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Tinjauan Pustaka

From Profiling to Management: A Systematic Review of The Prevalence, Clinical Profile, and Outcomes in Isolated Systolic Hypertension

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Abstract

***Introduction**: Isolated Systolic Hypertension (ISH) is a type of hypertension that was initially found mostly in the elderly, although recent studies indicate that it is increasingly common in younger adults. ISH has clinical implications for cardiovascular health and target organs. Limited awareness and management of ISH highlight the urgency of comprehensive studies to deepen understanding.*
***Method**: This study is a systematic review conducted in accordance with the PRISMA 2020 guidelines. Literature was searched from the PubMed, Scopus, and Web of Science databases. Included articles were primary studies with cross-sectional, cohort, RCT, or primary meta-analysis designs published between 2016 and 2025, in English, and available in open access. Risk of bias assessment was conducted using the RoB 2 tool and the Newcastle-Ottawa Scale.*
***Discussion**: A total of 24 articles met the inclusion criteria, covering more than 4 million participants from various age groups. Epidemiological studies indicate a high prevalence of ISH, even among adolescents and young adults. The main risk factors include age, high BMI, insulin resistance, low physical activity, and socioeconomic factors. ISH is associated with various clinical conditions, such as increased left ventricular mass, arterial stiffness, and impaired kidney function. Pharmacological interventions like calcium channel blockers and beta-blockers show varying effectiveness. Non-pharmacological approaches, such as renal denervation, have limited effects on pure ISH.*
***Conclusion**: ISH is a high-risk condition that is widespread across various age groups. Understanding its epidemiology, risk factors, pathophysiology, and response to treatment is important for appropriate therapy and prevention of long-term clinical implications.*

***Keywords:** hypertension, isolated systolic hypertension, risk factors, target organs, therapy*

1. INTRODUCTION

Isolated systolic hypertension (ISH) is a type of hypertension

characterized by an increase in systolic blood pressure ≥140 mmHg despite normal diastolic blood pressure (<90 mmHg). ISH was initially considered to be relevant only in the elderly, although recent studies have shown an increased prevalence in adolescents and working-age adults. A cohort study in China found more than 54,000 individuals aged 35–49 years with ISH who did not receive treatment for hypertension[1]. In Ethiopia, ISH prevalence in patients with type 2 diabetes mellitus reached more than 21%[2], and in the elderly population in Iran, ISH prevalence reached nearly 16%[3].

ISH has serious clinical implications because it is associated with an increased risk of morbidity and mortality from cardiovascular disease[4,5], accompanied by damage to target organs such as progressive decline in kidney function[6]. The pathophysiological mechanisms of ISH differ according to age group. In the elderly, it is generally caused by increased arterial stiffness due to the physiological aging process, while in younger individuals, it is associated with peripheral hemodynamic characteristics and pressure amplification[7]. Various risk factors play a role in the development of ISH, including insulin resistance, advanced age, obesity[8], low physical activity[9], smoking habits, and socioeconomic status[10].

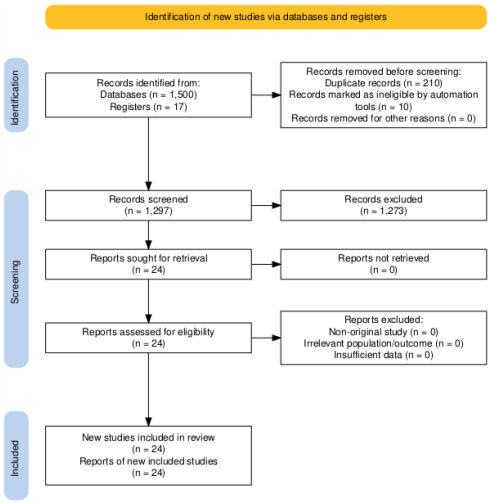
Despite its high prevalence and significant potential for complications, ISH often goes undiagnosed or untreated because it frequently does not cause symptoms. Its management remains controversial, particularly in younger age groups, due to the lack of clear consensus regarding therapeutic management and the efficacy of medications. Several pharmacological options have been studied, including diuretics, calcium channel blockers (CCB)[11], and beta-blockers such as nebivolol, which is superior to atenolol[12]. Non-pharmacological interventions such as renal denervation have not been proven to be superior in cases of pure ISH[13]. This complexity underscores the importance of conducting a comprehensive systematic review to update our understanding of ISH from basic physiology to clinical applications. This systematic review aims to present a synthesis of current studies focusing on epidemiological trends of ISH across various age groups, the main risk factors and comorbidities contributing to its development, the underlying pathophysiological mechanisms, and the effectiveness of various therapeutic approaches, both pharmacological and non-pharmacological. The scope is broad to ensure that this review provides a more focused and clinically relevant understanding

