Management of Patients with Elevated Blood Pressure

Cardiovascular risk begins to rise well below the traditional threshold for overt hypertension, yet the optimal management of patients with elevated or high-normal blood pressure (BP) remains controversial. This review summarizes current evidence on diagnosis, risk stratification, and treatment strategies, with particular focus on individuals with BP values of 120–139/80–89 mmHg and the differing recommendations of European and American guidelines.

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ABSTRACT

Background: Elevated blood pressure (BP), defined as systolic BP 120–139 mmHg and/or diastolic BP 80–89 mmHg, represents a highly prevalent and clinically relevant cardiovascular risk state. Although traditionally not classified as hypertension in all guidelines, accumulating evidence suggests that cardiovascular risk increases continuously from these levels onward. However, optimal management strategies, particularly in low- to moderate-risk individuals, remain debated due to differences in international guideline recommendations.

Methods: This review summarizes current evidence on the diagnosis, risk stratification, and management of patients with elevated BP and hypertension, with a focus on individuals with BP values between 120–139/80–89 mmHg. We analyzed contemporary European and American guideline recommendations and key randomized controlled trials evaluating lifestyle and pharmacological interventions.

Summary: Accurate BP assessment requires standardized office measurements and preferably confirmation with out-of-office methods, including ambulatory and home BP monitoring, to identify white-coat and masked hypertension. Risk stratification is central to management decisions, as cardiovascular risk within the elevated BP range is highly heterogeneous. Strong evidence supports intensive BP lowering in high-risk patients with hypertension, while benefits in low-risk individuals with mildly elevated BP remain less certain. Lifestyle interventions — including weight reduction, dietary modification (e.g., DASH or Mediterranean diet), sodium restriction, physical activity, and alcohol moderation — are consistently effective as first-line therapy. Pharmacological treatment is universally recommended for overt hypertension, while recommendations diverge for elevated BP, particularly between ESC and AHA guidelines, reflecting differences in risk thresholds and treatment initiation strategies.

Conclusion: Management of elevated BP requires an individualized, risk-based approach integrating accurate BP measurement, cardiovascular risk assessment, and patient preferences. While lifestyle modification remains the cornerstone of therapy, pharmacological treatment should be reserved for selected high-risk individuals. Ongoing uncertainty regarding optimal treatment thresholds underscores the need for further research to refine strategies for early cardiovascular prevention.

Keywords: Elevated blood pressure – Hypertension management – Cardiovascular risk stratification – Lifestyle intervention – Antihypertensive therapy guidelines

Introduction

Hypertension is one of the most prevalent cardiovascular risk factors worldwide and represents a major contributor to global morbidity and mortality. While overt hypertension is well established as a driver of cardiovascular disease, increasing evidence suggests that cardiovascular risk begins to rise at blood pressure (BP) levels below traditional hypertension thresholds. Individuals with systolic blood pressure (SBP) values between 120 and 139 mmHg or diastolic blood pressure (DBP) between 80 and 89 mmHg — often categorized as “elevated BP” or “high-normal BP” — constitute a large proportion of the adult population and represent a clinically important heterogenous group for preventive strategies.

Over the past decade, international guidelines have adopted different approaches to the classification and management of this BP range. American guidelines were the first to have lowered the diagnostic threshold for hypertension and introducing the term “elevated BP”. In contrast, European recommendations continue to set a different threshold for hypertension. These differences reflect ongoing debate regarding the optimal threshold for pharmacological

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treatment and the balance between early intervention and the risk of overtreatment.

A central challenge in the management of elevated BP lies in identifying those individuals who are most likely to benefit from intervention. Cardiovascular risk in this BP range is highly heterogeneous and strongly influenced by competing factors such as age, comorbidities, target-organ damage, and overall cardiovascular risk profile. Risk stratification therefore plays a pivotal role in determining management strategies, guiding decisions between lifestyle interventions alone and the initiation of pharmacological therapy in selected high-risk patients.

This review aims to provide an overview of the current evidence regarding the management of patients with elevated BP and hypertension. We focus on diagnostic strategies, risk stratification, and evidence-based approaches to lifestyle and pharmacological interventions especially in patients with BP values between 120 to 139/80 to 89 mmHg. Particular emphasis is placed on the comparison of European and American guideline recommendations concerning the treatment of these patients.

Figure 1: Summary of accurate Home-BP measurement (Fig. 1 by Ganna Degtiarova).

