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REVIEW ARTICLE

Contemporary Diagnosis and Management of Hypertension: An Evidence-Based Narrative Review

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Abstract: Background: Hypertension is a major modifiable risk factor for cardiovascular disease, chronic kidney disease, stroke, and premature mortality. Despite the availability of effective antihypertensive medications and established preventive strategies, inadequate detection, treatment, and long-term blood pressure control remain important public health challenges.Objective: This review examines current concepts in the epidemiology, pathophysiology, diagnosis, cardiovascular risk assessment, and management of adult hypertension, with emphasis on contemporary clinical guidelines and practical implications for routine care.Methods: A narrative review was developed using major international clinical guidelines, authoritative public health publications, randomized controlled trials, and relevant peer-reviewed studies on hypertension diagnosis, treatment, and cardiovascular outcomes. The literature was selected for clinical relevance rather than through a formal systematic-review protocol.Discussion: Hypertension is a heterogeneous disorder involving interactions among genetic susceptibility, renal sodium handling, neurohormonal activation, vascular dysfunction, metabolic factors, and environmental exposures. Accurate diagnosis requires standardized blood pressure measurement and, where feasible, confirmation with home or ambulatory monitoring. Lifestyle modification remains fundamental, while pharmacological treatment commonly involves thiazide or thiazide-like diuretics, angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, and long-acting calcium channel blockers. Treatment intensity should be individualized according to cardiovascular risk, comorbidities, tolerability, and guideline recommendations. Resistant hypertension warrants confirmation of adherence and exclusion of secondary causes before treatment escalation.Conclusion: Effective hypertension management requires more than prescribing medication. Standardized measurement, risk-based treatment, adherence support, longitudinal monitoring, and equitable access to affordable care are essential to reducing the global burden of cardiovascular disease.

Keywords: Hypertension; blood pressure; cardiovascular disease; antihypertensive therapy; hypertension-mediated organ damage; cardiovascular risk; primary prevention.

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Introduction

Hypertension is among the most important preventable causes of cardiovascular morbidity and premature death. Persistently elevated arterial blood pressure increases the risk of ischemic heart disease, stroke, heart failure, chronic kidney disease, peripheral arterial disease, and vascular cognitive impairment. Its clinical importance arises not only from the magnitude of the associated risk but also from its high prevalence, frequently asymptomatic presentation, and the availability of effective interventions.

The World Health Organization (WHO) estimated that approximately 1.4 billion adults aged 30–79 years had hypertension in 2024, representing approximately one-third of this age group worldwide. A substantial proportion remained undiagnosed or inadequately controlled, with the greatest burden concentrated in low- and middle-income countries [1]. These findings highlight the continuing gap between the availability of effective treatment and its successful implementation.

Hypertension is not a uniform disorder with a single underlying mechanism. Its development reflects interactions between inherited susceptibility, age-related vascular changes, renal function, dietary sodium, body weight, physical activity, alcohol consumption, sleep, medication

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exposure, and social determinants of health. Although many patients have primary hypertension without an identifiable single cause, a clinically important minority have secondary hypertension attributable to a specific disease or drug exposure. Recognizing these distinctions helps clinicians select appropriate investigations and treatment strategies.

The definition and classification of hypertension also vary across professional guidelines. The 2024 European Society of Cardiology (ESC) guideline defines office hypertension as systolic blood pressure of at least 140 mmHg or diastolic blood pressure of at least 90 mmHg, while introducing an elevated blood pressure category below this threshold [2]. Other guidelines use lower diagnostic thresholds or treatment targets in selected circumstances. These differences reflect distinct approaches to risk classification and treatment decisions rather than a disagreement that cardiovascular risk increases progressively with blood pressure.

This narrative review summarizes contemporary evidence relevant to adult hypertension, emphasizing reliable diagnosis, pathophysiological mechanisms, risk assessment, lifestyle intervention, pharmacological treatment, difficult-to-control disease, and practical challenges in routine clinical practice.

