of stress management, such as breathing control techniques or yoga, may be reasonable to prevent or treat elevated BP and hypertension, as an adjunct to lifestyle or medication interventions. ^{14,41,42}

*Dietary sodium reduction may be contraindicated in patients with severe, symptomatic orthostatic hypotension.

†This recommendation refers to potassium-based salt substitutes, which typically contain 25% to 30% potassium chloride, 65% to 75% sodium chloride, and 0% to 10% flavoring agents. Products that refer to themselves as "salt substitutes" that do not contain potassium chloride as a substitute for sodium chloride have unknown effects on BP.

‡Drugs that reduce potassium excretion include: potassium-sparing diuretics (eg, amiloride, triamterene), mineralocorticoid receptor antagonists (eg, spironolactone, eplerenone, finerenone), angiotensin-converting enzyme inhibitors (eg, captopril, enalapril, lisinopril, benazepril, and others), angiotensin receptor blockers (eg, losartan, valsartan, candesartan, telmisartan, and others), and some immunosuppressive agents (eg, cyclosporine, tacrolimus).

§Moderate potassium supplementation is <80 mmol/d (<80 mEq/d).

||One standard drink (12 to 14 g alcohol) is equivalent to 12 oz of beer (5% alcohol by volume), 5 oz of wine (12% alcohol by volume), or 1.5 oz of distilled spirits (40% alcohol by volume).

Lifestyle and Stress Reduction Interventions to Lower Blood Pressure

Intervention	Target/Biomarker	Evidence-Based Goals	Approximate Mean Change in SBP (mm Hg)*		References
			With Hypertension	Without Hypertension	
Weight loss	Body weight or BMI	Aim for sustained $\geq 5\%$ reduction in body weight or ≥ 3 kg/m ² reduction in BMI; expect about 1 mm Hg reduction for every 1-kg reduction in body weight	-6 to -8	-3 to -5	2,6,14,52
Heart-healthy diet	DASH eating pattern	Consume a diet rich in fruits, vegetables, whole grains, and low-fat dairy products, with reduced content of saturated and total fat	-5 to -8	-3 to -7	13-15,64,120
Reduced intake of sodium	Dietary sodium intake; 24-h urinary sodium	Optimal goal is <2300 mg/d, but aim for an ideal limit of <1500 mg/d	-6 to -8	-1 to -4	16-18,79,120,121
Use of salt substitute	Replace cooking/table salt (100% sodium chloride) with salt substitute (25%-30% potassium chloride, 65%-75% sodium chloride, and 0%-10% flavoring agents); 24-h urinary sodium and potassium	Reduce dietary sodium intake as above	-5 to -7	-5	20-22,93
Enhanced intake of potassium	Dietary potassium intake; 24-h urinary potassium	Aim for 3500-5000 mg/d, ideally by consumption of a diet rich in potassium; or alternative use of moderate-dose pharmacological potassium supplementation (<80 mmol)	-6	-3 to -6	25-27
Reduced alcohol intake	Alcohol consumption	Optimal goal is abstinence for all adults for best health outcomes; in patients who consume alcohol, aim for $>50\%$ reduction in daily intake to no more than 2 drinks/d in men or 1 drink/d in women	-4 to -6	-3	29
Exercise	Aerobic exercise	90-150 min/wk 65%-75% heart rate reserve	-4 to -8	-2 to -7	14,33,36,120,122
	Dynamic resistance	90-150 min/wk 50%-80% 1 rep maximum 6 exercises, 3 sets/exercise, 10 repetitions/set	-2 to -7	-2 to -5	33,36,106,107
	Isometric resistance	4 x 2 min (hand grip), 1 min rest between exercises, 30%-40% maximum voluntary contraction, 3 sessions/wk	-5 to -10	-4 to -6	14,32,33,36,109,110
Meditation	Transcendental meditation	Training by a professional, followed by 2 x 20 min sessions/d while seated comfortably with eyes closed	-5 to -7	-5	14,119
Breathing control	Slowing respiration	Device-guided session to decrease respiration to <10 breaths/min for 15 min/d	-5	-5	14

*Because inclusion/exclusion criteria and comparator groups vary across interventions, these values should not be compared directly to indicate comparative effectiveness.

BMI indicates body mass index; DASH, Dietary Approaches to Stop Hypertension; and SBP, systolic blood pressure.

Table 5. ESC 2024 GL on hypertension.

Recommendations for non-pharmacological treatment of blood pressure and cardiovascular risk reduction

Restriction of sodium to approximately 2 g per day is recommended where possible in all adults with elevated BP and hypertension [this is equivalent to about 5 g of salt (sodium chloride) per day or about a teaspoon or less]. ^{353,354}	I	A
Moderate intensity aerobic exercise of ≥ 150 min/week (≥ 30 min, 5–7 days/week) or alternatively 75 min of vigorous intensity aerobic exercise per week over 3 days are recommended and should be complemented with low- or moderate-intensity dynamic or isometric resistance training (2–3 times/week) to reduce BP and CVD risk. ^{1,381,390–393}	I	A
It is recommended to aim for a stable and healthy BMI (e.g. 20–25 kg/m ²) and waist circumference values (e.g. <94 cm in men and <80 cm in women) to reduce BP and CVD risk. ^{399–401}	I	A
Adopting a healthy and balanced diet, such as the Mediterranean or DASH diets, is recommended to help reduce BP and CVD risk. ^{412,438,439}	I	A
Men and women are recommended to drink less alcohol than the upper limit, which is about 100 g/week of pure alcohol. How this translates into number of drinks depends on portion size (the standards of which differ per country), but most drinks contain 8–14 g of alcohol per drink. Preferably, it is recommended to avoid alcohol to achieve the best health outcomes. ^{170,419,440,441}	I	B
It is recommended to restrict free sugar consumption, in particular sugar-sweetened beverages, to a maximum of 10% of energy intake. It is also recommended to discourage consumption of sugar-sweetened beverages, such as soft drinks and fruit juices, starting at a young age. ^{425–427}	I	B
It is recommended to stop tobacco smoking, initiate supportive care and refer to smoking cessation programmes, as tobacco use strongly and independently causes CVD, CVD events, and all-cause mortality. ^{428,429,431,437}	I	A
In patients with hypertension without moderate to advanced CKD and with high daily sodium intake, an increase of potassium intake by 0.5–1.0 g/day—for example through sodium substitution with potassium-enriched salt (comprising 75% sodium chloride and 25% potassium chloride) or through diets rich in fruits and vegetables—should be considered. ^{348,368,373,374,442}	IIa	A
In patients with CKD or taking potassium-sparing medication, such as some diuretics, ACE inhibitors, ARBs, or spironolactone, monitoring serum levels of potassium should be considered if dietary potassium is being increased.	IIa	C

ACE, angiotensin-converting enzyme; ARB, angiotensin receptor blocker; BMI, body mass index; BP, blood pressure; CKD, chronic kidney disease; CVD, cardiovascular disease; DASH, Dietary Approaches to Stop Hypertension.

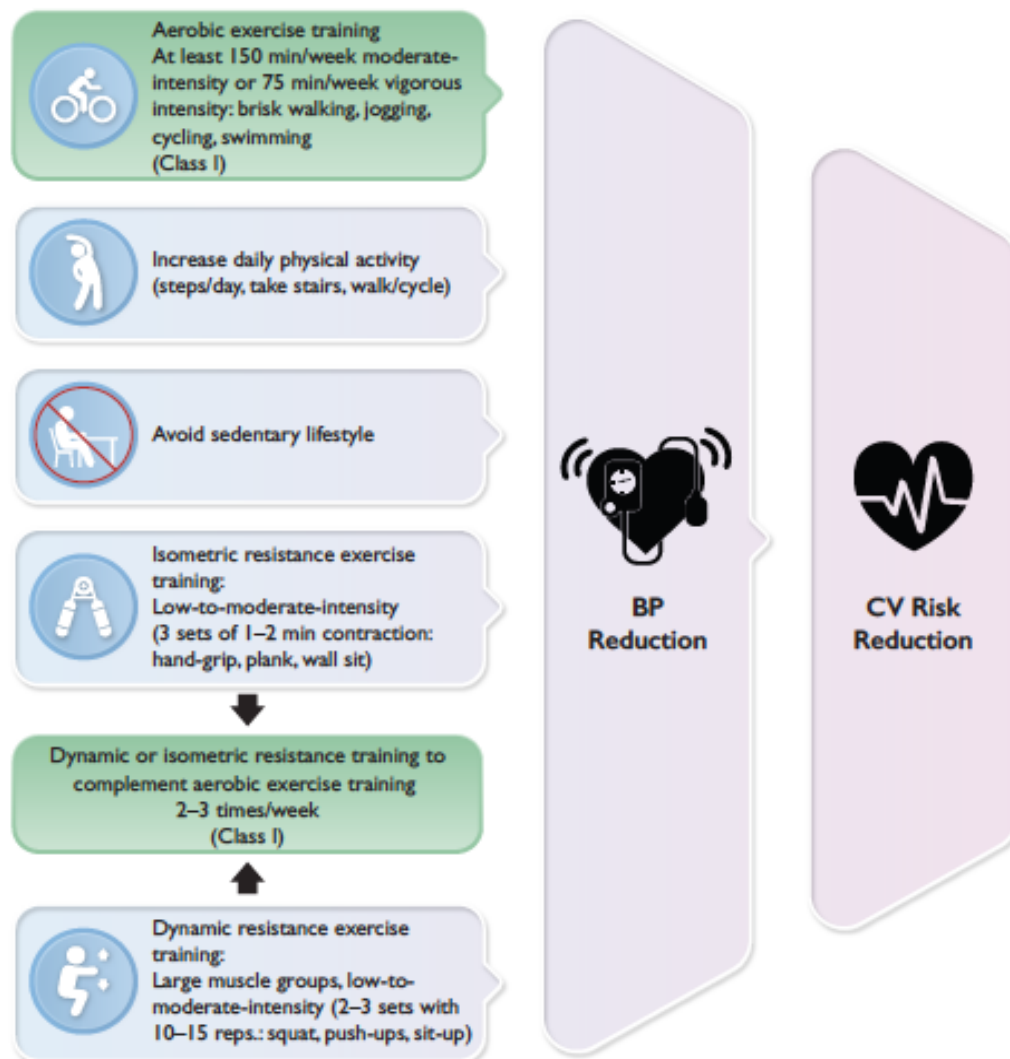


Figure 3. ESC 2024 GL on hypertension Physical activity according to different types of exercise and reduction of blood pressure and overall cardiovascular disease risk. Priority is given to aerobic exercise training (green).

BP, blood pressure; CVD, cardiovascular disease.

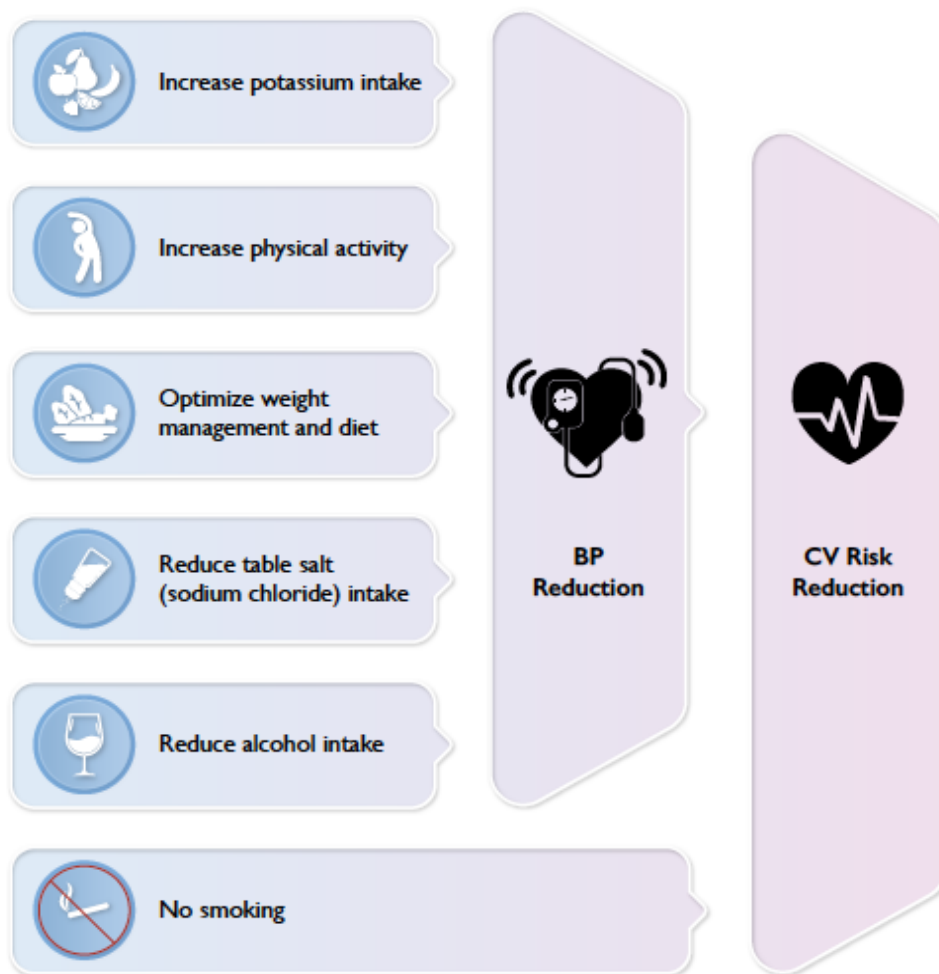


Figure 4. ESC 2024 GL on hypertension Effects of main lifestyle factors on blood pressure and cardiovascular risk reduction.

Smoking cessation reduces overall cardiovascular risk but not BP (long arrow). Salt reduction reduces BP and (for persons with high baseline intake) reduces cardiovascular risk. Increased potassium intake and higher physical activity, as well as optimized weight management, reduce BP and are associated with lower overall cardiovascular risk.

BP, blood pressure; CV, cardiovascular.

Table 6. AHA/ACC 2025 GL on hypertension. Target values

ESC 2024 GL on Hypertension. Recommendations for blood pressure targets with treatment

To reduce CVD risk, it is recommended that treated systolic BP values in most adults be targeted to 120–129 mmHg, provided the treatment is well tolerated. ^{22,122,131,523,541}	I	A
In cases where BP-lowering treatment is poorly tolerated and achieving a systolic of 120–129 mmHg is not possible, it is recommended to target a systolic BP level that is 'as low as reasonably achievable' (ALARA principle). ^{22,122,131,523,541}	I	A
Because the CVD benefit of an on-treatment systolic BP target of 120–129 mmHg may not generalize to the following specific settings, personalized and more lenient BP targets (e.g. <140 mmHg) should be considered among patients meeting the following criteria: pre-treatment symptomatic orthostatic hypotension, and/or age ≥85 years. ¹³¹	IIa	C
Because the CVD benefit of an on-treatment systolic BP target of 120–129 mmHg may not generalize to the following specific settings, personalized and more lenient BP targets (e.g. <140/90 mmHg) may be considered among patients meeting the following criteria: clinically significant moderate-to-severe frailty at any age, and/or limited predicted lifespan (<3 years).	IIb	C
In cases where on-treatment systolic BP is at or below target (120–129 mmHg) but diastolic BP is not at target (≥80 mmHg), intensifying BP-lowering treatment to achieve an on-treatment diastolic BP of 70–79 mmHg may be considered to reduce CVD risk.	IIb	C

ALARA, as low as reasonably achievable; BP, blood pressure; CVD, cardiovascular disease.

BP Treatment Threshold and the Use of CVD Risk Estimation to Guide Drug Treatment of Hypertension

1	A	1. In all adults with hypertension, initiation of medications to lower BP is recommended when average SBP is ≥ 140 mm Hg to reduce the risk of cardiovascular events and total mortality. ¹⁻⁶
1	A	2. In all adults with hypertension, initiation of medications to lower BP is recommended when average DBP is ≥ 90 mm Hg to reduce the risk of cardiovascular events and total mortality. ¹⁻⁶
1	A	3. In adults with hypertension and clinical CVD, initiation of medications to lower BP is recommended when average SBP is ≥ 130 mm Hg to reduce the risk of cardiovascular events and total mortality. ⁵⁻⁸
1	C-LD	4. In adults with hypertension and clinical CVD, initiation of medications to lower BP is recommended when average DBP is ≥ 80 mm Hg to reduce the risk of cardiovascular events and total mortality. ⁵⁻⁸

COR	LOE	Recommendations
1	A	5. In adults with hypertension without clinical CVD but with diabetes or CKD or at increased short-term CVD risk (ie, estimated 10-year CVD risk $\geq 7.5\%$ based on PREVENT*), initiation of medications to lower BP is recommended when average SBP is ≥ 130 mm Hg to reduce the risk of CVD events and total mortality. ⁵⁻¹⁰
1	C-LD	6. In adults with hypertension without clinical CVD but with diabetes or CKD or at increased 10-year CVD risk (ie, $\geq 7.5\%$ based on PREVENT*), initiation of medications to lower BP is recommended when average DBP is ≥ 80 mm Hg to reduce the risk of CVD events and total mortality. ⁵⁻¹⁰
1	B-R	7. In adults with hypertension without clinical CVD and with estimated 10-year CVD risk $< 7.5\%$ based on PREVENT*, initiation of medications to lower BP is recommended if average SBP remains ≥ 130 mm Hg after a 3- to 6-month trial of lifestyle intervention to prevent target organ damage and mitigate further rise in BP. ^{7,9,10}
1	B-R	8. In adults with hypertension without clinical CVD and with estimated 10-year CVD risk $< 7.5\%$ based on PREVENT*, initiation of medications to lower BP is recommended if average DBP ≥ 80 mm Hg after a 3- to 6-month trial of lifestyle intervention to prevent target organ damage and mitigate further rise in BP. ^{7,9,10}

*Increased short-term or 10-year risk is defined as a 10-year predicted risk for CVD events of $\geq 7.5\%$ based on PREVENT (Predicting Risk of cardiovascular disease EVENTS).

BP Goal for Patients With Hypertension

1	A	1. In adults with confirmed hypertension who are at increased risk* for CVD, an SBP goal of at least <130 mm Hg, with encouragement to achieve SBP <120 mm Hg, is recommended to reduce the risk of cardiovascular events and total mortality. ¹⁻⁴
2b	B-NR	2. In adults with confirmed hypertension who are not at increased risk* for CVD, an SBP goal of <130 mm Hg, with encouragement to achieve SBP <120 mm Hg, may be reasonable to reduce risk of further elevation of BP. ⁵
1	B-R	3. In adults with confirmed hypertension who are at increased risk* for CVD, a DBP target of <80 mm Hg is recommended to reduce the risk of cardiovascular events and total mortality. ⁶
2b	B-NR	4. In adults with confirmed hypertension who are not at increased risk* for CVD, a DBP target of <80 mm Hg may be reasonable to reduce the risk of cardiovascular events. ⁵

*Increased risk is defined as a 10-year predicted risk for CVD events of $\geq 7.5\%$ using PREVENT.