Establishing the diagnosis of hypertension / elevated blood pressure

The diagnosis of hypertension requires repeated documentation of BP values higher than the defined threshold *(Table 1)*, which is dependent of measurement modality and guideline which is followed. Out-of-office measurements, such as ambulatory BP monitoring (ABPM) and home BP monitoring (HBPM), have proven to be more reliable than office measurements (1). They provide more accurate data for diagnosis and follow-up, improve adherence to therapy, and actively engage patients in their care. Meanwhile, a major advantage of out-of-office measurements is their ability to detect white coat hypertension and masked hypertension, conditions that may remain undetected with office readings alone. White coat hypertension is characterized by elevated BP in the clinical setting with normal out-of-office readings. In contrast, masked hypertension refers to normal office BP but elevated BP on out-of-office measurements. Despite these limitations, most evidence from clinical trials concerning therapy continues to rely primarily on office BP measurements.

For all BP measurement modalities, accurate BP measurement requires a standardized approach, as readings can be influenced by body position, temperature, physical activity, and other factors *(Figure 1)*. A validated upper-arm device with an appropriately sized cuff is recommended. Forearm or wrist devices should only be used in patients with obesity if proper upper-arm cuff placement is not feasible. BP should be measured after five minutes of rest in a comfortable position. Caffeine-containing beverages should be avoided for at least 30 minutes prior to measurement, and the arm should be supported with the sleeve rolled up. For HBPM, at least two consecutive measurements at 1–2 minute intervals should be obtained, with the mean value used for interpretation. If the difference between readings exceeds 10 mmHg, additional measurements are recommended. Readings should be taken in the morning and evening at the same times for at least three, ideally seven consecutive days. For office-BP-measurements, three readings should be obtained while averaging the last two and discarding the first reading (2).

At the first visit, office BP should be measured in both arms. If there is a difference greater than 10 mmHg, the arm with the higher reading should be used for follow-up measurements. In patients with atrial fibrillation, the European Society of Cardiology (ESC) recommends manual auscultation, whereas the European Society of Hypertension (ESH) accepts automated oscillometric measurements (2,3). Screening for orthostatic hypotension is recommended by the ESC at the initial visit in all patients, while the ESH advises this only in high-risk individuals, such as those over 65 years of age, patients with diabetes, or those presenting with suggestive symptoms.

For the screening of hypertension, the ESC recommends opportunistic office measurements, which, in the case of elevated BP, should be confirmed with out-of-office measurements such as ABPM or HBPM. Repeatedly elevated office BP readings may also be accepted when out-of-office measurements are not feasible, however, in this scenario a white coat effect has to be considered (2).

The ESC differentiates between non-elevated BP, elevated BP, and hypertension. The cut-off values for each category, as well as for the different types of BP measurement according to the ESC guideline, are summarized in Table 1.

Table 1: Comparison of office, home, and ambulatory BP measurement thresholds for elevated BP and hypertension according to 2024 ESC guidelines (2). ABPM: ambulatory blood pressure measurement, BP: blood pressure (Tab. 1 by Ganna Degtiarova)

	Office BP (mmHg)	Home BP (mmHg)	Daytime ABPM (mmHg)	24h ABPM (mmHg)	Night-time ABPM (mmHg)
Non-elevated	< 120/70	< 120/70	< 120/70	< 115/65	< 110/60
Elevated BP	120/70 – <140/90	120/70 – <135/85	120/70 – <135/85	115/65 – < 130/80	110/60 – < 120/70
Hypertension	≥140/90	≥ 135/85	≥ 135/85	≥ 130/80	≥ 120/70

The initial evaluation of patients with elevated BP should include a detailed history, medication review, physical examination including ECG, and routine laboratory testing to assess cardiovascular risk. Recommended laboratory tests include HbA_{1c}, a lipid profile, electrolytes, kidney function tests, and urinalysis. Assessment of hypertension-mediated organ damage is a major component of the initial evaluation, because this would trigger the initiation of antihypertensive therapies (2).

Emerging technologies for continuous, everyday BP monitoring are currently under validation and may provide convenient long-term BP assessment in the future. However, they are not yet recommended by the current guidelines due to persistent inaccuracies.

