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Comparative Analysis of Hypothyroid and Euthyroid Condition in Coronary Artery Disease Patients Undergoing Percutaneous Coronary Intervention

Dr. Gokila Shanmuganathan *[1], K. Jayapriya[2], K. Madhumitha[3], Dr. Senthil Kumaran MD[4], S. Pushparaj[5]
MMM College of Health Sciences
Email: gokila83@gmail.com

***Abstract*— *Background**: Thyroid dysfunction is an important modifier of cardiovascular health. It is known to affect lipid metabolism, endothelial dysfunction and atherosclerotic progression, its influence on outcomes in patients undergoing PCI, needs to be explored. **Aim and Objectives:** To compare the demographic and laboratory profiles in euthyroid and hypothyroid patients undergoing PCI. To evaluate the potential influence of thyroid function status on cardiovascular risk factors. **Method**: Patients with coronary artery disease undergoing percutaneous coronary intervention with hypothyroidism were selected for the study and were grouped into two categories: Group 1 (Euthyroid) and Group 2 (Hypothyroid). Various parameters like baseline and clinical characteristics, lab investigations were studied and noted. **Result**: Among 344 CAD patients, it was found that 91.56% were euthyroid patients and 8.43% of them were hypothyroid patients. Abnormalities were seen in lipid parameters. **Conclusion**: The patients with hypothyroidism may have abnormal parametric values that have an adverse effect on outcome compared to euthyroid patients. Early detection of hypothyroidism may optimize PCI outcomes.*

Keywords— *Percutaneous coronary intervention, Hypothyroid, Euthyroid, Coronary Artery Disease.*

I. INTRODUCTION

Thyroid hormones play an important role in the normal function of heart and vascular physiology, and hypothyroidism produces profound cardiovascular effects. Hypothyroidism is a common condition characterized by insufficient thyroid hormone production, leading to a low metabolic state and various systemic effects. It is associated with an increased risk of coronary artery disease (CAD), primarily due to its role in promoting atherosclerosis, endothelial dysfunction, and adverse changes in blood pressure and lipid profiles[1]. Coronary heart disease (CHD), sometimes referred to as CAD, is brought on by the accumulation of plaque in the arteries that deliver oxygenated blood to the heart. Over time, calcium deposits, cholesterol, and fat can combine to form plaque in the arteries. Over time, this plaque can cause the narrowing and hardening of the coronary arteries, a condition called atherosclerosis[2]. A non-surgical procedure known as Percutaneous Coronary Intervention (PCI) uses a catheter, a thin flexible tube, to place a small structure known as a stent to open up blood vessels in the heart that have narrowed due to plaque buildup, a condition known as atherosclerosis[3]. A study was conducted to investigate whether the presence of hypothyroidism is associated with severe and diffuse coronary artery disease following PCI and in addition, about the parameters difference between hypothyroid and euthyroid patients[4,5].

II. METHODOLOGY

This study focuses on the causes of CAD severity among hypothyroid patients. And also to compare the various parameters of CAD patients undergoing PCI procedures in hypothyroid and euthyroid conditions. The prospective observational study was conducted. Categorized patients into 2 groups according to CAD with and without hypothyroid based on free T_3 for adult normal range from 3.2-6.8 Pmol/L & free T_4 for adult normal range from 10.3-34.7 Pmol/L, TSH normal range is from 0.4-4.2mlu/L between 21-54 years and from 0.5-8.9 mlu/L between 55-87 years. All patients underwent thyroid function tests: free T_3 T_4 & TSH. The inclusion criteria such as hypothyroidism, CAD patients undergoing PCI and patients age greater than 18 were included. The CAD with euthyroid controls were compared with hypothyroidism. The exclusion criteria excludes hyperthyroidism, other endocrine disorders, prior CABG, active malignancy and severe hepatic/renal dysfunction. Patients who matched the inclusion and exclusion criteria were selected randomly during period of approximately 3 months formed the study group. Incomplete data at the baseline were excluded from the analysis.

Group 1 (Euthyroid): Cases presenting with CAD but non-hypothyroid.

Group 2 (Hypothyroid): Previous known hypothyroid or first time detected hypothyroid presenting with CAD.

The total number of patients included in the study were 344. The assessment of various parameters like patient history, demographic and clinical characteristics, and lab investigations (cardiac markers, lipid profile, other parameters) were done. The continuous variables are presented as mean and standard deviation. Applying two sample t-test to find out whether the parameters significantly influence the severity and outcome of coronary artery disease. P-values of <0.05 were accepted as significant.

