Frequency of Thyroid Dysfunction in Heart Failure Patients with Reduced Ejection Fraction

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ABSTRACT

Objective: To look for the frequency of thyroid dysfunction in heart failure patients with reduced ejection fraction at Medicine/Cardiology Department.

Study Design: Cross-sectional study.

***Place and Duration of Study*:** Combined Military Hospital Sialkot, from Nov 2019 to Apr 2020.

Methodology: The sample population comprised of patients diagnosed with the heart failure and ejection fraction of 40% at Medicine/Cardiology unit. Patients underwent thyroid functions test from the laboratory of our hospital and were diagnosed as hypothyroid, hyperthyroid or euthyroid by consultant cardiologist and medical specialist. Age, gender, body mass index and New York heart association (NYHA) class were associated with thyroid dysfunction among the study participants.

Results: Out of 110 patients with heart failure and low ejection fraction who underwent thyroid function testing during the study period, 92 (83.6%) patients were euthyroid, 14 (12.7%) had thyroid profile parameters showing hypothyroidism, while 04 (3.6%) had laboratory findings of hyperthyroidism. After chi-square, we found that patients with New York heart association class III and IV and high body mass index had a statistically significant relationship with thyroid dysfunction (p-value 0.017 and <0.001 respectively) among the patients of heart failure with low ejection fraction.

Conclusion: Thyroid dysfunction, especially hypothyroidism, emerged as a common finding among heart failure patients with low ejection fraction. Patients with New York heart association class III and IV and high body mass index should be considered high-risk and may be screened for thyroid problems if present with heart failure.

Keywords: Ejection fraction, Heart failure, Thyroid dysfunction.

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INTRODUCTION

Heart failure has been one of the frequently encountered clinical conditions seen in Medicine, Emergency, Pulmonology and Cardiac Units.[1] Statistics around the globe reveal that this condition is prevalent in all parts of the world, including Pakistan. Manifestations of heart failure may be seen in almost all the major systems of the body.[2,3] Many non-cardiac clinical conditions may be the cause or consequence of heart failure among these patients.[4] Adequate knowledge of all these conditions may equip the physicians to cater for these patients in a better way.[5]

The thyroid gland is called as powerhouse of the body and impacts the overall physiology and well-being of an individual.[6] Thyroid dysfunction may cause multiple health-related issues in several ways depending upon the type and extent of dysfunction.[7] Sometimes hypothyroidism or hyperthyroidism may have a clear clinical picture, but in some cases, the symptoms may not be that profound, but the sub-clinical picture may be related to many underlying problems.[8] Timely detection of these conditions may save the patient from grave consequences. Cardiac problems and thyroid dysfunction have a strong relationship. Heart failure is one condition which has been less studied from the point of view of its relationship with thyroid function. [9]

There is huge burden of heart failure and thyroid dysfunction patients at all the levels of hospitals across the country. Various studies have been performed to look for the epidemiological statistics for both the problems independently.[3,10] Limited data has been available regarding the coexistence of both the illness or their relationship and overall quality of life of the patient. We, therefore, planned this study with the rationale to look for the frequency of thyroid dysfunction in heart failure patients with reduced ejection fraction at the Medicine/Cardiology department of our hospital.

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METHODOLOGY

This cross-sectional study was conducted at the Medicine/Cardiology department of a Combined Military Hospital Sialkot from Nov 2019 to Apr 2020. Ethical approval for the study was obtained from the Ethical Review Board Committee (IREB letter ERC/ 03/2020). The sample size was calculated using the World Health Organization (WHO) sample size calcula-tor using a population prevalence proportion of 2.6%.[11] Non-probability consecutive sampling tech-nique was used to gather the sample.

Inclusion Criteria: The study included all the patients who presented with heart failure and the ejection fraction less than 40% on echocardiogram diagnosed by consultant cardiologist or medical specialist.

Exclusion Criteria: The patients less than 18 years or more than 65 years of age or those already diagnosed with hypothyroidism or hyperthyroidism and taking any medications for that were excluded from the study. Patients with heart failure with an ejection fraction of more than 40% were also excluded from the study. Patients on any medications that could interfere with thyroid function were not included in the study.

Study participants were provided with the detai-led description of study and were inducted into the study after written informed consent. After confirma-tion of heart failure and ejection fraction less than 40%, patients underwent thyroid profile testing from the laboratory.

5ml venous blood samples were taken from each study participant. Chemiluminescent immunoassays for TSH, FT4, total T3 (TT3) were performed using the Architect i2000SR instrument. The reference ranges for TSH, FT4 and TT3 were 0.45 to 4.5 mIU/L, 0.7 to 1.7 ng/dL and 80-159 ng/dL, respectively.[12] The standard categories of thyroid function were as follows: subclinical hyperthyroidism (TSH <0.45 mIU/ L with FT4 level within the reference range), sub-clinical hypothyroidism (TSH 4.51–19.99 mIU/L with free T4 level within the reference range) and euthyroidism (TSH 0.45–4.50 mIU/L with FT4 and TT3 level within the reference range).[13,14]

All the statistical analysis was performed using Statistics Package for Social Sciences version 23.0 (SPSS-23.0). Characteristics of participants and the distribution of the thyroid dysfunction among the study participants were described using descriptive statistics. Chi-square was used to determine between-group variances in categorical correlates and to evaluate the relationship of Body mass index and New York heart association (NYHA) with thyroid dysfunc-tion among heart failure patients. Differences between groups were considered significant if p-values were less than or equal to 0.05.