Blood pressure targets

The current ESC guideline recommends initiating antihypertensive therapy in all patients with hypertension, targeting BP values of 120–129/70–79 mmHg with caution in patients ≥ 85 years or in those with frailty or orthostatic hypotension. Meanwhile, there is substantial scientific evidence showing a benefit of intensive BP reduction in patients with hypertension or elevated BP and high to very high cardiovascular risk (4–6). The first relevant randomized controlled trial in this context was the SPRINT trial, in which high-risk patients with SBP of ≥ 130 mmHg were randomized to a treatment goal of < 120 mmHg vs < 140 mmHg. It showed that patients in the intensive treatment arm had lower incidence of major adverse cardiovascular events, and the overall mortality in these patients was reduced by about 27% (4). Similarly, the ESPRIT trial also showed a significant benefit of a treatment goal of < 120 mmHg (Hazard Ratio [HR] 0.88) compared to < 140 mmHg in 11.000 high risk patients of whom 39% had diabetes (6).

The STEP trial demonstrated in elderly patients (60–80 years) that targeting SBP 110–130 mmHg vs 130–150 mmHg significantly reduced cardiovascular events (HR 0.74) without increasing serious adverse events (5).

Non-pharmacological treatment of hypertension and elevated blood pressure

Strong evidence supports the central role of lifestyle interventions as first-line therapy in patients with elevated BP and hypertension, either as stand-alone therapy or in conjunction with pharmacological therapies *(Table 2)*. Weight reduction (≥ 5% body weight or body mass index [BMI] decrease ≥ 3 kg/m²) leads to meaningful BP reductions. Dietary approaches such as the DASH (9) or Mediterranean diet (10) improve vascular function through increased intake of potassium, magnesium, calcium, and fiber. Sodium restriction (≤ 2 g/day) and the use of potassium-enriched salt substitutes further contribute to BP reduction. Alcohol

Table 2: Expected SBP reduction through lifestyle Interventions according to the ESC (2). (Tab. by Polina Dimitrova)

Intervention	Target/Recommendation	SBP reduction (mmHg)	Remarks
Weight reduction	BMI: 20–25 kg/m²; Waist: < 94 cm (♂), < 80 cm (♀)	5–10 per 10 kg lost	Greater effect in obesity; sustained loss required.
DASH diet	Fruits, vegetables, whole grains, low-fat dairy, lean proteins	8–14	Most effective in hypertension; additive with sodium restriction.
Sodium restriction	< 5 g/day salt (≈ 2 g sodium)	5–6	Greater effect in salt-sensitive individuals (e.g. older adults)
Potassium-rich diet	3.5–5 g/day (fruits, vegetables, nuts, legumes)	4–5	Avoid in kidney disease/hyperkalemia risk.
Aerobic exercise	90–150 min/week (65–75% max heart rate)	5–8	Brisk walking, cycling, swimming.
Isometric exercise	3 sessions/week (e.g. handgrip, 30% max effort, 8–10 repetitions)	5–10	Emerging evidence; adjunctive role.
Alcohol reduction	< 100 g/week, (♂) ≤ 2 & (♀) ≤ 1 drinks/day for a standard of 8–14 g/drink	4 (with 50% reduction)	Greater effect in heavy drinkers.

moderation (≤ 100 g/week) is also recommended (11). Moderate coffee consumption does not appear to increase hypertension risk (12), whereas energy drinks may elevate BP, particularly in younger individuals (13). Limiting free sugar intake, especially from sugar-sweetened beverages, is additionally advised (14).

However, long-term adherence to lifestyle interventions remains challenging. Digital health solutions, including telemonitoring and mobile health applications, offer promising tools to support sustained lifestyle modification and BP control (15).

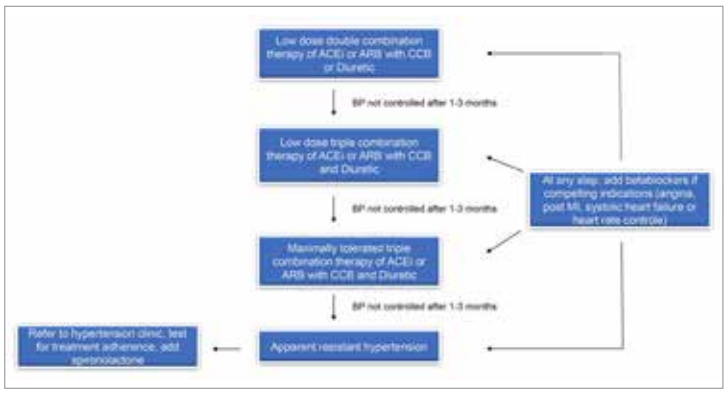

Figure 2: Pharmacological Treatment of hypertension according to the ESC (2). ACEi: ACE inhibitor, ARB: angiotensin receptor blocker, CCB: calcium channel Blocker (Fig. by David Fink)