to support the management of ISH across different age groups.

2. METHOD

This study is a systematic review conducted in accordance with the PRISMA 2020 guidelines (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) to ensure integrity and accuracy throughout all stages of the review, from the identification and selection processes to the synthesis of literature[2]. The main focus of this study is to evaluate the latest scientific evidence on isolated systolic hypertension (ISH) related to prevalence, etiology, risk factors, complications, and management approaches, including pharmacological and non-pharmacological therapies.

The literature included in this study consists of licensed scientific articles published between 2016 and 2025, written in English, published in peer-reviewed scientific journals, and most importantly, available in open access format for comprehensive review. Science using a combination of structured keywords such as ("isolated systolic hypertension" OR ISH) AND (prevalence OR epidemiology) AND ("target organ damage" OR TOD) AND ("antihypertensive treatment" OR "blood pressure control").



Gambar 1. PRISMA flow diagram

Inclusion criteria

Studies were included if they met all of the following criteria: primary studies with observational designs (prospective/retrospective cohort, cross-sectional), randomized controlled trials (RCTs), or meta-analyses presenting primary data on isolated systolic hypertension (ISH); adult or adolescent participants (aged ≥13 years); clear diagnosis of ISH reported using criteria of SBP ≥140 mmHg and DBP <90 mmHg for the classic definition, or other definitions stated by the study definition must be included in order to be recorded and

analyzed; and reports on at least one relevant outcome[9].

Exclusion criteria

Studies were excluded if they were case reports, editorials, narrative reviews without primary data, conference abstracts without full text, studies presenting only secondary analyses without new primary data, model-based studies, or studies investigating highly selective/non-representative populations that made generalizations about ISH impossible. If ISH data could not be extracted separately from other hypertension subtypes, the study was excluded.

Definition of ISH diagnosis and criteria application

If a study uses SBP/DBP definitions different from the review's primary definitions, we note the definition and perform a sensitivity analysis. Accepted ISH diagnoses include the average of ≥2 clinic blood pressure (office BP) measurements, or reported ABPM/HTM measurements that allow ISH identification (e.g., mean 24-hour SBP ≥ study threshold and DBP < threshold). If a study reported a single measurement without verification, it was classified as high risk of bias in the validity domain.

Participant characteristics and variables collected

The extraction and reporting process was conducted systematically, including age range (and relevant age groups: adolescents, younger adults, middle-aged adults, older adults), sex, race/ethnicity when available, antihypertensive treatment status (untreated/currently receiving treatment/history of treatment), follow-up duration (for cohort studies), major comorbidities (T2DM, CKD, cardiovascular disease, cancer), family history of hypertension, metabolic indicators (BMI, HOMA-IR/insulin resistance, fasting glucose, lipid profile), and blood pressure measurement methods (office vs. ABPM vs. home).

Remarks on generalizability and representativeness

Limitations related to representativeness (e.g., studies from specialized populations, ethnic/racial differences, or hospital vs. community settings) and, if necessary, presenting separate results for general population studies vs. selective clinical populations to avoid over-generalization.

Risk of bias (RoB)

To assess the methodological quality and risk of bias of each study, different approaches were used according to the type of study design. Risk of bias (RoB) assessment in these 24 studies was performed by adjusting the

assessment tool according to the design of each study. For studies with a randomized controlled trial (RCT) design, including post-hoc analyses and RCT meta-analyses, the RoB 2.0 tool was used to assess potential bias in the randomization process, intervention deviation, outcome data, data loss, and reporting of results[14]. For prospective cohort and secondary cohort studies, assessment was conducted using the Newcastle-Ottawa Scale (NOS), which covers three main domains: participant selection, group comparability, and accuracy of outcome measurement[15]. Meanwhile, for cross-sectional studies, a specific adaptation of the NOS for cross-sectional studies was used, which assessed the risk of participant selection bias, accuracy of variable measurement, and potential inadequate control of confounding factors.

