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Evaluation of Thyroid Hormones in Congestive Heart Failure Subjects Attending Federal University Teaching Hospital Owerri, Imo State

Ukamaka Edward[1], Esther E. Iwuajoku[1] and *Emmanuel Ifeanyi Obeagu[2]

[1]Department of Medical Laboratory Science, Imo State University, Owerri, Nigeria.
[2]Department of Medical Laboratory Science, Kampala International University, Uganda,
emmanuelobeagu@yahoo.com,obeagu.emmanuel@kiu.ac.ug, 0000-0002-4538-0161

Abstract

This study was carried out to evaluate levels of thyroid hormones in patients with congestive heart failure. A total of sixty (60) subjects aged forty-five (45) – sixty-five (65) years were recruited for the study and were divided into two groups subjects with congestive heart failure and control subjects. The data was analysed using SPSS version 21.0. The probability $P < 0.05$ was statistically significant. The serum thyroid stimulating hormones, triiodothyronine, thyroxine was assayed using ELISA method. The mean value of $P< 0.05$ was considered significant. The result obtained showed a significant higher ($P = 0.0001$) in thyroid stimulating hormone (6.65±0.57m/u/l). in subjects with congestive heart failure (subjects) when compared with thyroid stimulating hormone (2.91±0.23m/u/l) in control. There was significant lower ($P=0.0001$) in triiodothyronine (0.99±005ng/dl) in test when compared with triiodothyronine (2.25±0.288ng/dl) in control. There was significant lower ($P= 0.01$) in thyroxine (122.98±1734ng/dl) in test when compared with thyroxine (131.32±2.26ng/dl) in control. There was a non-significant positive correlation ($r = 0.08$, $p = 0.682$ and $r = 0.16$, $p = 0.407$) between thyroid stimulating hormone with triiodothyronine and thyroxine in congestive heart failure. It was however confirmed that patients with congestive heart failure have higher serum levels of thyroid stimulating hormone with relatively reduced triiodothyronine and thyroxine. The higher and lower level of thyroid hormone found in congestive heart failure should dysregulation in thyroid immune which can lead t0 complication and death. Therefore, it was concluded that thyroid hormones influence the cells and tissue of the heart and its homeostasis is essential to the optimal functioning of the heart, study support an association of thyroid dysfunction with increased risk for congestive heart failure.

Keywords*: thyroid Hormones, congestive heart failure, thyroxine*

Introduction

Congestive Heart Failure (CHF), is a syndrome, a group of signs and symptoms, caused by an impairment of the heart's blood pumping function. Chest pain, including angina, is not usually caused by heart failure, but may occur if the heart failure was caused by a heart attack. The severity of the heart failure is mainly decided based on ejection fraction and also measured by the severity of symptoms. Other conditions that may have symptoms similar to heart failure include obesity, kidney failure, liver disease, anemia, and thyroid disease.[1-5]

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Common causes of heart failure include coronary artery disease, heart attack, high blood pressure, atrial fibrillation, valvular heart disease, excessive alcohol consumption, infection, and cardiomyopathy. These cause heart failure by altering the structure or the function of the heart or in some cases both. There are different types of heart failure: right-sided heart failure, which affects the right heart, left-sided heart failure, which affects the left heart, and biventricular heart failure, which affects both sides of the heart. Left-sided heart failure may be present with a reduced ejection fraction or with a preserved ejection fraction. Heart failure is not the same as cardiac arrest, in which blood flow stops completely due to the failure of the heart to pump.[1]

Thyroid-stimulating hormone also known as thyrotropin, thyrotropic hormone, or abbreviated TSH) is a pituitary hormone that stimulates the thyroid gland to produce thyroxine (T_4), and then triiodothyronine (T_3) which stimulates the metabolism of almost every tissue in the body. It is a glycoprotein hormone produced by thyrotrope cells in the anterior pituitary gland, which regulates the endocrine function of the thyroid.[6-13]

The study was done to evaluate levels of thyroid hormones in patients with congestive heart failure.

Materials and Method

Study Area

The study was carried out at Federal University Reaching Hospital Owerri Imo State.

Ethical approval

The ethical approval was obtained to collect samples from the hospital. Informed consent was sought and obtained, after which the date for sample collection was fixed.

Study Population

Sample Size Calculation

The sample size was calculated using the formula below according to Araonye (2004). The precision of 0.05% with confidence level of 95% and standard normal deviation corresponding to confidence level 1.960, using a prevalence level of 2%. The study population was recruited from Federal University Teaching Hospital Owerri.

Sample Size Determination

Sample size was determined in accordance to Araonye (2004).

$$n = Z^2\frac{z^2(q)P}{D^2} = Z^2\frac{(1-P)P}{D^2}$$

Where;

n = the minimum sample size

Z = the standard normal deviation, usually set at 1.960 which corresponds to the 95% confidence interval

D = degree of precision required

Q = (1-P)

The required sample size is calculated as follows:

Prevalence = 2.0% = 2/100 = 0.02

$$n = Z^2\frac{(I-P)P}{D^2}$$

$$n = 1.96^2\frac{1-0.02)\ 0.02}{0.05^2}$$

$n = 3.8416 \frac{(0.98)0.02}{0.0025}$

$n = \frac{3.8416\ x\ 0.0196}{0.0025}$

$n = \frac{0.07529536}{0.0025}$

$n = 30$

The minimum sample size was thirty.

