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RESEARCH ARTICLE
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ASSESSING THE IMPACT OF THYROID HORMONE IMBALANCE ON CARDIOVASCULAR HEALTH IN AGING POPULATIONS

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ABSTRACT

Introduction: Thyroid hormones like T4 and T3 are hormones synthesized in the thyroid gland and are involved in metabolism, growth, and differentiation. It was also found that in aging people, the effects of thyroid hormone dysfunction in heart disease are aggravated. disease.

Objective: to investigate the effect of thyroid hormones dysregulation on cardiovascular disease in those who are 60 years of age and above.

Methodology: This cross-sectional study was conducted at Khyber Teaching Hospital, Peshawar, from January 2021 to January 2022 with a sample size of 85 participants, who were divided into two groups: hypothyroidism (n=51) and hyperthyroidism (n=34). Participants aged 60 years and older with confirmed thyroid hormone imbalances were included, while those with severe chronic illnesses affecting cardiovascular outcomes were excluded. Data were retrieved from hospital electronic medical records, encompassing demographic details, clinical characteristics, and cardiovascular health outcomes such as age, sex, BMI, duration of thyroid disorder, presence of hypertension and diabetes, ECG and echocardiogram results, LDL cholesterol levels, and incidence of atrial fibrillation

Results: The results indicated that the hypothyroid group had a significantly longer duration of thyroid disorder compared to the hyperthyroid group (7.3 ± 2.9 years vs. 5.4 ± 3.4 years, p=0.023). Hypothyroid patients also showed a higher prevalence of ECG abnormalities (68.2% vs. 31.7%, p=0.05) and elevated LDL cholesterol levels (>130 mg/dL) (38.8% vs. 28.2%, p=0.021). However, there were no significant differences in age, sex distribution, BMI, or the incidence of hypertension, diabetes, echocardiogram abnormalities, or atrial fibrillation between the groups. These findings underscore the considerable impact of hypothyroidism on cardiovascular health compared to hyperthyroidism in older adults.

Conclusion: Thyroid hormone dysfunctions play some role in initiating cardiovascular diseases in the aging population. Thus, according to the differences in cardiovascular outcomes in patients with hypothyroid and hyperthyroidism, the necessity of TSH measurement and individualized approach to CVD risk management in elderly patients with thyroid diseases is emphasized. These results should

apply at the patient care level and provide guidance for future investigations of thyroid diseases and their cardiovascular consequences in geriatric patients.

Keywords: Thyroid Hormone, Cardiovascular Health, Aging, Hyperthyroidism, Hypothyroidism

INTRODUCTION

Thyroid hormones like T4 and T3 are hormones synthesized in the thyroid gland and are involved in metabolism, growth, and differentiation.(1) These hormones are very vital and are part of the hormones that control the body physical balance and health. Thyroid gland situated in the neck secretes these hormones and they circulate in the bloodstream thereby being delivered to all body tissues.(2) They are majorly involved in controlling the metabolic rate of the body through the rate at which cells in the body metabolize oxygen and derive energy.

Hypothyroidism becomes more pronounce and far common as people grow older.(3) This disparity creates a condition characterized by low thyroid hormone levels, referred to as hypothyroidism or a high number of thyroid hormones, also called hyperthyroidism.(4) Hypothyroidism actually means that the production of thyroid hormones in body is reduced; thus, body metabolism rate is decreased, while hyperthyroidism produces an excessive number of thyroid hormones, the body's metabolic process is faster.(5, 6) Both conditions have major impact in cardiovascular diseases especially in aging population.(7-9)

Many aspects of cardiovascular health are related to thyroid function.(10) The thyroid hormones contain properties that affect the heart rate, the capability of the heart to contract and the vessel resistance.(11) They influence the production of several proteins and enzymes that are received to be involved in the control of cardiovascular function, including myosin heavy chain, sodium-potassium ATP-ase and beta- adrenergic receptors.(12) As a result, any change in the levels of thyroid hormones is bound to have an effect on the various aspects of cardiologic pathology if not deformity.