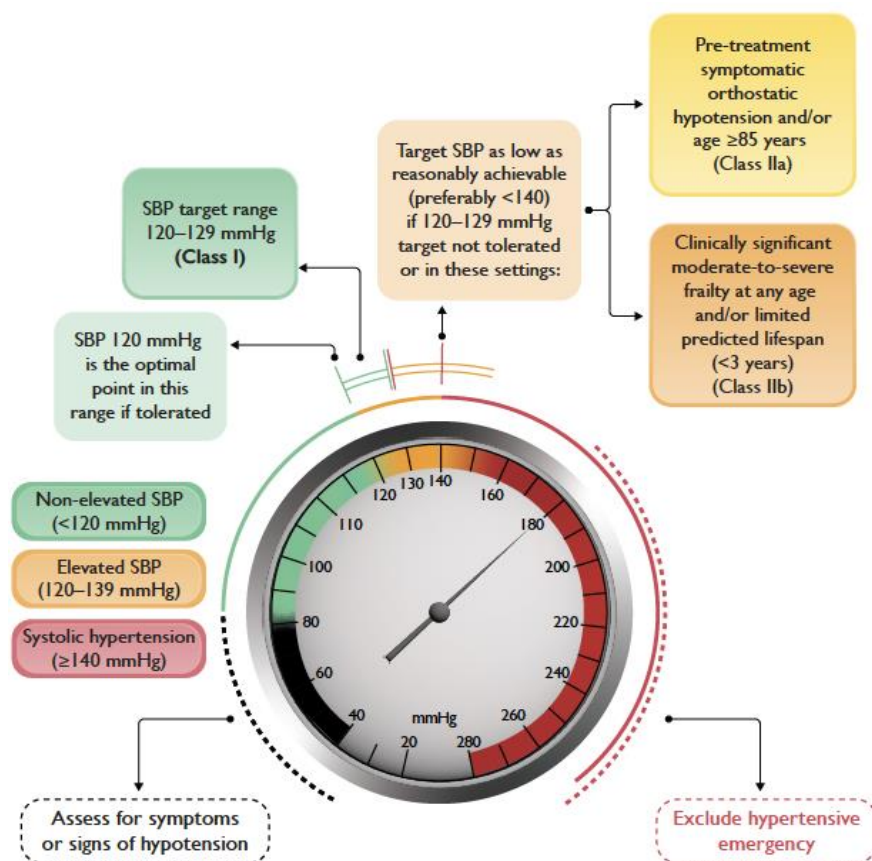


Figure 5. ESC 2024 GL on hypertension Systolic blood pressure categories and treatment target range.

BP, blood pressure; SBP, systolic blood pressure

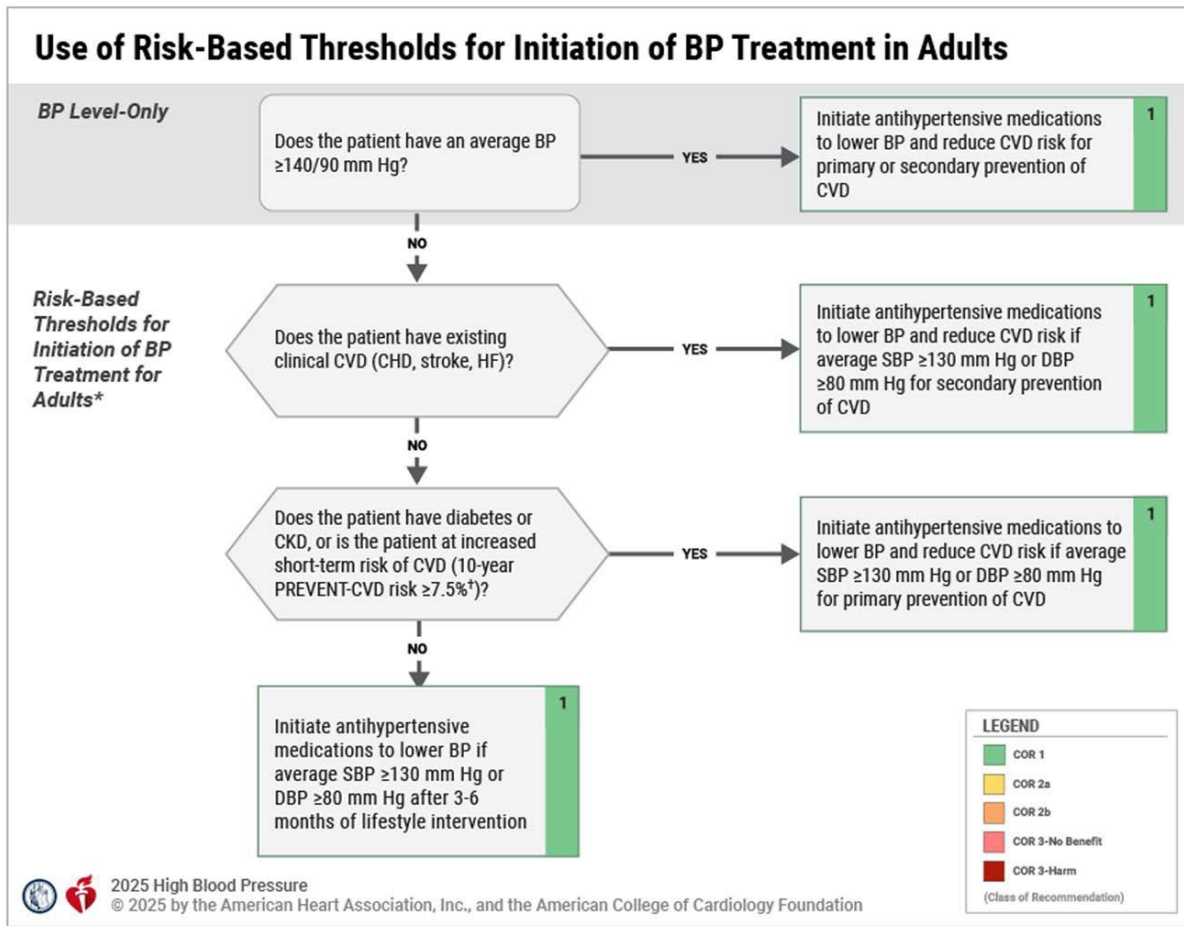


Figure 6. AHA/ACC 2025 GL on hypertension. Use of Risk-Based Thresholds for Initiation of BP Treatment in Adults.

*In older adults who may be frail or have a limited life expectancy, a clinician-patient assessment of potential benefits and harms of BP lowering should be pursued to align care with patient goals.

†Increased short-term or 10-year risk is defined as a 10-year predicted risk for CVD events of $\geq 7.5\%$ using PREVENT. BP indicates blood pressure; CHD, coronary heart disease; CKD, chronic kidney disease; CVD, cardiovascular disease; DBP, diastolic blood pressure; HF, heart failure; PREVENT, Predicting Risk of cardiovascular EVENTS; and SBP, systolic blood pressure.

Table 7. Older Patients

ESC 2024 GL on hypertension.

Recommendations for managing hypertension in patients who are very old or frail

It is recommended that treatment of elevated BP and hypertension among older patients aged <85 years who are not moderately to severely frail follows the same guidelines as for younger people, provided BP-lowering treatment is well tolerated. ^{131,523,524}	I	A
It is recommended to maintain BP-lowering drug treatment lifelong, even beyond the age of 85 years, if well tolerated. ^{523–525}	I	A
Because the benefit in reducing CVD outcomes is uncertain in these settings, and noting that close monitoring of treatment tolerance is advised, BP-lowering treatment should only be considered from $\geq 140/90$ mmHg among persons meeting the following criteria: pre-treatment symptomatic orthostatic hypotension, age ≥ 85 years, clinically significant moderate-to-severe frailty, and/or limited predicted lifespan (< 3 years). ^{131,524,526,527}	IIa	B
As the safety and efficacy of BP treatment is less certain in individuals with moderate or severe frailty, clinicians should consider screening older adults for frailty using validated clinical tests; frail patients' health priorities and a shared-decision approach should be considered when deciding on BP treatments and targets. ^{523,524,613,710}	IIa	C
When initiating BP-lowering treatment for patients aged ≥ 85 years, and/or with moderate-to-severe frailty (at any age), long-acting dihydropyridine CCBs or RAS inhibitors should be considered, followed if necessary by low-dose diuretic if tolerated, but preferably not a beta-blocker (unless compelling indications exist) or an alpha-blocker. ⁷¹¹	IIa	B
If BP drops with progressing frailty, deprescription of BP-lowering medications (and other drugs that can reduce BP, such as sedatives and prostate-specific alpha-blockers) may be considered. ⁷¹²	IIb	C

BP, blood pressure; CCB, calcium channel blocker; CVD, cardiovascular disease; RAS, renin–angiotensin system.

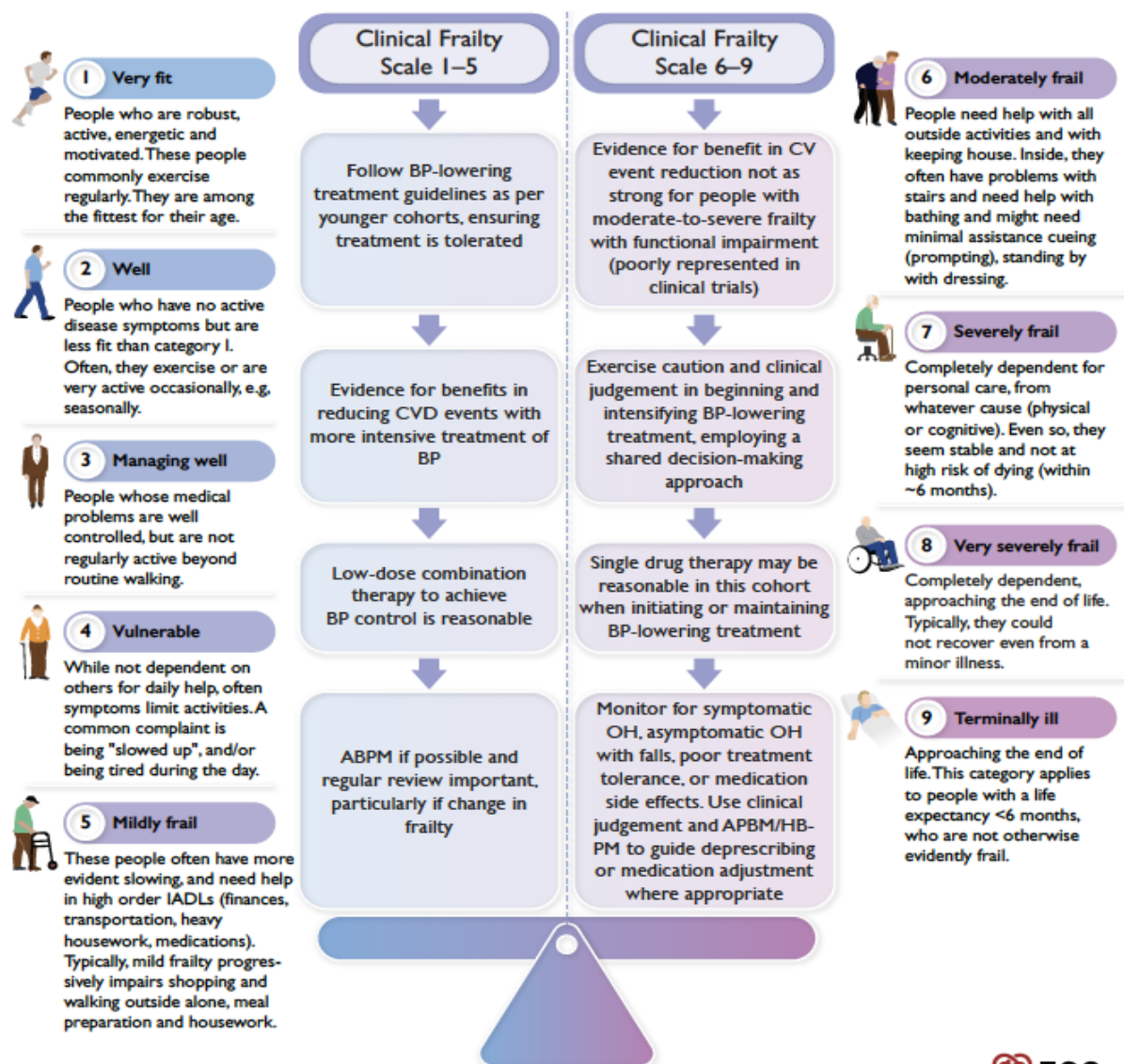


Figure 5. ESC 2024 GL on hypertension Frailty assessment in the management of blood pressure.

ABPM, ambulatory blood pressure monitoring; BP, blood pressure; CV, cardiovascular; CVD, cardiovascular disease; HBPM, home blood pressure monitoring; IADLs, independent activities of daily living; OH, orthostatic hypotension.

Table 8. ESC 2024 GL on hypertension. Recommendations for managing hypertension in young adults.

Comprehensive screening for the main causes of secondary hypertension is recommended in adults diagnosed with hypertension before the age of 40 years, except for obese young adults where it is recommended to start with an obstructive sleep apnoea evaluation. ^{316,626}	I	B
Since SCORE2 has not been validated for individuals <40 years, screening for HMOD may be considered in such young individuals with elevated BP without other increased CVD risk conditions to identify additional individuals for possible medical treatment. ^{28,215}	IIb	B

BP, blood pressure; CVD, cardiovascular disease; HMOD, hypertension-mediated organ damage; SCORE2, Systematic COronary Risk Evaluation 2.

Table 9. Ethnic groups

ACC/AHA 2017 GL on hypertension. Recommendations for Race and Ethnicity

Initial antihypertensive treatment including a thiazide-type diuretic or CCB in black adults with hypertension but without HF or CKD, including those with DM	I-B-R
Two or more antihypertensive medications to achieve a BP target < 130/80 mm Hg in most adults with hypertension, especially in black adults with hypertension	I-C-LD

ESC 2024 on hypertension. Recommendations for managing hypertension in different ethnic groups

In black patients from Sub-Saharan Africa who require BP-lowering treatment, combination therapy including a CCB combined with either a thiazide diuretic or a RAS blocker should be considered. ⁸⁷⁴	IIa	B
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BP, blood pressure; CCB, calcium channel blocker; RAS, renin–angiotensin system

Table 10. ESC 2024 GL on hypertension. Medical therapy

Initiation of blood pressure-lowering treatment based on confirmed blood pressure category and cardiovascular disease risk

Blood pressure (mmHg)	Non-elevated BP (<120/70)	Elevated BP (120/70 to 139/89)		Hypertension (≥140/90)
Risk		(a) All adults with SBP 120–129 mmHg (b) SBP 130–139 AND 10-year estimated CVD risk <10% AND no high-risk conditions or risk modifiers or abnormal risk tool tests	(a) SBP 130–139 AND high-risk conditions (e.g. established CVD, diabetes mellitus, CKD, FH or HMOD) (b) SBP 130–139 AND 10-year estimated CVD risk ≥10% (c) SBP 130–139 AND 10-year estimated CVD risk 5% - <10% AND risk modifiers or abnormal risk tool tests	Assumed all at sufficiently high risk to benefit from pharmacological treatment
Treatment	Lifestyle measures for prevention Screen BP and CVD risk opportunistically	Lifestyle measures for treatment Monitor BP and CVD risk yearly	Lifestyle measures and pharmacological treatment (after 3-month delay). Monitor BP yearly once treatment control is established	Lifestyle measures and pharmacological treatment (immediate) Monitor BP yearly once treatment control is established
Target (mmHg)	Maintain BP <120/70	Aim BP 120–129/70–79 mmHg^a		

BP, blood pressure; CKD, chronic kidney disease; CVD, cardiovascular disease; DBP, diastolic blood pressure; FH, familial hypercholesterolaemia; HMOD, hypertension-mediated organ damage; SBP, systolic blood pressure.

^a Caution in adults with orthostatic hypotension, moderate-to-severe frailty, limited life expectancy, and older patients (aged ≥85 years).

Recommendations for initiating blood pressure-lowering treatment

In adults with elevated BP and low/medium CVD risk (<10% over 10 years), BP lowering with lifestyle measures is recommended and can reduce the risk of CVD. ^{119,120,348,408,411,520,521}	I	B
In adults with elevated BP and sufficiently high CVD risk ^c , after 3 months of lifestyle intervention, BP lowering with pharmacological treatment is recommended for those with confirmed BP $\geq 130/80$ mmHg to reduce CVD risk. ^{116,522}	I	A
It is recommended that in hypertensive patients with confirmed BP $\geq 140/90$ mmHg, irrespective of CVD risk, lifestyle measures and pharmacological BP-lowering treatment are initiated promptly to reduce CVD risk. ^{116,121,122}	I	A
It is recommended to maintain BP-lowering drug treatment lifelong, even beyond the age of 85 years, if well tolerated. ^{523–525}	I	A
Because the benefit in reducing CVD outcomes is uncertain in these settings, and noting that close monitoring of treatment tolerance is advised, BP-lowering treatment should only be considered from $\geq 140/90$ mmHg among persons meeting the following criteria: pre-treatment symptomatic orthostatic hypotension, age ≥ 85 years, clinically significant moderate-to-severe frailty, and/or limited predicted lifespan (<3 years). ^{131,524,526,527}	IIa	B

c 10-year estimated CVD risk of $\geq 10\%$; or 10-year estimated CVD risk of $5\% - \leq 10\%$ plus risk modifiers or abnormal risk tool tests; or high-risk conditions (e.g. established CVD, diabetes, moderate or severe CKD, familial hypercholesterolaemia, or hypertension-mediated organ damage).

Recommendations for pharmacological treatment of hypertension

Among all BP-lowering drugs, ACE inhibitors, ARBs, dihydropyridine CCBs, and diuretics (thiazides and thiazide-like drugs such as chlorthalidone and indapamide) have demonstrated the most effective reduction of BP and CVD events, and are therefore recommended as first-line treatments to lower BP. ^{122,446}	I	A
It is recommended that beta-blockers are combined with any of the other major BP-lowering drug classes when there are other compelling indications for their use, e.g. angina, post-myocardial infarction, heart failure with reduced ejection fraction, or for heart rate control. ^{122,448–450}	I	A
It is recommended to take medications at the most convenient time of day for the patient to establish a habitual pattern of medication taking to improve adherence. ^{246,513}	I	B
Given trial evidence for more effective BP control vs. monotherapy, combination BP-lowering treatment is recommended for most patients with confirmed hypertension (BP $\geq 140/90$ mmHg) as initial therapy. Preferred combinations are a RAS blocker (either an ACE inhibitor or an ARB) with a dihydropyridine CCB or diuretic. Exceptions to consider include patients aged ≥ 85 years, those with symptomatic orthostatic hypotension, moderate-to-severe frailty, or elevated BP (systolic BP 120–139 mmHg or diastolic BP 70–89 mmHg) with a concomitant indication for treatment. ^{131,480,483,484,489}	I	B
In patients receiving combination BP-lowering treatment, fixed-dose single-pill combination treatment is recommended. ^{484,489,501,502,514}	I	B
If BP is not controlled with a two-drug combination, increasing to a three-drug combination is recommended, usually a RAS blocker with a dihydropyridine CCB and a thiazide/thiazide-like diuretic, and preferably in a single-pill combination. ⁴⁸⁹	I	B
If BP is not controlled with a three-drug combination, adding spironolactone should be considered. ⁴⁵⁹	IIa	B
If BP is not controlled with a three-drug combination and in whom spironolactone is not effective or tolerated, treatment with eplerenone instead of spironolactone, ⁵⁰³ or the addition of a beta-blocker if not already indicated ⁴⁵⁹ and, next, a centrally acting BP-lowering medication, ⁵¹⁵ an alpha-blocker, ⁵¹⁵ hydralazine, or a potassium-sparing diuretic should be considered. ⁵¹⁶	IIa	B
Combining two RAS blockers (ACE inhibitor and an ARB) is not recommended. ^{498–500,517}	III	A

ACE, angiotensin-converting enzyme; ARB, angiotensin receptor blocker; BP, blood pressure; CCB, calcium channel blocker; CVD, cardiovascular disease; RAS, renin– angiotensin system.

