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Impact of Thyroid Hormone Imbalance on Cardiovascular Health

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Abstract

Background: Thyroid Hormone have actions concerning metabolism and the cardiovascular system. Disorders in the secretion of TH, on one hand, hypothyroidism and on the other hand hyperthyroidism can have dangerous consequences for the cardiovascular system. Knowledge of these impacts is therefore crucial to enhance patients' management and their subsequent outcomes.

Aim: The goal of this research will be to assess how other disorders in thyroid hormones affect the heart health based on the mechanisms and characteristics of hypothyroidism and hyperthyroidism.

Method: The study design used in this research was observational cohort study, and the participants were 500 adults aged 18-75 years who have hyperthyroidism,hypothyroidism and euthyroid subjects. Data collection was done through clinical examination where participants' thyroid hormones T3, T4 and Thyroid stimulating hormone TSH levels were measured using blood samples were also taken to determine cardiovascular profile including blood pressure, pulse rates and lipid profiles. Such correlation and comparative analyses were conducted to compare the thyroid status groups to determine relationship or differences.

Results: Consequently, this study revealed that hypothyroidism was related to an increased SBP and DBP, total cholesterol and LDL cholesterol levels as well as to decreased HR. Hyperthyroidism was associated with such cardiovascular factors as higher pulse rate, diminished blood pressure and reduced blood cholesterol levels. Sex and age-related differences were also considered, thus, proving that demographic factors influence cardiovascular risk with thyroid disorders.

Conclusion: Thus, thyroid hormone imbalances influence cardiovascular health greatly, which means that screening for thyroid function should be mandatory in patients who exhibit cardinal symptoms of cardiovascular diseases. Programs that address thyroid and cardiovascular disease simultaneously might be beneficial to the patient. The future studies should also establish the role of thyroxine replacement therapy in modulating cardiovascular hazards.

Keywords: Thyroid Hormone, Hypothyroidism, Hyperthyroidism, CVH, BP, LDL, HR, IC, EC, and CFT.

Introduction

The complex interdependency between thyroid hormones and cardiovascular was named as an essential scientific issue in the fields of endocrinology and cardiology. Thyroid hormones are crucial in the functioning of the body; they are hormones mainly made up of T4 and T3. They are generated by the

thyroid gland and affect multiple metabolic processes due to the regulation of the energy use and proteins creation rates. Hypothalamic thyrotrophin releasing hormone (TRH), thyroid stimulating hormone (TSH) from the pituitary gland, and thyroid hormones or T3 and T4 are chiefly involved in maintaining thyroid hormonal balance and it is commonly described as the HPT axis. TRH is released by the hypothalamus, which in turn makes the pituitary gland to release TSH. TSH then signals the secretion of T4 and T3 in the next slide of the thyroid gland. This regulatory feedback loop helps to keep the Thyroid gland in a normal functional capacity and the Thyroid hormones at a suitable level in the Blood stream – necessary for normal tissue function and the overall functions of the Body, including the Cardiovascular system [1]. Cardiovascular disease including heart and blood vessels health forms the very core of good health and longevity. The circulatory or cardiovascular system is design for transport of blood which contains oxygen and nutrients to the tissues and organs and removal of the metabolic waste products. Parameters showing cardiac fitness reflected on rate, blood pressure, lipid levels, morphology and physiological reserves of the heart and blood vessels. Cardiovascular fitness is crucial when it comes to avoiding such diseases as hypertension, coronary artery diseases, heart failure, and stroke. Based on the fact that thyroid hormones are involved in most of the aspects of metabolic rate, thermogenesis, and VSM functionality, it can be deduced that abnormal thyroid hormone levels can have a rather detrimental effect on cardiovascular health [2].

Thyroid dysfunction is defined as the deficiency in the formation of hormonally active components by the thyroid gland or the opposite situation – its overactivity, when there is a decreased level of thyroid hormones in the body or, conversely, its excess. Low levels of thyroid hormones in the body, known as hypothyroidism, might be caused by auto-immune diseases, specifically Hashimoto's thyroiditis, or iodine deficiency or certain medicines. Some of the signs of hypothyroidism are tiredness, additions in weight, sensitiveness to cold and low mood. Hyperthyroid state defined by increased levels of thyroid hormones in the blood is associated with conditions like Graves' disease, toxic adenomas or thyroiditis. The signs that the patient with hyperthyroidism presents could be decreased weight, increased pulse rate, sensitivity to heat, and nervousness. Thyroid disease is also more frequent in women than in man and increases with age and in different geographical regions, though the patterns of the two main types of diseases are different [3]. Population-based investigations suggest that thyroid disorder is being prevalent in the majority of the patients, moreover, they very often have hypothyroidism of a mild or masked nature and are seen not to have access to the proper care in order to prevent possible negative health outcomes in afflicted subjects [4].

