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Systolic Hypertension: An Updated Review for Healthcare Professionals

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Abstract:

Background: Isolated systolic hypertension (ISH) is the most prevalent form of hypertension in older adults, defined by systolic blood pressure (SBP) ≥140 mmHg and diastolic blood pressure (DBP) <90 mmHg. The 2017 ACC/AHA guidelines redefined hypertension as SBP ≥130 mmHg, expanding the at-risk population. ISH is driven by arterial stiffening and poses significant risks for stroke, myocardial infarction, and renal dysfunction.

Aim: This review synthesizes current evidence on ISH pathophysiology, diagnosis, and management to guide healthcare professionals in optimizing patient outcomes.

Methods: A comprehensive analysis of clinical guidelines (ACC/AHA), landmark trials (HYVET, SHEP, SPRINT), and epidemiological studies (NHANES, Framingham) was conducted. Emphasis was placed on etiology, diagnostic approaches (including ambulatory monitoring to differentiate white-coat/masked hypertension), and evidence-based treatment strategies.

Results: ISH affects 30% of adults >60 years, with higher prevalence in women and non-Hispanic Black individuals. Pathophysiology centers on age-related vascular calcification and collagen deposition, leading to elevated pulse wave velocity. First-line therapies include thiazide diuretics and calcium channel blockers, with SBP targets <130 mmHg for most patients (or <140/90 mmHg in frail elderly). Nonpharmacologic interventions (DASH diet, sodium restriction, exercise) reduce SBP by 4–12 mmHg. The J-curve phenomenon cautions against excessive DBP reduction (<70 mmHg) in coronary artery disease.

Conclusion: ISH management requires individualized strategies balancing efficacy and safety, particularly in older adults. Interprofessional care models improve adherence and outcomes.

Keywords: Isolated systolic hypertension, arterial stiffness, elderly, antihypertensive therapy, J-curve phenomenon.

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Introduction:

Isolated systolic hypertension (ISH) is the most common form of hypertension observed in older adults, particularly those aged 60 years and above [1]. Clinically, ISH is diagnosed when systolic blood pressure (SBP) exceeds 140 mm Hg while diastolic blood pressure (DBP) remains below 90 mm Hg. Epidemiological studies indicate that approximately 15% of individuals within this age group meet the criteria for ISH under this traditional definition. However, the 2017 American College of Cardiology/American Heart Association (ACC/AHA) Blood Pressure guidelines introduced a significant revision by lowering the threshold for hypertension, now classifying an SBP of 130 mm Hg or higher as hypertensive, regardless of age [2]. This updated diagnostic standard is anticipated to substantially increase the number of elderly individuals identified with high blood pressure, thereby expanding the population requiring clinical intervention. The public health implications of ISH are considerable, as sustained elevations in SBP are strongly associated with heightened risks of cardiovascular morbidity and mortality. Chronic untreated ISH contributes to the development of serious complications, including stroke, myocardial infarction, and renal dysfunction. Given the aging global population, the management of ISH has become an increasingly critical priority in healthcare systems worldwide. Effective treatment strategies, including lifestyle modifications and antihypertensive therapy, are essential in reducing the long-term adverse effects of elevated SBP. Furthermore, early detection and consistent monitoring are vital in mitigating the progression of ISH-related complications. As clinical guidelines continue to evolve, healthcare providers must remain vigilant in applying evidence-based approaches to manage this prevalent condition in older adults.

Etiology of Isolated Systolic Hypertension

The majority of hypertension cases are classified as primary hypertension (also referred to as essential hypertension), where no single underlying cause can be identified. However, in contrast to primary hypertension, isolated systolic hypertension (ISH) may occasionally arise from secondary causes, though such instances are relatively uncommon. Several medical conditions have been linked to the development of ISH, including endocrine disorders such as hypothyroidism and hyperthyroidism, as well as metabolic diseases like diabetes mellitus. Additionally, cardiovascular and renal pathologies—such as chronic kidney disease, aortic insufficiency, arteriovenous fistulas, and atherosclerotic renal artery stenosis—can contribute to elevated systolic blood pressure. Other potential etiological factors include peripheral vascular disease, anemia, and Paget's disease of bone, all of which may disrupt normal hemodynamic regulation and lead to isolated systolic hypertension [3]. While primary hypertension remains the predominant form, the identification of secondary causes is crucial in clinical practice, as targeted treatment of the underlying condition may lead to better blood pressure control. For instance, correcting thyroid dysfunction or managing chronic kidney disease can significantly influence systolic blood pressure levels. Thus, in cases of ISH—particularly when presenting with atypical features—clinicians should consider a thorough diagnostic evaluation to rule out secondary contributors before attributing the condition solely to age-related vascular stiffness or idiopathic causes [3].

Epidemiology of Isolated Systolic Hypertension

Isolated systolic hypertension (ISH) exhibits a pronounced age-dependent prevalence, predominantly affecting the elderly population. Epidemiological data from the National Health and Nutrition Examination Survey (NHANES) 1999-2010 reveal that approximately 30% of individuals aged 60 years and older have untreated ISH. This contrasts sharply with younger demographics, where the condition is far less common—affecting only 6% of adults aged 40–50 years and a mere 1.8% of young adults aged 18–39 years[3][4][5]. The Framingham Heart Study further underscores the progressive nature of hypertension

risk with aging, demonstrating that a normotensive 65-year-old individual faces a 90% lifetime probability of developing hypertension. Within the elderly population, certain demographic groups exhibit a higher susceptibility to hypertensive disorders. Women and non-Hispanic Black individuals are disproportionately affected, showing elevated prevalence rates compared to other racial and ethnic groups. This disparity may be attributed to a combination of genetic, physiological, and socioeconomic factors influencing blood pressure regulation. Given the strong correlation between ISH and advancing age—along with its association with increased cardiovascular morbidity—this condition represents a significant public health challenge, particularly in aging societies. The demographic trends highlight the need for targeted screening and management strategies in high-risk populations to mitigate the long-term consequences of uncontrolled systolic hypertension.

