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Original Research Article

PREVALENCE AND RISK FACTORS OF HYPERTENSION WITH THYROID DYSFUNCTION AMONG INDIVIDUALS: A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Hypertension and thyroid dysfunction are prevalent endocrine and cardiovascular conditions that often coexist, sharing complex physiological interrelationships. Thyroid hormones significantly influence vascular resistance, cardiac output, and lipid metabolism, potentially affecting blood pressure regulation. This study aimed to assess the prevalence of hypertension among individuals with thyroid dysfunction and identify associated demographic, lifestyle, and biochemical risk factors.

Materials and Methods: A cross-sectional observational study was conducted involving 600 adult participants (aged 20–60 years) attending a tertiary care hospital. Participants were categorized based on thyroid status: euthyroid, hypothyroid, and hyperthyroid. Blood pressure was measured following standardized procedures. Thyroid function was assessed using serum TSH, free T3, and free T4 levels. Additional data on BMI, smoking, physical activity, and lipid profiles were collected. Statistical analysis included Chi-square tests, t-tests, and multivariate logistic regression.

Results: Among the 600 participants, 34.7% (n=208) had thyroid dysfunction (27.5% hypothyroid, 7.2% hyperthyroid). The prevalence of hypertension was 48.6% in hypothyroid and 38.4% in hyperthyroid individuals, compared to 21.9% in euthyroid individuals ($p < 0.001$). Mean systolic blood pressure was highest in the hypothyroid group (136.2 ± 12.7 mmHg) followed by hyperthyroid (132.1 ± 11.9 mmHg) and euthyroid groups (124.8 ± 10.2 mmHg). Logistic regression revealed significant associations of hypertension with hypothyroidism (OR: 2.84, 95% CI: 1.92–4.21), obesity (OR: 3.17), sedentary lifestyle (OR: 2.48), and dyslipidemia (OR: 2.33), all $p < 0.05$.

Conclusion: Thyroid dysfunction, especially hypothyroidism, is significantly associated with increased prevalence of hypertension. Identification and management of thyroid-related risk factors could play a pivotal role in hypertension prevention and control.

Keywords: Hypertension, Thyroid dysfunction, Hypothyroidism, Hyperthyroidism, Risk factors, Prevalence.

INTRODUCTION

Hypertension remains one of the leading risk factors for cardiovascular morbidity and mortality worldwide, affecting nearly 1.28 billion adults globally.[1] Simultaneously, thyroid dysfunction—particularly hypothyroidism and hyperthyroidism—is also increasingly recognized as a contributor to systemic metabolic derangements.[2] Thyroid hormones, primarily triiodothyronine (T3) and thyroxine (T4), exert significant influence on cardiovascular physiology, including modulation of systemic vascular resistance, cardiac output, and blood pressure regulation.[3]

Multiple studies have explored the bidirectional association between thyroid function and blood pressure. Hypothyroidism is often associated with diastolic hypertension due to increased systemic

vascular resistance, while hyperthyroidism has been linked with systolic hypertension from increased cardiac output.[4] Furthermore, thyroid dysfunction may influence lipid metabolism, insulin resistance, and endothelial function—all of which are implicated in the pathogenesis of hypertension.[5]

Although several epidemiological studies have evaluated the prevalence of thyroid disorders in hypertensive populations, fewer have examined the converse: the frequency and risk of developing hypertension in individuals with thyroid dysfunction. In the Indian context, where both thyroid disorders and non-communicable diseases like hypertension are highly prevalent, there exists a need to explore their coexistence and shared risk factors.

A recent study highlighted that thyroid dysfunction is often underdiagnosed in hypertensive individuals and may contribute to treatment-resistant hypertension.[6] However, comprehensive data delineating prevalence rates and associated predictors in euthyroid vs. thyroid-impaired populations remain scarce.

Objective: The present study was designed to assess the prevalence of hypertension in individuals with thyroid dysfunction and to evaluate the associated risk factors including demographic, clinical, and biochemical variables in a tertiary care population.

MATERIALS AND METHODS

Sample Size and Selection: A total of 600 adult individuals aged between 20 and 60 years were screened using a consecutive sampling method from the outpatient and health screening departments. Written informed consent was obtained. The sample size was calculated based on an expected prevalence of 25% for hypertension in thyroid dysfunction with a 5% margin of error and 95% confidence level.

Inclusion Criteria

- Adults aged 20–60 years
- No prior diagnosis of hypertension or thyroid dysfunction
- Willing to participate and provide informed consent

Exclusion Criteria

- Pregnant or lactating women
- Individuals on antihypertensive or thyroid medications
- Known chronic kidney disease, diabetes mellitus, or cardiovascular disease

Data Collection and Instruments

Participants underwent a comprehensive assessment including:

- Demographic information: age, sex, smoking, alcohol use, physical activity (self-reported).
- Anthropometric measurements: weight, height, BMI.
- Blood pressure measurement: Following WHO protocol using calibrated digital sphygmomanometer; three readings were taken and the average was recorded.
- Laboratory investigations:
  - Serum TSH, Free T3, and Free T4 (Electrochemiluminescence immunoassay)
  - Lipid profile (enzymatic method): Total cholesterol, HDL, LDL, and triglycerides
  - Fasting blood glucose (hexokinase method)