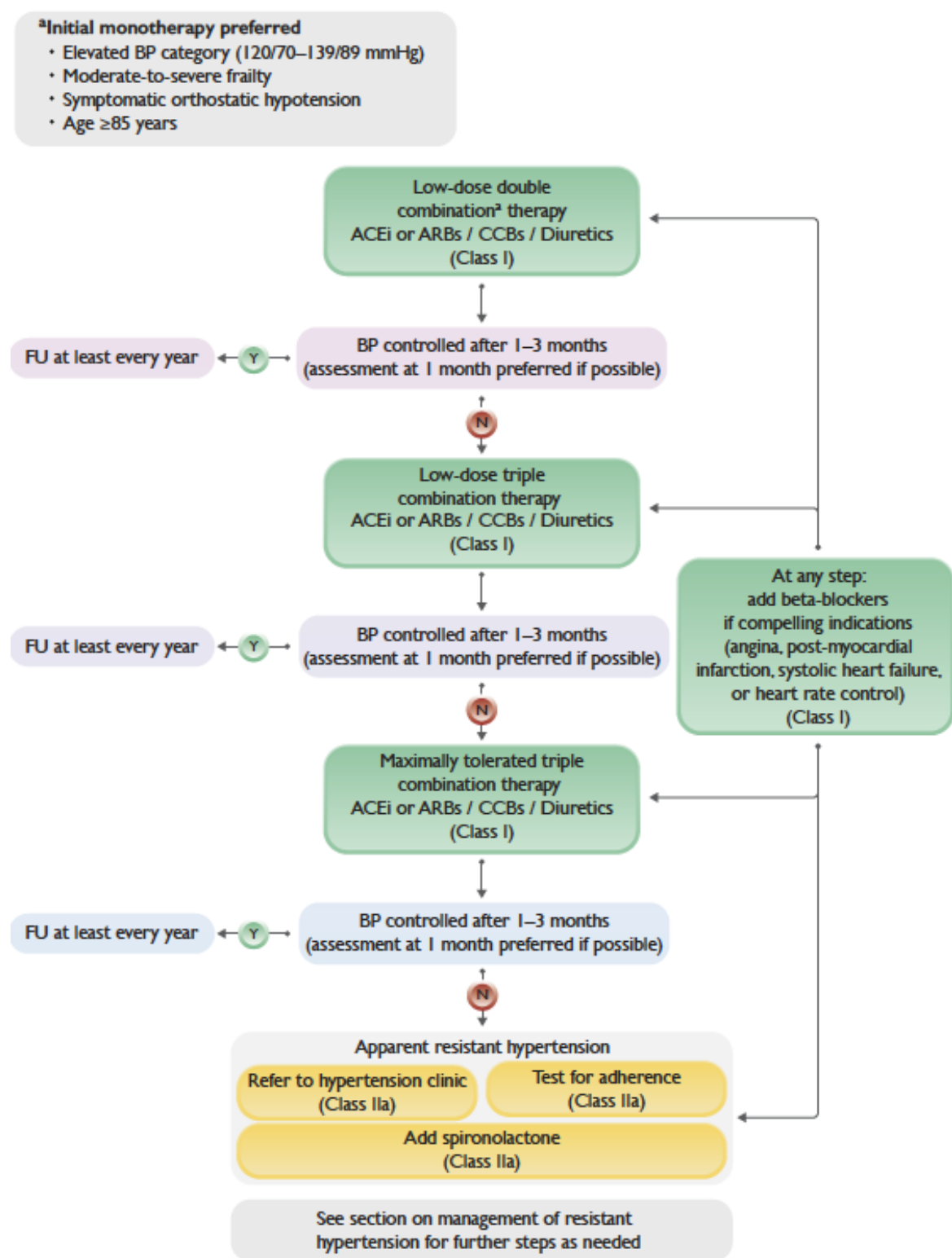


Figure 6. ESC 2024 GL on hypertension. Practical algorithm for pharmacological blood pressure lowering.

ACEi, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; BP, blood pressure; CCB, calcium channel blocker; FU, follow-up.

Table 11. AHA/ACC 2025 GL on hypertension. Medical Therapy

Initial Medication Selection for Treatment of Primary Hypertension

1	A	1. For adults initiating antihypertensive drug therapy, thiazide-type diuretics, long-acting dihydropyridine CCB, and ACEi or ARB are recommended as first-line therapy to prevent CVD. ^{1,2}
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Choice of Initial Monotherapy Versus Initial Combination Drug Therapy

1	B-R	1. In adults with stage 2 hypertension (SBP $\geq$ 140 mm Hg and DBP $\geq$ 90 mm Hg), initiation of antihypertensive drug therapy with 2 first-line agents of different classes, ideally in a single-pill combination (SPC), is recommended to improve BP control and adherence. ¹⁻⁶
2a	C-EO	2. In adults with stage 1 hypertension (SBP 130-139 mm Hg and DBP 80-89 mm Hg), initiation of antihypertensive drug therapy with a single first-line antihypertensive drug is reasonable, with dosage titration and sequential addition of other agents as needed to achieve BP control.
3: Harm	A	3. In adults with hypertension, simultaneous use of an ACEi, ARB, and/or renin inhibitor in combination is not recommended due to the potential for harm. ⁷⁻⁹

AHA/ACC 20225 GL on Hypertension. FDA-Approved Drugs for Treatment of Hypertension

Class	Drug	Usual Dose, Range (mg/d)*	Daily Frequency	Comments
Agents recommended for initial therapy				
Thiazide-type diuretics	Chlorthalidone	12.5-25	1	Chlorthalidone has a longer half-life and is more potent than hydrochlorothiazide on a mg-to-mg basis. Monitor for hyponatremia and hypokalemia, increased glucose, uric acid, and calcium levels. Monitor patients with history of acute gout unless patient is on uric acid-lowering therapy.
	Hydrochlorothiazide	25-50	1	
	Indapamide	1.25-2.5	1	
ACEi	Benazepril	10-40	1 or 2	Do not use in combination with ARB or direct renin inhibitor.
	Captopril	12.5-150	2 or 3	
	Enalapril	5-40	1 or 2	There is an increased risk of hyperkalemia, especially in patients with CKD or in those on K+ supplements or K+-sparing drugs.
	Fosinopril	10-40	1	
	Lisinopril	10-40	1	There is a risk of acute renal failure in patients with severe bilateral renal artery stenosis.
	Moexipril	7.5-30	1 or 2	
	Perindopril	4-16	1	Do not use if patient has history of angioedema with ACEi.
	Quinapril	10-80	1 or 2	
	Ramipril	2.5-20	1 or 2	Avoid use in pregnancy.
	Trandolapril	1-4	1	
ARBs	Azilsartan	40-80	1	Do not use in combination with ACEi or direct renin inhibitor.
	Candesartan	8-32	1	
	Eprosartan	600-800	1 or 2	There is an increased risk of hyperkalemia in CKD or in those on K+ supplements or K+-sparing drugs.
	Irbesartan	150-300	1	
	Losartan	50-100	1 or 2	There is a risk of acute renal failure in patients with severe bilateral renal artery stenosis.
	Olmesartan	20-40	1	
	Telmisartan	20-80	1	Do not use if patient has history of angioedema with ARBs. Patients with a history of angioedema with an ACE inhibitor can receive an ARB beginning 6 weeks after ACE inhibitor is discontinued.
	Valsartan	80-320	1	
CCB—dihydropyridines	Amlodipine	2.5-10	1	Associated with dose-related lower extremity edema, which is more common in women than men.
	Felodipine	2.5-10	1	
	Isradipine	5-10	2	
	Nicardipine SR	60-120	2	
	Nifedipine LA	30-90	1	
	Nisoldipine	17-34	1	
Alternative agents				
CCB—nondihydropyridines	Diltiazem ER	120-360	1	Avoid routine use with beta blockers because of increased risk of bradycardia and heart block.
	Verapamil IR	120-360	3	
	Verapamil SR	120-360	1 or 2	Do not use in patients with HFrEF. There are drug interactions with diltiazem and verapamil (CYP3A4 major substrate and moderate inhibitor).
	Verapamil-delayed onset ER	100-300	1 (in the evening)	
Diuretics—loop	Bumetanide	0.5-2	2	These are preferred diuretics in patients with symptomatic HF. They are preferred over thiazide-type diuretics in patients with moderate-to-severe CKD (eg, GFR <30 mL/min). The longer-acting choice of torsemide is preferred for treatment of hypertension. A loop diuretic is an option for patients who develop thiazide-type diuretic associated hyponatremia.
	Furosemide	20-80	2	
	Torsemide	5-10	1	

Diuretics—potassium-sparing	Amiloride	5-10	1 or 2	As monotherapy, these agents are minimally effective antihypertensive agents. Combination therapy of a potassium-sparing diuretic with a thiazide-type diuretic can be considered in patients with hypokalemia on thiazide-type diuretic monotherapy. Avoid use in patients with significant CKD (eg, GFR <45 mL/min).
	Triamterene	50-100	1 or 2	
Diuretics—aldosterone antagonists	Eplerenone	50-100	1 or 2	These are preferred agents in primary aldosteronism and resistant hypertension. Spironolactone is associated with greater risk of gynecomastia and impotence compared with eplerenone. Demonstrated efficacy as fourth-agent add-on therapy for resistant hypertension. Avoid use with K⁺ supplements, other K⁺-sparing diuretics, or significant renal dysfunction (eg, GFR <45 mL/min). Eplerenone often requires twice-daily dosing for adequate BP lowering. Avoid use in pregnancy.
	Spironolactone	25-100	1	
Beta blockers—cardioselective	Atenolol	25-100	2	Beta blockers are not recommended as first-line agents unless the patient has CHD or HF. These are preferred in patients with bronchospastic airway disease requiring a beta blocker. Bisoprolol and metoprolol succinate are preferred in patients with HFrEF. Avoid abrupt cessation. 
	Betaxolol	5-20	1	
	Bisoprolol	2.5-10	1	
	Metoprolol tartrate	100-200	2	
	Metoprolol succinate	50-200	1	
Beta blockers—cardioselective and vasodilatory	Nebivolol	5-40	1	Nebivolol induces nitric oxide-induced vasodilation. Avoid abrupt cessation.
Beta blockers—noncardioselective	Nadolol	40-120	1	Avoid use in patients with reactive airways disease. Avoid abrupt cessation.
	Propranolol IR	80-160	2	
	Propranolol LA	80-160	1	
Beta blockers—intrinsic sympathomimetic activity	Acebutolol	200-800	2	Generally avoid, especially in patients with CHD or HF. Avoid abrupt cessation.
	Penbutolol	10-40	1	
	Pindolol	10-60	2	
Combined alpha and beta blockers	Carvedilol	12.5-50	2	Use of carvedilol is preferred in patients with HFrEF. Avoid abrupt cessation.
	Carvedilol phosphate	20-80	1	
	Labetalol	200-1200	2	
Direct renin inhibitor	Aliskiren	150-300	1	Do not use in combination with ACEi or ARB. Aliskiren is very long acting. There is an increased risk of hyperkalemia in CKD or in those on K⁺ supplements or K⁺-sparing drugs. Aliskiren may cause acute renal failure in patients with severe bilateral renal artery stenosis. Avoid use in pregnancy.
Alpha-1 blockers	Doxazosin	1-16	1	These are associated with orthostatic hypotension, especially in older adults with a greater BP drop with first dose effect. These may be considered a second-line agent in patients with symptomatic benign prostatic hypertrophy.
	Prazosin	2-20	2 or 3	
	Terazosin	1-20	1 or 2	
Central alpha-2-agonist and other centrally acting drugs	Clonidine oral	0.1-0.8	2	These are generally reserved as last-line choices because of significant CNS adverse effects, especially in older adults. Avoid abrupt discontinuation of clonidine, which may induce hypertensive crisis. Clonidine must be tapered to avoid rebound hypertension.
	Clonidine patch	0.1-0.3	1 weekly	
	Methyldopa	250-1000	2	
	Guanfacine	0.5-2	1	
Direct vasodilators	Hydralazine	100-200	2 or 3	These are associated with sodium and water retention and reflex tachycardia and should be used with a diuretic and beta blocker. Hydralazine is associated with a drug-induced lupus-like syndrome at higher doses. Minoxidil is associated with hirsutism and requires a loop diuretic. Minoxidil can induce pericardial effusion.
	Minoxidil	5-40	1-2	
Dual endothelin receptor antagonist	Aprocitan	12.5	1	Associated with mild-to-moderate fluid retention usually occurring within the first 4-6 wks of therapy. Indicated as add-on therapy for patients whose BP is not adequately controlled on other antihypertensive medications. Avoid use in pregnancy.

ACEi indicates angiotensin-converting-enzyme inhibitors; ARB, angiotensin receptor blockers, BP, blood pressure; CCB, calcium channel blocker; CNS, central nervous system; CKD, chronic kidney disease; CHD, coronary heart disease; GFR, glomerular filtration rate; HF, heart failure; HFrEF, HF with reduced ejection fraction; and K⁺, potassium.

Pharmacokinetic Drug–Drug Interactions With Antihypertensive Medications

Blood Pressure Drug	Potential Interacting Drug	Clinical Effect
Absorption		
Thiazide-type diuretics	Cholestyramine	Decreased absorption leading to reduced BP lowering
Amlodipine, furosemide, metoprolol, carvedilol, bisoprolol, nebivolol, telmisartan	Potassium binder (patiomer)	Decreased absorption of antihypertensives leading to reduced BP-lowering effects. To mitigate this, administer the antihypertensives at least 3 h before or after taking the potassium binder
Furosemide	Potassium binder (sodium zirconium cyclosilicate)	Increased absorption of furosemide due to increased gastric pH leading to increased clinical effects (eg, diuresis or risk of hypokalemia); effect diminished with separation of administration by 2 h
Methyldopa	Iron salts	Decreased absorption of methyldopa leading to reduced BP lowering
Metabolism		
Bisoprolol, carvedilol, metoprolol	CYP2D6 inhibitors (eg, amiodarone, cimetidine, diphenhydramine, fluoxetine, paroxetine, terbinafine)	Increased BB concentration leading to enhanced clinical effects (eg, hypotension and bradycardia)
Diltiazem, verapamil	CYP3A4 inhibitors (eg, clarithromycin, erythromycin, itraconazole, ketoconazole)	Increased nondihydropyridine concentration leading to enhanced clinical effects (eg, hypotension and bradycardia)
Diltiazem, verapamil	CYP3A4 inducers (eg, carbamazepine, phenobarbital, phenytoin, St. John's Wort, rifampin)	Decreased nondihydropyridine CCB concentration leading to reduced clinical effects (eg, minimization of blood pressure and pulse lowering)
CYP3A4 inhibition via amlodipine, verapamil, or diltiazem or other CYP3A4 inhibitors	Tacrolimus, cyclosporine	Increased calcineurin inhibitor concentration leading to increased risk for side effects (eg, renal impairment)
	Dabigatran, rivaroxaban	Increased concentration leading to increased risk for bleeding
	Atorvastatin, simvastatin	Increased statin concentration leading to increased risk for side effects (eg, myopathy)
	Colchicine	Increased colchicine concentration leading to increased risk for adverse effects (eg, neuromuscular toxicity)
	Eplerenone	Increased risk of hypotension and hyperkalemia Using a lower dose of eplerenone when combined with diltiazem could be considered a productive interaction, as the inhibition of eplerenone's metabolism might allow for lower doses to be effective, reducing the risk of adverse effects while maintaining efficacy
Elimination		
Lithium	Thiazide-type diuretics, RAS blockers	Reduced lithium clearance leading to increased lithium toxicity risk
P-glycoprotein (P-gp)		
Verapamil via P-gp inhibition	Dabigatran	Reduced P-gp efflux of dabigatran leading to increased dabigatran levels, which results in a higher risk of bleeding
Verapamil and carvedilol via P-gp inhibition	Digoxin	Reduced P-gp efflux of digoxin leading to increased digoxin levels, resulting in a higher risk of digoxin toxicity

BB indicates beta blocker; BP, blood pressure; CCB, calcium channel blocker; h, hour; and P-gp, P-glycoprotein.

Pharmacokinetic Drug–Drug Interactions With Antihypertensive Medications

Drug Combinations		Clinical Effect
Cautionary interactions		
Any antihypertensive medication	NSAIDs	Reduced BP lowering via sodium retention
	Sympathomimetic (eg, pseudoephedrine, dextroamphetamine)	Reduced BP lowering
	Venlafaxine	Reduced BP lowering
Nondihydropyridine CCB	Beta blockers	Bradycardia or atrioventricular block
ACEi	ARBs	AKI, hyperkalemia
	Potassium-sparing diuretics (Spironolactone, eplerenone, triamterene, amiloride)	Hyperkalemia
	Sulfamethoxazole/trimethoprim	Hyperkalemia
	Potassium supplements	Hyperkalemia
	NSAIDs (eg, ibuprofen, naproxen)	AKI
Clonidine, methyldopa, guanfacine	CNS depressants (eg, zolpidem, alprazolam)	Sedation
Clonidine	Noncardioselective BB (eg, nadolol or propranolol)	Unopposed alpha agonism upon BB withdrawal leading to hypertensive crisis
Advantageous interactions		
Dihydropyridine CCB	RAS inhibitor	Reduced risk of dihydropyridine CCB-induced lower leg swelling
RAS inhibitors	Diuretics	Balanced effects on serum potassium levels with diminished possibility for hypokalemia (with diuretic) or hyperkalemia (with RAASi)
RAS inhibitors	Potassium binder	Lowers risk of hyperkalemia from the RAS inhibitor
Diuretic	Potassium supplement	Lowers risk of hypokalemia from the diuretic

ACEi indicates angiotensin-converting enzyme inhibitors; AKI, acute kidney injury; ARB, angiotensin receptor blockers; BB, beta blocker; BP, blood pressure; CCB, calcium channel blocker; CNS, central nervous system; NSAIDs, nonsteroidal anti-inflammatory drugs; RAASi, renin-angiotensin aldosterone inhibitor; and RAS, renin-angiotensin system.