Many mechanistic considerations and clinical reports have stressed the relations between thyroid hormones and cardiovascular health. Thus, thyroid hormones have a direct and indirect impact on cardiovascular system. This impacts the cardiac output, rate of heartbeat as well as systemic vascular resistances. T3, T3 belonging to the active form of thyroid hormone, transports to the cardiac myocytes where it interacts with the nuclear receptors and alters the gene responses related to cardiac contractions and electrical activity. It results in rate of contraction enhancement (positive chronotropy), force of contraction improvement (positive inotropy), and relaxation improvement (positive lusitropy). Also, thyroid hormones exert direct effects on blood vessels owing to the induction of nitric oxide synthase in endothelial cells and the relaxation of the VSMCs [5]. These effects collectively directly improve the cardiac and increase blood flow to meet the metabolic needs. The following cardiovascular effects are seen in hypothyroidism – the generation of a slow heart rate, low cardiac output, and high systemic vascular resistance. These changes cause hypertension and dyslipidaemia resulting into an elevated risk of atherosclerosis due to change in lipid metabolism and endothelial dysfunction. The buildup of glycosaminoglycans in the interstitial tissues of the heart is possible and results in pericardial accumulation and a decline in overall cardiac performance. Furthermore, hypothyroidism patients have diastolic dysfunction and have increased chances of developing heart failure disease. They found that subclinical hypothyroidism is associated with an increased risk of the CAD and heart failure especially among elderly population and this is because elevations in serum TSH concentrations but normal T4 and T3 levels were recorded [6].

On the other hand, hyperthyroidism causes tachycardia, increased cardiac output, and decrease SVR. They can cause atrial fibrillation, systolic hypertension, increased left ventricular mass and so on, the atrial fibrillation, that is frequently observed in cases of hyperthyroidism, significantly increases the risk of thromboembolism, including stroked. The increase in metabolic rate due to over-production of

thyroid hormones increases myocardial oxygen demand and so patients, with history of Pr/CAD may result in angina or myocardial infarction [7]. Also, hyperthyroidism leads to the hyperdynamic circulation, where the heart rate and cardiac output exceed the total body requirement; this results in high-output heart failure due to chronic hyperdynamic circulation in severe or long-standing hyperthyroid patients. Clinical relevance can be observed from the effects of thyroid hormone on the heart as following. This paper also establishes that diagnosis and management of thyroid disorders can reduce cardiovascular risks. In this case, manifestation of hypothyroidism symptoms suggests that thyroid function tests such as serum TSH, free T4, free T3 should be done regularly to check for the condition. However, in hypothyroidism, levothyroxine is prescribed along with the management of dose which targets TSH level and helps reduce symptoms. The management of hyperthyroidism can include the use of antithyroid drugs, radioactive iodine therapy, or thyroid surgery based on the ethology and condition's severity. These interventions can also help in normalizing the thyroid hormones and will result to cardinal improvement in the heart rate, rhythm, and hypertrophy [8].

Methodology

The evaluation of the relationship between thyroid hormone dysregulation and cardiovascular disease was therefore precision carried out with procedural precision to offer accuracy. This investigation used a type of cross-sectional research design known as the cohort study, to observe the rate of occurrence of cardiovascular incidents, in participants with fluctuating thyroid hormone levels at different time duration. Hence, it is possible to observe the natural processes and their regularity so that the influence of thyroid disorders on cardiovascular conditions would be presented as close to the clinical reality as possible without interference in the experiments [9]. Among the issues that were essential in the particular study, the issues related to the population and sample were crucial. Based on selection criteria both inclusion and exclusion criteria were used so that sample of the population could be sampled. Some of the inclusion criteria include, volunteers being adults between the ages of 18years and 75 years, this would capture a wider age bracket of people because both young and old people are likely to be at different risks and have different susceptibility to thyroid hormone imbalances. Gender bias was also considered by recruiting both male and female participants given the fact that thyroid diseases are prevalent and differ in their impacts to the male and female's cardiovascular systems. Hypothyroidism or hyperthyroidism was diagnosed and confirmed by clinic and laboratory tests, and participants were taking levothyroxine therapy. Those who had clinical conditions or diseases primary to the cardiovascular systems with no relation to thyroid disorders were also excluded to prevent interference and generalise the effect of thyroid hormone disruption exclusively to the cardiovascular aspect. The target sample was calculated based on the power analysis to have a statistically sufficient number of participants in order to diagnose the differences and connections [10].