Thyroid Function Classification

- Euthyroid: Normal TSH, T3, and T4 levels
- Hypothyroid: TSH > 5.0 mIU/L with low/normal T3, T4
- Hyperthyroid: TSH < 0.4 mIU/L with high T3, T4

Blood Pressure Classification

As per JNC 8 guidelines:

- Hypertensive: SBP ≥ 140 mmHg and/or DBP ≥ 90 mmHg
- Normotensive: SBP < 140 mmHg and DBP < 90 mmHg

Statistical Analysis: Data were analyzed using SPSS version 26.0. Descriptive statistics were used for demographic and clinical variables. Group comparisons were made using Chi-square test for categorical variables and independent t-test or ANOVA for continuous variables. Multivariate logistic regression was employed to identify independent risk factors for hypertension. Statistical significance was set at $p < 0.05$.

RESULTS

Participant Characteristics

Of the 600 participants, 288 were male (48%) and 312 were female (52%). The mean age was 41.6 ± 10.2 years. Based on thyroid function, 392 (65.3%) were euthyroid, 165 (27.5%) hypothyroid, and 43 (7.2%) hyperthyroid.

Prevalence of Hypertension

Overall prevalence of hypertension was 30.5% (n=183). Stratified by thyroid status:

- Hypothyroid: 48.6% (n=80)
- Hyperthyroid: 38.4% (n=17)
- Euthyroid: 21.9% (n=86)

Table 1: Prevalence of Hypertension by Thyroid Status

Thyroid Status	Total (n)	Hypertension (n, %)	Mean SBP (mmHg ± SD)	Mean DBP (mmHg ± SD)
Hypothyroid	165	80 (48.6%)	136.2 ± 12.7	89.1 ± 9.4
Hyperthyroid	43	17 (38.4%)	132.1 ± 11.9	86.8 ± 8.7
Euthyroid	392	86 (21.9%)	124.8 ± 10.2	82.6 ± 7.9

$p < 0.001$ across groups (ANOVA)

Risk Factor Analysis: BMI, physical activity level, smoking status, and lipid profiles differed significantly between hypertensive and normotensive individuals.

Table 2: Risk Factors Among Hypertensive vs. Normotensive Individuals

Variable	Hypertensive (n=183)	Normotensive (n=417)	p-value
Mean BMI (kg/m²)	28.9 ± 3.6	24.5 ± 2.9	<0.001
Smoking (%)	41.5%	22.3%	0.002
Sedentary lifestyle (%)	53.0%	28.7%	<0.001
Dyslipidemia (%)	62.8%	31.4%	<0.001

Multivariate Logistic Regression

After adjusting for confounders, the following variables were independently associated with hypertension:

- Hypothyroidism: OR = 2.84 (95% CI: 1.92–4.21), $p < 0.001$
- Obesity (BMI ≥ 27): OR = 3.17 (95% CI: 2.21–4.55), $p < 0.001$
- Sedentary lifestyle: OR = 2.48 (95% CI: 1.64–3.72), $p = 0.001$
- Dyslipidemia: OR = 2.33 (95% CI: 1.58–3.44), $p < 0.001$

DISCUSSION

Our study found a significantly higher prevalence of hypertension in individuals with thyroid dysfunction, particularly among those with hypothyroidism. These results support earlier findings that thyroid hormone imbalance—especially a deficiency—can lead to increased vascular resistance and impaired endothelial function, both of which contribute to elevated blood pressure.[7]

Previous studies have reported similar trends. For instance, a population-based study by Rodondi et al. demonstrated that subclinical hypothyroidism was independently associated with hypertension and increased risk of coronary artery disease.[8] Similarly, Iqbal et al. found that hypothyroid patients had significantly higher systolic and diastolic blood pressures than euthyroid controls.[9]

Mechanistically, hypothyroidism leads to decreased nitric oxide production, increased arterial stiffness, and dyslipidemia—all contributing to increased cardiovascular load.[10] Hyperthyroidism, although less frequently associated with hypertension, still showed an elevated systolic pressure in our cohort, possibly due to heightened sympathetic activity and cardiac output.[11]

The independent risk factors identified—obesity, sedentary lifestyle, and dyslipidemia—align with current understanding of metabolic syndrome and its impact on both thyroid and cardiovascular health.[12] These modifiable risk factors suggest potential targets for preventive strategies.

Strengths: This study used standardized BP and thyroid testing, a large sample size, and robust statistical analyses to draw associations between thyroid status and hypertension.

Limitations: Cross-sectional design limits causal inference. Additionally, thyroid antibody testing was not performed, which could have differentiated autoimmune causes. Longitudinal studies are needed to assess the progression from thyroid dysfunction to hypertension over time.

CONCLUSION

This study demonstrates a strong association between thyroid dysfunction—especially hypothyroidism—and the prevalence of hypertension. Lifestyle factors such as obesity, physical inactivity, and dyslipidemia further compound this risk. Routine screening for thyroid dysfunction in hypertensive patients and vice versa may facilitate early intervention and improve cardiovascular outcomes.

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