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A SINGLE CENTRE RETROSPECTIVE COHORT STUDY OF AMBULATORY HEART FAILURE PATIENTS WITH THYROID DYSFUNCTION FROM A TERTIARY HOSPITAL IN NORTHEAST INDIA

Cardiology

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ABSTRACT

Objectives: Thyroid dysfunction adversely affects myocardial contractility & relaxation, heart rate & cardiac output, which may finally lead to heart failure (HF). The purpose of the study was to determine the prevalence and type of thyroid dysfunction in ambulatory HF patients. **Methods:** Medical records of 138 patients diagnosed with HF based on Framingham's criteria enrolled at the cardiology outpatient department of our hospital were evaluated retrospectively. Demographic, risk factor, clinical and echocardiographic profiles of the patients were statistically analyzed according to their thyroid status. Patients were grouped into subclinical hypothyroidism, hypothyroidism, low T3 syndrome, subclinical hyperthyroidism, and hyperthyroidism. **Results:** The mean age of the patients was 64.7 ± 12.4 yrs. Male/female ratio was 2.1:1. Thyroid dysfunction was found in 39 % (n = 54) of the patients and 61 % (n = 84) patients had normal thyroid function. Most common type of thyroid dysfunction was low T3 syndrome which was found in 18.8 % (n = 26) patients; followed by subclinical hypothyroidism in 10.9 % (n = 15), hypothyroidism in 5.1 % (n = 7), subclinical hyperthyroidism in 2.1 % (n = 3), hyperthyroidism in 2.1 % (n = 3). Majority of patients (81.8 %, n = 113) were in NYHA class I & II. Hypertension was the predominant risk factor in both groups of patients with or without thyroid dysfunction (46.3 %; n = 25 and 42.8 %; n = 36). There was a high prevalence of HFrEF (72.2 %; n = 39) in patients with thyroid disorders compared to those with euthyroidism (34.5 %; n = 29). **Conclusion:** Significant number of ambulatory HF patients has thyroid dysfunction. Early detection and treatment of thyroid dysfunction in HF patients will slow the progression of HF and improve the prognosis.

KEYWORDS

Ambulatory, heart failure, thyroid dysfunction.

INTRODUCTION

Heart failure (HF) is a clinical syndrome that impairs the ability of the ventricle to fill or pump blood. It is a major cause of morbidity and mortality across the globe [1, 2]. In India, HF accounts for about 1 % of the population [3]. Thyroid hormones play an important role in regulating various cardiovascular events. Thyroid dysfunction: both hypothyroidism and hyperthyroidism have been associated with adverse changes in cardiac structure and function ultimately leading to HF [4, 5]. Subclinical thyroid dysfunction has recently been associated with the development of HF in patients with and without underlying heart disease [6]. So, thyroid dysfunction is a preventable risk factor in patients at risk of HF [7]. There are a few cohort studies in literature that have investigated the association of thyroid dysfunction and HF [8]. However, there is scarcity of such studies from Northeast India. The purpose of the study was to determine the type and prevalence of thyroid dysfunction in ambulatory HF patients.

METHODS

This study was conducted retrospectively in a superspeciality tertiary care hospital in Guwahati, Assam, India. From January 2020 to December 2021, a total of 204 ambulatory HF patients based on Framingham's criteria were enrolled at the cardiology department of our hospital [9]. Out of these, 138 patients who consented for study were selected. This included both male and female patients who were ≥ 21 yrs of age and with no missing medical records. Patients with congenital and structural heart disease, on amiodarone therapy and pregnant patients were excluded from the study. Patient information was retrieved from the medical records department (MRD) of the hospital. Chemiluminometric assay was used to measure triiodothyronine (T3), thyroxine (T4) and thyroid stimulating hormone (TSH) levels using the Liaison test kits. The thyroid function test was categorized as: normal thyroid function or euthyroidism (TSH 0.34-5.60 µlU/ml, T3 0.81-1.78 ng/ml, & T4 4.5-12.5 µg/dl) and thyroid dysfunction that included hypothyroidism (T4 < 4.5 µg/dl and TSH > 5.60 µlU/ml), subclinical hypothyroidism (normal T3 and T4 levels and TSH > 5.60 µlU/ml), hyperthyroidism (T4 > 12.5 µg/dl and TSH < 0.34 µlU/ml), subclinical hyperthyroidism (normal T3 and T4 levels and TSH < 0.34 µlU/ml), and low T3 syndrome (normal T4 and TSH levels and T3 < 0.81 ng/ml. HF was categorized based on left ventricle ejection fraction (LVEF) into HF with reduced ejection fraction (HFrEF) when LVEF ≤ 40 %, HF with mid-range ejection fraction (HFmrEF) when LVEF was between 41-49 % and HF with preserved ejection fraction (HFpEF) when LVEF ≥ 50 %. The results were expressed as mean ± standard deviation (SD) for continuous data and frequencies (percentages) for categorical data.