Table 12. Adherence to Medication

Recommendations for assessing adherence and persistence with treatment

Objective evaluation of adherence (either directly observed treatment or detecting prescribed drugs in blood or urine samples) should be considered in the clinical work-up of patients with apparent resistant hypertension, if resources allow. ^{261–263}	IIa	B
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Antihypertensive Medication Adherence Strategies

1	B-R	1. In adults with hypertension, antihypertensive medication dosing once daily rather than multiple times daily is beneficial to improve medication adherence. ^{1–3}
1	B-R	2. In adults with hypertension, the use of a SPC to reduce pill burden rather than taking separate pills is effective to improve medication adherence. ^{4–9}
2a	B-R	3. In adults with hypertension, use of medication reminder aids and educational or self-management interventions can be useful to improve medication adherence. ^{10–16}

Evidence-Based Strategies for Improving Antihypertensive Medication Adherence

Evidence-Based Strategies for Improving Antihypertensive Medication Adherence
Dose consolidation
Single pill combination rather than separate pills
Education/coaching by pharmacists and other health professionals
Electronic/home blood pressure monitoring and feedback
Integration of patient preferences and values/shared decision-making into management plan
Medication synchronization and reminder aids
Mindfulness-based stress reduction or counseling for high stress, anxiety, and/or depression
Self-management interventions

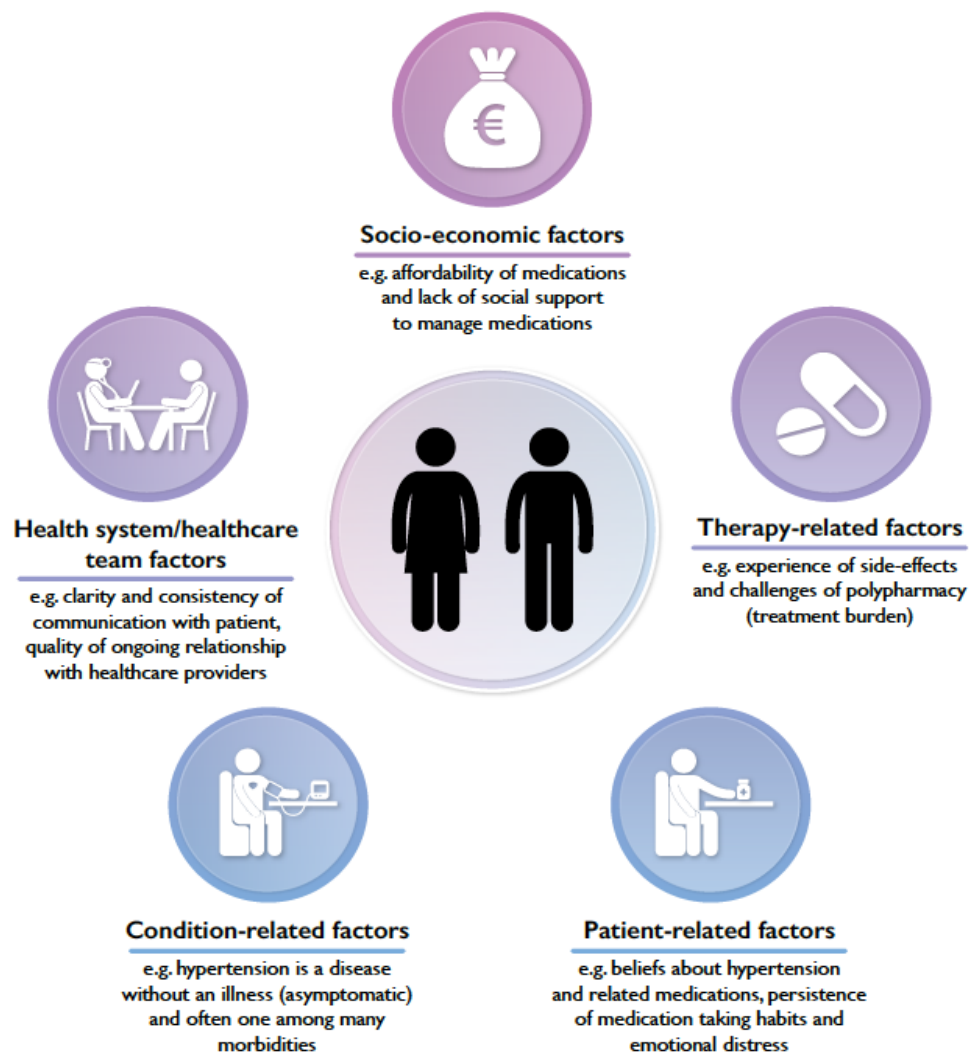


Figure 7. ESC 2024 GL on hypertension. The five dimensions of adherence (WHO, 2003) applied to hypertension.

Table 13. Orthostatic Hypotension

ESC 2024 GL on hypertension. Recommendations for managing hypertension in patients with

Before starting or intensifying BP-lowering medication, it is recommended to test for orthostatic hypotension, by first having the patient sit or lie for 5 min and then measuring BP 1 and/or 3 min after standing. ^{97,99}	I	B
It is recommended to pursue non-pharmacological approaches as the first-line treatment of orthostatic hypotension among persons with supine hypertension. For such patients, it is also recommended to switch BP-lowering medications that worsen orthostatic hypotension to an alternative BP-lowering therapy and not to simply de-intensify therapy. ^{726,727,729,730}	I	A

AHA/ACC 2025 guideline on hypertension. Orthostatic Hypotension

1	A	1. In adults with hypertension, improved BP control is recommended to reduce the risk for OH. ¹⁻⁴
2a	A	2. In adults receiving intensive BP-lowering therapy with asymptomatic OH, treatment with a goal of SBP <130 mm Hg is reasonable due to increased CVD and mortality benefit. ^{3,5}
2a	B-R	3. In adults with hypertension initiating treatment or adding medication with a goal of SBP <130 mm Hg, assessment for symptomatic OH is reasonable to detect other chronic conditions. ^{1-4,6,7}

Table 14. Diabetes Mellitus

AHA/ACC 2025 GL on hypertension. Recommendations for Diabetes

1	A	1. In adults with T2D and hypertension, antihypertensive drug treatment should be initiated at an SBP of ≥ 130 mm Hg with a treatment goal of < 130 mm Hg, with encouragement to achieve an SBP < 120 mm Hg to reduce CVD morbidity and mortality. ¹⁻⁵
1	C-LD	2. In adults with T2D and hypertension, antihypertensive drug treatment should be initiated at a DBP of ≥ 80 mm Hg with a treatment goal of < 80 mm Hg to reduce CVD morbidity and mortality. ⁶
1	A	3. In adults with T2D and hypertension, all first-line classes of antihypertensive agents (ie, thiazide-type diuretics, long-acting CCB, ACEi, and ARB) are useful and effective for BP lowering. ^{1,7-9}
1	A	4. In adults with diabetes and hypertension, ACEi or ARB are recommended in the presence of CKD as identified by eGFR < 60 mL/min/1.73 m ² or albuminuria ≥ 30 mg/g and should be considered when mild albuminuria (< 30 mg/g) is present to delay progression of diabetes-related kidney disease. ¹⁰⁻¹²

ESC 2024 GL on hypertension. Recommendations for managing hypertension in patients with diabetes

In most adults with elevated BP and diabetes, after a maximum of 3 months of lifestyle intervention, BP lowering with pharmacological treatment is recommended for those with confirmed office BP $\geq 130/80$ mmHg to reduce CVD risk. ^{445,749}	I	A
BP-lowering drug treatment is recommended for people with pre-diabetes or obesity when confirmed office BP is $\geq 140/90$ mmHg or when office BP is 130–139/80–89 mmHg and the patient is at predicted 10-year risk of CVD $\geq 10\%$ or with high-risk conditions, despite a maximum of 3 months of lifestyle therapy. ⁴⁴⁵	I	A
In persons with diabetes who are receiving BP-lowering drugs, it is recommended to target systolic BP to 120–129 mmHg, if tolerated. ^{136,146,445,747,749–752}	I	A

AHA/ACC 2025 GL on hypertension. Obesity and Metabolic Syndrome

2b	B-R	1. In adults with hypertension who also have overweight or obesity with a BMI ≥ 27 kg/m ² , incretin mimetics (eg, GLP-1 receptor agonists) when used for weight management may be effective as an adjunct to lower BP. ¹⁻⁴
2b	B-R	2. In adults with hypertension who have obesity with a BMI ≥ 35.0 kg/m ² , bariatric surgery (when considered for weight loss) in combination with behavioral interventions and antihypertensive therapies may be effective at lowering BP. ^{5,6}

Table 15. Coronary artery disease

ESC 2024 GL on hypertension. Recommendations for managing hypertension in patients with cardiac disease

In patients with a history of myocardial infarction who require BP-lowering treatment, beta-blockers and RAS blockers are recommended as part of that treatment. ⁵³⁸	I	A
In patients with symptomatic angina who require BP-lowering treatment, beta-blockers and/or CCBs are recommended as part of that treatment. ⁵³⁸	I	A
In patients with symptomatic HFrEF/HFmrEF, the following treatments with BP-lowering effects are recommended to improve outcomes: ACE inhibitors (or ARBs if ACE inhibitors are not tolerated) or ARNi, beta-blockers, MRAs, and SGLT2 inhibitors. ⁷⁹⁵	I	A
In hypertensive patients with symptomatic HFpEF, SGLT2 inhibitors are recommended to improve outcomes in addition to their modest BP-lowering properties. ⁷⁹⁵	I	A
In patients with a history of aortic valve stenosis and/or regurgitation who require BP-lowering treatment, RAS blockers should be considered as part of that treatment. ^{794,796}	IIa	C
In patients with a history of moderate-to-severe mitral valve regurgitation who require BP-lowering treatment, RAS blockers should be considered as part of that treatment. ⁷⁹⁴	IIa	C
In patients with symptomatic HFpEF who have BP above target, ARBs and/or MRAs may be considered to reduce heart failure hospitalizations and reduce BP. ^{795,799,800}	IIb	B

ACE, angiotensin-converting enzyme; ARB, angiotensin receptor blocker; ARNi, angiotensin receptor–neprilysin inhibitor; BP, blood pressure; CCB, calcium channel blocker; HFpEF, heart failure with preserved ejection fraction; HF(m)rEF, heart failure with (mildly) reduced ejection fraction; MRA, mineralocorticoid receptor antagonist; RAS, renin–angiotensin system; SGLT2, sodium–glucose co-transporter 2.

Table 16. Cerebrovascular disease and stroke

ESC 2024 GL on hypertension.

Recommendations for managing hypertension in patients with chronic cerebrovascular disease and cognitive impairment

It is recommended that the BP-lowering drug treatment strategy for preventing recurrent stroke should comprise a RAS blocker plus a CCB or a thiazide-like diuretic. ^{820,823,825,826}	I	A
In patients with confirmed BP $\geq 130/80$ mmHg with a history of TIA or stroke a systolic BP target of 120–129 mmHg is recommended to reduce CVD outcomes, provided treatment is tolerated. ^{824,827,828}	I	A

BP, blood pressure; CCB, calcium channel blocker; CVD, cardiovascular disease; RAS, renin–angiotensin system; TIA, transient ischaemic attack.

Recommendations for acutely managing blood pressure in patients with intracerebral haemorrhage or acute ischaemic stroke

For patients with ischaemic stroke or TIA and an indication for BP lowering, it is recommended that BP-lowering therapy be commenced before hospital discharge. ^{819,820,823}	I	B
In patients with acute ischaemic stroke, early BP lowering with BP-lowering therapy should be considered in the first 24 h in the following settings:		
• In patients who are eligible for re-perfusion therapy with intravenous thrombolysis or mechanical thrombectomy, BP should be carefully lowered and maintained at $<180/105$ mmHg for at least the first 24 h after treatment. ^{956–960}	IIa	B
• In patients with ischaemic stroke not receiving re-perfusion treatment and BP of $\geq 220/110$ mmHg, BP should be carefully lowered by approximately 15% during the first 24 h after stroke onset. ^{956–960}	IIa	C
In patients with intracerebral haemorrhage, immediate BP lowering (within 6 h of symptom onset) should be considered to a systolic target 140–160 mmHg to prevent haematoma expansion and improve functional outcome. ^{948,949}	IIa	A
In patients with intracerebral haemorrhage presenting with systolic BP ≥ 220 mmHg, acute reduction in systolic BP >70 mmHg from initial levels within 1 h of commencing treatment is not recommended. ^{950,951,960–963}	III	B

BP, blood pressure; TIA, transient ischaemic attack.

AHA/ACC 2025 GL on Hypertension.

Acute Intracerebral Hemorrhage

2a	A	1. For adult patients with acute spontaneous intracerebral hemorrhage (ICH) who present with SBP between 150 and 220 mm Hg, it can be beneficial to immediately lower SBP to 130 to <140 mm Hg for at least 7 days after ICH to improve functional outcomes but stop antihypertensive medications if SBP <130 mm Hg. ¹⁻³
2a	B-NR	2. In adults with acute spontaneous ICH requiring acute BP lowering, careful titration to ensure smooth, nonlabile, and sustained control of BP, avoiding peaks and large variability in SBP, can be beneficial for improving functional outcomes. ^{3,4}
3: Harm	B-NR	3. For adult patients with acute spontaneous ICH who present with SBP >220 mm Hg, SBP should not be lowered below 130 mm Hg to reduce adverse events. ⁵⁻⁷

Acute Ischemic Stroke

COR	LOE	Recommendations
1	C-LD	1. In patients with acute ischemic stroke, hypotension and hypovolemia should be corrected to maintain systemic perfusion levels necessary to support organ function. ¹⁻³
1	B-NR	2. Patients who have elevated BP and are otherwise eligible for treatment with IV thrombolytics should have their BP lowered to SBP <185 mm Hg and DBP <110 mm Hg before IV thrombolytic therapy is initiated and should be maintained below 180/105 mm Hg for at least the first 24 hours after initiating thrombolytic therapy to avoid complications. ^{4,5}
2a	B-NR	3. In patients who undergo endovascular treatment, it is reasonable to maintain the BP at ≤180/105 mm Hg during and for 24 hours after the procedure to improve long-term functional outcomes and prevent death. ^{6,7}
2b	C-LD	4. In patients with BP of ≥220/120 mm Hg who did not receive IV thrombolytic or endovascular treatment and have no comorbid conditions requiring acute antihypertensive treatment, it might be reasonable to lower BP by 15% during the first 24 hours after onset of stroke to improve outcomes. ^{2,3}

COR	LOE	Recommendations
3: No Benefit	A	5. In patients with BP <220/120 mm Hg who do not receive IV thrombolysis or endovascular treatment and do not have a comorbid condition requiring urgent antihypertensive treatment, initiating or reinitiating treatment of hypertension within the first 48 to 72 hours after an acute ischemic stroke is not effective to prevent death or disability. ⁸⁻¹¹
3: Harm	A	6. In patients undergoing successful brain reperfusion with endovascular treatment for a large vessel occlusion, lowering SBP <140 mm Hg within the first 24 to 72 hours after reperfusion can worsen long-term functional outcome. ¹²⁻¹⁴

Secondary Stroke Prevention

1	A	1. In patients with hypertension who have experienced an ischemic stroke, transient ischemic attack (TIA), or ICH, treatment with a thiazide-type diuretic, ACEi, or ARB is recommended for lowering BP and reducing recurrent stroke and ICH risk. ¹⁻³
1	B-R	2. In patients with hypertension who have experienced an ischemic stroke, TIA, or ICH, an office SBP/DBP goal of <130/80 mm Hg is recommended to reduce the risk of recurrent stroke, ICH, and other vascular events. ^{1,3-5}
2a	B-R	3. In patients with no history of hypertension who have experienced an ischemic stroke, TIA, or ICH and have an average office SBP/DBP of ≥130/80 mm Hg, antihypertensive medication treatment can be beneficial to reduce the risk of recurrent stroke, ICH, and other vascular events. ⁵⁻⁷

Mild Cognitive Impairment and Dementia

1	A	1. In adults with hypertension, a goal of <130 mm Hg SBP is recommended to prevent mild cognitive impairment and dementia. ¹⁻⁵
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Table 17. Chronic kidney disease

AHA/ACC 2025 GL on hypertension. Hypertension Treatment in Patients With CKD

1	A	1. For adults with hypertension and CKD as identified by eGFR <60 mL/min/1.73 m ² or albuminuria ≥30 mg albumin/g creatinine, treatment should target an SBP goal of <130 mm Hg to decrease all-cause mortality. ¹⁻³
1	B-R	2. For adults with hypertension and CKD as identified by eGFR <60 mL/min/1.73 m ² with albuminuria of ≥30 mg/g, RAASi (either with ACEi or ARB but not both) is recommended to decrease CVD and delay progression of kidney disease. ^{4,5}

ESC 2024 GL on hypertension. Recommendations for managing hypertension in patients with chronic kidney disease

In patients with diabetic or non-diabetic moderate-to-severe CKD and confirmed BP ≥130/80 mmHg, lifestyle optimization and BP-lowering medication are recommended to reduce CVD risk, provided such treatment is well tolerated. ^{275,766}	I	A
In adults with moderate-to-severe CKD who are receiving BP-lowering drugs and who have eGFR >30 mL/min/1.73 m ² , it is recommended to target systolic BP to 120–129 mmHg, if tolerated. Individualized BP targets are recommended for those with lower eGFR or renal transplantation. ^{274,779}	I	A
In hypertensive patients with CKD and eGFR >20 mL/min/1.73 m ² , SGLT2 inhibitors are recommended to improve outcomes in the context of their modest BP-lowering properties. ^{776,777}	I	A
ACE inhibitors or ARBs are more effective at reducing albuminuria than other BP-lowering agents and should be considered as part of the treatment strategy for patients with hypertension and microalbuminuria or proteinuria. ^{780–782}	IIa	B

ACE, angiotensin-converting enzyme; ARB, angiotensin receptor blocker; BP, blood pressure; CKD, chronic kidney disease, eGFR, estimated glomerular filtration rate; SGLT2, sodium–glucose co-transporter 2.

ESC 2026 GL on CKD. Recommendations for blood pressure management in chronic kidney disease

Screening by attended standardized office BP measurement ^c is recommended in all patients with CKD for early identification and confirmation of elevated BP/hypertension. ^{128,129}	I	A
Intensified BP control by lifestyle optimization and BP-lowering medications is recommended in patients with CKD and eGFR ≥ 30 mL/min/1.73 m ² , who have confirmed standardized office BP $\geq 130/80$ mmHg to reduce the risk of CVD. ^{127,147,155}	I	A
A systolic BP target of 120–129 mmHg, if tolerated, is recommended in patients with CKD and eGFR ≥ 30 mL/min/1.73 m ² to reduce the risk of CVD and reduce albuminuria. ^{127,132,133,143,146,156,157}	I	A
Performing out-of-office (i.e. ABPM or HBPM) is recommended in patients with CKD to identify white-coat hypertension, masked hypertension, or elevated night-time BP. ^{143,147,158–160}	I	C
Individualized BP targets are recommended in patients with eGFR < 30 mL/min/1.73 m ² to reduce risk of CVD. ^{146,161}	I	C

ABPM, ambulatory blood pressure monitoring; BP, blood pressure; CKD, chronic kidney disease; CVD, cardiovascular disease; eGFR, estimated glomerular filtration rate; HBPM, home blood pressure monitoring.