Table 1. Risk of Bias

Author	RoB	Domains Assessed
Wang C, et al.	RoB 2.0: Low risk	Intervention deviation, missing data, outcome measurement, selective reporting
Gu Q, et al.	NOS: Moderate	Sample representativeness, measurement validity, confounding control
Atasoy S, et al.	NOS: Low-moderate	Selection, comparability, outcome assessment
Hosseinzadeh A, et al.	NOS: Low	Sample representativeness, measurement validity, confounding control
Sarnecki J, et al.	NOS: Moderate	Sample representativeness, measurement validity, confounding control
Schattenkerk DW, et al.	NOS: Moderate	Sample representativeness, measurement validity, confounding control
Asmare DS, et al.	NOS: Low	Sample representativeness, measurement validity, confounding control
Shen Y, et al.	NOS: Moderate	Sample representativeness, measurement validity, confounding control
Jung H, et al.	NOS: Moderate	Selection, comparability, outcome assessment
Huang X, et al.	NOS: Low	Randomization, intervention deviation, missing data, outcome measurement, selective reporting

Wang SY, et al.	RoB 2.0: Moderate	Sample representativeness, measurement validity, confounding control
Hao Y, et al.	NOS: Moderate	Sample representativeness, measurement validity, confounding control
Li Y, et al.	RoB 2.0: Low	Sample representativeness, measurement validity, confounding control
Espeche W, et al.	NOS: Moderate	Sample representativeness, measurement validity, confounding control
Wang SY, et al.	NOS: Moderate	Sample representativeness, measurement validity, confounding control
Dagnew B, et al.	NOS: Moderate	Sample representativeness, measurement validity, confounding control
Xie K, et al.	NOS:Moderate	Selection, comparability, outcome assessment
Obrycki L, et al.	NOS:Moderate	Selection, comparability, outcome assessment
Bae EH, et al.	NOS: Low-Moderate	Sample representativeness, measurement validity, confounding control
Chuang SY, et al.	NOS:Moderate	Sample representativeness, measurement validity, confounding control
Citoni B, et al.	NOS:Moderate	Sample representativeness, measurement validity, confounding control
Tanially E, et al.	RoB 2.0: Low	Sample representativeness, measurement validity, confounding control
Brunström M, et al.	RoB 2.0: Low	Sample representativeness, measurement validity, confounding control
Kibria GMA, et al.	NOS: Moderate	Sample representativeness, measurement validity, confounding control

Table 2. Characteristics and data extracted from the included studies.

No	Author	Year	Design	Population	Comorbidity	Antihypertensive	Study objectives	Results
1	Wang C, et al.	2024	Post-hoc RCT, SBP ≥ 140 mmHg and DBP < 90 mmHg	China, n=15,986, > 60 y, 66.3% women	Diabetes: 10.4%; CKD: 0.7%; prior CVD: 20.4%.	Antihypertensive use: 56.4% in ISH group	The effect of SBP <130 mmHg	↓CVD HR 0.64[16]
2	Gu Q, et al.	2022	Cross-sectional, DBP < 90 mmHg and NFG	China, n=8,246, mean age 39.0 y, young men (29.3%) & middle-aged men (70.7%)	Smoking: 23.0%; Drinking: 23.45%	NR	IR (HOMA-IR) & ISH	Significant correlation between HOMA-IR[8]
3	Atasoy S, et al.	2021	Prospective cohort, SBP ≥ 140 mmHg and DBP < 90 mmHg	MONICA project, n=5,597, 25-45 y, 50.2% women	Diabetes: 0.52%; Smoking: 36.7%; Obesity: 11.4%, Dyslipidemia: 23.7%; CVD: 1.73	Antihypertensive drugs (HR 0.46) and height (HR 0.96) have a protective effect against cardiovascular mortality	ISH & CVD mortality	HR 1.89 for cardiovascular disease (CVD)[4]
4	Hosseinzadeh A, et al.	2022	Cross sectional, SBP ≥ 140 mmHg and DBP < 90 mmHg	Iran, n≈5,190, 40-70 y, 58.87% women	Diabetes: OR 1.64; Obesity: OR 1.03; High WHR: OR 9.81	NR	The prevalence & risk factors of ISH	The prevalence is 15.89%; age, Body Mass Index (BMI), Diabetes Mellitus (DM)[3]
5	Sarnecki J, et al.	2022	Cross-sectional, SBP ≥ 140 mmHg and DBP < 90 mmHg	n=73, 13-17 y, ≈82% men	NR	NR	LVMI & aortic PWV in ISH vs WCH	ISH showed LVH (47% vs. 14%), increased LV wall thickness & PWV[17]