Hypothyroidism leads to changes in the blood vessels; these include increased peripheral vascular resistance, a decrease in cardiac output and changes in lipid metabolism, which resulted in the construction of atherosclerosis.(13) In hypothyroid patients, there are high chances of getting increased total cholesterol, LDL cholesterol and triglycerides. These lipid abnormalities are CAD and other cardiovascular events' risk factors.(14) Moreover, hypothyroidism may have an effect on diastolic hypertension and the poorest availability of endothelial theirs function that underlines the cardiovascular risk.(15) Hyperthyroidism is associated with increased cardiac heave, decreased SVR and increased heart rate.(16) Such changes may result to development of conditions like atrial fibrillation which is a abnormal heart rhythm that doubles the risk of stroke and heart failure. Hyperthyroidism creates also a hypermetabolic state which raises the oxygen demand of the heart and therefore may contribute to the heart ischemic disease especially in patients with coronary arteries diseases.(17)

Thyroid hormone disorders become more common with age.(18) Normal aging affects thyroid function and diagnosing thyroid disorders in elderly patients more often is complicated because of the absence of specific symptoms, and the presence of other diseases.(19) For example, effects of hypothyroidism like fatigue, excessive weight gain, and changes in mental health can be fan off other related diseases of aging.(20) It was also found that in aging people, the effects of thyroid hormone dysfunction in heart disease are aggravated.(21) It is also agreed that elderly patient is at a greater risk of developing the complications of both hypothyroidism and hyperthyroidism because of age induced cardiovascular changes like increased arterial stiffness, lesser cardiac reserve, and increased prevalence of atherosclerosis disease.(22) Hence, even minor thyroid disorder in this population group is likely to have grave cardiovascular effects.

Recognizing that thyroid hormone has a direct influence on cardiovascular diseases and the elderly, particular attention should be paid to the timely diagnosis and adequate treatment of thyroid disorders

that existed before the occurrence of CHD. They recommend annual thyroid function tests in elderly patients with cardiovascular disease or risk factors should be done. The treatment of thyroid hormone disorder entails the normalization of thyroid hormone levels in the patient's body. In hypothyroidism, this usually entails the use of hormones known as levothyroxine. The treatment for hyperthyroidism may involve the use of antithyroid drugs, radioactive iodine or surgery based on the condition's gravity or the patient's general health status. The study concern in the present investigation is the effect of thyroid hormones dysregulation on cardiovascular disease in those who are 60 years of age and above.

METHODOLOGY

It is a cross-sectional type of research aimed at comparing the trends in thyroid hormones level to cardiovascular health among the elderly population. Data was collected through review of case records of admitted patients in hospitals. The study was on patients of Khyber Teaching Hospital, Peshawar, where medical records of the patients treated from January 2021 to January 2022 were examined.

The patients aged 60 years and above diagnosed with hypothyroidism or hyperthyroidism and underwent cardiovascular assessment were selected during the study period. The sample size for this study is 85 patients, which are using Cinnamon's products developed for Diabetes mellitus Type 2 patients. Male patients with confirmed hypothyroidism or hyperthyroidism over 60 years of age, with cardiovascular examination performed, including ECG, echocardiogram, lipid profile and patients with complete medical background were included in the study. On the other hand, patients with missing clinical records, patients with some types of congenital diseases, patients with a diagnosed endocrine disorder of thyroid function and other untreated cardiovascular or major surgery in the recent past, as well as severe acute disease were excluded from the study.

The study used research ethical approval from the institution review board (IRB). The demographic details of the patients, their diagnoses, and medications, and other medical information pertaining to each patient were retrieved from the hospital's electronic health records to screen them according to the inclusion and exclusion criteria outlined in Study Selection. Relevant data from the medical records were extracted, including: age, sex, BMI, plasma TSH, plasma T4 and T3, conventional ECG and echocardiography and the results of lipid profile, hypertension, diabetes and other diseases, the drugs taken, the treatments received and cardiovascular events such as new-onset arrhythmias, acute myocardial infarct, heart failure etc.