Pathophysiology of Isolated Systolic Hypertension

The primary pathophysiological mechanism underlying isolated systolic hypertension (ISH) involves age-related arterial stiffening, characterized by diminished elasticity of the vascular system. In older adults, this process is driven by progressive calcification and collagen deposition within the arterial walls, leading to structural and functional alterations in the vasculature [6]. These changes contribute to reduced arterial compliance, which manifests as a decreased lumen-to-wall ratio, intimal-medial thickening, and fibrotic remodeling of the vascular layers. Consequently, the stiffening of large conduit arteries results in elevated pulse pressure (PP) and increased pulse wave velocity (PWV), which amplify systolic blood pressure (SBP) while simultaneously reducing diastolic blood pressure (DBP). Additionally, chronic diseases associated with secondary hypertension—such as diabetes mellitus, chronic kidney disease, and atherosclerotic disorders—can exacerbate arterial stiffness by accelerating calcium deposition, collagen accumulation, and fibrotic vascular remodeling[6][7]. These pathological processes further impair arterial distensibility, perpetuating the hemodynamic disturbances seen in ISH. The resultant increased afterload on the left ventricle not only sustains elevated SBP but also contributes to cardiovascular complications, including left ventricular hypertrophy, heart failure, and microvascular dysfunction. Moreover, endothelial dysfunction and reduced nitric oxide bioavailability often accompany arterial stiffening, impairing vasodilation and perpetuating hypertension. The interplay between structural vascular changes and hemodynamic alterations underscores the progressive nature of ISH, highlighting the importance of early intervention to mitigate its adverse cardiovascular effects [6][7].

History and Physical Examination in Isolated Systolic Hypertension

Isolated systolic hypertension (ISH), like other forms of hypertension, poses significant risks of end-organ damage if left untreated. Early diagnosis, modification of risk factors, and timely initiation of treatment are essential to reduce associated morbidity and mortality. A comprehensive clinical history is crucial in evaluating hypertensive patients and should include an assessment of potential precipitating factors, lifestyle habits, familial predisposition, and symptoms indicative of secondary causes or end-organ damage.

Clinical History

A detailed patient history should first evaluate the use of medications and substances that may exacerbate hypertension. These include nonsteroidal anti-inflammatory drugs (NSAIDs), corticosteroids, sympathomimetic agents, cocaine, and estrogen-containing therapies. Additionally, modifiable risk factors such as tobacco use, diabetes mellitus, dyslipidemia, obesity, physical inactivity, and poor dietary habits must be identified. Dietary patterns, particularly excessive sodium intake, consumption of processed foods, high-fat diets, and alcohol, should also be assessed due to their well-documented association with elevated blood pressure. A family history of hypertension, renal disease, diabetes, or cardiovascular disorders further contributes to an individual's risk profile and should be carefully documented. Patients should also be screened for symptoms suggestive of secondary hypertension, which may include episodic tremors, diaphoresis, palpitations, muscle weakness, skin thinning, mood disturbances, hematuria, loud snoring, or excessive daytime sleepiness. Such findings may indicate underlying endocrine disorders, renal pathology, or obstructive sleep apnea. Furthermore, symptoms of end-organ damage—such as headaches, visual disturbances, exertional dyspnea, angina, or intermittent claudication—should prompt immediate

evaluation, as they reflect advanced hypertensive complications affecting the brain, eyes, heart, and peripheral vasculature [2][8].

Physical Examination

A thorough physical examination is fundamental in assessing hypertensive patients, with particular attention to accurate blood pressure measurement and signs of secondary causes or target organ injury.

Blood Pressure Measurement

Proper technique is critical to obtaining reliable blood pressure readings. Patients should be seated in a chair with their back support and feet flat on the floor, ensuring proper posture. The arm should rest on a flat surface at heart level, and an appropriately sized cuff must be used to avoid measurement errors. Systolic blood pressure (SBP) is recorded at the first Korotkoff sound, while diastolic blood pressure (DBP) corresponds to the fifth Korotkoff sound. To confirm a diagnosis of hypertension, an average of two to three readings taken during separate clinical encounters is recommended. Annual reassessment of blood pressure is advised for normotensive individuals to detect early hypertensive changes.

General Inspection

The physical examination begins with an assessment of general appearance. Body mass index (BMI) should be calculated to evaluate obesity, a major modifiable risk factor. Signs of Cushing syndrome—such as central obesity, a dorsocervical fat pad (buffalo hump), facial rounding (moon face), cutaneous atrophy, and violaceous striae—may suggest glucocorticoid excess as a secondary cause. Other notable findings include restlessness, excessive sweating, facial flushing, cutaneous neurofibromas, which may indicate underlying endocrine or genetic disorders.

Neck Examination

Palpation of the thyroid gland may reveal enlargement suggestive of hypo- or hyperthyroidism. Auscultation of the carotid arteries may detect bruits, indicating possible atherosclerotic disease, which is both a cause and consequence of chronic hypertension.

Fundoscopic Examination

Ophthalmoscopic evaluation is essential to identify hypertensive retinopathy, which manifests as arteriolar narrowing, arteriovenous nicking, flame-shaped hemorrhages, cotton wool spots, or papilledema in severe cases. These findings reflect microvascular damage and are strongly predictive of cardiovascular risk.

Cardiovascular Assessment

Auscultation of the heart may reveal a fourth heart sound (S4 gallop), indicative of left ventricular hypertrophy and reduced compliance. A parasternal heave or elevated jugular venous pressure suggests possible heart failure secondary to long-standing hypertension.

