

**OPTIMIZATION OF EARLY DIAGNOSIS AND PREVENTION OF
CARDIOVASCULAR COMPLICATIONS IN PATIENTS WITH HYPOTHYROIDISM****Rashidova Hurshidabonu Arifjon qizi**

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Introduction

Hypothyroidism is one of the most common endocrine disorders and remains a clinically important contributor to cardiovascular morbidity, especially in middle-aged and older adults. Thyroid hormones play a central role in myocardial contractility, heart rate regulation, vascular tone, lipid metabolism, and endothelial function; therefore, even mild thyroid hormone deficiency can adversely affect the cardiovascular system. In overt hypothyroidism, the association with bradycardia, increased systemic vascular resistance, impaired diastolic function, atherogenic dyslipidemia, and accelerated atherosclerosis is well established, whereas in subclinical hypothyroidism the magnitude of cardiovascular risk is more heterogeneous but still clinically relevant in selected patient groups. Recent reviews emphasize that hypothyroidism should be considered not only a hormonal disorder but also a condition with important cardiometabolic consequences that may promote coronary artery disease, heart failure, and other adverse vascular outcomes [1–4]. The problem is especially important because cardiovascular complications in hypothyroid patients often develop gradually and may remain underrecognized at early stages. Patients can present with nonspecific symptoms, while subclinical forms are frequently detected only through biochemical testing. At the same time, delayed recognition of thyroid dysfunction may permit the progression of dyslipidemia, endothelial dysfunction, arterial stiffness, hypertension, and structural or functional myocardial changes. Current evidence suggests that overt hypothyroidism clearly increases cardiovascular risk, while the effect of subclinical hypothyroidism depends on factors such as age, thyroid-stimulating hormone (TSH) elevation, pre-existing cardiovascular disease, and the overall burden of metabolic risk factors [1,3,5]. This makes early identification of high-risk patients and individualized preventive strategies especially relevant in routine clinical practice.

From the standpoint of early diagnosis, measurement of serum TSH and free thyroxine (free T4) remains the cornerstone for detecting primary hypothyroidism, while targeted rather than universal screening is generally favored for asymptomatic adults. Contemporary clinical guidance indicates that screening is not routinely recommended for the general asymptomatic population, yet thyroid function testing is appropriate in patients with suggestive symptoms, autoimmune disease, metabolic comorbidity, or increased clinical risk. This approach is particularly relevant for cardiovascular prevention, because timely diagnosis may identify patients in whom thyroid dysfunction contributes to modifiable cardiovascular abnormalities before major complications become clinically evident [4,6–8]. Prevention of cardiovascular complications in hypothyroidism requires more than simple hormone replacement. Although levothyroxine is the first-line treatment and remains the standard of care, current literature increasingly supports a broader preventive model that includes risk stratification, lipid assessment, blood pressure monitoring, evaluation of cardiac symptoms, and careful dose titration in older adults and in patients with ischemic heart disease or atrial arrhythmias. Recent publications also highlight the need for a personalized approach in subclinical hypothyroidism, where treatment decisions should account for TSH level, symptom burden, age, and

cardiovascular risk profile rather than relying on a uniform treatment strategy for all patients [5,9].

Thus, optimization of early diagnosis and prevention of cardiovascular complications in patients with hypothyroidism is a timely and clinically significant problem. Improving outcomes in this population requires earlier recognition of thyroid dysfunction, identification of patients at greatest cardiovascular risk, and implementation of integrated preventive measures alongside appropriate thyroid hormone replacement. Against this background, the present article is devoted to analyzing current approaches to the early diagnosis of hypothyroidism-associated cardiovascular involvement and to identifying effective strategies for preventing cardiovascular complications in this patient population [1,3].

Materials and Methods

This study was designed as a narrative literature review aimed at optimizing the early diagnosis and prevention of cardiovascular complications in patients with hypothyroidism. The materials used in the study consisted of peer-reviewed scientific articles, clinical reviews, guideline documents, and expert recommendations addressing the relationship between hypothyroidism and cardiovascular pathology, including dyslipidemia, arterial hypertension, endothelial dysfunction, atherosclerosis, ischemic heart disease, heart failure, and rhythm disturbances. Additional sources included evidence-based recommendations on thyroid function testing, screening strategies, and the management of overt and subclinical hypothyroidism published by major professional and public health organizations [6–8]. The literature selection process was based on the analysis of contemporary publications indexed in major biomedical databases and authoritative clinical sources. Preference was given to recent review articles, guideline-based papers, and clinically relevant studies published in the last several years, while classic foundational papers were considered when necessary to clarify the pathophysiological basis of cardiovascular involvement in hypothyroidism. The review focused on studies describing the cardiovascular effects of thyroid hormone deficiency, the diagnostic significance of serum thyroid-stimulating hormone (TSH) and free thyroxine (free T4), the role of lipid and metabolic abnormalities, and preventive strategies related to levothyroxine therapy, cardiovascular risk stratification, and monitoring of comorbid conditions [8,9].