RESULTS

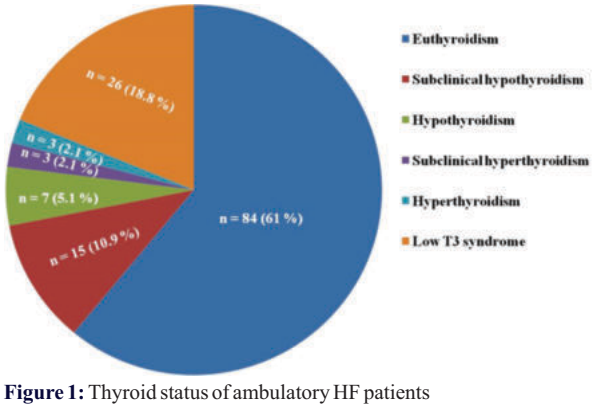

Figure 1: Thyroid status of ambulatory HF patients

The study included 94 males and 44 females with a male/female ratio of 2.1:1. Mean age of the overall cohort was 64.7 ± 12.4 yrs. Thyroid dysfunction was found in 39% (n = 54) patients and 61 % (n = 84)

patients had normal thyroid function. Among the patient with thyroid dysfunction 43 % (n = 23) were male and 57 % (n = 31) were female. Majority of patient (73.4%; n = 40) with thyroid dysfunction were above 60 yrs of age. Most common type of thyroid dysfunction was low T3 syndrome which was found in 18.8 % (n = 26) patients; followed by subclinical hypothyroidism in 10.9 % (n = 15), hypothyroidism in 5.1 % (n = 7), hyperthyroidism in 2.1 % (n = 3), and subclinical hyperthyroidism in 2.1 % (n = 3). Thyroid status of the patients with HF is shown in figure 1.

Maximum number of HF patients with euthyroidism belonged to age groups 60-69 yrs, majority of subclinical hypothyroidism patients represented age groups 60-79 yrs, patients with hypothyroidism and subclinical hyperthyroidism consisted of age groups 70-79 yrs, hyperthyroidism patients belonged to age group 60-69 yrs, and majority of low T3 syndrome patients represented 70-79 yrs of age group. Table 1 depicts distribution of HF patients based on age and thyroid status. Hypertension was the predominant risk factor in both groups of patients with or without thyroid dysfunction (46.3 %; n = 25 and 42.8 %; n = 36). 38.4 % (n = 53) of patients had coronary artery disease and 18.1 % (n = 25) had dilated cardiomyopathy. Majority of patients (81.8 %, n = 113) were in NYHA class I & II.

Table 1: Age Wise Distribution Of Ambulatory HF Patients According To Their Thyroid Status

Age (yrs)	Euthy-roidism n (%)	Subclinical hypothy-roidism n (%)	Hypothy-roidism n (%)	Subclinical hyperthy-roidism n (%)	Hyperthy-roidism n (%)	Low T3 syndrome n (%)
30-39	2 (2.3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
40-49	12 (14.3)	1 (6.7)	0 (0)	0 (0)	0 (0)	2 (7.7)
50-59	26 (31)	2 (13.3)	0 (0)	0 (0)	1 (25)	4 (15.4)
60-69	32 (38.1)	6 (40)	2 (28.6)	0 (0)	2 (75)	5 (19.2)
70-79	7 (8.3)	6 (40)	4 (57.1)	3 (100)	0 (0)	13 (50)
80+	5 (6)	0 (0)	1 (14.3)	0 (0)	0 (0)	2 (7.7)
Total (N)	84	15	7	3	3	26

