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RESEARCH ARTICLE

ASSESSMENT OF CARDIOVASCULAR RISK IN CASES OF HYPOTHYROIDISM: A HOSPITAL-BASED OBSERVATIONAL STUDY

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Key words:-
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Abstract

Background: Hypothyroidism is among the most prevalent endocrine diseases, associated with metabolic and cardiovascular alterations including dyslipidemia, endothelial dysfunction, hypertension, and insulin resistance. Subclinical hypothyroidism (SCH), although often asymptomatic, has significant effects on cardiovascular health. Early identification of these cardiovascular risks is vital for the prevention of adverse cardiac events.

Aim and Objectives: This study aimed to assess cardiovascular risk in patients with hypothyroidism by evaluating lipid profiles, thyroid function, blood pressure, cardiac status, and cardiovascular risk.

Methodology: A hospital-based observational study was conducted on 60 adult patients diagnosed with hypothyroidism. Patients underwent detailed clinical evaluation, thyroid function tests, autoimmune thyroid markers (anti-TPO and anti-Tg), lipid profile assessment, inflammatory markers (CRP), blood pressure measurement, electrocardiography (ECG), echocardiography, and thyroid ultrasonography. Cardiovascular risk was estimated using the Framingham Risk Score.

Results: The mean age of the patients was 51.18 years, with a marked female predominance (78.33%). Central obesity and overweight status were highly prevalent, with 95% of patients having a waist-to-hip ratio (WHR) between 0.8 and 1.2, and 100% of participants classified as overweight or obese. Dyslipidemia was common; the majority showed elevated total cholesterol and low-density lipoprotein (LDL) levels. According to the Framingham Risk Score, 65% of patients exhibited low to intermediate cardiovascular risk, while 35% demonstrated moderate to high risk. A highly significant association ($p < 0.0001$) was observed between an altered thyroid profile and higher Framingham risk scores.

Conclusion: Hypothyroidism, including subclinical variants, is not a benign condition and correlates with significant cardiovascular risk factors. Early screening, regular cardiovascular risk assessment, and timely interventions are essential to prevent the progression of overt cardiovascular disease.

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Introduction:-

An estimated 42 million people in India suffer from thyroid abnormalities, making it one of the most prevalent endocrine diseases worldwide. Hypothyroidism is the most common thyroid condition in India, affecting one in ten adults (11%), a stark contrast to the 2% to 4.6% prevalence reported in Western populations. The prevalence of subclinical hypothyroidism is estimated to be between 4 and 15% globally. Hypothyroidism is characterized by a deficiency of thyroid hormones, typically caused by insufficient hormone production or impaired thyroid hormone action in target tissues. This condition triggers multiple metabolic and cardiovascular alterations, including dyslipidemia, endothelial dysfunction, hypertension, and insulin resistance, all of which progressively contribute to an increased cardiovascular risk. Even subclinical hypothyroidism (SCH), where patients often remain asymptomatic, is increasingly recognized as an independent risk factor for established cardiovascular disease (CVD) components. Given the growing prevalence of this disorder, early identification of cardiovascular risk in hypothyroid patients is critical for the prevention of adverse cardiac events. This hospital-based observational study was undertaken to evaluate the clinical, biochemical, metabolic, and cardiovascular profiles of patients with hypothyroidism, specifically utilizing the Framingham Risk Score to assess their associated cardiovascular risk.

Materials and Methods:-

Study Design and Setting: A hospital-based observational study was conducted over an 18-month period (12 months of data collection and 6 months of data compilation) in the Department of General Medicine at Muzaffarnagar Medical College, Muzaffarnagar, U.P. Ethical approval was obtained from the Institutional Ethics Committee, and informed written consent was taken from all participants.

Study Population and Sampling: A total of 60 adult patients (aged ≥ 18 years) diagnosed with hypothyroidism attending the outpatient and inpatient departments were enrolled using a purposive sampling technique. Patients with pregnancy, known endocrine disorders, women receiving oral contraceptive pills, patients with significant comorbid conditions (Diabetes mellitus, heart diseases, hypertension, psychiatric disorders), malignancies on chemotherapy/radiotherapy, or those taking medications known to interfere with thyroid function (diuretics, proton pump inhibitors, etc.) were excluded from the study.