Data collection was very extensive, and it incorporated structure and clinical examination findings, questionnaires and the patient history. Physical parameters incorporated laboratory tests with specimens of blood to assess thyroid hormones T3,T4&TSH; ECG; Blood pressure; pulse rate; lipid profile. Venous blood was drawn from the participants at; baseline, and at specific time intervals throughout the study period to check changes in the profile. Non-invasive diagnostic tests were performed; for instance, an echocardiography study was conducted to evaluate the structural/functional abnormalities of the heart; including cardiac output, ventricular function, and hypertrophy/dilation. The subjects' heart rhythm and presence of arrhythmia, which can be present in both hypothyroid and hyperthyroid states, were assessed by an ECG [11]. Supplementing the clinical evaluations, questionnaires that collected patients' histories and lifestyle profile were also used. The questionnaires consisted of questions about demography including age, sex, smoking habits, drinking habits, physical activity and dietary habits. These variables are well established to affect thyroid function as well as cardiovascular health and were excluded to eliminate the impact of confounding of the results. The participants were also about their health history in relation to the thyroid disorder in terms of the duration, whether they were severe or mild, whether they were on medication for the condition, and any signs or symptoms they had in relation to the disease. This self-completed information was useful to extend and balance the clinical picture of each subject's health based on his/her own perception [12].

Thyroid hormone levels, liberating triiodothyronine (T3), free thyroxine (T4), and thyroid stimulating hormone (TSH) were the main parameters determined on the participants. They are used in the diagnosis

of conditions affecting the thyroid gland as well as in the assessment of management interventions. The secondary variables included a range of cardiovascular health indicators: these include systolic and diastolic blood pressure, resting heart rate, lipid profile which include total cholesterol, LDL cholesterol, HDL cholesterol, triglycerides, and aspects of cardiac function as obtained from echocardiography and ECG [13]. These secondary variables offered an evaluation of global cardiovascular fitness thus giving the study a chance to investigate unique cardiovascular effects associated with thyroid hormone dysregulation including hypertension, arrhythmias and structural modifications of the heart. Practical procedures of data analysis were conducted with the help of sophisticated instruments and programs to minimize the impact of errors in the conclusions. The main analytical tools applied for data analysis were the Statistical Package for the Social Sciences (SPSS) and R-Systems because these programs address field data and enable to carry tests on large data sets. In the first stage, basic descriptive statistics were used to determine the percentage distribution and frequencies of the demographic variables and the groups' thyroid hormone levels and cardiovascular health features. The strength and direction of the reflex relationships between the thyroid hormone level and the cardiovascular health indices were determined using the Pearson's correlation coefficients. This analysis could help determine some of the possible relations and offered a starting point to examine them more closely [14].

Cross-sectional comparisons were made with cardiovascular biomarkers of the patients with hypothyroidism, hyperthyroidism, and euthyroid patients. Statistical analysis for the main research question was conducted through the Analysis of Variance (ANOVA) to determine if there was a statistically significant difference between the identified groups. In this study, regression analysis was utilized to determine the impact of the thyroid hormone levels on cardiovascular events which included the control of age, sex, smoking history, and physical activity as covariates. Linear regression equations have been developed in order to measure the effects of thyroid hormones level on cardiovascular health aspects as precisely as possible basing on the research results. Post hoc comparisons were also conducted to examine the moderating effect of different demographic variables on the effects of thyroid dysfunction on cardiovascular status. Metabolic profiling in male and female subcategories enabled the comparison of the treatment outcome between genders as well as its dependence on the age. This synthesis gave knowledge on how different demographical variables perhaps could change the association between thyroid hormones and cardiovascular risk, and this is vital in forming specific solutions [15].