Pharmacological treatment of hypertension and elevated blood pressure

The major drug classes with evidence for reducing cardiovascular events in patients with hypertension are ACE inhibitors (ACEi), angiotensin receptor blockers (ARB), dihydropyridine calcium channel blockers and thiazide or thiazide-like diuretics. In patients with overt hypertension (BP ≥ 140/90 mmHg) antihypertensive therapy should be initiated with low-dose dual therapy, consisting of a combination of two of the major drug classes listed above and including an ACEi or ARB (but not the combination of the two). In the presence of compelling indications (particularly coronary artery disease, systolic heart failure and/or arrhythmias), beta-blockers should be added at any step of therapy. Assessment of BP control should be performed after 1–3 months. If BP is still not controlled with low-dose dual therapy, a third major drug class should be added, with subsequent dose uptitration until BP targets are achieved. (*Figure 2).*

Pharmacological treatment in special populations

In **chronic kidney disease (CKD)** Guidelines recommend ACEi or ARBs and CCBs as first-line therapy. SGLT2 inhibitors should be added in patients with albuminuria (> A2–A3) or diabetes, also for lowering BP (16). Mineralocorticoid receptor antagonists (MRAs) (if estimated glomerular filtration rate [eGFR] > 30 ml/min/1.73 m²) and thiazide-like diuretics such as chlorthalidone in advanced CKD (eGFR <30 ml/min/1.73 m²) can be considered (17) (18). BP targets vary between guidelines. Whereas the ESC guidelines recommend a BP target < 130 mmHg and < 80 mmHg, the "Kidney Disease: Improving Global Outcomes (KDIGO)" recommends a systolic target < 120 mmHg due to the high cardiovascular risk in CKD (19). Similar to the ESC, the America Heart Association (AHA) also recommends a BP target < 130/80 mmHg with considering an SBP <120 mmHg if tolerated. (20)

Patients with **diabetes mellitus (DM)** have an increased risk for cardiovascular complications and hypertension due to vascular stiffness, microvascular dysfunction, renin-angiotensin-aldosterone system activation, inflammation, albuminuria, and CKD. Initial treatment consists of combination therapy including an ACE inhibitor or ARB, given the high likelihood of albuminuria and their nephroprotective effects targeting SBP of 120–129 mmHg (21,22). However, the BPROAD study suggests additional cardiovascular benefits with more intensive targets < 120 mmHg (23).

Hypertension in **elderly individuals (≥ 60–65 years)** is highly prevalent in Western countries (60–68%) (24). Treatment generally follows standard hypertension management, as it improves survival and cardiovascular outcomes (25).

However, management in older adults should consider life expectancy (ESC: < 3 years), frailty, orthostatic hypotension, and adverse drug effects (26). As guidelines differ, individualized and less strict targets may be appropriate. Depending on frailty and comorbidities, SBPgoals of < 130–150 mmHg are reasonable in frail patients.

Management of patients in the ESC "elevated blood pressure" category

Whereas the management recommendations for patients with a BP ≥ 140/90 mmHg are largely similar across the different societies (ESC, ESH, and AHA), the classification/denotation of lower BP and the management recommendations for these patients differ between these societies *(Table 3*).

The AHA was the first to introduce the term "elevated BP" in their 2017 guideline. Intriguingly, in this guideline, the threshold for the definition of hypertension was lowered to SBP ≥ 130 or DBP ≥ 80 mmHg and restricting the elevated BP category to 120–129/< 80 mmHg, with the reasoning that several observational and randomized controlled studies

Table 3: Comparison of guidelines considering classification of elevated BP and hypertension according to office measurements in mmHg (2,3,20). (Tab. 3 by David Fink)

	ESC 2024	ESH 2023	AHA 2025
Elevated BP	120–139/70–89		SBP 120–129 and DBP < 80
High-normal BP		130–139/85–89	
Hypertension	≥ 140/90	≥ 140/90	SBP ≥ 130 and/or DBP ≥ 80