RESULTS

Out of 110 patients of heart failure with low ejection fraction who underwent thyroid function testing during the study period, 92 (83.6%) patients were euthyroid, 14 (12.7%) had thyroid profile parameters showing hypothyroidism, while 04 (3.6%) had laboratory findings of hyperthyroidism. The mean age of the patients was 51.33 ± 7.332 years. 76 (69.1%) patients were males, while 34 (30.9%) were females.

Table showed that after applying the chi-square test, NYHA class III and IV and high BMI had an association with the presence of thyroid dysfunction among heart failure patients. We found that patients with NYHA class III and IV and high BMI had a statistically significant relationship with the presence of thyroid dysfunction. In contrast, age and gender had no such association (*p*-value 0.492 and 0.591 respectively) among the heart failure patients with low ejection fractions.

Table-1: Characteristics of the study group and Thyroid dysfunction among the patients of heart failure with low ejection fraction.

Factors	Euthyroid	Thyroid dysfunctio n	*p*-value
Age			
40 year or less	51 (55.4%)	07 (38.9%)	0.0198
>40 years	41 (44.6%)	11 (61.1%)	
Gender			
Male	63 (68.4%)	13 (72.2%)	0.751
Female	29 (31.6%)	05 (27.8%)	
New York Heart Association Classification			
Class I an d II	67 (72.8%)	07 (38.8%)	0.022
III and IV	25 (27.2%)	09 (61.2%)	
Body Mass Index			
Normal	75 (81.5%)	07 (38.9%)	<0.001
Obese or over weight	17 (18.5%)	11 (61.1%)s	

DISCUSSION

Thyroid gland holds a pivotal position in main-taining the homeostasis. The cardiovascular system gets grossly affected if the thyroid gland is not func-tioning optimally. Pakistan is a country with a high prevalence of cardiac and thyroid problems.[15] There have been epidemiological studies to look for the exact figures and correlation of both the conditions.

However, little work has been done to evaluate their relationship.

Fister *et al,* in 2010 investigated the relationship of low T3 syndrome with the cardiac marker NT-pro BNP and its effect on the prognosis of the cardiac patients. They concluded that fT3 and low-T3 syndrome are significantly related to NT-pro-BNP in patients with cardiovascular disease but they are predictors of mortality independently of NT-pro-BNP and another known cardiovascular risk parameters.[16] Our aim was to study the heart failure patients only and both hyper and hypothyroidism. However, our results still showed that hypothyroidism is far more common in such patients than hyperthyroidism.

Amin *et al,* in 2015 studied a similar phenomenon from another angle and did a study assessing the changes in functional, biochemical, and echocardiographic measures following long-term liothyronine therapy in heart failure (HF) patients with low-triiodothyronine (T3) syndrome (LT3S). They showed that Triiodothyronine replacement by chronic liothyronine therapy seems to safely benefit stable heart failure patients with low T3 syndrome receiving optimal heart failure medications.[17] Results of this study were indirectly supported by our study as subclinical hypothyroidism was a fairly common finding in our patients with heart failure and low ejection fraction.

Yang *et al*, in 2019 published a meta-analysis on the same subject comprising of fourteen studies, and a total of [21], 221 patients with heart failure were included in the meta-analysis.[7] Compared with HF patients with euthyroidism, the pooled HR of subclinical hypothyroidism for all-cause mortality was 1.45 (95% CI 1.26–1.67) in a randomized effects model with mild heterogeneity (I2 = 40.1, p=0.073). The pooled HR of subclinical hypothyroidism for cardiac death and hospitalization was 1.33 (1.17–1.50) in a randomized effects model with moderate heterogeneity (I2=69.4, p< 0.001). Subclinical hyperthyroid can increase the risk of all-cause mortality without heterogeneity (HR 1.31, 95% CI 1.10–1.55, I2=25.5%, p=0.225) but have no influence on the risk of cardiac death and/or hospitalization (HR 1.03, 95% CI 0.87–1.23, I2=0.0%, p=0.958).

Vale *et al,* in 2019 concluded that a significant proportion of patients with heart failure presents some form of thyroid dysfunction, including hypothyroidism, hyperthyroidism, and low T3 syndrome. Furthermore, thyroid hormones can vary indepen-dently of the serum TH levels at a local level. This may lead to local cardiac hypothyroidism in heart failure. They also mentioned that data from epidemiological studies support a higher risk of heart failure and a worse prognosis in heart failure patients with low levels of thyroid hormone.[18] Our conclusion was quite similar that thyroid dysfunction emerged as a consi-derably common finding among heart failure patients with low ejection fraction. Hypothyroidism was more common than hyperthyroidism. Patients with NYHA class-III and IV and high BMI should be considered high-risk and may be screened for thyroid problems if present with heart failure.

STUDY LIMITATIONS

Small sample size has been the main limitation of our study as we only included the patients with low ejection fraction; therefore, many patients with heart failure were excluded. Extensive multicentre longitudinal studies can generate data that may be generalizable to the local population and may help the clinicians inform local guidelines regarding patients of heart failure who are at high risk of thyroid dysfunction and need to be tested during their clinical presentation.

CONCLUSION

Thyroid dysfunction emerged as a considerably common finding among patients of heart failure with low ejection fraction. Hypothyroidism was more common than hyperthyroidism. Patients with NYHA class III and IV and high BMI should be considered high-risk and may be screened for thyroid problems if present with heart failure.

Conflict of Interest: None.

Authors' Contribution

MAMUQ: Direct contribution, SA:, AK:, EA:, KRB:, AR:, Intellectual contribution.

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