Respiratory and Abdominal Evaluation

Pulmonary auscultation may detect rales or rhonchi, which could signify fluid overload or concomitant lung disease. Abdominal examination should assess for renal enlargement, aortic aneurysms, or bruits over the renal arteries, which may point toward renovascular hypertension.

Neurologic and Peripheral Vascular Assessment

A focused neurologic exam may reveal visual field defects, cognitive impairment, or focal motor deficits, raising concern for cerebrovascular complications. Examination of the extremities should evaluate peripheral pulses, temperature, and the presence of edema, which may indicate peripheral arterial disease or venous insufficiency. A systematic approach to history-taking and physical examination in patients with ISH is vital for accurate diagnosis, identification of secondary causes, and assessment of end-organ damage. This comprehensive evaluation guides appropriate management strategies, ultimately improving clinical outcomes in this high-risk population.

Evaluation and Further Investigation of Isolated Systolic Hypertension

The evaluation of isolated systolic hypertension (ISH) requires a systematic approach to assess cardiovascular risk factors, identify end-organ damage, detect secondary causes, and evaluate comorbid conditions that may influence prognosis and treatment strategies [2][8]. When reliable blood pressure measurements confirm the presence of ISH, a comprehensive diagnostic workup is essential to guide appropriate clinical management. This evaluation involves routine laboratory investigations, targeted diagnostic tests, and specialized assessments based on individual patient characteristics.

Initial Evaluation and Risk Stratification

The primary objectives in evaluating patients with ISH include determining the presence of modifiable cardiovascular risk factors, assessing the extent of target organ damage, and identifying potential secondary causes of hypertension. A thorough clinical assessment should be complemented by laboratory and imaging studies to obtain a complete picture of the patient's cardiovascular health. The identification of concomitant conditions, such as diabetes mellitus, chronic kidney disease, or obstructive sleep apnea, is particularly important, as these comorbidities significantly influence both short-term and long-term management decisions [2][8].

Routine Laboratory and Clinical Investigations

A series of baseline investigations should be performed in all patients with suspected or confirmed ISH to evaluate cardiovascular risk and detect underlying systemic diseases. A 12-lead electrocardiogram (ECG) is essential for identifying left ventricular hypertrophy, atrial enlargement, or arrhythmias, all of which may indicate hypertensive heart disease. Additionally, a lipid panel should be obtained to calculate the 10-year risk of atherosclerotic cardiovascular disease (ASCVD), which helps stratify patients into appropriate risk categories for preventive interventions. Renal function must be assessed through serum creatinine measurement, with estimation of the glomerular filtration rate (GFR) to evaluate for chronic kidney disease. Serum electrolytes, particularly sodium and potassium, should be measured, as abnormalities may suggest underlying endocrine disorders or the effects of antihypertensive medications. Thyroid function tests, including thyroid-stimulating hormone (TSH) levels, are recommended given the association between thyroid dysfunction and blood pressure dysregulation. Urinalysis is another critical component of the initial workup, as it may reveal proteinuria or microalbuminuria, both of which are markers of renal damage and predictors of cardiovascular risk [2][8].

Additional Diagnostic Tests Based on Clinical Suspicion

Further testing should be guided by findings from the history, physical examination, and initial laboratory results. Hemoglobin A1c (HbA1c) measurement is indicated in patients with risk factors for diabetes mellitus, as poor glycemic control exacerbates hypertension and accelerates end-organ damage. Serum uric acid levels may be useful, particularly in patients with gout or those at risk of metabolic syndrome. The ankle-brachial index (ABI) is a non-invasive test that assesses peripheral arterial disease, which frequently coexists with hypertension and contributes to overall cardiovascular risk. Imaging studies play a crucial role in the evaluation of ISH, particularly when secondary causes or advanced organ damage are suspected. Renal ultrasound with Doppler ultrasonography is recommended in patients with unexplained renal dysfunction, asymmetrical kidney size, or clinical features suggestive of renovascular hypertension. Quantitative proteinuria assessment, either through a spot urine protein-to-creatinine ratio or 24-hour urine collection, provides valuable information about the severity of renal involvement. Echocardiography is particularly important in patients with symptoms or signs of heart failure, as it allows for the assessment of left ventricular hypertrophy, systolic and diastolic dysfunction, and valvular abnormalities [2][8].

Specialized Testing for Secondary Hypertension

In cases where secondary hypertension is suspected, targeted diagnostic tests should be performed to identify the underlying etiology. Plasma-free metanephrines and 24-hour urinary fractionated metanephrines are essential for screening for pheochromocytoma in patients with episodic hypertension, headaches, or palpitations. A 24-hour urinary cortisol test or late-night salivary cortisol measurement may be indicated if Cushing syndrome is suspected based on clinical features such as central obesity, proximal muscle weakness, or cutaneous striae. The aldosterone-to-renin ratio (ARR) is the preferred screening test for primary aldosteronism, particularly in patients with resistant hypertension or spontaneous hypokalemia.

Comprehensive Risk Assessment and Individualized Approach

The diagnostic evaluation of ISH should not be limited to confirming elevated blood pressure but must also focus on characterizing the patient's overall cardiovascular risk profile. This requires integration of clinical, laboratory, and imaging data to develop a personalized management plan. For instance, a patient with left ventricular hypertrophy on echocardiography, microalbuminuria, and an elevated ASCVD risk score requires more aggressive blood pressure control and risk factor modification than a patient without these findings. Similarly, the identification of a secondary cause, such as primary aldosteronism or renal artery stenosis, may lead to targeted interventions that significantly alter the natural history of hypertension.

