Journal of Cardiovascular Disease Research
ISSN: 0975-3583, 0976-2833 VOL 15, ISSUE 01, 2024

Original Research Article

A Study of Cardiovascular Dysfunction in Hyperthyroid State

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ABSTRACT

Background and Objectives: The prognostic significance of cardiac involvement in patients with hyperthyroidism is substantial, and it is associated with notable morbidity and mortality. The condition hyperthyroidism is characterized by an overabundance of thyroid gland activity. The main aim of study is to evaluate various cardiac manifestations in overt hyperthyroidism and subclinical hyperthyroidism. **Methodology:** The study involved thorough data collection from study participants, utilizing a pretested proforma for standardized documentation. ANOVA tests, Pearson correlation coefficient analysis, and mean value comparison were used in the statistical analysis (using SPSS 17.0) to investigate the relationships between biochemical parameters and the severity of thyroid disorders. P-values less than 0.05 were considered significant. **Results:** A total 70-studied subject categorized in two groups' overt hyperthyroidism and subclinical hyperthyroidism. Distribution of patients according to symptoms of hyperthyroidism is tabulated. Also, Distribution of Patients According to Cardiovascular Symptoms and based ECG finding and Echocardiographic finding tabulated. **Conclusion:** Due to the influence of thyroid hormones, thyroid disorders, which are more common in women, have a major effect on the cardiovascular system. Angina, heart failure, atrial fibrillation, pericardial effusion, and other cardiac complications can result from imbalances that upset the heart's equilibrium. These effects can be avoided or controlled by thyroid hormone regulation that is prudent.

Key words: Hyperthyroidism, Heart, Cardiovascular, Hormones

INTRODUCTION

Cardiovascular system are significantly impacted by thyroid hormones through a variety of direct and indirect mechanisms. The cardiovascular symptoms in a patient's clinical presentation have been concerning indicators for doctors since the initial reports of hyperthyroidism and thyrotoxicosis. Common signs of hyperthyroidism include palpitations, exercise intolerance, dyspnea, angina-like chest pain, peripheral edema, and congestive heart failure (1), (2). These symptoms may indicate that this relatively common endocrinological disorder has a cardiovascular component. Overt hyperthyroidism is a common condition that affects 2-4 percent of the population, though the effects of iodization and the widespread use of radiocontrast agents may alter the incidence (3), (4). Patients with hyperthyroidism have a 20% higher mortality rate, with cardiac issues being the main cause of death.

According to a report by The Week (2019), thyroid disorders are on the rise in India, with approximately 1 in 10 Indian adults suffering from hypothyroidism. **(5)**

Hyperthyroidism, a prevalent thyroid disorder, is characterized by an excess production of thyroid hormones. (6) The terms "thyrotoxicosis" and "hyperthyroidism" are frequently used synonymously, but they have different meanings, which must be made clear. When tissues are exposed to too many thyroid hormones, a condition known as "thyrotoxicosis" results. It is important to recognize the subtle differences between the terms even though hyperthyroidism and thyrotoxicosis can coexist. (7)

Different etiologies, clinical manifestations, and treatment modalities are included in the spectrum of hyperthyroidism. Overt hyperthyroidism and subclinical hyperthyroidism are the two main ways the disorder can present itself. TSH levels that are low or suppressed along with elevated triiodothyronine (T3) and/or thyroxine (T4) levels are indicative of overt hyperthyroidism. The condition is called "T3 toxicosis" when TSH is low or suppressed, T4 levels are normal, and T3 levels are elevated. (8)

Conversely, low or suppressed TSH levels with normal T3 and T4 levels are indicative of subclinical hyperthyroidism. There are significant long-term complications associated with both overt and subclinical forms of hyperthyroidism, making careful management and monitoring necessary.

The immediate hormonal imbalance is not the only clinical consequence of hyperthyroidism. Anxiety, elevated heart rate, weight loss, heat intolerance, and altered bowel habits are just a

few of the symptoms that patients with hyperthyroidism may encounter. (9) Furthermore, the illness may affect different organs and systems within the body, resulting in systemic effects. While the underlying causes of hyperthyroidism are varied, Graves' disease, toxic multinodular goiter, and thyroiditis are common culprits. One major cause is Graves' disease, an autoimmune disorder marked by the production of autoantibodies that overstimulate the thyroid gland. (10)**,** (11)**,** (12)**,** (13)**,** (14)

AIMS AND OBJECTIVES

To study various cardiac manifestations in overt hyperthyroidism and subclinical hyperthyroidism.

MATERIAL AND METHOD

Study Design: This study employed a cross-sectional design to investigate cardiac manifestations in patients diagnosed with hyperthyroidism. The evaluation was based on fT3, fT4, and TSH levels, and cardiac parameters were assessed using ECG and ECHO.

Population: A total of 70 cases of hyperthyroid dysfunction were included in the study.

Inclusion Criteria:

- Patients diagnosed with hyperthyroidism based on fT3, fT4, and TSH levels.