6	Schattenkerk DW, et al.	2018	Cross-sectional, SBP ≥ 140 mmHg and DBP < 90 mmHg	Multi-ethnic population, n=3,744, <40 y, 44% men	Smoking: 23–30%; Diabetes: 2.3–4.6%; Total cholesterol: 4.6–4.9 ± 0.9 mmol/L	Participants receiving antihypertensive therapy (n=93) were excluded	cSBP, PWV & ISH in younger adults	Younger adults with ISH have lower cSBP & PWV than other HT; markers of elasticity & amplification[7]
7	Asmare DS, et al.	2025	Cross-sectional, SBP ≥ 140 mmHg and DBP < 90 mmHg	Ethiopia, n=258, >18 y, 51,6% men	NR	NR	The prevalence and predictors of ISH	ISH 21.3%; age, fasting blood glucose (FBS), body mass index (BMI)[18]
8	Shen Y, et al.	2023	Cross-sectional, SBP ≥ 140 mmHg and DBP < 90 mmHg	n=119	Excluded if present: cancer, stroke, AF, renal failure, heart failure, previous CVD	All participants were antihypertensive-naïve.	Metabolite profile based on hypertension subtype	ISH is characterized by metabolites associated with pulse pressure[2]
9	Jung H, et al.	2024	Secondary group, SBP ≥ 140 mmHg and DBP < 90 mmHg	Republic of Korea, adult cancer survivors, n= 173.951	Cancer survivor; other comorbidities NR	NR	Comparison of CVD risks	ISH is associated with cardiovascular disease mortality compared to normal blood pressure[5]
10	Huang X, et al.	2024	Cross-sectional study, SBP ≥ 140 mmHg and DBP < 90 mmHg	China, n=1,312, ≥80 y	Drinking (OR 1.85); Overweight (OR 1.88); High HR (OR 0.66)	NR	Determining Factors of ISH	Age, activity ↓, BMI ↑[9]
11	Wang SY, et al.	2022	Secondary RCT, SBP ≥ 140 mmHg and DBP < 90 mmHg	United States, n=12,845, 69 ± 8 y, 53% women	Diabetes: 35%; Smoking: 21%; High cholesterol: 28%; CHD:	Chlorthalidone (46%), Amlodipine (27%), Lisinopril (27%)	Antihypertensive drugs for ISH	CCBs > heart failure compared to diuretics[11]