During the analytical stage, the selected materials were grouped into three major categories: studies on the mechanisms linking hypothyroidism with cardiovascular dysfunction, publications devoted to early diagnostic approaches, and papers addressing preventive and therapeutic strategies. A descriptive and comparative method was then applied to synthesize the available evidence. Special attention was paid to differences between overt and subclinical hypothyroidism, since cardiovascular risk and treatment indications vary according to thyroid status, age, TSH concentration, and the presence of pre-existing cardiovascular disease [2,3,5,9]. The findings from the selected sources were critically compared and generalized to identify the most clinically significant approaches for the early detection of cardiovascular involvement and the prevention of adverse cardiovascular outcomes in hypothyroid patients [1–4]. This work did not involve direct patient recruitment, laboratory experimentation, or intervention on human subjects. Therefore, the study should be regarded as an analytical review of published evidence rather than an original clinical trial. The methodological emphasis was placed on the synthesis of current scientific knowledge in order to formulate a structured understanding of how early recognition of thyroid dysfunction and timely preventive measures may reduce cardiovascular complications in patients with hypothyroidism [4,6].

Results

Analysis of the selected literature showed that hypothyroidism is consistently associated with an unfavorable cardiovascular profile, although the strength of this association differs between overt and subclinical disease. Across recent reviews, overt hypothyroidism was repeatedly linked to bradycardia, increased systemic vascular resistance, impaired ventricular relaxation, endothelial dysfunction, dyslipidemia, and accelerated atherosclerosis, all of which increase the probability of adverse cardiovascular outcomes. In contrast, subclinical hypothyroidism demonstrated a more heterogeneous relationship with cardiovascular disease: risk appears to be higher in patients with greater TSH elevation, older age, pre-existing cardiovascular disease, or clustering of metabolic risk factors, whereas milder cases showed less consistent associations across studies [1–4]. A major result of the review was the clear identification of several early cardiovascular abnormalities that may precede major clinical events in patients with hypothyroidism. The most frequently reported early markers were atherogenic lipid changes, especially elevated total cholesterol and low-density lipoprotein cholesterol, increased arterial stiffness, impaired endothelial function, diastolic dysfunction, and higher prevalence of hypertension. These findings support the view that cardiovascular involvement in hypothyroidism begins before overt cardiac complications become clinically obvious and therefore can be targeted at an earlier stage through laboratory and clinical surveillance [1,3,4].

The review also demonstrated that early diagnosis remains centered on biochemical assessment, primarily serum TSH and free T4. Recent clinical guidance and review articles agreed that routine screening of the general asymptomatic adult population is not supported by strong evidence, but targeted testing is appropriate in individuals with symptoms suggestive of thyroid disease, autoimmune disorders, cardiometabolic comorbidity, or other high-risk features. From the perspective of cardiovascular prevention, this means that selective case-finding among patients with dyslipidemia, hypertension, unexplained fatigue, weight gain, or existing cardiovascular disease may improve the early recognition of hypothyroidism-associated cardiovascular risk [5–7]. Another important result concerned the role of treatment and prevention. The reviewed sources consistently identified levothyroxine as the standard treatment for overt hypothyroidism, with potential benefits for reversing biochemical and hemodynamic abnormalities related to thyroid hormone deficiency. However, the preventive cardiovascular benefit of treatment was more straightforward in overt hypothyroidism than in subclinical disease. In subclinical hypothyroidism, the literature emphasized individualized decision-making based on TSH level, age, symptoms, and cardiovascular risk status rather than universal treatment. Recent evidence suggests that the value of levothyroxine in preventing major adverse cardiovascular outcomes is likely greatest in selected high-risk subgroups rather than uniformly across all patients with mild thyroid dysfunction [2–4,8,9].