Table 18. Peripheral arterial disease**ACC/AHA 2017 GL on hypertension. Treatment of Hypertension in Patients With Peripheral Arterial Disease**

Patients should be treated similarly to those without peripheral arterial disease. I-B-NR

Table 19. ESC 2022 GL on cardio-oncology. Recommendations for the management of arterial hypertension in patients receiving anticancer treatment**General**

Effective treatment of cancer therapy-induced arterial hypertension to prevent cancer
Treatment interruption and CV complications I C

A BP target <140 mmHg systolic and <90 mmHg diastolic during cancer therapy. I C

A BP target <130 mmHg systolic and <80 mmHg diastolic
during cancer therapy provided that the treatment is well tolerated. IIb C

In selected asymptomatic patients with metastatic cancer,
a systolic BP 140–160 mmHg and diastolic BP 90–100 mmHg treatment
threshold, provided there is ongoing BP monitoring. IIb C

The competing cancer and CV risk evaluation is recommended if the systolic
BP is ≥ 180 mmHg or diastolic BP ≥ 110 mmHg, and any cancer therapy
associated with hypertension should be deferred or temporarily withheld
until the BP is controlled to values <160 mmHg (systolic) and
<100 mmHg (diastolic). I C

Cancer therapy-induced arterial hypertension treatment

ACE-I or ARB are the first-line antihypertensive drugs^a I B

Dihydropyridine CCB as second-line antihypertensive drugs for
uncontrolled BP. I C

Combination therapy with ACE-I or ARB and dihydropyridine CCB
in systolic BP ≥ 160 mmHg and diastolic BP ≥ 100 mmHg. I C

Diltiazem and verapamil are not recommended to treat arterial hypertension
in patients with cancer due to their drug–drug interactions.^b III C

ACE-I, angiotensin-converting enzyme inhibitors; ARB, angiotensin receptor blockers;
BP, blood pressure; CCB, calcium channel blockers; CV, cardiovascular.

^a Unless contraindicated.

^b In selected patients with cancer, who are intolerant to multiple other antihypertensive
drugs, diltiazem and verapamil may be considered with close monitoring of drug–drug
interactions.

Recommended threshold for asymptomatic hypertension treatment
in different clinical scenarios

Home BP mmHg	CS	Curable cancer during treatment	Metastatic cancer Prognosis >3 years	Metastatic cancer Prognosis 1–3 years	Metastatic cancer Prognosis <1 year
160+	Treat	Treat	Treat	Treat	Treat
140–159	Treat	Treat	Treat	Consider treatment	May treat
135–139	Treat	May treat	Consider treatment	May treat	None
130–134	May treat	None	None	None	None
<130	None	None	None	None	None

● Class I
 ● Class IIa
 ● Class IIb

Figure 8. ESC 2022 GL on cardio-oncology. Recommended threshold for asymptomatic hypertension treatment in different clinical scenarios.
BP, blood pressure; CS, cancer survivors.

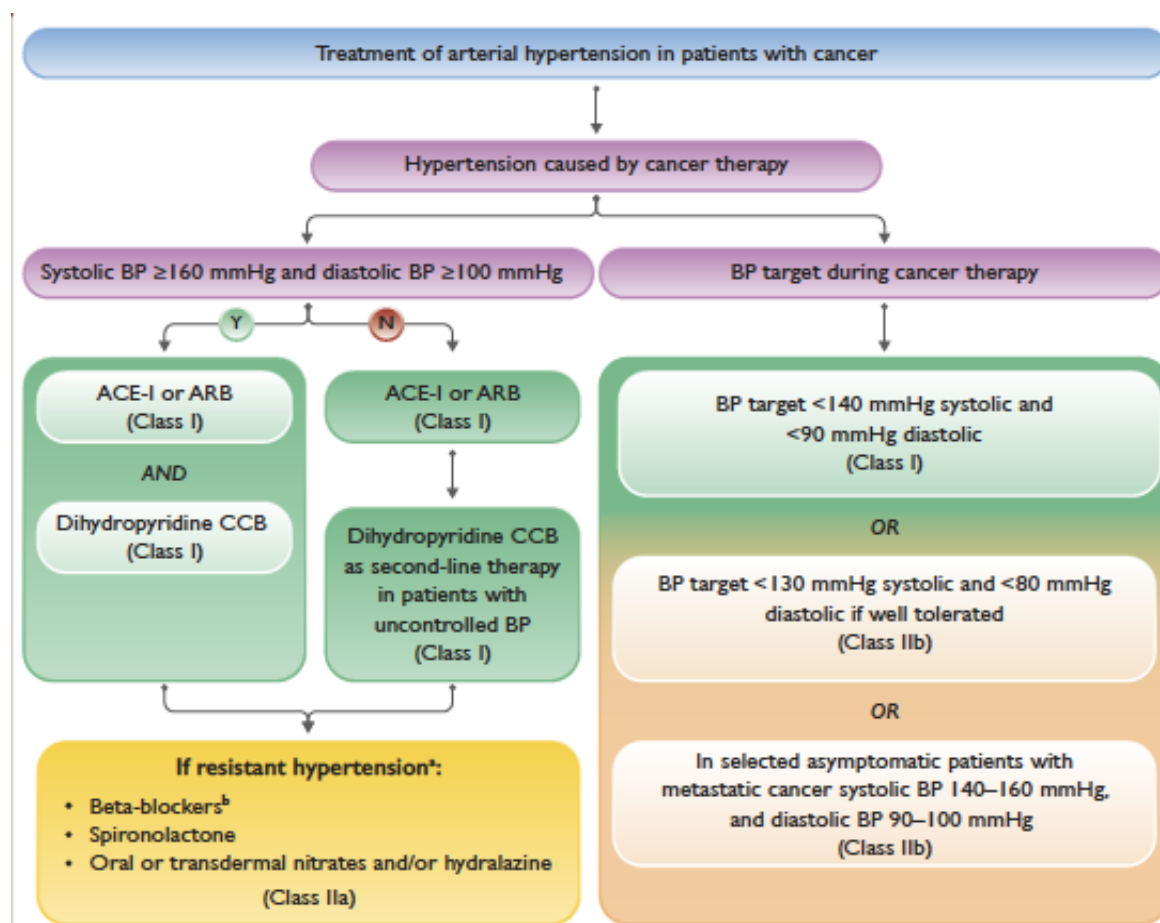


Figure 9. ESC 2022 GL on cardio-oncology. Treatment of arterial hypertension in patients with cancer.

a Resistant hypertension is defined as BP being uncontrolled despite treatment with optimal or best-tolerated doses of three or more drugs including a diuretic, and confirmed by ambulatory and home BP monitoring.

b Consider beta-blockers (nebivolol or carvedilol are preferred in patients on VEGFi) at any treatment step, when there is a specific indication for their use, e.g. HF, angina, post-MI, or AF.

AF, atrial fibrillation; ACE-I, angiotensin-converting enzyme inhibitors; ARB, angiotensin receptor blockers; BP, blood pressure; CCB, calcium channel blockers; HF, heart failure; MI, myocardial infarction; N, no; VEGFi, vascular endothelial growth factor inhibitors; Y, yes.

Table 20. Patients Undergoing Surgical Procedures

ESC 2022 Guidelines on noncardiac surgery. Recommendations for pre-operative management of hypertension

- | | |
|---|-------|
| In patients with chronic hypertension undergoing elective NCS, avoid large peri-operative fluctuations in blood pressure, particularly hypotension, during the peri-operative period. | I A |
| Perform pre-operative screening for hypertension-mediated organ damage and CV risk factors in newly diagnosed hypertensive patients who are scheduled for elective high-risk NCS. | I C |
| It is not recommended to defer NCS in patients with stage 1 or 2 hypertension. | III C |

CV, cardiovascular; NCS, non-cardiac surgery.

AHA/ACC 2024 GL on Noncardiac Surgery. Recommendations for Hypertension and Perioperative Blood Pressure Management

Preoperative Blood Pressure Management		
2a	C-EO	1. In most* patients with hypertension planned for elective NCS, it is reasonable to continue medical therapy for hypertension throughout the perioperative period.†
2b	C-LD	2. In patients undergoing elective elevated-risk surgery who have cardiovascular risk factors for perioperative complications‡ and recent history of poorly controlled hypertension (systolic blood pressure [SBP] ≥180 mm Hg or diastolic blood pressure [DBP] ≥110 mm Hg before the day of surgery), deferring surgery may be considered to reduce the risk of perioperative complications.† 1-2
Intraoperative Blood Pressure Management		
1	B-NR	3. In patients undergoing NCS, maintaining an intraoperative mean arterial pressure (MAP) ≥60 to 65 mm Hg or SBP ≥90 mm Hg is recommended to reduce the risk of myocardial injury.3-9
Postoperative Blood Pressure Management		
1	B-NR	4. In patients undergoing NCS, treatment of hypotension (MAP <60-65 or SBP <90 mm Hg) in the post-operative period is recommended to limit the risk of cardiovascular, cerebrovascular, renal events, and mortality.6
1	C-EO	5. In patients with hypertension undergoing NCS, it is recommended that preoperative antihypertensive medications be restarted as soon as clinically reasonable to avoid complications from postoperative hypertension.

*Caution is advised when continuing antihypertensive therapy in patients with low or low-normal perioperative BPs, older adults (≥65 years), and patients in whom the risk for perioperative hypotension is high based on an evaluation of the patient's overall clinical status, surgery type, and anesthetic plan.

†Modified from the "2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA High Blood Pressure Guideline."

‡One or more components of the RCRI: CAD, congestive heart failure, cerebrovascular accident, baseline serum creatinine >2.0 mg/dL, or preoperative insulin treatment.

AHA/ACC 2025 GL on Hypertension. Recommendations for Patients Scheduled for Surgical Procedures

1	B-NR	1. In patients with hypertension scheduled for major surgery who have been on BBs chronically, BBs should be continued throughout the perioperative period to assist with BP control. ¹⁻⁵
2a	C-EO	2. In patients with hypertension scheduled for elective major surgery, it is reasonable to continue most medications for hypertension throughout the perioperative period.
2b	B-R	3. In patients with hypertension scheduled for major surgery, discontinuation of ACEi or ARB preoperatively may be considered to prevent hypotension during surgery. ⁶⁻¹⁰
2b	C-LD	4. In patients scheduled for elective major surgery with SBP $\geq$ 180 mm Hg or DBP $\geq$ 110 mm Hg, deferring surgery may be considered especially in high-risk patients to minimize perioperative complications. ¹¹⁻¹³
3: Harm	B-NR	5. In patients with hypertension scheduled for surgery, abrupt preoperative discontinuation of BB or clonidine may result in rebound hypertension and is potentially harmful. ¹⁴
3: Harm	B-R	6. For patients with hypertension scheduled for surgery, BB should not be started on the day of surgery in BB-naïve patients because of increased risk of postoperative mortality. ^{4,15,16}

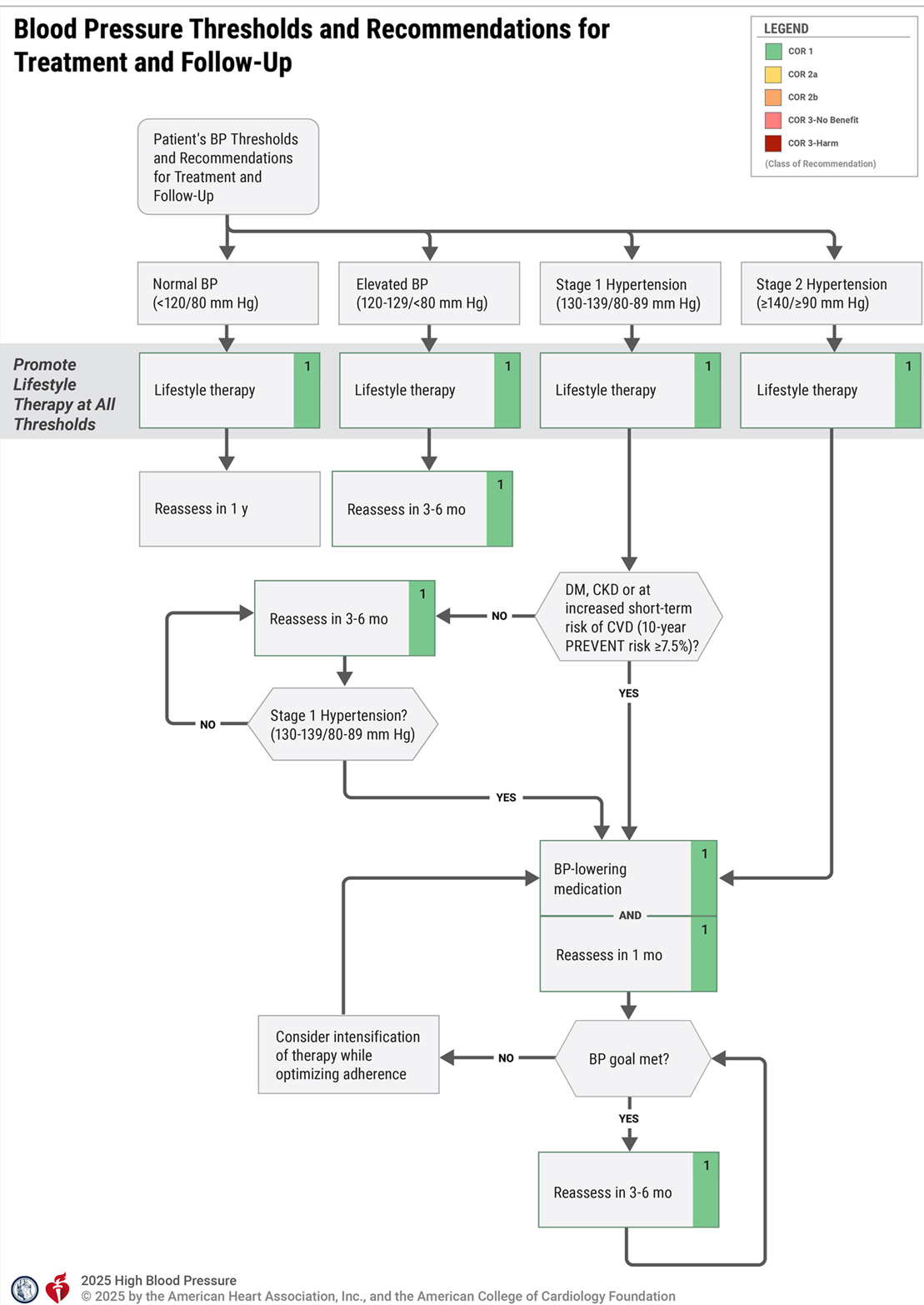


Figure 10. AHA/ACC 2025 GL on Hypertension. BP Thresholds and Recommendations for Treatment and Follow-Up.

BP indicates blood pressure; CVD, cardiovascular disease; DM, diabetes mellitus. Based on the PREVENT calculator.

Table 21. Follow-up

ESC 2024 GL on hypertension.

Recommendations for follow-up in patients with treated hypertension

Once BP is controlled and stable under BP-lowering therapy, at least a yearly follow-up for BP and other CVD risk factors should be considered.	IIa	C
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Recommendations for communicating consequences of treatment

An informed discussion about CVD risk and treatment benefits tailored to the needs of a patient is recommended as part of hypertension management. ⁹⁹²	I	C
Motivational interviewing should be considered for patients with hypertension at hospitals and community health centres to assist patients in controlling their BP and to enhance treatment adherence. ^{993,994}	IIa	B
Physician–patient web communications are an effective tool that should be considered in primary care, including reporting on home BP readings. ⁹⁹⁵	IIa	C

Recommendations for self-measuring and monitoring blood pressure

Home BP measurement for managing hypertension by using self-monitored BP is recommended to achieve better BP control.	I	B
Self-measurement, when properly performed, is recommended due to positive effects on the acceptance of a diagnosis of hypertension, patient empowerment, and adherence to treatment. ¹⁰⁰¹	I	C
Enhanced self-monitoring of BP using a device paired with a connected smartphone application may be considered, though evidence to date suggests that this may be no more effective than standard self-monitoring. ^{1005,1006}	IIb	B

Recommendations for multi/interdisciplinary blood pressure management

Multidisciplinary approaches in the management of patients with elevated BP and hypertension, including appropriate and safe task-shifting away from physicians, are recommended to improve BP control. ^{227,229,230,1012–1014,1016}	I	A
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AHA/ACC 2025 GL on Hypertension. Plan of Care for Hypertension

Recommendations for Plan of Care for Hypertension

1	A	1. For adults with uncontrolled hypertension, a team-based care approach is recommended to achieve and maintain BP control. ¹⁻⁴
1	C-LD	2. For adults with uncontrolled hypertension, an evidence-based care plan utilizing HBPM, and team-based care that is responsive to addressing adverse SDOH, is recommended to achieve and maintain BP control. ^{5,6}
Framework in Clinical Practice to Improve Hypertension Control		
1	B-NR	3. For adults with uncontrolled hypertension, an integrated treatment model that includes accurate BP measurement, prompt treatment, patient engagement, and ongoing review of HBPM is recommended to improve BP control. ⁷⁻¹⁰
Follow-Up After Initial BP Evaluation and Initiation of Antihypertensive Therapy		
1	B-R	4. Adults with uncontrolled hypertension placed on new or intensified medical therapy should have follow-up evaluations for medication adherence and response to treatment at monthly intervals until control is achieved. ¹¹⁻¹³
Health Information Technology		
1	B-R	5. For adults with uncontrolled hypertension, health information technology (HIT) by synchronous (eg, phone, video call) or asynchronous (eg, text, e-mail) communication is beneficial in improving BP control, access to care, and adherence to standards of care and should be incorporated in the management of hypertension, including the titration of BP medications. ¹⁴⁻¹⁷
1	B-NR	6. In adults with undiagnosed or uncontrolled hypertension, use of the electronic health record (EHR) and patient registries is beneficial for screening and identification of hypertension to focus on those who need additional care. ¹⁵
2a	B-R	7. In adults with uncontrolled hypertension, telehealth interventions can be useful to reduce BP ¹⁸⁻²⁶ and improve office BP control. ^{19,21,23-26}

Hypertension Team Responsibilities	
Communication, shared decision-making, and care coordination among various clinical team members, the patient, and patient caregivers Effective use of evidence-based diagnosis and management guidelines Regular, structured follow-up mechanisms and reminder systems to monitor patient progress Medication adherence support and patient education about hypertension medication Medication initiation, addition, and titration using evidence-based treatment algorithms Use of evidence-based tools and resources designed to maximize self-management (including health behavior change, lifestyle modification, etc)	
Individual Hypertension Team Members	Roles (examples)
Primary care physician/cardiologist, physician assistant or associate/nurse practitioner/advanced practice nurse	Routine and complex hypertension care, managing primary care issues
Cardiologist/physician assistant or associate/nurse practitioner/advanced practice nurse	Routine and complex hypertension care, especially for patients with cardiac disease or high risk for major cardiovascular events
Nephrologist, endocrinologist, hypertension specialist	Management of complex hypertension care, especially due to secondary causes, and/or resistant hypertension
Nurse (including in-office, home care, internal and external population health personnel)	Accurate assessment of BP, medication reconciliation, patient education, self-management, lifestyle modification, and adherence
Clinical Pharmacist	Comprehensive medication management, identification of medication-related interactions, and educating patients on their medication regimen
Dietician	Ongoing patient-centered counseling to assess dietary habits and preferences and set and monitor goals for healthy lifestyle
Social Worker	Assess for psychosocial, cultural, and financial barriers and find solutions to overcome these barriers
Community health worker	Assess and address social determinants of health and identify and promote acceptable community-based resources to overcome these barriers

Table 22. ESC 2024 GL on hypertension.