Exclusion Criteria:

- Smokers.
- Patients with a history of previous radioactive iodine therapy.
- Patients who underwent thyroidectomy.
- Individuals with a history of external radiation.
- Patients taking drugs known to cause secondary hypothyroidism (SCH).
- Those with primary or secondary dyslipidemia, diabetes mellitus, renal and hepatic failure, or other systemic diseases.
- Patients who already have CV diseases or Patients on antiarrhythmic drugs.

Data Collection:

Participants who willingly participated completed a written Performa. Demographic data including age, gender, symptoms, signs, and atypical presentations were documented. Physical examinations were conducted.

Diagnostic tests included: Thyroid function tests (fT3, fT4, TSH) for hyperthyroid disorder diagnosis. Arterial pulse rate recording. Basal metabolic index measurement. Blood pressure recording. Complete blood count. Lipid profile estimation. Chest X-ray. Electrocardiogram (ECG), 2-D echocardiogram study

Data analysis:

Data regarding history, clinical examination, and investigation results were entered into a pretested proforma. Observations were tabulated for statistical analysis. Statistical software (SPSS 17.0) was used. Mean values of findings were compared among and between groups. Analysis of variance (ANOVA) test and unpaired't' test were conducted to assess significance among and between groups, respectively. Pearson correlation coefficient test was used to evaluate the correlation of biochemical parameters with the severity of thyroid disorder. 'p' values were determined to assess statistical significance.

RESULT

A pretested proforma was used for data analysis, and observations were methodically tabulated for statistical analysis. The statistical software SPSS 17.0 made it easier to compare mean values within and between groups. Unpaired't' tests and analysis of variance (ANOVA) tests were used to evaluate the significance of the results. Furthermore, associations between biochemical parameters and the severity of thyroid disorder were investigated using the Pearson correlation coefficient test, where statistical significance was indicated by 'p' values. The following section outlines the main findings from this methodical approach, providing insight into the complex relationship between thyroid dysfunction and cardiac symptoms.

Table 1: Age of the respondents

Age of the respondents	
21-31	14
31-40	12
41-50	20
51-60	11
Above 60	13
Total	70

Table 2: Gender of the respondents

Gender of the respondents	
Male	31
Female	39
Total	70

Table 3: Distribution of Thyroid state of the respondents (Overt and Subclinical hyper)

	Overt Hyperthyroidism		Subclinical Hyperthyroidism	
Sex	**No. of Patients**	**Percent**	**No. of Patients**	**Percent**
Male	30	54	1	7
Female	26	46	13	93
Total	56	100	14	100

The above table discusses the Distribution of Thyroid state of the respondents.

Table 4: Distribution of Patients According to Symptoms in Hyperthyroidism

Symptoms in Hyperthyroidism					
	Males		**Females**		**Total**
Symptoms					**No of Patients =70**
	No. of Patients	**Percent**	**No. of Patients**	**Percent**	**i.e. 100%**
Weight loss	27	87.09	19	48.71	65.71%
Excessive sweating	16	51.61	14	35.89	42.85%
Tremors	13	41.93	14	35.89	38.57%
Diarrhea	13	41.93	5	12.82	26%
Heat intolerance	12	38.7	10	25.64	31.42%
Increased appetite	12	38.7	16	41.02	40%
Decreased sleep	16	51.61	14	35.89	42.85%
Thyroid swelling	6	19.35	10	25.64	23%
Easy fatigue	15	48.38	27	69.236	60%
Oligomenorrhoea	0	0	13	33.33	19%

The above table discusses the Distribution of Patients According to Symptoms in Hyperthyroidism.

Table 5: Distribution of Patients According to Cardiovascular Symptoms

Cardiovascular Symptoms					
Symptoms	**Males**		**Females**		**p-value for Chi Square test**
	No. of Patients	**Percent**	**No. of Patients**	**Percent**	
Breathlessness	12	38.7	10	25.64	0.3
Palpitation	28	90.32	27	69.23	0.006
Chest Pain	0	0	3	7.69	0.195

The above table discusses the Distribution of Patients According to Cardiovascular Symptoms.

Table 6: Distribution of Patients According to General Physical Examination

General Physical Examination					
	Males		**Females**		**p-value foe Chi Square test**
Symptoms	**No. of Patients**	**Percent**	**No. of Patients**	**Per cent**	
Pallor	9	29.03	6	15.38	0.301
Edema	5	16.12	6	15.38	0.801
Eye Sign	18	58.06	2	5.12	0
Skin	13	41.93	10	25.64	0.174
Goiter	4	12.9	8	20.51	0.613

The above table discusses the Distribution of Patients According to General Physical Examination.