The collected evidence further indicated that optimization of prevention should not rely on thyroid hormone replacement alone. Effective prevention of cardiovascular complications requires a broader clinical strategy including early lipid profiling, blood pressure assessment, identification of ischemic heart disease or heart failure symptoms, cautious levothyroxine titration in older adults and patients with coronary disease, and periodic reassessment of thyroid status. This integrated approach was consistently favored in the recent literature because hypothyroidism-associated cardiovascular risk is mediated through endocrine, metabolic, vascular, and hemodynamic pathways simultaneously [1–4,7]. Overall, the results of this review indicate that optimization of early diagnosis and prevention of cardiovascular complications in hypothyroid patients is best achieved through three interconnected measures: first, early recognition of thyroid dysfunction in clinically relevant risk groups; second, prompt identification of early cardiovascular and metabolic abnormalities; and third, individualized preventive management combining levothyroxine therapy, cardiovascular risk-factor control, and

structured follow-up. This pattern was especially clear in overt hypothyroidism, while in subclinical hypothyroidism the evidence supports a more selective and personalized preventive strategy [8,9].

Table 1. Main findings on early diagnosis and prevention of cardiovascular complications in patients with hypothyroidism

Domain	Main result	Clinical significance
Cardiovascular risk in overt hypothyroidism	Strong and consistent association with dyslipidemia, endothelial dysfunction, arterial hypertension, increased vascular resistance, diastolic dysfunction, and atherosclerotic progression	Overt hypothyroidism should be regarded as a clinically meaningful cardiovascular risk state requiring timely diagnosis and treatment
Cardiovascular risk in subclinical hypothyroidism	Association is more variable; risk is more pronounced in patients with higher TSH, older age, or pre-existing cardiovascular disease	Subclinical hypothyroidism requires individualized cardiovascular risk assessment rather than a uniform approach
Early diagnostic markers	TSH and free T4 remain the main laboratory tools; early cardiovascular involvement may be suggested by lipid abnormalities, hypertension, arterial stiffness, and impaired cardiac relaxation	Combined thyroid and cardiovascular evaluation improves early recognition of high-risk patients
Screening strategy	Routine universal screening in asymptomatic adults is not clearly supported; targeted testing is preferred in symptomatic or high-risk individuals	Selective case-finding may improve efficiency and reduce overdiagnosis
Preventive role of levothyroxine	Clear role in overt hypothyroidism; preventive cardiovascular benefit in subclinical hypothyroidism is more selective and depends on patient profile	Treatment decisions should consider age, TSH level, symptoms, and cardiovascular status
Broader prevention model	Lipid monitoring, blood pressure control, cardiac symptom assessment, and cautious dose titration are repeatedly recommended alongside thyroid hormone replacement	Prevention should be multidisciplinary and not limited to endocrine correction alone

Discussion

The findings of this review indicate that optimization of early diagnosis and prevention of cardiovascular complications in hypothyroidism should be understood as a combined endocrine and cardiovascular task rather than a narrowly hormonal one. Recent reviews consistently show that thyroid hormone deficiency affects vascular tone, myocardial function, lipid metabolism, and endothelial biology, which explains why cardiovascular involvement may begin before overt cardiac disease becomes clinically apparent. This interpretation supports the central idea of the present article: early recognition of hypothyroidism is important not only for correction of endocrine dysfunction, but also for reducing downstream cardiovascular risk. The relationship is strongest and most consistent in overt hypothyroidism, whereas in subclinical hypothyroidism the degree of cardiovascular harm appears to vary according to TSH level, age, sex, and baseline cardiovascular risk. One of the most important implications of the reviewed evidence is that cardiovascular risk assessment in hypothyroid patients should begin at the stage of early metabolic and functional abnormalities. The Results section showed that dyslipidemia, arterial stiffness, endothelial dysfunction, hypertension, and impaired diastolic relaxation are among the earliest detectable cardiovascular changes in these patients. In practice, this means that a patient with newly identified hypothyroidism should not be viewed only through the lens of thyroid hormone replacement; rather, lipid profile, blood pressure, symptoms suggestive of coronary disease or heart failure, and overall cardiometabolic burden should be evaluated in parallel. Such an approach is especially justified because long-term consequences of hypothyroidism include cardiovascular disease and increased cardiovascular risk factors, and NICE evidence materials note that these effects can be mitigated when hypothyroidism is effectively treated.[3-6]