Current definition of resistant hypertension

Definition of resistant hypertension
Hypertension is defined as resistant when a treatment strategy including appropriate lifestyle measures and treatment with maximum or maximally tolerated doses of a diuretic (thiazide or thiazide-like), a RAS blocker, and a calcium channel blocker fail to lower office systolic and diastolic BP values to <140 mmHg and/or <90 mmHg, respectively. These uncontrolled BP values must be confirmed by out-of-office BP measurements (HBPM or ABPM—Section 5.1 for relevant BP thresholds).
Key considerations
• Resistant hypertension is not a disease, but an indicator that should be used to identify patients at high risk for CVD, in which secondary hypertension is also frequent; • Pseudo-resistant hypertension must be excluded, including that caused by non-adherence to treatment; • In patients with decreased eGFR (i.e. <30 mL/min/1.73 m²) an adequately up-titrated loop diuretic is necessary to define resistant hypertension; • Patients with suspected resistant hypertension should be referred to specialized centres; • These ESC Guidelines do not include the terms 'controlled resistant hypertension' (BP at target but requiring ≥4 medications) or 'refractory hypertension' (BP not at target despite ≥5 medications).

ABPM, ambulatory blood pressure monitoring; BP, blood pressure; CVD, cardiovascular disease; eGFR, estimated glomerular filtration rate; HBPM, home blood pressure monitoring; RAS, renin–angiotensin system.

Conditions found to cause pseudo-resistance or resistance to blood pressure-lowering treatment

Causes of pseudo-resistant hypertension

Poor adherence to and persistence with treatment White-coat phenomenon Poor BP measurement method
Marked brachial artery calcification (Osler phenomenon) Clinician inertia (inadequate doses, inappropriate combinations of BP-lowering drugs) Munchausen syndrome (rare)

Causes of resistant hypertension

Behavioural factors Overweight/obesity Physical inactivity Excess daily dietary sodium Excess habitual alcohol consumption

Use of drugs or substances that may increase BP

Use of drugs or substances that may increase BP

Undetected secondary hypertension

Recommendations for resistant hypertension work-up

Patients with resistant hypertension should be considered for referral to clinical centres with expertise in hypertension management for further testing. ^{309,312}	IIa	B
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Table 23. ACC/AHA 2017 GL on hypertension. Resistant Hypertension: Diagnosis, Evaluation, and Treatment.

Confirm treatment resistance with 1 of the following: • Office BP $\geq$130/80 mm Hg and on $\geq$3 antihypertensives ◦ Combination of ACEi or ARB + CCB + thiazide-like diuretics preferred • Office BP <130/80 mm Hg but requires $\geq$4 antihypertensives ◦ Combination of ACEi or ARB + CCB + thiazide-like diuretics preferred
Exclude pseudoresistance • Ensure accurate office BP measurements • Assess for medication nonadherence with prescribed regimen • Obtain home, work, or ambulatory BP readings to exclude white-coat effect
Identify and reverse contributing lifestyle factors*
Discontinue or minimize interfering substances†
Screen for secondary causes of hypertension‡
Pharmacological treatment • Maximize diuretic therapy ◦ Replace thiazide-type diuretics with chlorthalidone 12.5-25 mg qd or indapamide 1.25-2.5 mg qd • Add spironolactone (25-50 mg qd) or equivalent dosage of eplerenone (25-50 mg BID) if eGFR $\geq$45 • Use chlorthalidone or loop diuretics in patients with CKD stage 4 or greater • Add agents with different MOA ◦ BB, central sympatholytic drugs, or nondihydropyridine CCB for elevated heart rate • Add potent vasodilators ◦ eg, aprocitentan, hydralazine, or minoxidil only if already on BB (or bradycardic) and loop diuretic
Refer to specialist: • For known or suspected secondary cause(s) of hypertension • If BP remains uncontrolled >6 months of treatment

ARB indicates angiotensin receptor blocker; BB, beta blocker; BP, blood pressure; BID, 2 times daily; CCB, calcium channel blocker; CKD, chronic kidney disease; DBP, diastolic blood pressure; eGFR, estimated glomerular filtration rate; mo, month; MOA, mechanisms of action; NSAIDs, nonsteroidal anti-inflammatory drugs; OSA, obstructive sleep apnea; qd, daily; and SBP, systolic blood pressure.

Table 24. ESC 2024 GL on hypertension Recommendations for treating resistant hypertension

In patients with resistant hypertension and uncontrolled BP despite use of first-line BP lowering therapies, the addition of spironolactone to existing treatment should be considered. ^{459,515}	IIa	B
In patients with resistant hypertension in whom spironolactone is not effective or tolerated, treatment with eplerenone instead of spironolactone, ⁵⁰³ or the addition of a beta-blocker if not already indicated ⁴⁵⁹ and, next, a centrally acting BP-lowering medication, ⁵¹⁵ an alpha-blocker, ⁵¹⁵ hydralazine, or a potassium-sparing diuretic ⁵¹⁶ should be considered.	IIa	B
To reduce BP, and if performed at a medium-to-high volume centre, catheter-based renal denervation may be considered for resistant hypertension patients who have BP that is uncontrolled despite a three BP-lowering drug combination, and who express a preference to undergo renal denervation after a shared risk-benefit discussion and multidisciplinary assessment. ^{564,566–568,586–590}	IIb	B

Table 25. ESC 2024 GL on hypertension. Device Therapy

Recommendations for device-based treatment of hypertension

To reduce BP, and if performed at a medium-to-high volume centre, catheter-based renal denervation may be considered for resistant hypertension patients who have BP that is uncontrolled despite a three BP-lowering drug combination (including a thiazide or thiazide-like diuretic), and who express a preference to undergo renal denervation after a shared risk-benefit discussion and multidisciplinary assessment. ^{564,566–568,586–590}	IIb	B
To reduce BP, and if performed at a medium-to-high volume centre, catheter-based renal denervation may be considered for patients with both increased CVD risk and uncontrolled hypertension on fewer than three drugs, if they express a preference to undergo renal denervation after a shared risk-benefit discussion and multidisciplinary assessment. ^{564,566–568,586–590}	IIb	A
Due to a lack of adequately powered outcomes trials demonstrating its safety and CVD benefits, renal denervation is not recommended as a first-line BP-lowering intervention for hypertension.	III	C
Renal denervation is not recommended for treating hypertension in patients with moderate-to-severely impaired renal function (eGFR <40 mL/min/1.73 m ²) or secondary causes of hypertension, until further evidence becomes available.	III	C

BP, blood pressure; CVD, cardiovascular disease; eGFR, estimated glomerular filtration rate.

AHA/ACC 20-25 GL on hypertension.

Resistant Hypertension and Renal Denervation

Resistant Hypertension		
1	B-NR	1. In adults with resistant hypertension, a more detailed evaluation for secondary causes, to include careful review of all medications and removal of those with interfering effects on BP, is beneficial for lowering BP and simplifying treatment. ¹⁻⁵
1	B-R	2. In adults with uncontrolled resistant hypertension despite optimal treatment with first-line antihypertensive therapy (ie, a combination of ACEi or ARB plus CCB and thiazide-like diuretic [chlorthalidone or indapamide] and with an eGFR of ≥ 45 mL/min/1.73 m ²), addition of a MRA is recommended to control BP. ^{6,7}
2a	B-NR	3. In adults with uncontrolled resistant hypertension who cannot tolerate or have contraindications to MRA, the addition of one of the following agents or classes—amiloride, BBs, alpha-blockers, central sympatholytic drugs, dual endothelin receptor antagonists, or direct vasodilators—is reasonable to control BP. ⁸⁻¹¹
Renal Denervation		
2b	B-R	4. In carefully selected patients with systolic and diastolic hypertension (office SBP 140-180 mm Hg and DBP ≥ 90 mm Hg) and eGFR ≥ 40 mL/min/1.73 m ² who have resistant hypertension despite optimal treatment, or intolerable side effects to additional antihypertensive drug therapy, renal denervation (RDN) may be reasonable as an adjunct treatment to BP medications and lifestyle modification to reduce BP. ¹²⁻¹⁴
1	B-NR	5. All patients with hypertension who are being considered for RDN should be evaluated by a multidisciplinary team with expertise in resistant hypertension and RDN. ¹²⁻¹⁴
1	C-EO	6. For patients with hypertension for whom RDN is contemplated, the benefits of lowering BP and potential procedural risks compared with continuing medical therapy should be discussed as part of a shared decision-making process to ensure patients choose the therapy that meets their expectations.

Patient Selection for Renal Denervation.

Resistant hypertension OR uncontrolled hypertension*

- Patients with stage 2 hypertension (with both office SBP ≥ 140 mm Hg and office DBP ≥ 90 mm Hg) in whom BP is not at goal despite taking ≥ 4 antihypertensive medications at optimal dosages (ACEi/ARB +CCB +thiazide-type diuretics, and MRA)^{38,47}
- Patients with stage 2 hypertension (with both office SBP ≥ 140 mm Hg and office DBP ≥ 90 mm Hg) who are unable to take antihypertensive medications at the optimal dosages or additional medications^{11,12,14}

Contraindications^{13,14,26–28,46}

- Neurogenic orthostatic hypotension
- Pregnancy
- Fibromuscular dysplasia
- Stented renal artery
- Renal artery aneurysm
- Significant renal artery stenosis
- Known kidney or secreting adrenal tumors

ACEi indicates angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; CCB, calcium channel blocker; DBP, diastolic blood pressure; MRA, mineralocorticoid receptor antagonist; and SBP, systolic blood pressure.

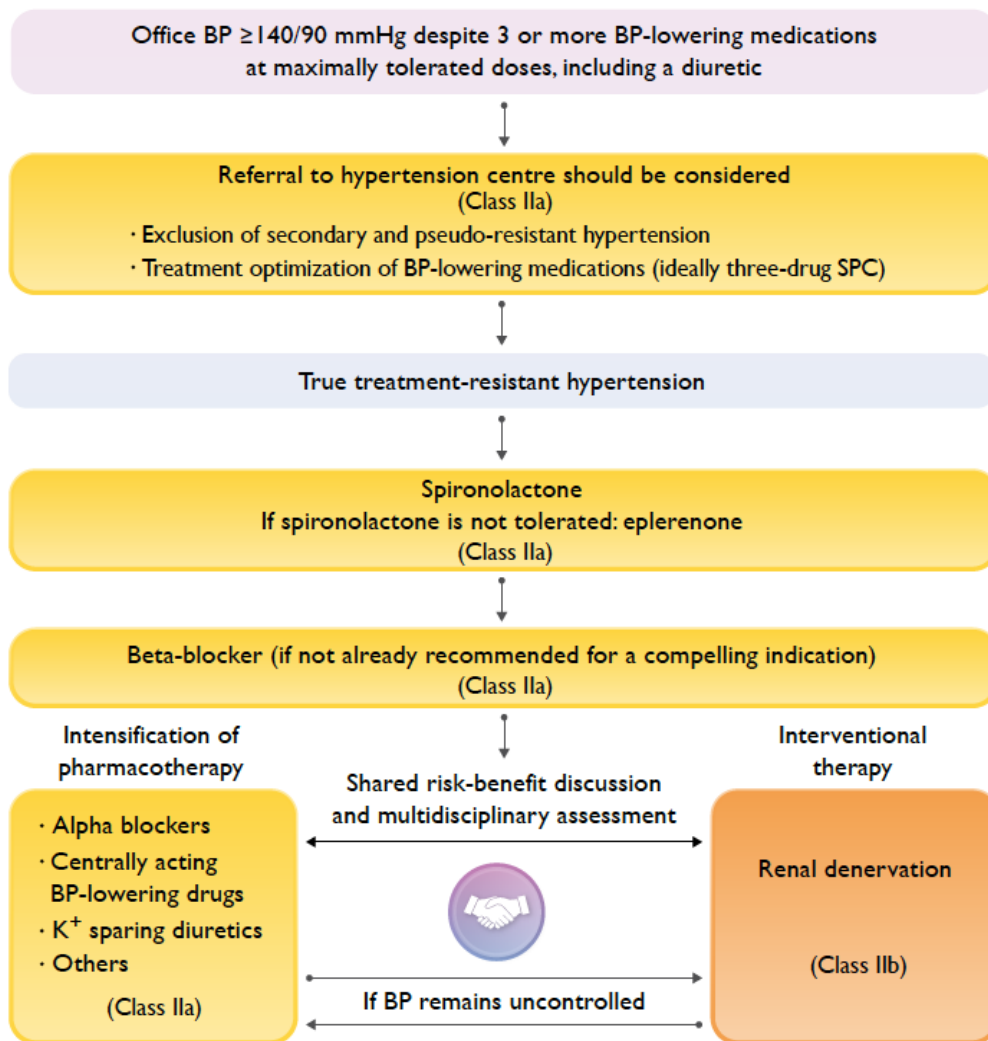


Figure 11. ESC 2024 GL on hypertension. Management of resistant hypertension.

BP, blood pressure; K⁺, potassium; SPC, single-pill combination.

Table 26. AHA/ACC 2025 GL on hypertension. Hypertensive Emergencies and Severe Hypertension in Nonpregnant and Nonstroke Patients

1	B-NR	1. In adults with a hypertensive emergency (BP >180 and/or >120 mm Hg and evidence of acute target organ damage), admission to an intensive care unit is recommended for continuous monitoring of BP and target organ damage and for consideration of parenteral administration of appropriate therapy (Tables 26 and 27, Figure 9). ¹⁻³
1	C-LD	2. For adults with a hypertensive emergency related to a compelling condition (eg, acute aortic syndrome or acute aortic dissection), SBP should be reduced to <140 mm Hg for most conditions and to <120 mm Hg in aortic dissection during the first hour, while monitoring for other target organ dysfunction. ⁴⁻⁷
1	C-LD	3. For adults with a hypertensive emergency but without a compelling condition, SBP should be reduced with oral or parenteral therapy by no more than 25% within the first hour; then, if stable, to <160/100 mm Hg within the next 2 to 6 hours; and then cautiously to 130 to 140 mm Hg during the next 24 to 48 hours to limit target organ injury. ^{2,8,9}
3: Harm	B-NR	4. For adults with severe hypertension (>180/120 mm Hg) who are hospitalized for noncardiac conditions without evidence of acute target organ damage, intermittent use of additional IV or oral antihypertensive medications are not recommended to acutely reduce BP. ^{8,10,11}

Table 27. AHA/ACC 2025 GL on hypertension. Intravenous Antihypertensive Drugs for Treatment of Hypertensive Emergencies

Class	Drug(s)	Usual Dose Range	Comments
CCB—dihydropyridines	Nicardipine	Initial 5 mg/h, increasing every 5 min by 2.5 mg/h to maximum 15 mg/h	Contraindicated in advanced aortic stenosis; no dose adjustment needed for persons aged ≥65 y. No negative inotropic or chronotropic effects.
	Clevidipine	Initial 1-2 mg/h, doubling every 90 s until BP approaches target, then increasing by less than double every 5-10 min; maximum dose 21 mg/h; maximum duration 72 h	Contraindicated in patients with soybean, soy product, egg, and egg product allergy and in patients with defective lipid metabolism (eg, pathological hyperlipidemia, lipid nephrosis [minimal change disease] or acute pancreatitis). No negative inotropic or chronotropic effects. Decreased risk of reflex tachycardia.
Vasodilators—nitric-oxide dependent	Sodium nitroprusside	Initial 0.3-0.5 mcg/kg/min; increase in increments of 0.5 mcg/kg/min every 5 min to achieve BP target; maximum dose 10 mcg/kg/min; duration of treatment as short as possible	Due to potency, intra-arterial BP monitoring is recommended to prevent "overshoot." Lower dose required for older adults. Tachyphylaxis is common with extended use. No negative inotropic or chronotropic effects. Due to increased mortality risk, should be avoided in acute cerebrovascular disease unless other agents are not available. Use cautiously in pregnancy or older adults. Cyanide toxicity (increased risk in liver dysfunction and chronic kidney disease) and thiocyanate toxicity (increased risk in kidney dysfunction, sCr >3) may occur for infusion rates ≥3 mcg/kg/min and/or duration ≥3 d. Cyanide toxicity and thiocyanate toxicity may present similarly with metabolic acidosis, altered mental status, and cardiac arrhythmia. For either toxicity state, nitroprusside should be discontinued and sodium thiosulfate or cyanocobalamin should be administered.
	Nitroglycerin	Initial 5 mcg/min; increase in increments of 5 mcg/min every 3-5 min to a maximum rate of 200 mcg/min	Use only in patients with acute coronary syndrome and/or acute pulmonary edema. Do not use in volume-depleted patients. Tachyphylaxis is common with extended use.
Vasodilators—direct	Hydralazine	Initial 10 mg via slow IV infusion (maximum initial dose 20 mg); repeat every 4-6 h as needed. Adjust rate up to total cumulative dose of 200 mg/24 h	BP begins to decrease within 10-30 min, and the fall lasts 2-4 h. Hydralazine is an undesirable first-line agent for acute treatment in most patients due to unpredictability of response and prolonged duration of action.
Adrenergic blockers—beta-1 receptor selective antagonist	Esmolol	Loading dose 500-1000 mcg/kg/min over 1 min followed by a 50-mcg/kg/min infusion. For additional dosing, the bolus dose is repeated, and the infusion increased in 50-mcg/kg/min increments as needed to a maximum of 300 mcg/kg/min	Contraindicated in patients with concurrent beta-blocker therapy, bradycardia, or decompensated HF. Monitor for bradycardia. Higher doses may block beta-2 receptors and impact lung function in reactive airway and obstructive pulmonary disease.
Adrenergic blockers—combined alpha-1 and nonselective beta receptor antagonist	Labetalol	Initial 0.3- to 1.0-mg/kg dose (maximum 20 mg) slow IV injection every 2 min or 0.4-1.0-mg/kg/h IV infusion up to 3 mg/kg/h. Adjust rate up to total cumulative dose of 300 mg/24 h	Contraindicated in reactive airway or obstructive pulmonary disease. Especially useful in hyperadrenergic syndromes. May worsen HF and should not be given in patients with second- or third-degree heart block or bradycardia.
Adrenergic blockers—nonselective alpha receptor antagonist	Phentolamine	IV bolus dose 5 mg. Additional bolus doses every 10 min as needed to lower BP to target. Adjust rate up to total cumulative dose of 50 mg/24 h	Used in hypertensive emergencies induced by catecholamine excess (pheochromocytoma, interactions between monoamine oxidase inhibitors and other drugs or food, cocaine toxicity, amphetamine overdose, or clonidine withdrawal).
Dopamine-1-receptor selective agonist	Fenoldopam	Initial 0.1-0.3 mcg/kg/min; may be increased in increments of 0.05-0.1 mcg/kg/min every 15 min until target BP is reached. Maximum infusion rate 1.6 mcg/kg/min	Contraindicated in patients at risk of increased intraocular pressure (glaucoma) or intracranial pressure and those with sulfite allergy.
ACE inhibitor	Enalaprilat	Initial 1.25 mg over a 5-min period. Doses can be increased up to 5 mg every 6 h as needed to achieve BP target. Adjust rate up to total cumulative dose of 50 mg/24 h	Contraindicated in pregnancy and should not be used in acute MI or bilateral renal artery stenosis. Mainly useful in hypertensive emergencies associated with high plasma renin activity. Poorly defined dose adjustments for kidney failure and may worsen kidney injury in those with CKD. Relatively slow onset of action (15 min) and unpredictability of BP response.

BP indicates blood pressure; CCB, calcium channel blocker; CKD, chronic kidney disease; HF, heart failure; IV, intravenous; and MI, myocardial infarction.