Importance of Longitudinal Monitoring

Given the progressive nature of ISH, particularly in older adults, ongoing monitoring is essential to assess treatment efficacy and detect new-onset complications. Repeat evaluations of renal function, electrolyte balance, and cardiac structure may be necessary, especially in patients with borderline abnormalities at initial presentation. Ambulatory blood pressure monitoring (ABPM) or home blood pressure monitoring should be considered in select cases to confirm the diagnosis, assess diurnal blood pressure patterns, and identify masked or white-coat hypertension. The evaluation of isolated systolic hypertension demands a multifaceted approach that incorporates routine laboratory tests, targeted diagnostic studies, and specialized investigations when secondary causes are suspected. A comprehensive assessment not only confirms the diagnosis but also stratifies cardiovascular risk, identifies end-organ damage, and guides evidence-based treatment decisions. By adopting a systematic and individualized evaluation strategy, clinicians can optimize outcomes for patients with ISH, reducing the burden of hypertension-related complications [2][8].

Comprehensive Management of Isolated Systolic Hypertension: Evidence-Based Approaches

The management of isolated systolic hypertension (ISH) requires a nuanced approach that incorporates both nonpharmacologic interventions and pharmacologic therapies, guided by contemporary clinical guidelines and evidence from major clinical trials. The 2017 American College of Cardiology/American Heart Association (ACC/AHA) blood pressure guidelines provide a framework for classifying blood pressure levels and determining appropriate treatment strategies based on individual patient characteristics and cardiovascular risk profiles [2].

Blood Pressure Classification and Treatment Thresholds

According to the ACC/AHA guidelines, blood pressure is categorized into four distinct classifications that inform clinical decision-making. Normal blood pressure is defined as systolic blood pressure (SBP) less than 120 mm Hg and diastolic blood pressure (DBP) less than 80 mm Hg. For individuals in this category, the focus remains on promoting healthy lifestyle modifications to maintain optimal cardiovascular health. Elevated blood pressure, characterized by SBP ranging from 120 to 129 mm Hg with DBP below 80 mm Hg, warrants initiation of nonpharmacologic therapy with reassessment recommended within 3 to 6 months. Hypertension Stage 1 (SBP 130-139 mm Hg or DBP 80-89 mm Hg) requires a differentiated approach based on the patient's atherosclerotic cardiovascular disease (ASCVD) risk. For patients without established ASCVD and a 10-year ASCVD risk below 10%, nonpharmacologic therapy is initiated with follow-up in 3 to

6 months. However, for those with existing ASCVD or a 10-year risk exceeding 10%, the addition of a single oral antihypertensive agent is recommended alongside lifestyle modifications, with reassessment after one month. Hypertension Stage 2 (SBP >139 mm Hg or DBP >89 mm Hg) necessitates immediate initiation of both nonpharmacologic therapy and a single antihypertensive medication, with close follow-up within one month to assess treatment response.

Evidence Supporting Treatment Benefits

Major clinical trials have consistently demonstrated the benefits of treating ISH in older adult populations. The Hypertension in the Very Elderly Trial (HYVET) and Systolic Hypertension in the Elderly Program (SHEP) showed that active treatment of ISH resulted in significant reductions in all-cause mortality (13%), cardiovascular mortality (18%), stroke incidence (30%), and coronary events (23%) compared to placebo. These findings underscore the importance of timely intervention in managing ISH, particularly in elderly patients who are at heightened risk of cardiovascular complications [2][8].

Nonpharmacologic Therapy: Foundation of Hypertension Management

Nonpharmacologic interventions form the cornerstone of hypertension management and are recommended for all patients regardless of blood pressure classification. Dietary sodium restriction to 1.5 grams or less per day has been shown in randomized controlled trials to reduce blood pressure by an average of 4.8/2.5 mm Hg. Weight reduction represents another critical component, with evidence indicating that each pound (0.45 kg) of weight loss corresponds to approximately 1 mm Hg reduction in blood pressure. The Dietary Approaches to Stop Hypertension (DASH) diet, which emphasizes consumption of fruits, vegetables, whole grains, fish, and low-fat dairy products, has demonstrated efficacy in lowering blood pressure by an average of 6/4 mm Hg in clinical trials. Regular physical activity incorporating both aerobic and resistance training can yield additional reductions of 4-6 mm Hg in systolic pressure, independent of changes in body weight. Other lifestyle modifications include limiting alcohol intake to no more than one drink daily for women and two for men, potassium supplementation (unless contraindicated in chronic kidney disease), smoking cessation, and stress management techniques.

Pharmacologic Therapy: Strategic Medication Selection

Pharmacologic treatment of ISH typically begins with single-agent therapy, particularly in elderly patients who may be susceptible to orthostatic hypotension. Exceptions to this approach include cases where initial SBP exceeds 160 mm Hg or when blood pressure is more than 20/10 mm Hg above target levels, scenarios that often warrant initiation of two antihypertensive agents simultaneously. Four major classes of antihypertensive medications have demonstrated efficacy in managing ISH: thiazide-like diuretics (chlorthalidone, indapamide), dihydropyridine calcium channel blockers (amlodipine, nifedipine, nitrendipine), angiotensin-converting enzyme inhibitors (lisinopril, ramipril), and angiotensin receptor blockers (losartan, valsartan). Clinical trial evidence supports thiazide-like diuretics and calcium channel blockers as preferred first-line agents for ISH due to their proven benefits in reducing stroke risk and other cardiovascular morbidities. Dose titration of the initial agent to maximum tolerated levels is recommended before considering addition of a second medication. For patients requiring dual therapy, combinations of thiazide-like diuretics with calcium channel blockers are often preferred. ACE inhibitors or ARBs are particularly indicated for patients with compelling conditions such as heart failure with reduced ejection fraction, post-myocardial infarction status, diabetes mellitus, or chronic kidney disease. Importantly, concurrent use of ACE inhibitors and ARBs is contraindicated due to increased risks of adverse effects without additional therapeutic benefit.