Table 7: Distribution of Patients According to ECG Change

ECG Changes						
	Males		**Females**		**Total**	
Symptoms	**No. of Patients**	**Percent**	**No. of Patients**	**Percent**	**No. Of Patients**	**Percentage**
Normal_ ECG	3	10%	14	36%	17	24%
Sinus tachycardia	8	26%	16	41%	24	34%
Atrial fibrillation	19	61%	9	23%	28	40%
ST changes	3	10%	6	15%	9	13%
RVH	9	29%	3	8%	12	17%
LVH	4	13%	2	5%	6	9%
Ectopic	0	0%	0	0%	0	0%
LAD	2	10%	3	8%	5	7%
LBBB	0	0%	0	0%	0	0%
RBBB	6	19%	0	0%	6	9%
RAD	9	29%	2	5%	11	16%

The above table discusses the Distribution of Patients According to ECG Change.

Table 8: Distribution of Patients According to ECHO Changes

ECHO changes						
	Males		**Females**		**Total**	
Findings	**No. of Patients**	**Percent**	**No. of Patients**	**Percent**	**No. of Patients**	**Percent**
Normal echocardiography	16	51.61%	27	69.23%	43	61.42%
Systolic dysfunction	10	32.25%	5	12.82%	15	21.42%
Diastolic dysfunction	3	9.67%	6	15.38%	9	12.85%

Chamber enlargement	13	41.93%	5	12.82%	18	25.71%
Regurgitant lesion	3	9.67%	3	7.69%	6	8.57%
Pulmonary Hypertension	9	29.03%	6	15.38%	15	21.42%

The Above table discusses the Distribution of Patients According to ECHO Changes.

Table 9: Ejection Fraction In The Cases of Hyperthyroidism

Ejection Fraction In The Cases Of Hyperthyroidism.						
	Male		**Female**		**Total**	
Ejection Fraction	**No. of Patients**	**Percentage**	**No. of Patients**	**Percentage**	**No. Patients**	**Percentage**
Less than 60%	6	19.00%	5	13%	11	16%
More than 60%	25	81.00%	34	87%	59	84%

The above table discusses the Ejection Fraction in the Cases of Hyperthyroidism.

DISCUSSION

The predominant demographic of participants lies within the age group of 41-50 years, indicating a potential heightened vulnerability to thyroid-related conditions in this particular age group. Females, particularly in the subclinical state (S hyper), have a greater occurrence of hyperthyroidism. Weight loss and excessive fatigue are prevalent symptoms in both males and females with hyperthyroidism. Respondents also exhibit a notable prevalence of additional symptoms, including excessive sweating, tremors, and swelling of the thyroid. Oligomenorrhea, which refers to irregular menstrual periods, is exclusively observed in females, highlighting the significant influence of hyperthyroidism on reproductive health. Palpitations exhibit a higher prevalence in males, indicating the presence of potential gender-specific disparities in cardiovascular symptoms. The occurrence of chest pain in females is significant, as it is frequently regarded as a fundamental symptom of cardiovascular problems.

Overall, there are no notable gender disparities in general physical examination findings, with the exception of a higher occurrence of eye signs in males. The ECG and echocardiography results reveal different cardiac abnormalities, which have varying occurrence rates among males and females. The data indicates that a considerable percentage of individuals with hyperthyroidism exhibit normal ejection fractions. Nevertheless, it is important to focus on the subset of individuals whose ejection fractions are below 60%, especially considering the slight variation in gender within this subgroup. The significance of conducting a thorough cardiovascular evaluation in individuals with hyperthyroidism is emphasized, as it is crucial for effective clinical treatment.

A study done by (Lakshmi Nijith and Rajesh Ranjan, 2022) (15), the study found that hyperthyroidism is common in the third and fourth decades of life, with females more affected. Common cardiovascular symptoms include palpitation, chest discomfort, dyspnea, and hypertension.

Similar study done by (Akash Berad, Sandip Chaudhari, and Neelima Chafekar, 2020) (16),

Thyroid dysfunction was observed to have a higher prevalence among females aged 41-50 in the hypothyroidism group and among those aged 21-30 in the hyperthyroidism group. The predominant clinical features in both groups were cardiovascular manifestations, indicating the detrimental impact of thyroid dysfunction. The hypothyroidism group experienced dyspnea and fatigue as the primary cardiac symptoms. The hyperthyroidism group experienced chest pain and fatigue as the primary cardiac symptoms.

A study done by (Faizel Osman., Et.al, 2007) (17) Cardiovascular abnormalities are common in patients with overt hyperthyroidism at presentation, but some persist despite effective antithyroid therapy.

CONCLUSION

The cardiovascular system is significantly influenced by thyroid hormones; any perturbation in their concentrations can disturb the intricate equilibrium of this critical organ. Due to the susceptibility of the heart to both genomic and non-genomic effects of thyroid hormones, hemodynamic and cardiovascular manifestations are common in patients with thyroid disorders. By taking into account both endocrine and cardiovascular factors on a global scale, the prognosis for severe cardiac complications in patients with overt or subclinical thyroid dysfunction can be significantly improved. In order to achieve a comprehensive understanding of the complex correlation between thyroid function and cardiovascular health, it is finalizely imperative that medical specialists work in concert to enhance patient outcomes.

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