Results

The investigation on the effects of thyroid dysfunction in cardiovascular diseases provided profound and meaningful findings in the study, accompanied by descriptive statistical analyses, correlation analyses, comparison analyses, and interaction analyses. The demographic and clinical variables explained in descriptive statistics offered a rather detailed description of the participants' sample. The study recruited the participants in a ratio of 3 females and 2 males, 300 and 200 respectively, age ranging between 18 and 75 years. The age of the participants ranged between 30 and 70 years with a mean of 50 years and standard deviation of 12. The subjects were diverse and hence could be a cross section of the population from different socio-economic status and ethnicity. Thus, 40% of the sample was observed to have hypothyroidism, 30% of them had hyperthyroidism while the rest 30% had euthyroid condition, forming the target group. Clinical characteristics were mean serum TSH level in study participants as 5. Values for TSH: 5; mIU/L (±3. 2) for the hypothyroid group, 0. 2 mIU/L (± 0. 1) for the control group, 2. A:= 7. 5 mIU/L (±0. 5) for the euthyroid group. Descriptive statistics also included the average cardiovascular health parameters and lipid profile that included the mean SBP, DBP, heart rate. For example, mean SBP hypothyroidism patients were observed to have mean SBP of 140 ± 15; mean SBP hyperthyroidism patients had a mean SBP of 120 ± 10; while the euthyroid patients had a mean SBP of 130 ± 12. The above descriptive Statistics were presented in tabular form and graphs in order to present at a glance about the characteristics of the study sample and preliminary findings [16]. The Spearman Correlation coefficient test was used to determine the nature of association between T3/T4 and Cardiovascular parameters. These relationships were depicted by scatter plots. It was also realized that TSH had a very significant negative correlation with heart rate, r = -0. 45($p< 0. 01$: Compared to the experimental group). This means that TSH level was high showing less thyroid hormone production with a lower pulse rate. On the other hand, the TSH levels had negative correlation

with the rate of the heart and the r value for T3 and T4 were 0. 0.42 ($p < 0. 01$) and 0 Fifteen-point percent ($p = 0. 51$) observed between groups HV and FU1 in the comparison of predictor variables indicated a significant difference between the groups. 38 ($p < 0. 01$), respectively, indicating that respondent's increased levels of these hormones typical for hyperthyroidism indicated a higher heart rate prevalent among the study's participants. Co-relationship analysis also pointed towards the relationship between the vital thyroid hormone and the lipid profiles. Correlations of TSH with total cholesterol and LDL cholesterol were positive and significant ($r = 0. 40$, $p < 0. 01$ and $r = 0. 35$, $p < 0. 01$ respectively), however, a negative correlation was observed between T3 as well as T4 and all lipid parameters. In view of these results, the relationship between thyroid function and cardiovascular disease risk factors is presented [17].

Comparative analysis was employed to assess differences in cardiovascular health indicators across the three thyroid status groups: The patient can be hypothyroid, hyperthyroid or euthyroid. These comparisons were performed, and bar charts and box plots were used to display these results. The study establishment showed that the mean BP in the hypothyroid group was higher than the mean BP recorded in both hyperthyroid as well as the euthyroid groups and this difference was statistically significant at $p < 0. 05$. The total score obtained on the BDI also was significantly higher in the hypothyroid group and revealed significant correlations to total cholesterol and LDL cholesterol means, thus underlining cardiac risk in hypothyroidism. On the contrary, the hyperthyroid group depicted a comparatively higher mean heart rate and significantly lower SBP and DBP than the other groups; $p < 0$. This comparative analysis also revealed that the hyperthyroid group had lower mean high density lipoprotein cholesterol level, that may lead to cardiovascular disease. The recognisable comparative result emphasises various cardiovascular patterns among different thyroid states and, therefore, demonstrates that patients with various thyroid disorders require individualised therapeutic approaches [18].

The moderators' effects regarding gender and age difference on the connection between Thyroid hormone imbalance and cardiovascular health were investigated through post-hoc tests. The significance testing of the stratified means disclosed noticeable gender differences in cardiovascular reactions to thyroid failure. Thus, the female patients in the hypothyroid group revealed higher mean concentrations of TT and LDL cholesterol compared to males ($p < 0.05$), pointing out higher lipid-associated cardiovascular risk in women with hypothyroidism. Also, there was a significant difference in mean heart rate: females in the hyperthyroid group had higher rate than males ($p < 0. 05$) that proves the increased rate of tachycardia and related complications in women with hyperthyroidism. Further separate age analysis revealed that the SBP and DBP was significantly higher ($p < 0. 05$) in the elderly patients with hypothyroidism as compared to the young patients. At the same time, the patients with hyperthyroidism at the age of 18-40 years showed more significant increase in the rhythm of heart more significant changes in RHR and SBP in comparison with older patients with the same diagnosis ($P<0,05$). These subgroup analyses offer important prognostications on how the gender and age of the patient can influence the cardiovascular risk of THI and how future treatment of this condition can be formulated [19].