III. RESULT

Prevalence of Hypothyroidism:

It was found that among 344 patients, 29 patients were

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found to be hypothyroid patients (Group 2) and remaining 315 patients (Group 1) were found to be euthyroid patients. The demographic characteristics of the study population and result are shown in Table 1. Among age (58.337±10.167 vs 54.896±10.469, p = 0.0418), height (163.07±8.0 vs 163.82±7.29, p = 0.3557), weight (69.59±10.96 vs 67.53±7.98, p = 0.2266) and BMI (26.242±4.016 vs 25.1±1.955, p = 0.123), age was found to be significant. The study also showed male predominance (282 out of 344) in both euthyroid and hypothyroid group, than females (62 out of 344). But 27.5 % of the female had hypothyroidism.17 % of the female was found to be euthyroid.

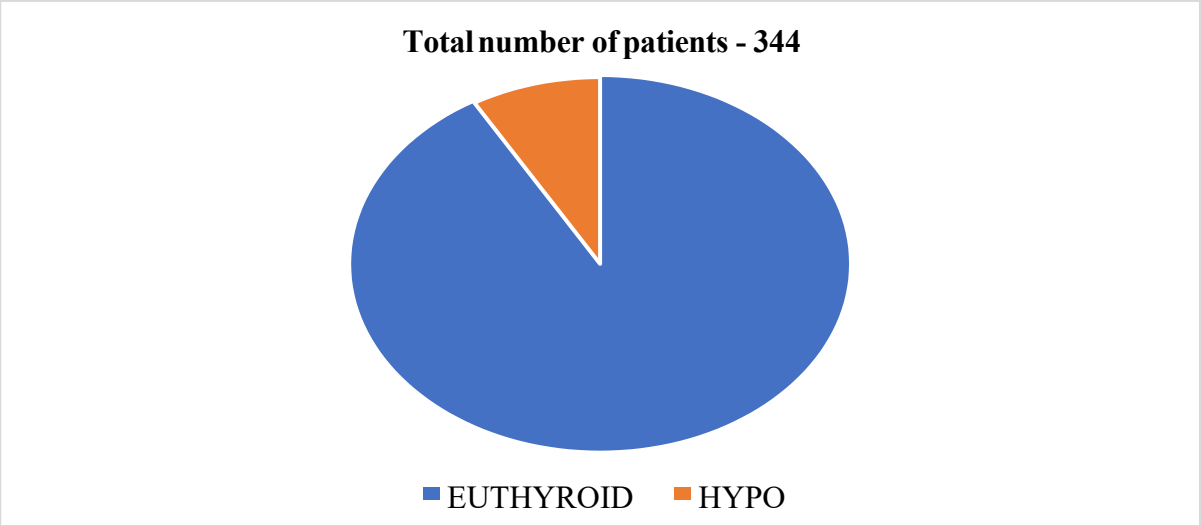

Figure 1. Shows that among 344 CAD patients it was found that 91.56% of them were euthyroid patients, 8.43% of them were hypothyroid patients who have undergone PCI.

TABLE 1: Demographic Characteristics

VARIABLES	Group 1 (n=315)	Group 2 (n=29)	p VALUE
Age	58.337±10.167	54.896±10.469	**0.0418**
Sex	260(M),54(F)	21(M),8(F)	**0.042**
Height(cm)	163.07±8.00	163.82±7.29	0.3557
Weight(kg)	69.59±10.96	67.53±7.98	0.2266
BMI(kg/m²)	26.242±4.016	25.1±1.955	0.123

TABLE 2: Clinical Parameters

VARIABLES	GROUP1 (n=315)	GROUP 2 (n=29)	p VALUE
Heart Rate (BPM)	79.76±12.61	78.72±13.55	0.3372
Systolic BP (mmHg)	135.81±22.54	137.17±17.94	0.3783
Diastolic BP(mmHg)	77.18±10.801	77.96±13.94	0.3594
Mean Blood Pressure (mmHg)	99.96±15.21	103.07±12.85	0.1587

TABLE 3: Laboratory Investigations

VARIABLES	GROUP1 (n=315)	GROUP 2 (n=29)	p VALUE
CK NAC(IU/L)	80.05±37.16	61.75±25.07	0.1711
CKMB(ng/ ml)	1.53±0.86	1.34±0.97	0.3409
Troponin(ng/ ml)	0.14±0.13	0.19±0.13	0.1736
Free T_3(Pmol/ L)	4.34±1.11	4.401±1.03	0.3936
Free T_4(Pmol/ L)	15.35±4.28	12.78±3.56	**0.0011**
TSH(mIu/ L)	2.52±1.804	12.16±8.01	**0.0001**
TGL(mg/ dl)	157.43±75.31	204.85±108.34	**0.0166**
TC(mg/ dl)	161.41±46.87	207.15±51.42	**0.0001**
HDL(mg/ dl)	37.51±10.74	41.42±12.49	0.102
LDL(mg/ dl)	109.13±41.61	142.28±45.26	**0.0026**
Hb mg(g/ dl)	13.25±2.17	13.01±1.72	0.2843
Platelets(lak/Cmm)	2.91±2.05	3.09±0.97	0.3228
Urea(mg / dl)	27.68±14.14	24.25±6.13	0.1038
Creatinine(mg / dl)	0.89±0.51	0.82±0.32	0.2358