Study Procedure and Investigations: Detailed demographic information, clinical history, and symptoms were recorded. Anthropometric measurements including Body Mass Index (BMI) and Waist-to-Hip Ratio (WHR) were calculated. Fasting venous blood samples were collected under aseptic precautions following an 8–10 hour overnight fast. Biochemical assessments included a complete blood count, fasting and post-prandial plasma glucose, HbA1c, complete lipid profile (Total Cholesterol [TC], LDL, HDL, VLDL), renal and liver function tests, and inflammatory markers (high sensitivity C-Reactive Protein [CRP]). Thyroid function was evaluated via Thyroid Stimulating Hormone (TSH), free tri-iodothyronine (fT3), and free thyroxine (fT4). Autoimmune parameters included Anti-Thyroid Peroxidase (Anti-TPO) and Anti-Thyroglobulin (Anti-Tg) antibodies. Insulin resistance was assessed using the Homeostatic Model Assessment for Insulin Resistance (HOMA-IR).

Cardiovascular and radiological assessments included resting 12-lead electrocardiography (ECG), transthoracic two-dimensional echocardiography (to assess left ventricular hypertrophy, ejection fraction, and diastolic dysfunction), and thyroid ultrasonography (USG). Cardiovascular risk was formally estimated using the 10-year Framingham Risk Score, combining age, gender, TC, HDL, systolic blood pressure, and smoking status.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using SPSS version 30. Continuous variables were summarized as mean ± standard deviation (SD), and categorical variables as frequencies and percentages. The Chi-square test of independence (or Fisher's Exact test where cell counts were <5) was applied to evaluate associations between categorical variables. A p value <0.05 was considered statistically significant, and <0.001 as highly statistically significant.

Results:-

The study group comprised 60 patients with an overall mean age of 51.18 years. The demographic profile indicated a marked female preponderance, with females accounting for 78.33% of the study population compared to 21.67% males.

Table 1: Distribution of patients according to Age and Gender (N=60)

Parameter	Category	No. of cases	Percentage (%)
Age Group (Years)	30-40	07	11.67%
	40-50	19	31.67%
	50-60	21	35.00%
	60-70	13	21.66%
Gender	Male	13	21.67%
	Female	47	78.33%

Regarding anthropometric distribution, 75% of patients were classified as overweight (BMI 25.0 - 29.9 kg/m²) and 25% were obese (BMI 30.0 - 34.9 kg/m²). Additionally, 95% of patients exhibited central obesity, documented by a Waist-to-Hip Ratio (WHR) between 0.8 and 1.2. The most frequently reported clinical complaints were fatigue (18.33%), palpitations (13.33%), and hair fall (13.33%). Furthermore, a positive family history of hypothyroidism was observed in 61.67% of cases, highlighting strong familial clustering.

Table 2: Distribution of patients according to Lipid Profile (N=60)

Lipid Parameter	Range (mg/dL)	No. of cases	Percentage (%)
Total Cholesterol (TC)	160-180	07	11.67%
	180-200	17	28.33%
	200-220	12	20.00%
	220-240	21	35.00%
	240-260	03	5.00%
LDL Cholesterol	100-120	18	30.00%

Lipid Parameter	Range (mg/dL)	No. of cases	Percentage (%)
Total Cholesterol (TC)	160-180	07	11.67%
	180-200	17	28.33%
	200-220	12	20.00%
	220-240	21	35.00%
	120-140	19	31.67%
	140-160	16	26.67%
	160-180	07	11.66%
HDL Cholesterol	30-35	13	21.67%
	35-40	17	28.33%
	40-45	20	33.33%
	45-50	10	16.67%

The lipid profile demonstrated an atherogenic pattern. Total cholesterol was ≥200 mg/dL in 60% of the patients. LDL cholesterol was primarily clustered in the intermediate-to-high ranges (120-160 mg/dL), while HDL cholesterol levels were predominantly in the lower limits (30-45 mg/dL). Assessment of blood pressure revealed pre-hypertensive to hypertensive states among the participants. 81.67% of patients had a systolic blood pressure between 130 and 150 mmHg, while 56.66% presented with a diastolic blood pressure between 90 and 110 mmHg. High-sensitivity C-reactive protein (hs-CRP) analysis showed that 40% of the sample displayed moderate to high inflammatory levels (CRP >6 mg/L).

Cardiovascular status evaluation using ECG showed that only 41.67% of the cohort possessed a normal trace. Ischemic changes were noted in 20%, left ventricular (LV) strain in 11.67%, and left ventricular hypertrophy (LVH) in 10% of cases. Echocardiographic evaluation corroborated these findings, indicating normal cardiac structure in just 35% of the subjects. Structural abnormalities such as LVH (20%), mild LVH (11.67%), and diastolic dysfunction (3.33%) were highly prevalent.