Epidemiology and pathophysiological mechanisms

Hypertension affects populations across different income levels, geographic regions, and healthcare systems. A pooled analysis of population-representative studies covering 184 countries demonstrated substantial changes in hypertension prevalence, awareness, treatment, and control between 1990 and 2019, with major inequalities persisting between countries and regions [3]. Although improved screening and treatment have benefited many populations, demographic ageing, urbanization, excess dietary sodium, physical inactivity, obesity, and metabolic disease continue to contribute to the burden.

Primary hypertension accounts for most adult cases. Its pathophysiology involves multiple interacting mechanisms that regulate cardiac output, systemic vascular resistance, circulating volume, and vascular responsiveness. The kidneys are central to long-term blood pressure regulation through sodium and water excretion. When renal sodium handling is insufficient relative to intake, extracellular fluid volume may increase, contributing to elevated blood pressure. Over time, compensatory changes in vascular resistance and renal function can sustain hypertension even when the initial physiological disturbance is no longer obvious.

The renin–angiotensin–aldosterone system (RAAS) contributes through angiotensin II-mediated vasoconstriction, stimulation of aldosterone secretion, and effects on sodium retention and vascular remodeling. Sympathetic nervous system activation increases heart rate, vascular tone, and renin release. Endothelial dysfunction, reduced nitric oxide bioavailability, oxidative stress, inflammation, and arterial stiffness further impair vascular regulation. These pathways interact rather than operate independently, explaining why patients with apparently similar blood pressure measurements may have different patterns of organ damage and treatment response.

Age-related arterial stiffening is particularly relevant in older adults, in whom isolated systolic hypertension and widened pulse pressure are common. Obesity may promote hypertension through sympathetic activation, insulin resistance, inflammation, renal compression, and altered sodium handling. Obstructive sleep apnoea can contribute through intermittent hypoxaemia and sympathetic activation. Excess sodium intake and inadequate dietary potassium may further influence blood pressure, although potassium supplementation requires caution in patients with impaired renal function or those taking medications that increase serum potassium.

Secondary hypertension should be considered when hypertension develops unusually early, deteriorates abruptly, remains uncontrolled despite an appropriate multidrug regimen, or is accompanied by clinical or biochemical clues to an underlying disorder. Important causes include renal parenchymal disease, renovascular disease, primary aldosteronism, obstructive sleep apnoea, thyroid disorders, and catecholamine-secreting tumours. Medications and substances such as non-steroidal anti-inflammatory drugs, glucocorticoids, some hormonal preparations, stimulants, and certain decongestants can raise blood pressure. The probability of a secondary cause should guide targeted testing rather than indiscriminate investigation.

Diagnosis and clinical assessment

Accurate measurement is the foundation of hypertension diagnosis. Errors in technique can lead to unnecessary treatment or missed disease. Before measurement, the patient should ideally avoid smoking, caffeine, and exercise for at least 30 minutes, empty the bladder if needed, and rest quietly for approximately five minutes. The patient should be seated with back supported, feet flat on the floor, legs uncrossed, and the arm supported at

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heart level. A validated upper-arm device and an appropriately sized cuff should be used. Talking during measurement should be avoided, and multiple readings should be obtained and averaged according to the applicable guideline [2].

A single elevated reading does not always establish sustained hypertension. Blood pressure varies with pain, anxiety, activity, sleep, temperature, medication timing, and measurement conditions. When practical, confirmation with ambulatory blood pressure monitoring (ABPM) or home blood pressure monitoring (HBPM) improves diagnostic accuracy. ABPM records measurements during routine daytime activity and sleep, providing information about nocturnal blood pressure and circadian patterns. HBPM provides repeated measurements in the home environment and is particularly useful for longitudinal monitoring and treatment adjustment.

White-coat hypertension refers to elevated office readings with lower out-of-office measurements, whereas masked hypertension describes normal office readings despite elevated blood pressure outside the clinical setting. Both patterns can affect clinical decisions. Masked hypertension may be particularly concerning because it can delay treatment in people whose actual blood pressure exposure is underestimated. White-coat hypertension should not automatically be regarded as harmless; cardiovascular risk factors and subsequent blood pressure patterns still require evaluation.