Intravenous Antihypertensive Drugs for Treatment of Hypertensive Emergencies in Patients With Selected Comorbidities

Comorbidity	Preferred Drug(s)*	Comments
Acute aortic dissection	Esmolol, labetalol	Requires rapid lowering of SBP to ≤ 120 mm Hg. Beta blockade should precede vasodilator (eg, nicardipine or nitroprusside) administration, if needed for BP control or to prevent reflex tachycardia or inotropic effect; SBP ≤ 120 mm Hg should be achieved within 20 min.
Acute pulmonary edema	Clevidipine, nitroglycerin, nitroprusside	Beta blockers contraindicated.
Acute coronary syndromes	Esmolol†, labetalol, nicardipine, nitroglycerin†	Nitrates given in the presence of PDE-5 inhibitors may induce profound hypotension. Contraindications to beta blockers include moderate-to-severe LV failure with pulmonary edema, bradycardia (<60 beats/min), hypotension (SBP <100 mm Hg), poor peripheral perfusion, second- or third-degree heart block, and reactive airways disease.
Acute kidney injury	Clevidipine, fenoldopam, nicardipine	N/A
Eclampsia or preeclampsia	Hydralazine, labetalol, nicardipine, nifedipine	Requires rapid BP lowering. ACE inhibitors, ARB, renin inhibitors, and nitroprusside contraindicated.
Perioperative hypertension (BP $\geq 160/90$ mm Hg or SBP elevation $\geq 20\%$ of the preoperative value that persists for >15 min)	Clevidipine, esmolol, nicardipine, nitroglycerin	Intraoperative hypertension is most frequently seen during anesthesia induction and airway manipulation.
Acute sympathetic discharge or catecholamine excess states (eg, pheochromocytoma, postcarotid endarterectomy status)	Clevidipine, nicardipine, phentolamine	Requires rapid lowering of BP.
Acute ICH	Clevidipine, nicardipine, esmolol, labetalol, hydralazine	Section 5.3.9.1
Acute ischemic stroke	Clevidipine, nicardipine, esmolol, labetalol, hydralazine	Section 5.3.9.2

*Agents are listed in alphabetical order, not in order of preference.

†Agent of choice for acute coronary syndromes.

ACE indicates angiotensin-converting enzyme; ARB, angiotensin receptor blocker; BP, blood pressure; ICH, intracerebral hemorrhage; LV, left ventricular; PDE-5, phosphodiesterase type-5; and SBP, systolic blood pressure.

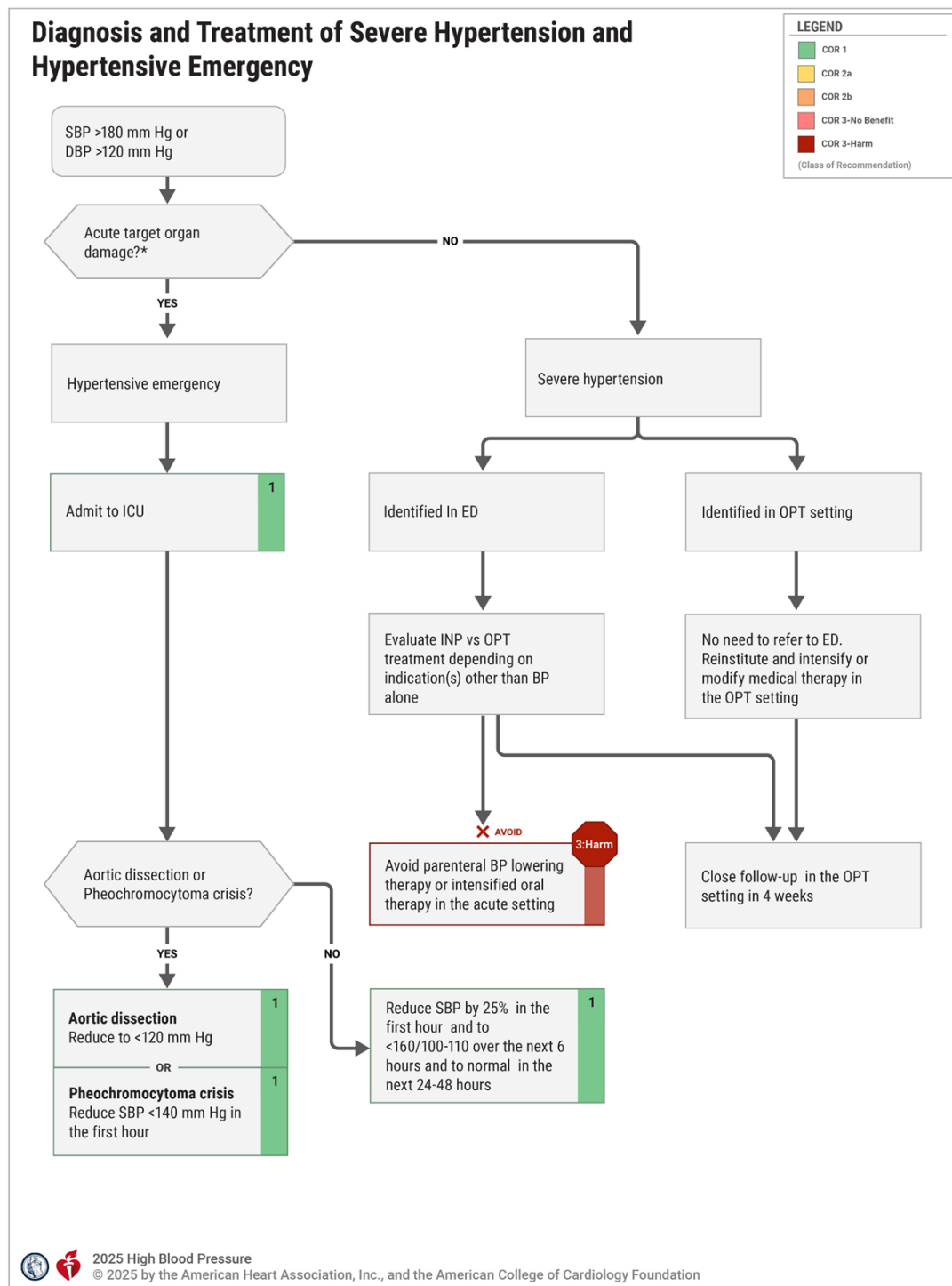


Figure 11. AHA/ACC 2025 GL on Hypertension. Diagnosis and Treatment of Severe Hypertension and Hypertensive Emergency.

*Defined as acute heart failure/pulmonary edema, neurologic disorders (posterior reversible encephalopathy syndrome, encephalopathy, retinal hemorrhage, papilledema, intracranial hemorrhage, acute ischemic stroke), acute decompensated heart failure, acute coronary syndrome, acute kidney injury, acute aortic syndrome (penetrating aortic ulcer, aortic dissection). DBP indicates diastolic blood pressure; ED, emergency department; ICU, intensive care unit; INP, inpatient; OPT, outpatient; and SBP, systolic blood pressure.

Table 28. American College of Obstetricians and Gynecologists

Definitions of Hypertensive Disorders

Disorder	Definition
Hypertension in pregnancy	Systolic blood pressure ≥ 140 mm Hg or diastolic BP ≥ 90 mm Hg, or both, measured on two occasions at least 4 hours apart
Severe-range hypertension	Systolic blood pressure ≥ 160 mm Hg or diastolic BP ≥ 110 mm Hg, or both, measured on two occasions at least 4 hours apart
Chronic hypertension	Hypertension diagnosed or present before pregnancy or before 20 weeks of gestation; or hypertension that is diagnosed for the first time during pregnancy and that does not resolve in the postpartum period
Chronic hypertension with superimposed preeclampsia	Preeclampsia in a woman with a history of hypertension before pregnancy or before 20 weeks of gestation

Diagnostic Criteria for Preeclampsia

Blood pressure

- Systolic blood pressure of 140 mm Hg or more or diastolic blood pressure of 90 mm Hg or more on two occasions at least 4 hours apart after 20 weeks of gestation in a woman with a previously normal blood pressure
- Systolic blood pressure of 160 mm Hg or more or diastolic blood pressure of 110 mm Hg or more. (Severe hypertension can be confirmed within a short interval (minutes) to facilitate timely antihypertensive therapy).

and

Proteinuria

- 300 mg or more per 24 hour urine collection (or this amount extrapolated from a timed collection) or
- Protein/creatinine ratio of 0.3 mg/dL or more or
- Dipstick reading of 2+ (used only if other quantitative methods not available)

Or in the absence of proteinuria, new-onset hypertension with the new onset of any of the following:

- Thrombocytopenia: Platelet count less than $100,000 \times 10^9/L$
- Renal insufficiency: Serum creatinine concentrations greater than 1.1 mg/dL or a doubling of the serum creatinine concentration in the absence of other renal disease
- Impaired liver function: Elevated blood concentrations of liver transaminases to twice normal concentration
- Pulmonary edema
 - New-onset headache unresponsive to medication and not accounted for by alternative diagnoses or visual symptoms

ACOG Practice Bulletin No. 203: Chronic Hypertension in Pregnancy. *Obstet Gynecol.* 2019;133:e26-e50.

Table 29. ESC 2025 GL on pregnancy.

Hypertensive disorders of pregnancy

A. Pre-existing (chronic) hypertension
Hypertension which either precedes pregnancy or develops before 20 weeks gestation, usually persisting >6 weeks post-partum, and which may be associated with proteinuria.
(1) Primary hypertension
(2) Secondary hypertension
(3) White-coat hypertension
(4) Masked hypertension
B. Gestational hypertension
Hypertension which develops after 20 weeks gestation and usually resolves within 6 weeks post-partum.
Transient gestational hypertension
Usually detected in the clinic but then settles with repeated BP measurements taken over several hours; associated with a 40% risk of developing true gestational hypertension or pre-eclampsia in the remainder of the pregnancy, thus requiring careful follow-up.
C. Pre-eclampsia
Gestational hypertension accompanied by one or more of the following new-onset conditions at or after 20 weeks gestation:
• Proteinuria [urinary albumin excretion in a 24 h urine sample >0.3 g/day or UACR in a random spot urine sample >30 mg/mmol (0.3 mg/mg)] • Other maternal organ dysfunction including: • Acute kidney injury (serum creatinine $\geq 90 \mu\text{mol/L}$; 1 mg/dL) • Liver dysfunction (elevated ALT or AST >40 IU/L; >0.67 $\mu\text{kat/L}$ with or without right upper quadrant or epigastric abdominal pain) • Neurological complications (e.g. eclampsia/convulsions, altered mental status, blindness, stroke, clonus, severe headaches, persistent visual scotomata) • Haematological complications (platelet count <150 000/μL, disseminated intravascular coagulation, haemolysis) • Uteroplacental dysfunction (IUGR, abnormal umbilical artery Doppler waveform analysis, or stillbirth).
D. Pre-existing hypertension + superimposed pre-eclampsia
Pre-existing hypertension associated with any of the above maternal organ dysfunctions consistent with pre-eclampsia or a further increase in BP with new-onset proteinuria.
E. Antenatally unclassifiable hypertension
When BP is first recorded after 20 weeks gestation and hypertension is diagnosed, reassessment is necessary at or after 6 weeks post-partum. If hypertension resolves, it should be reclassified as gestational hypertension, whereas if hypertension persists, it should be reclassified as pre-existing/chronic hypertension.

ALT, alanine transaminase; AST, aspartate aminotransferase; BP, blood pressure; IUGR, intrauterine growth restriction; UACR, urine albumin–creatinine ratio.

Risk factors for pre-eclampsia

High risk factors for pre-eclampsia
Hypertensive disorders during a previous pregnancy
Chronic hypertension
Chronic kidney disease
Type 1 or type 2 diabetes mellitus
Autoimmune diseases such as systemic lupus erythematosus or antiphospholipid syndrome
Assisted reproductive therapy in the current pregnancy
Moderate risk factors for pre-eclampsia
Nulliparity
Age ≥ 40 years
Pregnancy interval of more than 10 years
BMI $\geq 35 \text{ kg/m}^2$ at the first visit
Family history of pre-eclampsia
Multi-foetal pregnancy

BMI, body mass index.

AHA/ACC 2025 GL on Hypertension.

Hypertension and Pregnancy

1	A	1. For individuals with hypertension who are planning a pregnancy or who become pregnant, labetalol and extended-release nifedipine are preferred agents to treat hypertension and minimize fetal risk. ¹
1	B-R	2. Individuals with hypertension who are planning a pregnancy or who become pregnant should be counseled about the benefits of low-dose (81 mg/day) aspirin to reduce the risk of preeclampsia and its sequelae. ²
1	B-R	3. Pregnant individuals with SBP $\geq$ 160 mm Hg or DBP $\geq$ 110 mm Hg confirmed on repeat measurement within 15 minutes should receive antihypertensive medication (Table 23) to lower BP to $<$ 160/ $<$ 110 mm Hg within 30 to 60 minutes to prevent adverse events. ³⁻⁷
1	B-R	4. Pregnant individuals with chronic [†] hypertension (defined as prepregnancy hypertension or SBP 140 to 159 mm Hg and/or DBP 90 to 109 mm Hg prior to 20 weeks' gestation) should receive antihypertensive therapy to achieve BP $<$ 140/90 mm Hg to prevent maternal and perinatal morbidity and mortality. ^{1,8,9}
3: Harm	C-LD	5. Individuals with hypertension who are planning a pregnancy or who become pregnant should not be treated with atenolol, ACEi, ARB, direct renin inhibitors, nitroprusside, or MRA to avoid fetal harm. ¹⁰⁻¹⁴

[†]Chronic hypertension in pregnancy is defined as a preexisting diagnosis of hypertension or SBP $\geq$ 140 mm Hg and/or DBP $\geq$ 90 mm Hg on 2 occasions at least 4 hours apart before 20 weeks' gestation.

Classification of Hypertensive Disorders of Pregnancy

Condition	Definition
Chronic hypertension	Diagnosis prior to pregnancy or at $<$ 20 wks' gestation
Gestational hypertension	De novo hypertension at $\geq$ 20 wks' gestation in the absence of proteinuria or other signs of preeclampsia
Preeclampsia	Gestational hypertension with proteinuria or other maternal end-organ dysfunction including neurologic findings, pulmonary edema, hematologic findings, acute kidney injury, hepatic dysfunction (Section 5.5.2 "Preeclampsia and Eclampsia, Including Preeclampsia Superimposed on Chronic Hypertension")
Preeclampsia superimposed on chronic hypertension	Preeclampsia in a woman with a history of hypertension before pregnancy or before 20 weeks' gestation

ACOG Diagnostic Criteria for Hypertension in Pregnancy

Condition	Definition
Hypertension in pregnancy	SBP ≥ 140 mm Hg and/or DBP ≥ 90 mm Hg
Severe-range hypertension	SBP ≥ 160 mm Hg and/or DBP ≥ 110 mm Hg

ACOG indicates American College of Obstetricians and Gynecologists; DBP, diastolic blood pressure; and SBP, systolic blood pressure.

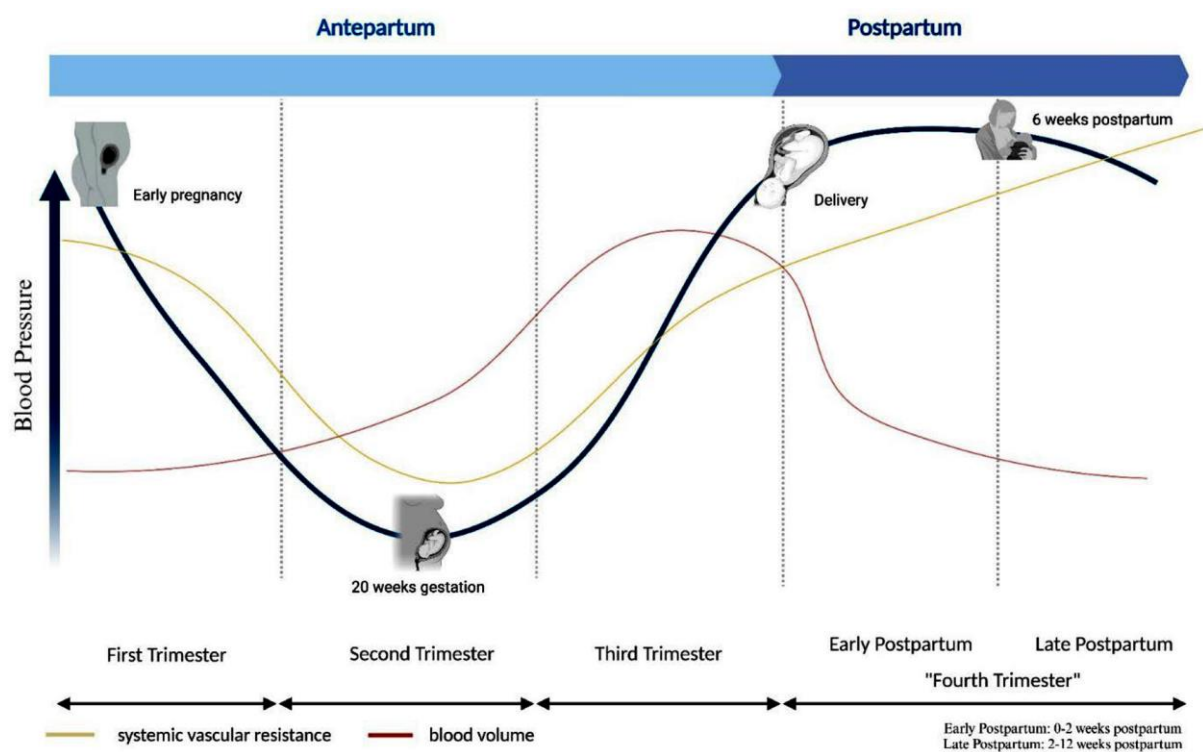


Figure 12. Expected antepartum and postpartum blood pressure trajectories in a healthy pregnancy.

Countouris M, et al. Hypertension in Pregnancy and Postpartum: Current Standards and Opportunities to Improve Care. *Circulation*. 2025;151:490-507.