Table 3: Distribution of participants according to Framingham Risk Score (N=60)

Framingham risk score	Number of cases	Percentage (%)
0-10 (Low Risk)	19	31.67%
10-20 (Intermediate Risk)	20	33.33%
20-30 (Moderate-High Risk)	17	28.33%
30-40 (High Risk)	04	6.67%

The application of the Framingham Risk Score quantified the 10-year risk of cardiovascular disease. The cumulative data showed that while 65% of patients had low to intermediate risk (score 0-20), a critical 35% of patients fell into the moderate-to-high risk category (score 20-40). Crucially, a highly significant association ($p < 0.0001$) was documented between worsening thyroid parameters and escalating Framingham risk bands. Mid-to-high TSH levels (10-40 mIU/L), low fT4 levels (<5 µg/dL), and high autoimmune antibody titers (Anti-TPO 150-200 IU/mL; Anti-Tg 60-80 IU/mL) were strongly correlated with higher cardiovascular risk categorizations.

Discussion:-

This study successfully mapped the multidimensional clinical, metabolic, and cardiovascular impacts of hypothyroidism. The demographic layout of the present cohort—characterized by a mean age of 51.18 years and a significant female preponderance (78.33%)—is consistent with established epidemiological features of autoimmune and chronic thyroid disorders. Selvamuthukumaran et al. reported a parallel trend where 64% of their hypothyroid sample fell in the middle-aged bracket and 78% were female. Similarly, Dey et al. recorded an 80% female cohort in their study of subclinical hypothyroidism.

The anthropometric analysis demonstrated a marked burden in this population: 100% of participants were either overweight or obese, with an exceptionally high rate (95%) of central obesity determined via WHR. While previous studies, such as KC R et al. documented a lower average BMI (21.9 kg/m²) in their subjects, our current cohort's striking obesity rates echo findings by Shafeek et al., who noted a strong positive correlation between elevated TSH levels, anti-TPO positivity, and increased BMI and waist circumference. This anthropometric profile likely contributes to increased long-term cardiovascular risk.

Dyslipidemia emerged as a defining feature of the thyroid-impaired state in our subjects. The high frequency of elevated total cholesterol (≥200 mg/dL in 60%), elevated LDL, and reduced HDL cholesterol directly maps onto the well-described suppression of LDL-receptor expression resulting from thyroid hormone deficit. These results are consistent with Selvamuthukumaran et al. who observed significantly elevated total cholesterol and triglycerides in hypothyroid patients. Kumar A et al. correspondingly found 41% higher total cholesterol in hypothyroid groups compared to euthyroid controls.

Hemodynamically, a high prevalence of elevated blood pressure was observed. The concentration of systolic blood pressure between 130–150 mmHg alongside elevated diastolic pressure strongly reflects the systemic vascular resistance commonly induced by a hypothyroid state. This corroborates data from KC et al., who recorded significantly higher diastolic blood pressure in hypothyroidism cohorts, and Shafeek et al., who verified parallel hypertensive shifts in their patient population. This chronic hypertensive state translates into physical cardiac remodeling; evidenced in our study by the 58.33% of patients displaying abnormal ECGs (including ischemic changes and LV strain) and the 65% presenting structural alterations on echocardiography (predominantly LVH).

Such findings closely mirror Selvamuthukumaran et al., who identified compromised cardiac function indicators via ECG and ECHO in nearly half of their overt hypothyroid sample.

By aggregating these risk factors through the Framingham Risk Score, we captured the definitive clinical trajectory of these patients. Thirty-five percent (35%) of participants were classified into the moderate-to-high risk bracket for a cardiovascular event within 10 years. The direct, highly statistically significant linkage ($p < 0.0001$) between deteriorating functional markers (such as high TSH and high autoimmune antibody titers) and heightened Framingham scores supports the premise that autoimmune thyroid failure acts as an aggressive, systemic driver of athero-cardiovascular disease.

Conclusion:-

The findings of this hospital-based observational study suggest that hypothyroidism is not a benign, isolated endocrine derangement. It is associated with a complex cascade of cardiovascular risk factors including central obesity, atherogenic dyslipidemia, systemic inflammation, and pre-hypertensive hemodynamic stress. These physiological disruptions are associated with objective structural cardiac changes—such as left ventricular hypertrophy and ischemic patterns—which consequentially propel patients into higher Framingham cardiovascular risk tiers. A highly significant correlation exists between the severity of the biochemical thyroid deficit (alongside high autoimmune titers) and long-term cardiovascular jeopardy. Therefore, routine and rigorous cardiovascular risk assessment should be considered for any patient diagnosed with hypothyroidism. A multidisciplinary clinical approach must be adopted, focusing simultaneously on restoring thyroid function and aggressively managing modifiable metabolic risk factors to curb long-term cardiovascular morbidity and mortality.

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