The initial assessment should document the duration and severity of elevated blood pressure, previous treatment, medication adherence, family history, smoking, alcohol consumption, dietary habits, physical activity, and symptoms suggesting cardiovascular or renal disease. Examination should assess body mass index, pulse, peripheral pulses, signs of heart failure, and features suggesting secondary hypertension or target-organ damage. Funduscopic examination may be appropriate in selected patients, particularly when severe hypertension or acute organ injury is suspected.

Investigations commonly include serum electrolytes, creatinine and estimated glomerular filtration rate, glucose or glycated haemoglobin, lipid profile, urinalysis, and assessment for albuminuria. An electrocardiogram can identify evidence of left ventricular hypertrophy, arrhythmia, or previous myocardial injury. Further testing should be guided by clinical findings, severity, age, treatment resistance, and suspected secondary causes. The purpose is not simply to confirm a numerical diagnosis but also to estimate overall cardiovascular risk and identify conditions that influence treatment choice.

Cardiovascular risk and hypertension-mediated organ damage

Blood pressure should be interpreted in the context of the patient's overall cardiovascular risk. Age, smoking, diabetes, dyslipidaemia, chronic kidney disease, established cardiovascular disease, obesity, and family history can substantially influence the absolute benefit expected from treatment. A person with moderately elevated blood pressure and established cardiovascular disease may have a greater short-term absolute risk than a younger individual with the same measurement but no additional risk factors.

Sustained hypertension promotes structural and functional changes in the heart, brain, kidneys, retina, and vasculature. Increased left ventricular afterload can lead to myocardial hypertrophy, impaired relaxation, and eventually heart failure. Cerebral small-vessel injury increases the risk of stroke and vascular cognitive impairment. Renal microvascular injury can cause albuminuria and progressive loss of filtration, while chronic kidney disease can further worsen blood pressure control. These processes may reinforce one another, creating a cycle of vascular injury and deteriorating organ function.

Evidence from randomized trials supports the cardiovascular benefits of lowering blood pressure. In a major systematic review and meta-analysis, Ettehad and colleagues found that a 10 mmHg reduction in systolic blood pressure was associated with reductions in major cardiovascular events, coronary heart disease, stroke, and heart failure [4]. The size of the absolute benefit depends on baseline risk, duration of treatment, competing risks, and the population studied.

The Systolic Blood Pressure Intervention Trial (SPRINT) compared intensive systolic blood pressure treatment targeting less than 120 mmHg with standard treatment targeting less than 140 mmHg among selected high-risk adults without diabetes or previous stroke. Intensive treatment reduced the primary cardiovascular outcome and all-cause mortality during the intervention period, although some adverse events, including hypotension, electrolyte abnormalities, and acute kidney injury, occurred more frequently [5]. Its results support intensive treatment in appropriately selected patients but should not be applied mechanically to every patient. The trial population, measurement methods, comorbidities, frailty, and individual treatment tolerance all matter when translating the findings into practice.

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Lifestyle modification

Lifestyle modification is recommended for people with elevated blood pressure and remains an essential component of treatment for established hypertension. Its effects are additive, and the benefits extend beyond the blood pressure measurement itself. Nevertheless, lifestyle advice should not be used to delay indicated medication in patients with confirmed hypertension or high cardiovascular risk.

Dietary strategies include reducing excessive sodium intake, increasing consumption of vegetables, fruits, legumes, and other minimally processed foods, and limiting foods rich in salt and saturated fat. Dietary patterns similar to the Dietary Approaches to Stop Hypertension (DASH) approach can reduce blood pressure, particularly when combined with sodium reduction. Potassium-rich foods may be beneficial for many individuals, but potassium intake and supplementation must be individualized in chronic kidney disease and in patients taking RAAS-blocking medications.