Empirical data collected was keyed into a database to enhance its validity and keep it secure. Socio-demographic and clinical data of the patients included in the study were described by means, median, standard deviation, frequency, and percentage. Patients' cardiovascular health status between the hypothyroidism and hyperthyroidism groups was compared by using related statistical measures and tests such as the chi-square tests for categorical data, t-tests for quantitative data. SPSS version 26. 0 was utilized for statistical analysis in this work.

RESULTS

The study included a total of 85 participants, divided into two groups: 51 individuals with hypothyroidism and 34 with hyperthyroidism. The average age of participants was 71.3 ± 8.9 years, with no significant difference between the hypothyroidism group (72.4 ± 8.2 years) and the hyperthyroidism group (70.2 ± 7.9 years; $p = 0.32$). The sex distribution was nearly equal, with 48.2% male (25 with hypothyroidism and 16 with hyperthyroidism) and 51.7% female (24 with hypothyroidism and 20 with hyperthyroidism; $p = 0.98$). (Table 1)

The mean Body Mass Index (BMI) was 29.7 ± 3.4, with hypothyroid patients having a slightly higher BMI (30.2 ± 4.2) compared to hyperthyroid patients (28.2 ± 5.4), though this difference was not statistically significant ($p = 0.23$). The duration of thyroid disorder was significantly longer in the hypothyroidism group (7.3 ± 2.9 years) compared to the hyperthyroidism group (5.4 ± 3.4 years; $p = 0.023$). Regarding comorbidities, hypertension was present in 76.4% of the participants, with a higher prevalence in hypothyroid patients (61.5%) compared to hyperthyroid patients (38.4%; $p = 0.21$).

Diabetes was found in 37.6% of the participants, with no significant difference between the groups (hypothyroidism: 65.6%, hyperthyroidism: 34.3%; p = 0.32). (Table 1)

Cardiovascular health outcomes showed notable differences between the two groups. ECG abnormalities were observed in 48.2% of the total participants, with a significantly higher incidence in the hypothyroidism group (68.2%) compared to the hyperthyroidism group (31.7%; p = 0.05). Echocardiogram abnormalities were found in 40% of the participants, with a higher prevalence in hypothyroid patients (67.6%) compared to hyperthyroid patients (32.3%), although this difference was not statistically significant (p = 0.25). Elevated LDL cholesterol levels (> 130 mg/dL) were significantly more common in the hypothyroidism group (38.8%) compared to the hyperthyroidism group (28.2%; p = 0.021). (Table 2)

The incidence of atrial fibrillation was similar between the two groups, with 16.4% of the total participants affected. Among them, 57.1% were in the hypothyroidism group and 42.8% in the hyperthyroidism group, but this difference was not statistically significant (p = 0.98). (Table 2)

Table 1: Demographic and Clinical Characteristics of Participants

Variable	Total (n = 85)	Hypothyroidism (n = 51)	Hyperthyroidism (n = 34)	p-value
Age (years)	71.3 ± 8.9	72.4 ± 8.2	70.2 ± 7.9	0.32
Sex				
Male	41(48.2%)	25 (55.2%)	16 (49.2%%)	
Female	44 (5.7%)	24 (47.2%)	20 (50.1%)	0.98
Body Mass Index (BMI)	29.7 ± 3.4	30.2 ± 4.2	28.2 ± 5.4	0.23
Duration of Thyroid Disorder (years)	6.4 ± 2.3	7.3 ± 2.9	5.4 ± 3.4	0.023
Comorbidities				
Hypertension	65 (76.4%)	40 (61.5%)	25 (38.4%)	0.21
Diabetes	32 (37.6%)	21 (65.6%)	11 (34.3%)	0.32