Blood Pressure Targets: Balancing Benefits and Risks

The establishment of appropriate blood pressure targets remains a subject of ongoing investigation and debate. The SHEP and HYVET trials demonstrated significant clinical benefits with SBP targets below 150 mm Hg in elderly populations. The Valsartan in Elderly Isolated Systolic Hypertension (VALISH) trial found no significant difference in primary cardiovascular outcomes between strict (<140 mm Hg) and moderate (140-150 mm Hg) SBP control, though the study was limited by low event rates. The landmark Systolic

Blood Pressure Intervention Trial (SPRINT) showed that intensive SBP reduction to <120 mm Hg improved cardiovascular outcomes and overall survival compared to standard targets of 135-139 mm Hg. However, aggressive blood pressure lowering may pose risks in elderly patients, potentially leading to adverse effects such as hypotension, end-organ hypoperfusion (manifesting as acute kidney injury or cognitive impairment), and medication-related complications. Current evidence suggests that a target SBP <130 mm Hg is appropriate for most patients who can tolerate it, while a more conservative goal of <140/90 mm Hg may be preferable for elderly individuals or those with labile blood pressure or polypharmacy concerns [9][10][11].

The J-Curve Phenomenon: Clinical Implications

The relationship between blood pressure reduction and cardiovascular risk has been shown to follow a J-curve pattern in various studies. This phenomenon suggests that while moderate blood pressure lowering reduces cardiovascular risk, excessive reduction - particularly in diastolic pressure - may paradoxically increase the likelihood of myocardial infarction and mortality. In ISH patients, aggressive antihypertensive treatment can lead to disproportionate decreases in DBP, potentially compromising coronary perfusion that occurs primarily during diastole. This underscores the importance of individualized treatment approaches that consider both systolic and diastolic pressures, particularly in patients with underlying coronary artery disease [12].

Patient-Centered Approach to Management

Optimal management of ISH requires a patient-centered strategy that balances the benefits of blood pressure control with potential risks of treatment. This approach should consider factors such as age, comorbidities, medication tolerance, and overall frailty. Regular monitoring and dose adjustments are essential to maintain blood pressure within target ranges while minimizing adverse effects. Particular attention should be paid to elderly patients, who may be more susceptible to orthostatic hypotension, electrolyte disturbances, and drug-drug interactions. The management of isolated systolic hypertension represents a complex clinical challenge that requires integration of lifestyle modifications, judicious medication selection, and careful monitoring of treatment effects. Contemporary guidelines emphasize the importance of risk stratification and individualized treatment targets based on robust clinical trial evidence. While significant advances have been made in understanding the optimal management of ISH, ongoing research continues to refine treatment approaches, particularly regarding ideal blood pressure targets in specific patient populations. Clinicians must remain vigilant to both the benefits and potential risks of antihypertensive therapy, particularly in vulnerable elderly patients, to optimize cardiovascular outcomes while maintaining quality of life [12][13].

Differential Diagnosis of Isolated Systolic Hypertension

Accurate differentiation between true isolated systolic hypertension (ISH) and other conditions that may mimic elevated blood pressure readings is essential to prevent inappropriate treatment decisions that could lead to significant morbidity and mortality. Three key conditions must be carefully considered in the diagnostic evaluation: white coat hypertension, masked hypertension, and pseudo-hypertension. White coat hypertension is characterized by consistently elevated blood pressure measurements in clinical settings but normal readings in out-of-office environments. This phenomenon is particularly relevant in older adults who may experience anxiety during medical visits, leading to spuriously high office readings. Conversely, masked hypertension presents normal office blood pressure measurements but elevated readings in other settings, representing a potentially dangerous condition where hypertension goes undetected during routine clinical assessments. Both conditions underscore the importance of ambulatory blood pressure monitoring (ABPM) or home blood pressure monitoring to obtain accurate measurements and guide appropriate management [14].

Pseudo-hypertension represents another critical diagnostic consideration, particularly in elderly patients with arterial calcification. This condition occurs when rigid, calcified peripheral arteries become incompressible, causing the blood pressure cuff to overestimate true intraluminal pressure. The resulting

false elevation in measured blood pressure may lead to misdiagnosis and unnecessary antihypertensive treatment. A useful clinical maneuver to identify pseudo-hypertension involves comparing standing and supine blood pressure measurements, as the discrepancy between these readings may suggest arterial stiffness rather than true hypertension. Patients presenting with apparently resistant hypertension should be evaluated for pseudo-hypertension before intensifying pharmacologic therapy, as inappropriate treatment escalation in these cases could result in harmful hypotension and end-organ hypoperfusion [14]. The distinction between these conditions and true ISH has important therapeutic implications. Misdiagnosis of white coat hypertension as true hypertension may lead to unnecessary medication use and associated side effects, while failure to recognize masked hypertension could result in inadequate cardiovascular risk management. Similarly, incorrectly labeling pseudo-hypertension as resistant hypertension may prompt overly aggressive treatment with potential adverse consequences. These diagnostic challenges highlight the need for comprehensive evaluation incorporating multiple blood pressure measurement techniques and clinical assessment of arterial compliance when ISH is suspected [15].