Weight reduction can improve blood pressure in people with overweight or obesity. Regular aerobic activity, supplemented by resistance exercise when appropriate, improves cardiovascular fitness and can contribute to sustained blood pressure reduction. Adults should generally aim for at least 150 minutes of moderate-intensity aerobic activity per week, adjusted to their health status and functional capacity. Reducing excessive alcohol consumption, avoiding tobacco, and addressing sleep disorders can provide additional benefits.

Lifestyle interventions are most effective when recommendations are practical and adapted to a patient's circumstances. Food affordability, work schedules, cultural dietary patterns, safe exercise environments, health literacy, and family support all influence long-term adherence. Brief advice alone may be insufficient; structured follow-up, community-based support, and repeated reinforcement can help translate recommendations into sustainable changes.

Pharmacological treatment

The choice to initiate medication depends on confirmed blood pressure, cardiovascular risk, evidence of organ damage, comorbidities, and applicable guideline recommendations. The WHO guideline recommends pharmacological treatment for appropriately diagnosed adults with blood pressure of at least 140/90 mmHg, alongside lifestyle counselling, with specific recommendations for initiation, targets, follow-up, and treatment selection [6]. Some guidelines also support treatment at lower thresholds for selected high-risk individuals.

First-line drug classes include thiazide or thiazide-like diuretics, angiotensin-converting enzyme inhibitors (ACE inhibitors), angiotensin receptor blockers (ARBs), and long-acting dihydropyridine calcium channel blockers. These agents reduce blood pressure through complementary physiological mechanisms and have substantial clinical evidence supporting their use. Selection should account for renal function, electrolytes, pregnancy potential, coexisting disease, adverse effects, affordability, and patient preference.

ACE inhibitors and ARBs are particularly useful in selected patients with albuminuric chronic kidney disease and other appropriate indications. They should not be used during pregnancy, and ACE inhibitors and ARBs should not ordinarily be combined because dual blockade increases adverse effects without providing a routine clinical advantage. Serum creatinine and potassium should be assessed before treatment and rechecked after initiation or dose escalation in patients at risk of renal dysfunction or hyperkalaemia.

Long-acting calcium channel blockers are effective, including in many older patients and individuals with isolated systolic hypertension. Ankle oedema, flushing, and headache can occur. Thiazide-like diuretics can cause hyponatraemia, hypokalaemia, hyperuricaemia, and changes in glucose metabolism, requiring appropriate monitoring. Beta-blockers have important indications in conditions such as certain arrhythmias, angina, and heart failure with reduced ejection fraction, but are not the preferred initial choice for uncomplicated hypertension in many contemporary guidelines.

For many patients with confirmed hypertension, combination therapy provides more rapid and reliable blood pressure reduction than prolonged sequential monotherapy. A common approach is to combine an ACE inhibitor or ARB with a calcium channel blocker or thiazide-like diuretic. Single-pill combinations can reduce pill burden and may improve adherence. The starting regimen should nevertheless be individualized, particularly in older adults, people with orthostatic symptoms, frailty, or substantial renal impairment.

Treatment targets differ among guidelines and clinical groups. The 2024 ESC guideline recommends a treated systolic blood pressure target of 120–129 mmHg for many adults when treatment is tolerated, with exceptions and individualization where appropriate [2]. Other guidance uses different targets according to age, comorbidity, and treatment setting. Clinicians should avoid treating these figures as universal mandates: the goal is to reduce long-term cardiovascular risk without

causing unacceptable hypotension, falls, electrolyte disturbances, or deterioration in renal function.

Resistant hypertension and special clinical circumstances

Resistant hypertension is generally considered when blood pressure remains above the recommended target despite the use of three appropriately selected antihypertensive agents at tolerated doses, usually including a diuretic. Before establishing this diagnosis, clinicians should confirm measurement accuracy, evaluate adherence, review interfering substances, and exclude white-coat effects using out-of-office measurements when possible. Apparent treatment resistance is often attributable to inadequate doses, complex regimens, missed medication, or unrecognized secondary causes.