					24%; MI: 13%; Stroke: 6%; LVH: 6%			
12	Hao Y, et al.	2021	Cross-sectional, SBP ≥ 140 mmHg and DBP < 90 mmHg	China, n=2,459, 18–75 y, 44.4% women	CKD	The use of antihypertensive drugs was included as an adjustment variable	ISH and target organ damage in CKD	ISH → ↑ LV mass, ↑ ACR, ↓ eGFR[19]
13	Le Li, et al.	2023	RCT, SBP ≥ 140 mmHg and DBP < 90 mmHg	Global, n=1,405	NR	RDN (renal denervation) compared with non-ISH	Assessing the effectiveness of renal denervation (RDN) in ISH	RDN produced a greater reduction in central systolic blood pressure in patients with CH[13]
14	Espeche W, et al.	2024	Cross-sectional, SBP ≥ 140 mmHg and DBP < 90 mmHg	Argentina, n=395, 16–40 y, 69% women	Family history HTN (75%); Smoking (12.5%)	All participants did not use antihypertensive therapy	White coat & nocturnal ISH	29.2% white coat, 12.5% nocturnal[20]
15	Wang SY, et al.	2020	Cross-sectional study, SBP ≥ 140 mmHg and DBP < 90 mmHg	China, n=898,929, 35–49 y, 65,9% women	Diabetes, Obesitas, CVD	86.7% of ISH participants have not yet received treatment	The prevalence and management of ISH in adolescents	54,463 individuals with ISH who did not receive treatment[11]
16	Dagnew B, et al.	2019	Cross-sectional, SBP ≥ 140 mmHg and DBP < 90 mmHg	Ethiopia, n=315, 50–60 y, 48.6% women	NR	NR	Risk factors for ISH in type 2 diabetes mellitus (T2DM)	The prevalence is 27.6%; age, gender, occupation[21]
17	Xie K, et al.	2021	Cross-sectional, SBP ≥ 140 mmHg and DBP < 90 mmHg	China, n=8,475, 63.67 ± 12.78 y, 54.4% men	Smoking: 18.5%; On antihypertensive agents: 89.4%; BMI 24.83 ± 3.85 kg/m²	Antihypertensive: 88.4% in ISH	The prevalence and risk factors of ISH nationwide	OR: advanced age, high BMI, smoking, low educational attainment are associated with ISH[10]

18	Obrycki L, et al.	2021	Prospective, SBP ≥ 140 mmHg and DBP < 90 mmHg	n = 294, ± 16,7 y, 86% men	NR	Non-pharmacological therapy	The transition from sHT to HTN	23% became sustained HTN[22]
19	Bae EH, et al.	2021	Prospective cohort, SBP ≥ 140 mmHg and DBP < 90 mmHg	Republic of Korea, n=3,030,884, 20–39 y	CKD	NR	ISH & progression of CKD	ISH → increased risk of eGFR decline of more than 30% within 5 years[6]
20	Chuang SY, et al.	2021	National Cross-sectional Study, SBP ≥ 140 mmHg and DBP < 90 mmHg	Taiwan, n=2,029, <50 y, 42.65% men	NR	All participants did not use antihypertensive therapy	The correlation between ISH and central blood pressure	ISH is associated with central hypertension and high pulse pressure compared to normal blood pressure[23]
21	Citoni B, et al.	2022	Cross-sectional 24-hour ABPM, SBP ≥ 140 mmHg and DBP < 90 mmHg	n=2,127, 18-50 y, 61.1% men	NR	NR	The prevalence of ISH & clinical profile	ISH is associated with increased SBP, higher cardiovascular risk based on SCORE scores, and evidence of microvascular damage (HMOD)[24]
22	Tanially E, et al.	2025	RCT, SBP ≥ 140 mmHg and DBP < 90 mmHg	Global, n=334	NR	NR	The effectiveness of beta-blockers	Nebivolol > Atenolol[12]
23	Brunström M, et al.	2023	Meta-analysis of RCTs, SBP ≥ 140 mmHg and	Global, n=113,105,	Diabetes: 35%; CKD: 21%; High cholesterol:	Various antihypertensive drugs (intensive vs.	The effectiveness of antihypertensive therapy for ISH	Decrease in MACE RR ~0.91; greater

			DBP < 90 mmHg	≥60 y, 40% women	28%; Coronary heart disease (CHD): 24% ; Myocardial infarction (MI): 13%; Stroke: 6%, Left ventricular hypertrophy (LVH): 6%	less intensive; drug vs. placebo)		effect on SBP ≥160 mmHg[25]
24	Kibria GMA, et al.	2021	Cross-sectional NHANES 2001–16, SBP ≥ 140 mmHg and DBP < 90 mmHg	United States, n= ± 13.000, ≥65 y	NR	Untreated	Trends in prevalence	ISH has been declining in the United States[26]