Table 2 demonstrated echocardiography profile of the ambulatory HF patients based on their thyroid status. There is a high prevalence of HFrEF (72.2 %; n = 39) in patients with thyroid disorders compared to those with euthyroidism (34.5 %; n = 29). However, 65.5 % (n = 55) patients with euthyroidism and 27.7 % (n = 15) patients with thyroid disorders had HFmrEF and HFpEF. Lower T3 levels were found in HF with EF < 40% versus EF > 50% (2.6 ± 2.16 vs. 5.4 ± 1.23 ng/ml).

Table 2: Echocardiography Profile Of Ambulatory HF Patients According To Their Thyroid Status

	Euthy-roidism	Subclinical hypothy-roidism	Hypothy-roidism	Subclinical hyperthy-roidism	Hyperthy-roidism	Low T3 syndrome
HFrEF, n (%)	29 (34.5)	14 (93.3)	4 (57.1)	1 (33.3)	3 (100)	17 (65.4)
HFmrEF, n (%)	36 (42.9)	0 (0)	2 (28.6)	0 (0)	0 (0)	7 (26.9)
HFpEF, n (%)	19 (22.6)	1 (6.7)	1 (14.3)	2 (66.7)	0 (0)	2 (7.7)

DISCUSSION

Thyroid hormones regulate diverse cardiovascular functions. Increase or decrease in the thyroid levels can lead to multiple cardiac abnormalities including HF with a severity depending on the degree and the duration of thyroid hormone dysfunction [10, 11]. The current study is the first to investigate thyroid dysfunction among the ambulatory HF patients of Northeast India.

The overall prevalence of thyroid dysfunction was 39% (n = 54) in our study. The present study revealed high prevalence of low T3 syndrome (18.8 %; n = 26) followed by subclinical hypothyroidism (10.9 %; n = 15) in patients with HF. Low levels of T3 with normal levels of TSH and T4, known as low T3 syndrome in HF has been reported by other studies also [12]. Nägele et al found a positive correlation between low T3 and LVEF in HF patients [13]. In HF, low T3 levels correlate with the severity of the disease such as NYHA class and it is also found to be an independent predictor of mortality in HF [14]. Lower T3 levels were found in HF with EF < 40% versus EF > 50% (2.6 ± 2.16 vs. 5.4 ± 1.23 ng/ml). Majority of our patients with all the thyroid dysfunction conditions had HFrEF.

Triiodothyronine (T3) is the biologically active thyroid hormone. It is derived from monodeiodination of thyroxine (T4) in peripheral tissues. T3 is needed to maintain cardiac structure and function [9]. T3 improves diastolic relaxation of heart and also promotes relaxation of the peripheral vasculature. Hypothyroidism is a reversible cause of HF. Screening of serum TSH levels is recommended for all cases of newly diagnosed HF [1]. Thyroid hormone metabolism itself is adversely affected in HF. The conversion of T4 to T3 is impaired and a low serum T3 syndrome may develop in HF [15]. In our study about 48.1 % (n = 26) thyroid disorder patients belonged to age group 70-79 yrs while 38.1 % (n = 32) euthyroidism patients belonged to 60-69 yrs age group. Our study showed hypertension as the most common associated risk factor among all thyroid conditions. This is in accordance with other studies [8, 9, 10]. Our study revealed that HFrEF (72.2 %) was highly prevalent among all the thyroid disorders similar to the study by Mohammud et al [8]. The limitations of our study include small sample size, retrospective data collection, and cross-sectional observation. Thus, our study needs to be considered as preliminary and we aim to carry out multi-centre prospective studies in future.

CONCLUSION

Our study revealed high prevalence of thyroid dysfunction among ambulatory HF patients. Thyroid function should be evaluated in all patients with HF. Since thyroid dysfunction is a reversible cause of HF, its early detection and treatment can prevent and/or retard progression of HF pathophysiology.

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