Prognosis of Hypertension and Associated Risks

Hypertension, particularly when left untreated or poorly controlled, carries significant long-term risks for cardiovascular complications and end-organ damage. In cases of mild to moderate hypertension, approximately 30% of untreated individuals develop atherosclerotic cardiovascular disease within 8 to 10 years of disease onset, while up to 50% exhibit evidence of target organ damage over the same period. The progressive nature of hypertensive vascular injury underscores the importance of early detection and consistent management to mitigate these adverse outcomes. Patients with resistant hypertension—defined as blood pressure that remains above target despite optimal doses of three antihypertensive medications including a diuretic—face particularly poor prognostic outcomes. This risk is substantially amplified in the presence of comorbidities such as chronic kidney disease or ischemic heart disease, which accelerate end-organ damage through synergistic pathological mechanisms. However, evidence suggests that even in resistant hypertension, achieving lower blood pressure levels through intensive management can reduce the incidence of major cardiovascular events, including stroke, coronary heart disease, and heart failure. The relationship between blood pressure control and cardiovascular risk follows a continuum, with each incremental reduction in blood pressure conferring additional protective benefits. This highlights the critical importance of sustained blood pressure management across all stages of hypertension, as improved control directly correlates with reduced morbidity and mortality. Early intervention and adherence to treatment regimens remain essential strategies for altering the natural history of hypertensive disease and improving long-term patient outcomes [15].

Complications of Uncontrolled Systolic Hypertension

Persistent elevation of systolic blood pressure represents a significant modifiable risk factor for numerous cardiovascular and systemic complications. The excessive pressure exerted on arterial walls accelerates vascular damage through several pathological mechanisms, including endothelial dysfunction, vascular remodeling, and accelerated atherosclerosis. These changes predispose patients to catastrophic cerebrovascular events, with stroke representing one of the most devastating consequences of uncontrolled hypertension. The risk of both ischemic and hemorrhagic stroke increases proportionally with systolic blood pressure levels, particularly when values exceed 140 mmHg. Cardiovascular complications manifest through multiple pathways, with myocardial infarction occurring secondary to coronary artery disease exacerbated by hypertensive stress on the vascular system. The chronic pressure overload leads to left ventricular hypertrophy and diastolic dysfunction, ultimately progressing to overt heart failure with preserved or reduced ejection fraction. Peripheral vascular disease develops as a consequence of atherosclerotic changes in medium and large arteries, often presenting as claudication or critical limb ischemia. The mechanical stress on arterial walls also predisposes to aneurysm formation, particularly in the aortic vasculature, creating risk for life-threatening dissection or rupture. Renal complications emerge through hypertensive nephropathy, characterized by glomerular hyperfiltration injury, arteriolosclerosis, and subsequent decline in renal function. This process frequently culminates in chronic kidney disease,

with hypertension being the second leading cause of end-stage renal disease. Ocular manifestations include hypertensive retinopathy, which progresses from arteriolar narrowing to flame-shaped hemorrhages and papilledema in severe cases. Less recognized but equally impactful is the association with erectile dysfunction, resulting from both vascular insufficiency and endothelial dysfunction in penile arteries. These diverse complications underscore the systemic nature of hypertensive damage and the critical importance of achieving optimal blood pressure control to prevent multiorgan dysfunction [15].

Patient Education for Hypertension Management

Hypertension is a chronic condition that requires long-term management through both lifestyle modifications and pharmacologic therapy when necessary. Effective patient education is crucial for achieving optimal blood pressure control and reducing cardiovascular risk. Healthcare providers should emphasize the importance of consistent lifestyle changes that have been proven to lower blood pressure and improve overall cardiovascular health. Regular physical activity is fundamental to hypertension management. Patients should be encouraged to engage in at least 30 minutes of moderate-intensity aerobic exercise most days of the week. Dietary modifications play an equally important role, with emphasis on reducing sodium intake to less than 2,300 mg per day (ideally 1,500 mg for most adults), limiting total and saturated fats, and increasing consumption of fruits, vegetables, whole grains, and low-fat dairy products. The Dietary Approaches to Stop Hypertension (DASH) eating plan has been specifically shown to lower blood pressure and should be recommended.

Patients should maintain adequate intake of essential minerals including potassium (found in bananas, oranges, and potatoes), calcium, and magnesium, which help regulate blood pressure. Alcohol consumption should be limited to no more than one drink per day for women and two for men. Complete smoking cessation is critical, as tobacco use significantly increases cardiovascular risk and interferes with blood pressure control. For overweight or obese patients, even modest weight loss of 5-10% of total body weight can produce significant reductions in blood pressure. Patients should also be counseled to avoid illicit substances like cocaine and amphetamines, which can cause dangerous blood pressure spikes. Stress management techniques such as meditation or deep breathing exercises may provide additional benefits. Regular follow-up with healthcare providers is essential to monitor progress, adjust medications if needed, and reinforce the importance of treatment adherence. Patients should understand that hypertension is typically asymptomatic until complications develop, making consistent management vital even when they feel well.

Other Issues in Isolated Systolic Hypertension

Isolated systolic hypertension (ISH) represents the most prevalent form of hypertension in elderly populations, carrying significant implications for cardiovascular risk management. Unlike diastolic blood pressure (DBP), systolic blood pressure (SBP) demonstrates stronger predictive value for cardiovascular events, including myocardial infarction, stroke, and heart failure. This underscores the importance of targeted SBP control in reducing morbidity and mortality. While optimal SBP targets remain debated, current evidence suggests maintaining SBP below 140 mm Hg while preserving DBP above 70 mm Hg to balance efficacy and safety. Excessive DBP reduction may compromise coronary perfusion, particularly in patients with existing cardiovascular disease. The management of ISH requires careful consideration of age-related vascular changes, including arterial stiffness and reduced compliance, which contribute to widened pulse pressure. Treatment strategies should prioritize gradual blood pressure reduction to avoid complications such as orthostatic hypotension or end-organ hypoperfusion, especially in frail elderly patients. Regular monitoring and individualized approaches are essential to optimize outcomes while minimizing adverse effects [15].