3. DISCUSSION

The studies synthesized in this review cumulatively included a total of more than 4 million participants, with two large population studies contributing significantly to this figure: one national survey study in China involving 898,929 participants aged 35–49 years, and one population-based cohort study in South Korea with 3,030,884 younger adults. Other studies involved groups with specific clinical conditions such as patients with chronic kidney disease, type 2 diabetes mellitus, and cancer survivors, and covered a wide age range from adolescents to the elderly. The main focus of the studies included a prevalence of ISH, metabolic and demographic risk factors, impact on target organs such as left ventricular mass and renal function, and the effectiveness of pharmacological interventions such as the use of calcium channel blockers, beta blockers, and non-pharmacological interventions such as renal denervation. Some studies also evaluate differences in characteristics between ISH and other subtypes of hypertension, such as isolated diastolic hypertension and systolic-diastolic hypertension, and consider central blood pressure and ambulatory measurements as diagnostic methods.

Isolated Systolic Hypertension (ISH) is a form of hypertension that was initially associated with the elderly population, with systolic blood pressure increasing linearly with age[27]. Recent studies from various countries have shown a relatively high prevalence of ISH in younger age groups, including the 35–49 age group who have not received treatment in China(Mahajan et al., 2020). In that study, there were 54,463 cases of ISH among a total of 898,929 individuals, indicating low awareness and management of this condition in the younger population[28].

ISH and Metabolic Comorbidity

Several studies have highlighted the association between ISH and type 2 diabetes mellitus, with the prevalence of ISH among T2DM patients in Ethiopia and Iran reaching 21.3% and 27.6%, respectively, significantly higher than in the general population[18,21]. Hyperglycemia and insulin resistance, which are common in T2DM, lead to increased peripheral arterial resistance caused by endothelial dysfunction and oxidative stress, a process that narrows the lumen of blood vessels and reduces vascular relaxation[29]. In addition, sodium

resistance and increased intravascular volume due to the activity of the renin-angiotensin-aldosterone system (RAAS) exacerbate blood pressure due to insulin resistance[30].

Not all patients with T2DM experience ISH, but the combination of uncontrolled hyperglycemia and high BMI can increase the risk[18]. The increase in systolic blood pressure due to a high body mass index (BMI) can increase blood volume and cardiac output, as well as accelerate the process of arteriosclerosis[3,18]. In the non-diabetic population, increased HOMA-IR values remain significantly associated with ISH, indicating that metabolic disorders may be the initial cause of ISH[8]. High HOMA-IR values play a role in triggering endothelial dysfunction, increasing sympathetic nervous system activity, and activating the renin-angiotensin-aldosterone system (RAAS). These mechanisms lead to increased vascular tone and arterial stiffness even before blood glucose levels rise.

Classic and Social Risk Factors

The factors of advanced age, obesity, smoking habits, gender, certain types of work, and even low education contribute to the risk of isolated systolic hypertension (ISH) because each affects physiological mechanisms. In older age, vascular aging occurs, including a decrease in the elasticity of blood vessel walls due to collagen accumulation and elastin fragmentation, leading to increased stiffness of the aorta and other large vessels, thereby causing an increase in systolic pressure[3]. Obesity, which causes visceral fat accumulation, increases the workload on the heart through increased cardiac output and peripheral resistance. Visceral adipose tissue is metabolically active, producing inflammatory cytokines such as IL-6 and TNF-α, which trigger chronic inflammation, endothelial dysfunction, and insulin resistance. This process exacerbates blood pressure regulation disorders[3,10]. Smoking accelerates the mechanism of atherosclerosis through oxidative stress, thereby increasing blood vessel stiffness and disrupting the release of nitric oxide (NO)[10]. Male gender carries a higher risk before menopause in women, partly due to the protective effects of estrogen, which supports vascular elasticity and lipid profiles[3]. Occupations involving heavy physical stress, excessive heat exposure, or chronic psychological stress can trigger activation of the sympathetic nervous system and the hypothalamic-pituitary-adrenal (HPA) axis, which can increase blood pressure over the long term[21]. On the other hand, low

education levels are often correlated with limited health knowledge, poor access to health services, and unhealthy lifestyles (high sodium intake and lack of physical activity), all of which are risk factors for hypertension[10,21].