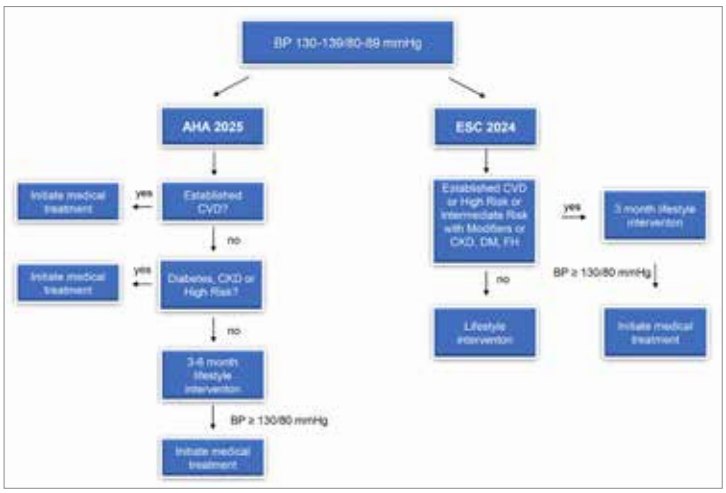

Figure 3: Management of patients with BP 130-139 mmHg systolic and/or 80-89 mmHg diastolic according to recent guidelines of the ESC and ACC/AHA (2) (20). CVD: cardiovascular disease, CKD: chronic kidney disease. (Fig. 3 by David Fink)

and metaanalyses showed an almost linear association of BP with different outcomes (27). In the most recent version of the AHA/ACC Hypertension guidelines (20) adopting this classification, it is recommended to initiate pharmacological treatment without delay in patients with BP ≥ 130/80 and high or very high cardiovascular risk (established cardiovascular disease, diabetes, CKD, or increased cardiovascular risk defined as a PREVENT-CVD score ≥ 7.5%). Several randomized controlled trials showing a benefit of intensive vs standard BP targets included patients with systolic BP 130–140 mmHg with high cardiovascular risk, although most of these patients were already treated at baseline (4,6,23,28). In patients at lower cardiovascular risk and BP ≥130/80 mmHg, pharmacological treatment is recommended if BP remains increased after 3–6 months of lifestyle intervention (20), given that the relative risk reduction for cardiovascular disease prevention with use of BP-lowering medications is fairly constant for all cardiovascular risk groups, however with a marked difference in absolute risk reduction (27). Randomized controlled trial data from the PREVER-Prevention study (31) demonstrated lower rates of progression to stage 2 hypertension (≥ 140/90 mmHg) and end-organ damage (left ventricular mass) following a 3-month lifestyle intervention among participants with elevated BP (120 to 139/80 to 89 mmHg) who were subsequently randomized to diuretic treatment compared with placebo in adults aged 30 to 70 years (20).

The ESC takes a more conservative approach, recommending initiation of pharmacological therapy in patients with BP ≥ 130/80 mmHg only after a 3-month period of lifestyle intervention and in the presence of established cardiovascular disease, moderate/severe CKD, diabetes or familial hypercholesterolaemia as well as high cardiovascular risk (10-year CVD risk (SCORE) > 10%), or intermediate risk (10-year CVD risk 5–10%) with additional risk modifiers (2). All other patients with elevated BP should undergo lifestyle interventions only and be followed up. Similar to the ESC, the ESH recommends initiating pharmacological treatment in patients with high-normal BP only in those with the highest risk, i.e. established cardiovascular disease (mainly coronary artery disease) (3). Patients with low to moderate cardiovascular risk and BP between 130–140/80–90 mmHg and patients with BP values of 120–129/70–79 mmHg should undergo lifestyle interventions (2) *(Figure 3)*.

Based on the results of several randomized controlled trials, the BP goals in patients treated for hypertension or elevated BP are similar (see above). Importantly, if medical therapy in patients with a BP of 130–140/80–90 mmHg is initiated, guidelines recommend initiating monotherapy to avoid too extensive BP-lowering with potential side effects (2).

Taken together, these considerations raise uncertainty about the extent to which the observed benefits can be directly translated into treatment recommendations for untreated, low-risk individuals with only mildly elevated BP. In addition, the potential harms of drug therapy should not be overlooked. Although antihypertensive medications are generally well tolerated, they may be associated with adverse effects affecting adherence and quality of life, particularly in low-risk individuals. Furthermore, the initiation of lifelong daily medication can represent a significant burden, especially for younger patients, many of whom may be reluctant to accept chronic pharmacotherapy in the absence of manifest disease or substantial short-term risk.

Conclusion

In summary, while there is broad consensus on the management of overt hypertension, important discrepancies remain in the definition and treatment of elevated BP, particularly in low-risk individuals. Although emerging evidence suggests potential benefits of earlier pharmacological intervention, uncertainties regarding its applicability, risk-benefit balance, and long-term adherence persist. Therefore, an individualized approach — prioritizing lifestyle modification and carefully weighing cardiovascular risk, patient preferences, and potential harms — remains essential in the management of elevated BP. □

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Conflict of interest: The authors declare no conflicts of interests.
Received: April 2026
Accepted: April 2026
Published: 21 May 2026

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