Table 2 summarize on the clinical parameters of the study population like heart rate and blood pressure which was not significant. Laboratory investigations are summarized in Table 3. On study about thyroid profile, free T_4 (15.35±4.28 vs 12.78±3.56, p= 0.0011) and TSH (2.52±1.804 vs 12.16±8.01, p= 0.0001) were found to be significant. Higher TGL(157.43±75.31 vs 204.85±108.34, p= 0.0166) TC-(161.41±46.87 vs 207.15±51.42, p = 0.0001) and LDL (109.13±41.61vs 142.28±45.26, p= 0.0026) were observed in Group 2 with clinical significance.

IV. Discussion

In the present study we compared demographic and biochemical parameters between euthyroid and hypothyroid patients undergoing PCI for CAD. Notable difference was observed in the age distribution among patients. The present study revealed that comparing both groups female preponderance exist in hypothyroid cohort. Fen- Yu Tseng, et al. (2012) [6] found that female sex increases the prevalence of SCH. Additionally age and sex differences highlight the importance of considering thyroid screening as part of routine cardiovascular risk assessment, particularly women with CAD. From our findings, baseline characteristics BMI was not significant and thus height and weight have no impact in the study population. In contrast Fen-Yu Tseng et al. (2012) found that patients with SCH had higher BMIs and increased frequency of hyperlipidemia compared with euthyroid subjects. From our data, diastolic blood pressure was not statistically significant. Nicolas Rodondi, et al. (2008) [10], said that measurement of diastolic function associated with heart failure was greater in the patients with TSH compared with euthyroid participants. The basic clinical parameters like heart rate, systolic BP, diastolic BP and mean blood pressure had no effect

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on outcomes in hypothyroid patients.

By definition, hypothyroid group had significantly higher T_3 levels compared to euthyroid group. Beyond diagnostic categorization, these biochemical patterns had pathological implications. Hypothyroidism was associated with reduced cardiac output, impaired endothelial function and altered lipid metabolism, all of which may exacerbate CAD and influence PCI outcomes. The current study, analysed that the levels of total cholesterol and LDL-cholesterol are statistically significant. Rodrigo Diaz-Olmos et al. (2010) [11], demonstrated that the serum levels of total cholesterol and LDL-cholesterol are significantly higher in patients with subclinical hypothyroidism than in euthyroid patients. Significantly higher level of triglycerides, total cholesterol and LDL were found. These finding are consistent with prior studies suggesting that thyroid hormone deficiency slows LDL receptor activity and reduces lipid clearance, leading to pro-atherogenic lipid profile. Elevated triglycerides and LDL are known contributors to plaque instability and restenosis suggesting a potential higher cardiovascular risk burden in hypothyroid individuals. These demographic and laboratory patterns may contribute to differential risk profiles and responses to PCI.

V. CONCLUSION

Hypothyroidism is a commonly encountered clinical condition with variable prevalence. It significantly influenced cardiac function, which can affect contractility, vascular resistance, blood pressure, and rhythm. Hypothyroid patients were generally older and more likely to be females, consistent with known epidemiological trends. Thyroid function influences many cardiovascular risk parameters. Hypothyroid patients have worse metabolic profiles. They also exhibited a markedly altered lipid profiles. The dyslipidemia observed in hypothyroid patients suggests a need for more aggressive lipid lowering therapy and closer monitoring in this subgroup, even post-PCI. In summary, the various parameters are studied in CAD patients and it shows the peculiarity leads which may worser PCI outcomes. The study concluded that CAD patients with hypothyroid having several abnormalities which may impact outcomes than euthyroid patients. Thus, hypothyroidism had been found as a predictor of cardiovascular diseases. Additionally, it is better to diagnose thyroid profile in CAD patients before PCI and follow the medications if found so as to reduce poor outcomes. Furthermore prospective studies are needed to explore whether optimizing thyroid function and lipid levels prior to PCI could improve procedural outcomes and long-term cardiovascular prognosis in this high risk population.

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