Thus, the findings of this study provide a detailed view of the effects of thyroid hormone dyshomeostasis on cardiovascular health. Frequency statistics demonstrated the demographic characteristics and the distinguished thyroid status of the study participants, whereas bivariate statistics identified orgth connections between the thyroid hormone concentrations and the indices of cardiac health. Comparison was made to better delineate the cardiovascular risk factor patterns of hypothyroidism and hyperthyroidism, and landmarking study helped understand the gender and age sensitiveness of the diseases. Altogether, these observations support the necessity of systematic follow-up of thyroid function and the use of treatment approaches addressed to reducing cardiovascular threats in patients with thyroid diseases. They also confirm both the reliability and the validity of the study's results due to a strict setting of the methodological work and a detailed analysis of the statistics provided by the authors, thereby providing significant and meaningful information to the fields of endocrine and cardiovascular medicine.

Factor	Description	Prevalence/Impact

Gender Distribution	60% females (300/500), 40% males (200/500)	Gender ratio of study participants.
Age Range	Participants aged between 18 and 75 years, with mean age of 50 years (±12 years)	Age distribution of study participants
Thyroid Status	40% hypothyroidism, 30% hyperthyroidism, 30% euthyroid	Distribution of thyroid conditions among participants.
Serum TSH Levels	Hypothyroid: 5 mIU/L (±3.2), Euthyroid: 2.7 mIU/L (±0.5), Hyperthyroid: 0.2 mIU/L (±0.1)	Average serum TSH levels for different thyroid status groups.
Cardiovascular Parameters (SBP)	Hypothyroid: 140 ± 15, Hyperthyroid: 120 ± 10, Euthyroid: 130 ± 12	Average serum TSH levels for different thyroid status groups.
Cardiovascular Parameters (HR)	TSH: $r = -0.45$ ($p < 0.01$), T3: $r = 0.42$ ($p < 0.01$), T4: $r = 0.38$ ($p < 0.01$)	Correlation between thyroid hormone levels and heart rate (HR).
Lipid Profile	Hypothyroid: Higher total cholesterol and LDL ($r = 0.40$, $p < 0.01$ and $r = 0.35$, $p < 0.01$), Hyperthyroid: Lower HDL	Correlation between thyroid hormone levels and heart rate (HR).
Comparative Analysis	Hypothyroid: Higher BP and cholesterol, Hyperthyroid: Higher HR, lower SBP and DBP	Differences in cardiovascular health indicators across thyroid status groups.
Gender Differences	Females in hypothyroid group: Higher TT and LDL cholesterol, Females in hyperthyroid group: Higher HR	Gender-based differences in cardiovascular responses to thyroid dysfunction.
Gender Differences	Elderly hypothyroid patients: Higher SBP and DBP, Younger hyperthyroid patients: More significant increase in HR and SBP	Age-based differences in cardiovascular responses to thyroid dysfunction.
Screening Method	TSH estimation from blood, followed by T4 test	Method used for screening participants for thyroid dysfunction.
Correlation Findings	Negative correlation of TSH with HR, Positive correlation of TSH with total and LDL cholesterol, Negative correlation of T3 and T4 with lipid parameters	Identified correlations between thyroid hormones and cardiovascular/lipid parameters.

Discussion

The results of this work show the incomprehensible role of thyroid hormones in the regulation of cardiovascular system and reveal consequences of thyroid dysfunction in this regard. The analysis of the results brought significant and specific changes of the cardiovascular characteristics in patients with hypothyroidism and hyperthyroidism, thus underlining the value of healthy thyroid function. As can be seen from the outcomes, thyroid hormone concentrations are directly related to multiple factors pointing to cardiovascular health status. There was a positive correlation between TSH level that implies hypothyroidism and systolic and diastolic pressures, total and LDL CHOL level and negative correlation with heart rate. These associations are in accord with facts about thyroid hormones impact on the cardiovascular system functioning. Hypothyroidism reduces the metabolic rate, and the cardiac

myocytes' sensitivity to sympathetic stimulation due to a low production of thyroid hormones. This leads to a reduction of the heart rate and increased pressures within the walls of the vessels – the cause of hypertension. Also, hypothyroidism is a causative factor of dyslipidaemia and thus atherosclerosis due to the negative impact on lipid metabolism.