Primary aldosteronism deserves particular consideration in resistant hypertension, unexplained hypokalaemia, and selected patients with early-onset or severe disease. Other investigations may assess renal disease, renovascular pathology, and obstructive sleep apnoea. Specialist referral can be appropriate when the diagnosis remains uncertain or blood pressure is uncontrolled despite a rational multidrug regimen. Spironolactone can be an effective additional treatment in selected patients with resistant hypertension, but its use requires attention to renal function and serum potassium. Other options depend on comorbidities, previous treatment, and specialist assessment. In chronic kidney disease, treatment selection should account for albuminuria, estimated glomerular filtration rate, potassium levels, and the risk of acute kidney injury. Diabetes and established cardiovascular disease often strengthen the rationale for intensive risk-factor management beyond blood pressure alone.

Pregnancy-associated hypertension requires a distinct clinical approach. ACE inhibitors and ARBs are contraindicated during pregnancy, and patients planning pregnancy should have their medication reviewed in advance. Severe hypertension in pregnancy requires prompt assessment and management because of maternal and fetal risks. Acute severe blood pressure elevation accompanied by neurological deficits, chest pain, pulmonary oedema, acute kidney injury, or other evidence of acute target-organ damage is an emergency and should not be managed through routine outpatient medication adjustments.

Table 1. Practical framework for hypertension assessment and management

Clinical component	Practical approach	Clinical purpose
Blood pressure measurement	Validated device, correct cuff, standardized positioning, repeated readings	Reduce measurement error
Diagnostic confirmation	ABPM or HBPM when feasible and appropriate	Detect white-coat or masked hypertension
Baseline evaluation	Renal function, electrolytes, glucose, lipids, urine assessment, ECG as indicated	Identify comorbidity and organ damage
Lifestyle measures	Sodium reduction, healthy dietary pattern, physical activity, weight management, alcohol moderation	Lower blood pressure and overall risk
Initial pharmacotherapy	Individualized use of first-line agents, often combination therapy	Achieve effective control
Follow-up	Assess blood pressure, adherence, adverse effects, and laboratory results	Maintain control and treatment safety
Apparent resistance	Confirm adherence and measurement, review substances, investigate secondary causes	Avoid inappropriate escalation
Long-term prevention	Integrate lipid, diabetes, smoking, kidney, and cardiovascular risk management	Reduce cardiovascular events

Public health implications and future directions

The persistent gap between hypertension detection and control demonstrates that effective treatment requires coordinated health-system strategies. Standardized treatment protocols, reliable supplies of affordable medication, task-sharing with appropriately trained healthcare workers, and team-based care can improve management. The WHO has emphasized simplified pharmacological algorithms and treatment delivery approaches to support hypertension control, particularly in settings where specialist access is limited [6].

Digital blood pressure monitoring and telehealth may support follow-up and self-management, but their benefits depend on validated devices, patient training, connectivity, and clear clinical escalation pathways. Digital systems should complement rather than replace accessible in-person care. In resource-limited settings, the availability of basic diagnostics and uninterrupted access to common antihypertensive medicines may be more important

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than sophisticated technology.
Future research should clarify optimal treatment targets in very old and frail adults, improve approaches to resistant hypertension, identify patients most likely to benefit from specific treatment combinations, and develop implementation strategies that reduce inequities. Better integration of hypertension care with diabetes, kidney disease, and cardiovascular prevention programmes could improve both clinical outcomes and health-system efficiency.

Conclusion

Hypertension is a common, often asymptomatic condition that contributes substantially to cardiovascular and renal disease. Its effective management begins with accurate measurement and appropriate diagnostic confirmation, followed by comprehensive cardiovascular risk assessment. Lifestyle modification remains fundamental, while evidence-based pharmacological treatment should be selected and adjusted according to blood pressure, comorbidities, safety, and patient preferences. Resistant hypertension requires a structured evaluation rather than indiscriminate escalation. At the population level, early detection, affordable medicines, continuity of care, and sustained adherence support are essential to reducing avoidable cardiovascular events and premature mortality.

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