Differences in the Pathophysiology of ISH in the Elderly and Younger Individuals

ISH has different pathophysiological mechanisms between older and younger age groups. In older adults, the aging process causes a loss of elasticity in the arterial walls, particularly the aorta, due to elastin fragmentation and increased collagen deposition[31]. This results in the inability of arteries to absorb energy during the systolic phase, leading to increased systolic pressure. Diastolic pressure tends to decrease due to reduced elastic recoil, resulting in widened pulse pressure[32].

Reduced elasticity also increases pulse wave velocity, exacerbating central systolic pressure elevation.

In young individuals, ISH is generally not caused by central arterial stiffness but rather by peripheral pressure amplification[7]. This mechanism occurs when pressure waves emitted from the heart bounce back from smaller, stiffer peripheral arteries and accumulate with new pressure waves released by the heart. Characteristics of peripheral arteries in young individuals, such as smaller diameter, higher vascular smooth muscle tone, and low peripheral elasticity, enhance the wave reflection effect[33]. One study showed that in individuals under the age of 40, central blood pressure and pulse wave velocity were lower than in other age groups, confirming that increased blood pressure in young people is mostly caused by amplification of peripheral pressure[7].

Long-Term Effects on Target Organs

ISH is a serious condition, even in young people. Cardiac imaging studies using MRI show that ISH in adolescents is associated with left ventricular wall thickness, increased left ventricular mass index (LVMI), and pulse wave velocity, indicating cardiac remodeling from an early age[17]. In patients with chronic kidney disease not on dialysis, ISH is associated with decreased eGFR, increased left ventricular mass, and increased albumin-creatinine ratio [19]. In South Korea, a five-year national cohort study of over 3 million young adults showed that ISH increases the risk of eGFR decline ≥30%[6].

ISH has also increased the risk of cardiovascular mortality. In the MONICA/KORA study of 5,597 young adults, a hazard ratio of 1.89 showed a significant increase in the risk of cardiovascular death in patients with ISH[4]. In cancer

survivors, the presence of ISH may increase the risk of death from heart disease compared to patients with normal blood pressure [5].

Therapeutic Strategies and Clinical Challenges

Management strategies for ISH still depend on age, cardiovascular risk, and the presence of comorbidities. A follow-up study of ALLHAT showed that calcium channel blockers (CCBs) are more effective than diuretics in preventing heart failure in patients with ISH[11]. A meta-analysis of over 113,000 ISH patients aged ≥60 years with systolic blood pressure ≥160 mmHg showed that antihypertensive therapy can reduce the incidence of MACE[23]. Another randomized controlled trial showed that beta-blockers, specifically nebivolol, provide better systolic blood pressure reduction compared to atenolol([12]. In non-pharmacological approaches, renal denervation (RDN) shows promising results in lowering central systolic blood pressure in some patients with mixed hypertension, but its effectiveness in pure ISH remains inconclusive[13]. Public awareness of ISH, especially among younger age groups, studies in China show that most young ISH sufferers are unaware of their hypertensive status and only a small proportion receive treatment(Mahajan et al., 2020).

4. CONCLUSION

Isolated systolic hypertension (ISH) is a clinical condition that is highly relevant not only in the elderly, but also in younger adults and working-age adults. This study shows that ISH often presents without symptoms and has a significant impact on target organs, such as the heart and kidneys. Various factors such as age, obesity, insulin resistance, and low physical activity contribute to an increased risk of ISH. In addition, hemodynamic characteristics such as arterial stiffness and pressure amplification influence the pathogenesis and pathophysiology of ISH, especially in younger adults.

This study also revealed that effective therapeutic approaches for ISH require further research. Calcium channel blockers have proven more effective in preventing cardiovascular complications compared to other drug classes in certain populations, while beta-blockers and interventions such as renal denervation still yield varying results depending on patient characteristics. Therapeutic success depends on early detection and accurate understanding of the subtype of

hypertension the patient is experiencing.

It is important to raise awareness, implement proactive screening, and adopt personalized therapeutic approaches in managing ISH. Educational efforts and strengthening primary healthcare services are key to preventing disease progression and minimizing long-term impacts on the quality of life of ISH patients. Further comprehensive research is also needed to evaluate the effectiveness of management strategies across different age groups and comorbidities.

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