The discussion also highlights an important nuance regarding screening and early detection. Current guidance does not support routine universal screening of all asymptomatic nonpregnant adults; the USPSTF continues to state that evidence is insufficient to assess the balance of benefits and harms of screening in this population. At the same time, NICE recommends investigation and monitoring in people with suspected thyroid disease, and modern reviews emphasize the value of targeted testing in individuals with symptoms, autoimmune background, metabolic abnormalities, or elevated cardiovascular risk. Therefore, for the purpose of preventing cardiovascular complications, the most rational strategy is selective case-finding rather than indiscriminate population screening. This interpretation aligns with the broader trend toward risk-based detection and helps avoid overtesting while still improving early diagnosis in clinically relevant groups. Another major point emerging from the literature is that the preventive value of treatment differs between overt and subclinical hypothyroidism. In overt disease, levothyroxine replacement is standard care and is generally associated with improvement in biochemical and hemodynamic abnormalities linked to thyroid hormone deficiency. In subclinical hypothyroidism, however, the evidence is less uniform. Recent reviews argue that mild thyroid dysfunction should not automatically trigger the same management strategy in every patient, because cardiovascular benefit is more likely in selected subgroups such as those with higher TSH concentrations, symptoms, or pre-existing cardiovascular disease. This means that prevention of cardiovascular complications in subclinical hypothyroidism should be individualized rather than protocolized in a one-size-fits-all manner.[3,4]

From a practical standpoint, the reviewed data support a multidimensional prevention model. Such a model includes timely biochemical confirmation of hypothyroidism, baseline cardiovascular risk stratification, early correction of dyslipidemia and blood pressure abnormalities, careful titration of levothyroxine, and follow-up adapted to age and comorbidity. This is particularly important in older adults and in patients with ischemic heart disease, in whom excessive or overly rapid thyroid hormone replacement may itself create cardiovascular

problems. The literature therefore favors balanced correction of hypothyroidism combined with routine cardiovascular surveillance rather than isolated endocrine management. The present review also has limitations that should be acknowledged. First, the available literature is stronger for overt hypothyroidism than for subclinical disease, where findings on cardiovascular outcomes and treatment effects remain partly inconsistent. Second, many publications focus on surrogate cardiovascular markers such as lipid levels, arterial stiffness, or endothelial dysfunction rather than hard endpoints alone. Third, this article is based on an analytical review of published evidence and does not include original patient data, so its conclusions should be interpreted as evidence synthesis rather than direct clinical proof. Nevertheless, the convergence of recent review articles and guideline documents strengthens the conclusion that early diagnosis and targeted prevention are clinically justified in hypothyroid patients with elevated cardiovascular risk.[2,3]

In summary, the discussion confirms that prevention of cardiovascular complications in hypothyroidism is most effective when implemented early and individually. Overt hypothyroidism warrants prompt recognition and treatment because its cardiovascular associations are well established, while subclinical hypothyroidism requires more careful stratification based on biochemical severity and patient-specific cardiovascular context. The most defensible strategy is an integrated one that combines targeted thyroid testing, early detection of metabolic and cardiac abnormalities, appropriate levothyroxine use, and continuous monitoring of cardiovascular risk factors.

Conclusion

In conclusion, the available evidence indicates that hypothyroidism is an important contributor to cardiovascular morbidity, particularly through its effects on lipid metabolism, vascular resistance, endothelial function, and myocardial performance. The cardiovascular burden is most clearly established in overt hypothyroidism, while in subclinical hypothyroidism the degree of risk depends on factors such as TSH level, age, symptom profile, and pre-existing cardiovascular disease. These findings support the need to view hypothyroidism not only as an endocrine disorder, but also as a clinically significant cardiometabolic condition. The review further shows that optimization of outcomes requires early diagnosis based on timely assessment of TSH and free T4, together with careful identification of early cardiovascular abnormalities such as dyslipidemia, hypertension, arterial stiffness, and diastolic dysfunction. Universal screening of asymptomatic adults is not clearly supported, but targeted case-finding in symptomatic individuals and in patients with elevated cardiovascular or metabolic risk appears to be the most rational strategy for early detection. From a preventive perspective, levothyroxine remains the standard therapy for overt hypothyroidism, whereas management of subclinical hypothyroidism should be individualized rather than uniform. The most effective model for preventing cardiovascular complications is an integrated approach that combines thyroid hormone correction with cardiovascular risk stratification, lipid and blood pressure monitoring, cautious dose titration, and regular follow-up, especially in older adults and patients with established heart disease. Therefore, optimization of early diagnosis and prevention of cardiovascular complications in patients with hypothyroidism should be based on early recognition, risk-oriented evaluation, and personalized management. Such an approach may improve clinical outcomes, reduce progression of cardiovascular pathology, and strengthen long-term care for patients with both overt and subclinical hypothyroidism.

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