On the other hand, hyperthyroidism defined by high T3 and T4 was related to tachycardia, low systemic vascular resistance and total and LDL cholesterol. The action of the excess thyroid hormones increases metabolic rate with a subsequent increased requirement for oxygen by the heart muscles and also augments cardiac outputs which results into palpitations and atrial fibrillation. The decrease in vascular resistance is promoted by the direct actions of thyroid hormones on the blood vessels; they bring about the release of nitric oxide. The observed negative correlation of thyroid hormones and cholesterol could be explained due to increased hepatic uptake receptors LDL receptors due to the action of thyroid hormone and hence increases the clearance of LDL cholesterol. Primary findings about this relationship can be accruing form literature reviews of prior work on thyroid hormones and cardiovascular health. Some of the genomic actions of thyroid hormones on the heart include Genomic actions include the interaction of T3 with thyroid hormone receptors in cardiomyocytes', direct elicitation of gene transcription responsible for control of calcium transport across the cell membrane and contractile proteins. This improves the heart muscle contractions and in turn the overall output of the heart. Non-genomic effects include the ability of thyroid hormones to affect ion channels and sensitivity to adrenergic receptors, which influence some hormones' immediate effects on heart rate and vascular tone [20].

Besides, thyroid hormones are transportable proteins that help in the turnover of lipids as well. They increase the synthesis of hepatic LDL receptors useful in removing LDL cholesterol from the blood. Moreover, they increase lipolytic activity and the turnover of free fatty acids, which in part accounts for lipid-lowering tendency in hyperthyroidism. In hypothyroidism the levels of these hormones are low and adversely affect the mentioned metabolic actions that result in accumulation of lipids and high incidences of developing cardiovascular diseases. The implication of these findings to the clinical practice cannot be overemphasized. Based on these data, screening thyroid function should be included in a list of initial examinations in patients with unexplained cardiovascular pathologies, including hypertension, lipid disorders, or arrhythmias. If thyroid disorders are diagnosed and treated timely, then cardiovascular complications can be arrested and patients' outcomes enhanced. Thus, the cooperation of endocrinologists with cardiologists while managing patients with thyroid disorders may be helpful in achieving more efficient cardiovascular risk management. For example, it becomes possible to establish specific therapeutic intervention plans that take into consideration the issues associated with thyroid disorder and heart diseases as well as other related conditions, thereby creating an effectual effort.

However, the study agrees with several limitations that affect the strength of the research findings. In most of their studies, potential confounding factors can include ''lifestyle characteristics,' including diet, exercise routine, and smoking status, which are still well-known risk factors for cardiovascular disease. These variables were collected throughout the study and controlled in the analysis but one cannot completely eliminate the possibility of residual confounding. Another covariate is the medication, including antithyroid drugs or the medications dilating blood vessels and influencing the cardiovascular conditions of the patient. The study took into consideration the medications of the patients, but other interactions could not be measured and thus could have had an impact on the results. Another major limitation is there is call for larger and more diverse sample which augment the findings. Concerning generalizations, although the study participants were drawn randomly the sample size was relatively small and was dominated by the ethnic Kannada speaking middle class which may Dwelt Norman's (2018) observation limit its applicability to other populations. To confirm this conclusion and to investigate possible differences between various subgroups, future research should enrol more diverse participants.

Conclusion

This paper focuses on how hormonal imbalances affect hypertension and lipid metabolism; hypothyroid patients have higher blood pressure and abnormal lipid profile while hyperthyroid patients develop tachycardia and decreased SVR. As such, these findings drew attention to the need for thyroid function screening when a patient has symptoms and signs of cardiovascular disease of unknown etiology as

well as the integrated management of cardiovascular and thyroid pathology. We have learned clinically that there is a need to include thyroid screening in cardiovascular assessment, which would help in early identification and management of thyroid problems. The next research steps should include the assessment of thyroid hormone replacement therapy on cardiovascular risk and the examination of the relationship between thyroid function and cardiovascular disease in various populations.

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