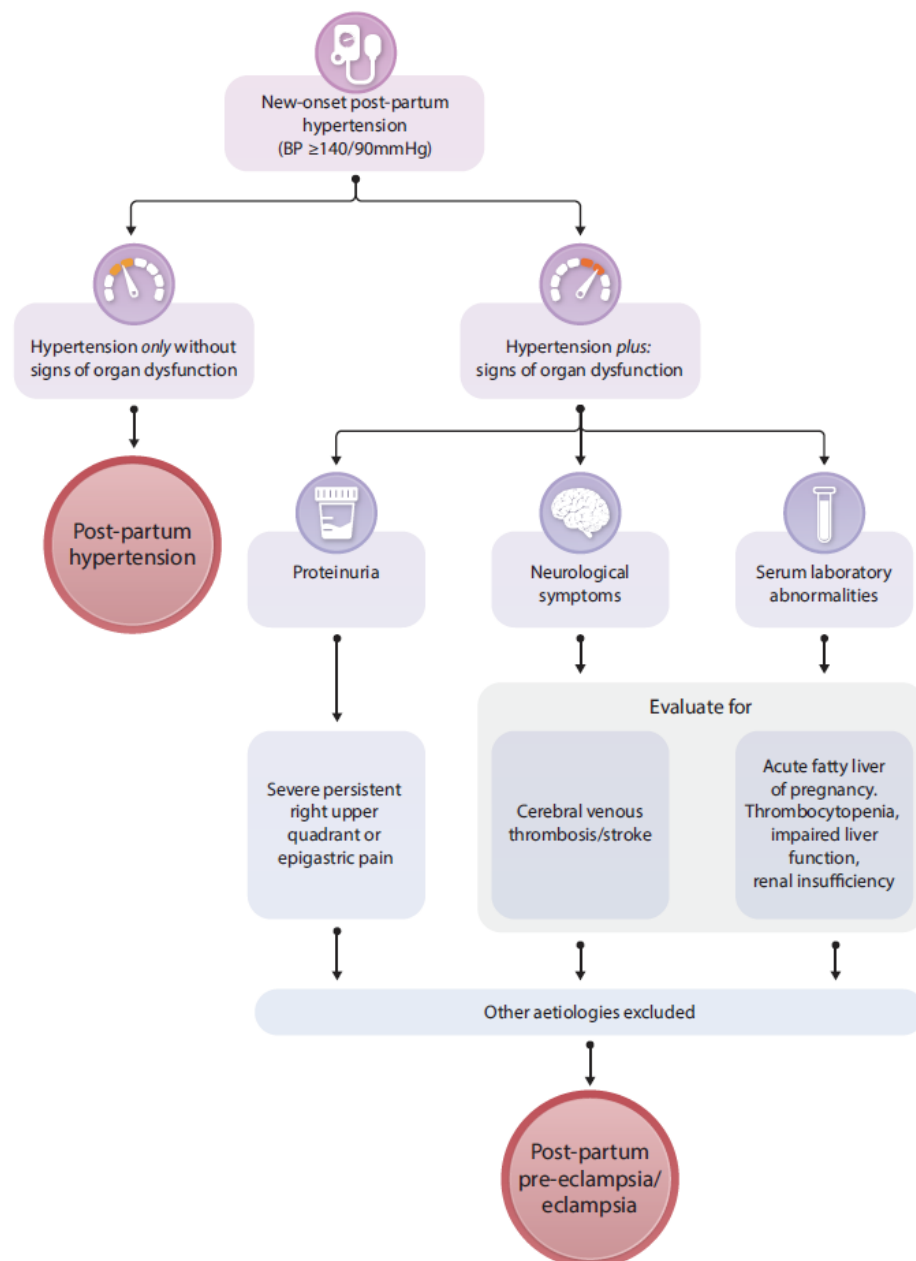


Figure 13. ESC 2025 guidelines on pregnancy. Algorithm for the management of new-onset post-partum hypertension.

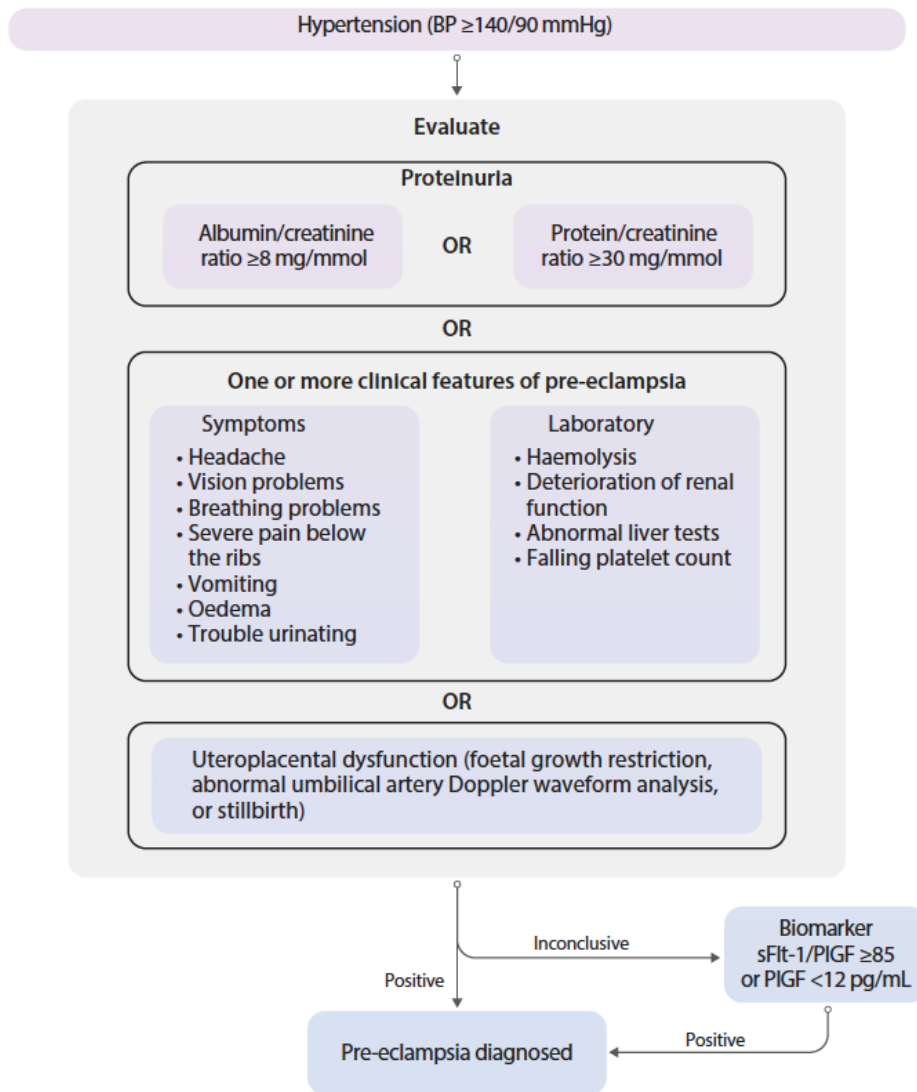


Figure 14. ESC 2025 guidelines on pregnancy. Proteinuria assessment and diagnosis of pre-eclampsia.

BP, blood pressure; PIGF, placental growth factor; sFlt-1, soluble fms-like tyrosine kinase-1.

Table 30. Therapy of hypertension in pregnancy

ESC 2024 GL on hypertension Recommendations for managing hypertension in pregnancy

In women with gestational hypertension, starting drug treatment is recommended for those with confirmed office systolic BP ≥ 140 mmHg or diastolic BP ≥ 90 mmHg. ⁶⁶¹	I	B
In pregnant women with chronic hypertension, starting drug treatment is recommended for those with confirmed office systolic BP ≥ 140 mmHg or diastolic BP ≥ 90 mmHg. ^{88,660,661,678}	I	B
In women with chronic and gestational hypertension, it is recommended to lower BP below 140/90 mmHg but not below 80 mmHg for diastolic BP.	I	C
Dihydropyridine CCBs (preferably extended-release nifedipine), labetalol, and methyldopa are recommended first-line BP-lowering medications for treating hypertension in pregnancy.	I	C
In consultation with an obstetrician, low- to moderate-intensity exercise is recommended in all pregnant women without contraindications to reduce the risk of gestational hypertension and pre-eclampsia. ^{654,655}	I	B
Systolic BP ≥ 160 mmHg or diastolic BP ≥ 110 mmHg in pregnancy can indicate an emergency, and immediate hospitalization should be considered.	IIa	C
HBPM and ABPM should be considered to exclude white-coat and masked hypertension, which are more common in pregnancy. ⁶⁷⁹	IIa	C
RAS blockers are not recommended during pregnancy. ^{680,681}	III	B

ABPM, ambulatory blood pressure monitoring; BP, blood pressure; CCB, calcium channel blocker; HBPM, home blood pressure monitoring; RAS, renin–angiotensin system

ESC 2025 guidelines on pregnancy. Recommendations for hypertensive disorders and pregnancy

It is recommended to aim for systolic BP <140 mmHg and diastolic BP <90 mmHg in pregnant women. ^{583,585,609}	I	B
Systolic BP ≥160 mmHg or diastolic BP ≥110 mmHg in a pregnant woman is an emergency, and treatment in a hospital setting is recommended. ^{43,584}	I	C
Low-dose aspirin (75–150 mg daily) is recommended in women at moderate or high risk of pre-eclampsia (i.e. at least one high-risk factor or two moderate-risk factors for pre-eclampsia) from weeks 12 to 36/37. ^{610,621,622}	I	A
In women with gestational hypertension, initiation of drug treatment is recommended at systolic BP ≥140 mmHg or diastolic BP ≥90 mmHg. ^{583–585,609}	I	B
Methyldopa is recommended for the treatment of hypertension in pregnancy. ^{623,624}	I	B
Labetalol, metoprolol, and dihydropyridine CCBs are recommended for the treatment of hypertension in pregnancy. ⁶²³	I	C
In severe hypertension, drug treatment with i.v. labetalol, urapidil, nicardipine, or oral short acting nifedipine or methyldopa is recommended for acute reduction in blood pressure. ^{625,626} Intravenous hydralazine is a second-line option.	I	C
In pre-eclampsia associated with pulmonary oedema, nitroglycerine given as an i.v. infusion is recommended. ⁶²⁷	I	C
In women with pre-eclampsia without severe features, delivery is recommended at 37 weeks. ^{620,628}	I	B
It is recommended to expedite delivery in women with pre-eclampsia associated with adverse markers such as haemostatic disorders. ⁶²⁹	I	C
In women with gestational hypertension, delivery is recommended at 39 weeks. ^{620,628}	I	B
Ambulatory BP or home BP monitoring should be considered to exclude white-coat and masked hypertension, which are common in pregnancy.	IIa	C
Home BP monitoring may be considered as an adjunct to office BP measurements in pregnant women to detect new-onset hypertension or for monitoring BP control. ^{595,596}	IIb	B

BP, blood pressure; CCB, calcium channel blocker; i.v, intravenous.

AHA/ACC 2025 GL on hypertension.

Common Oral Antihypertensive Agents in Pregnancy

Drug	Dosage	Comments
Labetalol	200-2400 mg/d orally in 2 to 3 divided doses. Commonly initiated at 100-200 mg twice daily.	Potential bronchoconstrictive effects. Avoid in women with asthma, preexisting myocardial disease, decompensated cardiac function, and heart block and bradycardia.
Nifedipine	30-120 mg/d orally of an extended-release preparation. Commonly initiated at 30-60 mg once daily (extended release).	Do not use sublingual form. Immediate-release formulation should generally be reserved for control of severe, acutely elevated blood pressures in hospitalized patients. Should be avoided in tachycardia.
Methyldopa	500-3000 mg/d orally in 2 to 4 divided doses. Commonly initiated at 250 mg 2 or 3 times daily.	Safety data up to 7 y of age in offspring. May not be as effective as other medications, especially in control of severe hypertension. Use limited by side effect profile (sedation, depression, dizziness).
Hydrochlorothiazide	12.5-50 mg daily	Second- or third-line agent.

Antihypertensive Agents Used for Urgent Blood Pressure Control in Pregnancy

Drug	Dose	Comments	Onset of Action
Labetalol	10-20 mg IV, then 20-80 mg every 10-30 min to a maximum cumulative dosage of 300 mg; or constant infusion 1-3 mg/min IV	Tachycardia is less common with fewer adverse effects. Avoid in women with asthma, preexisting myocardial disease, decompensated cardiac function, and heart block and bradycardia.	1-2 min
Hydralazine	5 mg IV or IM, then 5-10 mg IV every 20-40 min to a maximum cumulative dosage of 20 mg; or constant infusion of 0.5-10 mg/h	Higher or frequent dosage associated with maternal hypotension, headaches, and abnormal fetal heart rate tracings; may be more common than other agents.	10-20 min
Nifedipine (immediate release)	10-20 mg orally, repeat in 20 min if needed; then 10-20 mg every 2-6 h; maximum daily dose is 180 mg	May observe reflex tachycardia and headaches.	5-10 min

TABLE 31. Antihypertensive drugs in pregnancy

Systolic BP 140-160 mmHg or Diastolic BP 90-100 mm Hg

Labetalol	100 mg tds (up to 1200 mg/day)
Nifedipine	10 mg tds (or long-acting 30 mg od, up to 120 mg/day)
Methyldopa	250 mg tds (up to 2250 mg/day)

If BP control is not achieved within a week with a medium dose, consider adding a low–medium dose from another class, rather than a high dose of the same medication, for a maximum of three medications

Systolic BP $\geq$ 160 mmHg or Diastolic BP $\geq$ 110 mm Hg

		Starting dose	30 min	60 min	90 min	120 min	150 min
Labetalol	Oral — mg	200	—	200	—	200	—
	Intermittent IV — mg	10–20	20–40	40–80	40–80	40–80	40–80
	IV infusion — mg/min	0.5–2.0	→	→	→	→	→
Nifedipine	Oral capsule — mg	5–10	10	—	10	—	10
	Oral tablet (PA/MR) — mg	10	—	10	—	10	—
Hydralazine	Intermittent IV — mg	5	5–10	5–10	5–10	—	—
Methyldopa	Oral (if other medications unavailable or for in utero transfer without monitoring) — mg	1000	—	—	—	—	—

If BP control is not achieved despite maximal doses, move to another class of medication.

Data from Magee LA, et al. The 2021 International Society for the Study of Hypertension in Pregnancy classification, diagnosis & management recommendations for international practice. *Pregnancy Hypertens.* 2022;27:148-169.

AHA/ACC 2025 GL on hypertension. Diagnostic Criteria for Preeclampsia

Blood pressure	SBP ≥ 140 mm Hg or DBP ≥ 90 mm Hg on 2 occasions at least 4 h apart after 20 wks of gestation in a woman with previously normal BP <i>or</i> SBP ≥ 160 mm Hg or DBP ≥ 110 mm Hg (severe hypertension can be confirmed within a short interval [min] to facilitate timely antihypertensive therapy).
AND	
Proteinuria	≥ 300 mg per 24-h urine collection (or this amount extrapolated from a timed collection) <i>or</i> Protein/creatinine ratio ≥ 0.3 <i>or</i> Dipstick reading of 2+ (used only if other quantitative methods are not available)
OR in the Absence of Proteinuria, New Onset Hypertension With the New Onset of Any of the Following:	
Thrombocytopenia: Platelet count $< 100 \times 10^9/L$	
Renal insufficiency: Serum creatinine concentrations > 1.1 mg/dL or a doubling of serum creatinine concentration in the absence of other renal disease	
Impaired liver function: Elevated blood concentration of liver transaminases to twice normal concentration	
Pulmonary edema	
New-onset headache unresponsive to medication and not accounted for by the alternative diagnoses or visual symptoms	

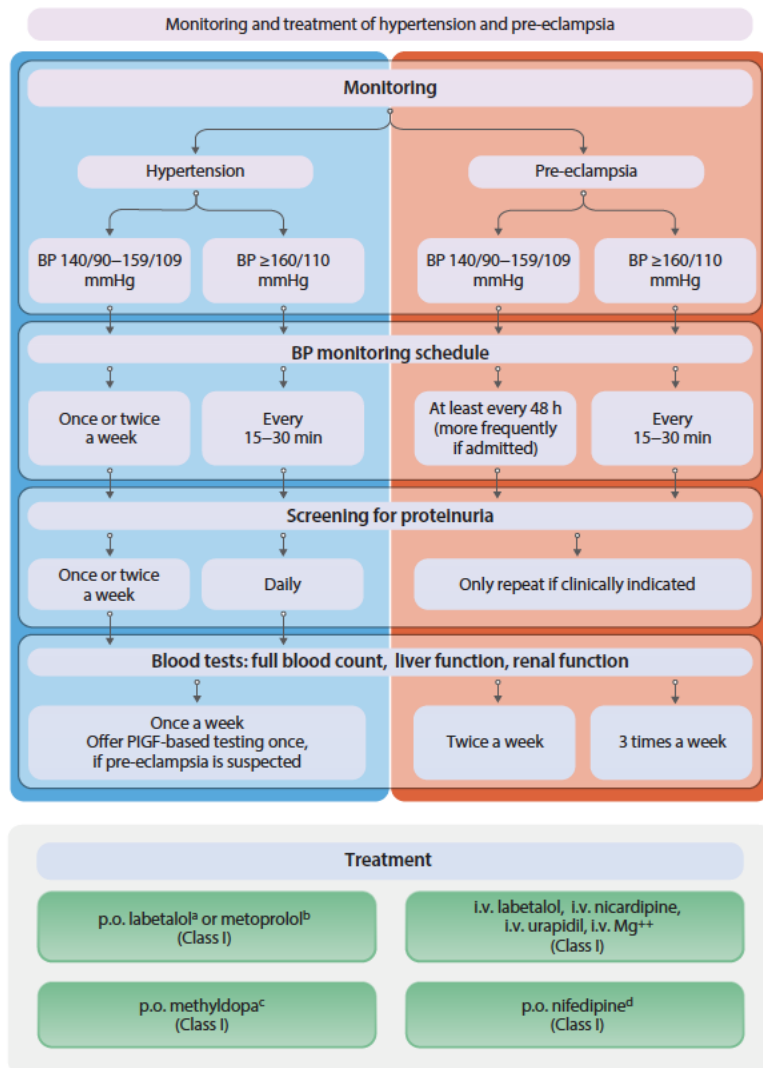


Figure 15. ESC 2025 guidelines on pregnancy. Monitoring and treatment of hypertension and pre-eclampsia.

Mg, magnesium; PlGF, placental growth factor; p.o., per oral.

aLabetalol 100 mg p.o. b.i.d.

bMetoprolol 100 mg p.o. b.i.d.

cMethyldopa 250 mg p.o. b.i.d./t.i.d.

dNifedipine 5–10 mg p.o. 10 mg p.o. if >160/110 mmHg.

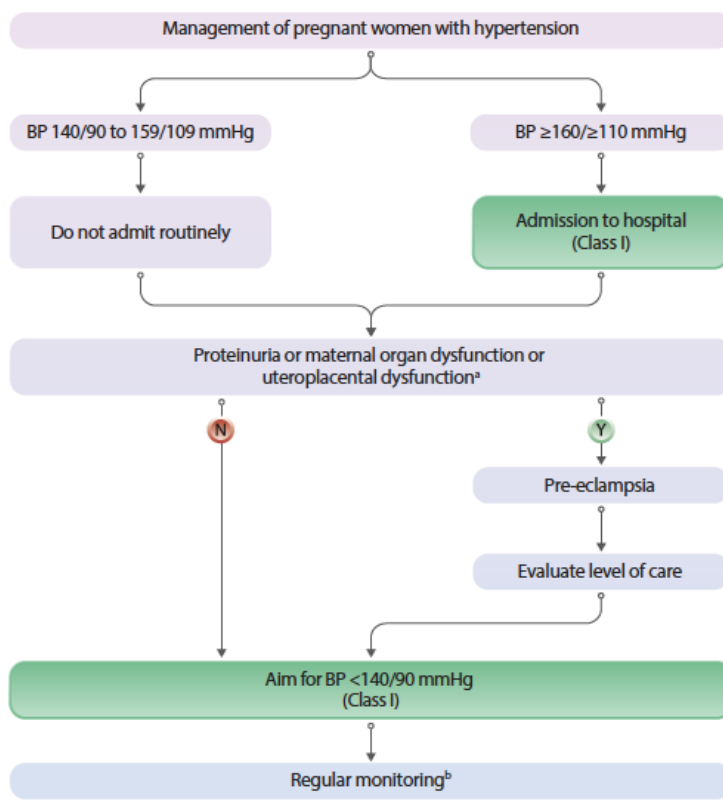


Figure 16. ESC 2025 guidelines on pregnancy. Management of hypertension and pre-eclampsia in the emergency ward.