Enhancing Healthcare Team Outcomes in Systolic Hypertension Management

Effective management of systolic hypertension necessitates a collaborative, interprofessional approach to ensure comprehensive patient care. Given its status as a major modifiable risk factor for cardiovascular disease, all healthcare providers—including primary care physicians, nurse practitioners, cardiologists, and

emergency medicine specialists—must remain current with the latest American College of Cardiology/American Heart Association (ACC/AHA) guidelines. These guidelines provide evidence-based recommendations for blood pressure targets, pharmacologic therapy, and lifestyle interventions tailored to individual patient profiles [15]. Pharmacologic management often requires specialist input, particularly in complex cases or when treatment resistance emerges. Cardiologist consultation can optimize drug selection, especially when navigating comorbidities such as chronic kidney disease or heart failure. Studies demonstrate that interprofessional care models—incorporating nurses for patient education, pharmacists for medication adherence support, and dietitians for lifestyle counseling—significantly improve hypertension control rates. Such teamwork enhances medication adherence, promotes consistent follow-up, and reduces cardiovascular event rates. By fostering open communication and shared decision-making, healthcare teams can address the multifaceted challenges of systolic hypertension, ultimately improving patient outcomes and reducing the burden of preventable complications [15][16][17] [18].

Conclusion:

The management of isolated systolic hypertension (ISH) represents a critical challenge in aging populations, demanding a nuanced understanding of its unique pathophysiology and clinical implications. As outlined in this review, ISH arises predominantly from age-related arterial stiffening, characterized by vascular calcification and endothelial dysfunction, which disproportionately elevates SBP while lowering DBP. The 2017 ACC/AHA guidelines' reclassification of hypertension thresholds has underscored the importance of early intervention, with evidence from trials like SPRINT demonstrating that intensive SBP control (<120 mmHg) reduces cardiovascular events, albeit with caution required in frail elderly patients due to risks of hypoperfusion and orthostatic hypotension. A key consideration in ISH management is the *J-curve phenomenon*, where excessive DBP reduction (<70 mmHg) may compromise coronary perfusion, particularly in patients with existing cardiovascular disease. This necessitates tailored treatment plans that prioritize gradual SBP lowering while preserving adequate diastolic pressure. First-line pharmacologic agents—thiazide-like diuretics (e.g., chlorthalidone) and calcium channel blockers (e.g., amlodipine)—are preferred due to their efficacy in reducing arterial stiffness and stroke risk, as demonstrated in HYVET and SHEP. For patients with comorbid conditions like diabetes or chronic kidney disease, ACE inhibitors or ARBs offer additional organ-protective benefits.

Nonpharmacologic interventions remain foundational, with the DASH diet, sodium restriction (<1.5 g/day), and aerobic exercise achieving clinically meaningful SBP reductions. Patient education must emphasize adherence to these lifestyle modifications, as uncontrolled ISH leads to end-organ damage in 50% of cases within a decade. Diagnostic vigilance is equally critical; pseudo-hypertension (due to incompressible arteries) and masked hypertension require ambulatory monitoring to avoid misclassification and inappropriate treatment. The success of ISH management hinges on interprofessional collaboration. Primary care providers, cardiologists, pharmacists, and nurses must align with guideline-directed protocols while addressing barriers like polypharmacy in elderly patients. Future research should refine SBP targets for high-risk subgroups and explore novel therapies targeting vascular stiffness. In conclusion, ISH demands a patient-centered approach that balances aggressive risk reduction with individualized safety considerations, ensuring optimal cardiovascular outcomes for this growing population.

References:

1. Bavishi C, Goel S, Messerli FH. Isolated Systolic Hypertension: An Update After SPRINT. Am J Med. 2016 Dec;129(12):1251-1258.
2. Whelton PK, Carey RM, Aronow WS, Casey DE, Collins KJ, Dennison Himmelfarb C, DePalma SM, Gidding S, Jamerson KA, Jones DW, MacLaughlin EJ, Muntner P, Ovbiagele B, Smith SC, Spencer CC, Stafford RS, Taler SJ, Thomas RJ, Williams KA, Williamson JD, Wright JT. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. Circulation. 2018 Oct 23;138(17):e484-e594.