Table 2: Cardiovascular Health Outcomes by Thyroid Disorder Type

Outcome Measure	Total (n = 85)	Hypothyroidism (n = 51)	Hyperthyroidism (n = 34)	p-value
ECG Abnormalities				
Yes	41 (48.2%)	28 (68.2%)	13 (31.7%)	0.05
No	44 (51.7%)	23 (52.2%)	21 (47.7%)	
Echocardiogram Abnormalities				
Yes	34 (40%)	23 (67.6%)	11 (32.3%)	0.25
No	51 (60%)	28 (54.9%)	23 (45%)	
Elevated LDL Cholesterol (> 130 mg/dL)				
Yes	46 (54.1%)	33 (38.8%)	13 (28.2%)	0.021
No	39 (45.8%)	18 (21.1%)	21 (53.8%)	
Incidence of Atrial Fibrillation				
Yes	14 (16.4%)	8 (57.1%)	6 (42.8%)	0.98
No	71 (83.5%)	43 (60.5%)	28 (39.4%)	

DISCUSSION

The findings from our study on the impact of thyroid hormone imbalance on cardiovascular health in an aging population align with previous research that underscores the intricate relationship between thyroid disorders and cardiovascular outcomes.

Our study found no significant age difference between hypothyroid and hyperthyroid groups; a finding consistent with other studies. For example, Razvi et al. (2018) demonstrated that while both hypothyroidism and hyperthyroidism are prevalent in older adults, the age distribution between these conditions does not significantly differ.(8) Additionally, our gender distribution results align with those of Birck MG et al. (2022), who reported similar gender prevalence in thyroid disorders, reflecting broader epidemiological trends.(23)

Our study observed a higher BMI in the hypothyroid group compared to the hyperthyroid group, which corroborates with findings by Kalra S et al. (2021) that hypothyroidism is often associated with

weight gain and obesity, while hyperthyroidism typically leads to weight loss.(24) The longer duration of thyroid disorder in the hypothyroid group in our study is in line with the narrative review by Feldt-Rasmussen U et al. (2024), which noted that hypothyroid conditions often go undiagnosed for extended periods, leading to a longer disease duration before intervention.(25)

Our findings on the prevalence of hypertension and diabetes among participants are consistent with several studies. Jabbar et al. (2017) noted that hypothyroidism is often associated with a higher prevalence of comorbid conditions like hypertension and diabetes due to its metabolic impact.(26) Similarly, the study by Gluvic ZM et al. (2022) emphasized that thyroid dysfunction exacerbates cardiovascular risk factors, including hypertension and dyslipidemia.(27)

Our study's significant findings on ECG abnormalities in the hypothyroid group align with the comprehensive review by Gluvic Z et al. (2021), which highlighted the high incidence of cardiac arrhythmias and conduction abnormalities in hypothyroid patients.(28) The higher prevalence of echocardiogram abnormalities in the hypothyroid group is supported by Ahmadi N et al. (2020), who documented the adverse structural and functional cardiac changes associated with thyroid hormone deficiencies.(29)

Our observation of elevated LDL cholesterol levels in hypothyroid patients is consistent with the work of Jabbar et al. (2017), who reported that hypothyroidism is frequently linked to dyslipidemia, which increases cardiovascular risk.(30) Although we found no significant difference in the incidence of atrial fibrillation between the groups, previous research by Bekiaridou A (2022) noted that while both thyroid disorders can predispose individuals to atrial fibrillation, the overall prevalence may vary depending on the population studied.(31)

The study by Biondi B et al. (2022) provides a broader perspective by showing that thyroid dysfunction, particularly subclinical hypothyroidism, is a significant predictor of cardiovascular events in the elderly, which aligns with our findings of increased cardiovascular abnormalities in hypothyroid patients.(32) Similarly, a recent update by Paschou SA et al., (2022) emphasized the critical need for early detection and management of thyroid disorders to mitigate cardiovascular risks, underscoring the importance of our study's findings for clinical practice.

CONCLUSION

Thyroid hormone dysfunctions play some role in initiating cardiovascular diseases in the aging population. Thus, according to the differences in cardiovascular outcomes in patients with hypothyroid and hyperthyroidism, the necessity of TSH measurement and individualized approach to CVD risk management in elderly patients with thyroid diseases is emphasized. These results should apply at the patient care level and provide guidance for future investigations of thyroid diseases and their cardiovascular consequences in geriatric patients.

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