3. Viera AJ, Neutze DM. Diagnosis of secondary hypertension: an age-based approach. Am Fam Physician. 2010 Dec 15;82(12):1471-8.
4. Egan BM, Li J, Hutchison FN, Ferdinand KC. Hypertension in the United States, 1999 to 2012: progress toward Healthy People 2020 goals. Circulation. 2014 Nov 04;130(19):1692-9.
5. Liu X, Rodriguez CJ, Wang K. Prevalence and trends of isolated systolic hypertension among untreated adults in the United States. J Am Soc Hypertens. 2015 Mar;9(3):197-205.
6. AlGhatrif M, Lakatta EG. The conundrum of arterial stiffness, elevated blood pressure, and aging. Curr Hypertens Rep. 2015 Feb;17(2):12.
7. Chobanian AV. Clinical practice. Isolated systolic hypertension in the elderly. N Engl J Med. 2007 Aug 23;357(8):789-96.
8. Mancia G, Fagard R, Narkiewicz K, Redon J, Zanchetti A, Böhm M, Christiaens T, Cifkova R, De Backer G, Dominiczak A, Galderisi M, Grobbee DE, Jaarsma T, Kirchhof P, Kjeldsen SE, Laurent S, Manolis AJ, Nilsson PM, Ruilope LM, Schmieder RE, Sirnes PA, Sleight P, Viigimaa M, Waeber B, Zannad F., Task Force for the Management of Arterial Hypertension of the European Society of Hypertension and the European Society of Cardiology. 2013 ESH/ESC Practice Guidelines for the Management of Arterial Hypertension. Blood Press. 2014 Feb;23(1):3-16.
9. Prevention of stroke by antihypertensive drug treatment in older persons with isolated systolic hypertension. Final results of the Systolic Hypertension in the Elderly Program (SHEP). SHEP Cooperative Research Group. JAMA. 1991 Jun 26;265(24):3255-64.
10. Beckett NS, Peters R, Fletcher AE, Staessen JA, Liu L, Dumitrascu D, Stoyanovsky V, Antikainen RL, Nikitin Y, Anderson C, Belhani A, Forette F, Rajkumar C, Thijs L, Banya W, Bulpitt CJ., HYVET Study Group. Treatment of hypertension in patients 80 years of age or older. N Engl J Med. 2008 May 01;358(18):1887-98.
11. SPRINT Research Group. Wright JT, Williamson JD, Whelton PK, Snyder JK, Sink KM, Rocco MV, Reboussin DM, Rahman M, Oparil S, Lewis CE, Kimmel PL, Johnson KC, Goff DC, Fine LJ, Cutler JA, Cushman WC, Cheung AK, Ambrosius WT. A Randomized Trial of Intensive versus Standard Blood-Pressure Control. N Engl J Med. 2015 Nov 26;373(22):2103-16.
12. Kimm H, Mok Y, Lee SJ, Lee S, Back JH, Jee SH. The J-curve between Diastolic Blood Pressure and Risk of All-cause and Cardiovascular Death. Korean Circ J. 2018 Jan;48(1):36-47.
13. Kang YY, Wang JG. The J-Curve Phenomenon in Hypertension. Pulse (Basel). 2016 Jul;4(1):49-60.
14. Zweifler AJ, Shahab ST. Pseudohypertension: a new assessment. J Hypertens. 1993 Jan;11(1):1-6.
15. Benetos A, Petrovic M, Strandberg T. Hypertension Management in Older and Frail Older Patients. Circ Res. 2019 Mar 29;124(7):1045-1060.
16. Ojji DB, Mayosi B, Francis V, Badri M, Cornelius V, Smythe W, Kramer N, Barasa F, Damasceno A, Dzudie A, Jones E, Mondo C, Ogah O, Ogola E, Sani MU, Shedul GL, Shedul G, Rayner B, Okpechi IG, Sliwa K, Poulter N., CREOLE Study Investigators. Comparison of Dual Therapies for Lowering Blood Pressure in Black Africans. N Engl J Med. 2019 Jun 20;380(25):2429-2439.
17. Poblete F, Barticevic N, Bastías G, Quevedo D, Vargas I. [Effectiveness of a case management intervention for high blood pressure and type II diabetes in primary health care]. Rev Med Chil. 2018 Nov;146(11):1269-1277.
18. Tan, J. L., & Thakur, K. (2023). Systolic hypertension. In *StatPearls [Internet]*. StatPearls Publishing.

ارتفاع ضغط الدم الانقباضي: مراجعة محدثة لمقدمي الرعاية الصحية

المستخلص:

الخلفية: يُعد ارتفاع ضغط الدم الانقباضي المعزول (ISH) الشكل الأكثر انتشارًا لارتفاع ضغط الدم لدى كبار السن، ويُعرَّف بضغط الدم الانقباضي (SBP) ≥140ملم زئبق وضغط الدم الانبساطي (DBP) <90 ملم زئبق. أعادت إرشادات ACC/AHA 2017 تعريف ارتفاع ضغط الدم بأنه SBP ≥130 ملم زئبق، مما وسع نطاق السكان المعرضين للخطر. ينتج ISH عن تصلب الشرايين ويشكل مخاطر كبيرة للسكتة الدماغية واحتشاء عضلة القلب والخلل الكلوي.

الهدف: تهدف هذه المراجعة إلى تجميع الأدلة الحالية حول الفيزيولوجيا المرضية والتشخيص وإدارة ISH لتوجيه مقدمي الرعاية الصحية في تحسين نتائج المرضى.

الطرق: تم إجراء تحليل شامل للإرشادات السريرية(ACC/AHA) ، والتجارب الرائدةHYVET) ، SHEP، (SPRINT، والدراسات الوبائيةNHANES) ، .(Framinghamتم التركيز على المسببات، ومناهج التشخيص (بما في ذلك المراقبة المتنقلة للتمييز بين ارتفاع ضغط الدم المعطف الأبيض/المقنع)، واستراتيجيات العلاج القائمة على الأدلة.

النتائج: يصيب ISH 30% من البالغين 60<عامًا، مع انتشار أعلى لدى النساء والأفراد السود غير اللاتينيين. تركز الفيزيولوجيا المرضية على التكلس الوعائي المرتبط بالعمر وترسب الكولاجين، مما يؤدي إلى ارتفاع سرعة موجة النبض. تشمل العلاجات الخط الأول مدرات البول الثيازيدية وحاصرات قنوات الكالسيوم، مع أهداف SBP 130>ملم زئبق لمعظم المرضى (أو 140/90>ملم زئبق لدى كبار السن الضعفاء). تقلل التدخلات غير الدوائية (نظام DASH الغذائي، تقييد الصوديوم، التمارين SBP (بمقدار 4-12 ملم زئبق. تحذر ظاهرة المنحنى J من التقليل المفرط لـ 70>) DBP ملم زئبق) في مرض الشريان التاجي.

الاستنتاج: تتطلب إدارة ISH استراتيجيات فردية توازن بين الفعالية والسلامة، خاصة لدى كبار السن. تعمل نماذج الرعاية المشتركة بين التخصصات على تحسين الالتزام والنتائج.

الكلمات المفتاحية: ارتفاع ضغط الدم الانقباضي المعزول، تصلب الشرايين، كبار السن، العلاج الخافض للضغط، ظاهرة المنحنى.J