Sixty subjects were recruited for the study. Thirty were confirmed congestive heart failure subjects who has been attending heart clinic for the past three months while thirty were apparently healthy individuals that served as control subjects.

Inclusion Criteria

The participants were recruited based on

i) Subjects who were recently diagnosed of congestive heart failure.
ii) Subject within the ages of forty-five – sixty-five years with congestive heart failure.
iii) Subjects who were apparently healthy and served as control subjects.
iv) Subjects who gave their consent to participate in the study.

Exclusion Criteria

The following were excluded from the study;

i) Subject who was below forty-five years or above sixty-five years
ii) Subject with chronic or complicated diseases.
iii) Those whose informed consent could not be obtained because they are sceptical about the purpose of the research work

Sample Collection

Venous blood samples (5ml) were collected aseptically by venipuncture from each of the subjects using 5ml sterile disposable syringe and needle. The whole blood samples were dispensed into a pre-labelled plain dry specimen container and allowed to clot. The clotted samples were centrifuged at 3000rpm for 5 minutes to separate and to obtain the serum. It was extracted using a pipette and was dispensed into another container and stored at -20^0C prior to use.

Laboratory Procedures

A. Determination of Thyroid Stimulating Hormones using ELISA Method (ACCU-BIND, TSH-3425-300) as modified by Monobind Inc. Lake forest, USA catalogue No: CA-92630

Procedure

Microplates' wells were formatted for each serum reference calibrator, control and patient specimen to be assayed induplicate. Then 0.050 ml (50µl) of the appropriate serum reference, control or specimen was Pipetted into the assigned well.0.100 ml (100µl) of the TSH Enzyme Reagent was added to each well. It was dispensed close to the bottom of the coated well. The microplate was gently swirled for 20-30 seconds to mix and covered. Incubated 60 minutes at room temperature. Contents of the microplate were 6. Discarded by decantation. Blotted dry with absorbent paper.0.350ml (350µl) of wash buffer was added decanted. Repeat two (2) additional times for a total of three (3) washes.0.100 ml (100µl) of working substrate solution was added to all wells. Always add reagents inthe same order to minimize reaction time differences between wells. It was Incubated at room temperature for fifteen (15) minutes.0.050ml (50µl) of stop

solution was added to each well and mixed gently for 15-20 seconds. Absorbance in each well at 450nm in a microplate reader. The results should be read within thirty (30) minutes of adding the stop solution

B. Determination of triiodothyronine using ELISA Method (ACCU-BIND, T3-125-300) as modified by Monobind Inc. Lake forest, USA catalogue No: CA-92630

Procedure

Microplates' wells were formatted for each serum reference, control and patient specimen to be assayed in duplicate. Unused microwell strips were replaced back into the aluminum bag, sealed and stored at 2-8°C.0.050 ml (50µl) of the appropriate serum reference, control or specimen was Pipetted into the assigned well.0.100 ml (100µl) of Working Reagent A, T3 Enzyme Reagent was added to all wells. the microplate was gently swirled for 20-30 seconds to mix and cover. It was incubated for 60 minutes at room temperature. The contents of the microplate were discarded by decantation. blotted dry with absorbentpaper.350µl of wash buffer was added, decanted blotted, this was Repeat two (2) additional times for a total of three (3) washes. 0.100 ml (100µl) of working substrate solution was added to all wells. Incubated at room temperature for fifteen (15) minutes.0.050ml (50µl) of stop solution was added to each well and gently mix for 15-20 seconds. The absorbance in each well was read at 450nm (using a reference wavelength of 620-630nm to minimize well imperfections) in a microplate reader the results wasread within thirty (30) minutes of adding the stop solution

C. Determination of thyroxine using ELISA Method (ACCU-BIND, T4-225-300) as modified by Monobind Inc. Lake forest, USA catalogue No: CA-92630

Procedure

The microplate wells for each serum reference, control and patient specimen to be assayed was Formatted in duplicate. unused microwell strips was replaced back into the aluminum bag, sealed and stored at 2-8°C0.050 ml (50µl) of the appropriate serum reference, control or specimen was pipetted into the assigned wells.0.100 ml (100µl) of fT4 Enzyme Reagent was added to all wells. The microplate was gently Swirled for 20-30 seconds to mix and covered. Incubated for 60 minutes at room temperature. The contents of the microplate were discarded by decantation blotted dry the plate dried with absorbentpaper.350µl of wash buffer was added decanted blotted for a total of three (3) washes 0.100 ml (100µl) of working substrate solution was added to all wells. Incubate at room temperature for fifteen (15) minutes.0.050ml (50µl) of stop solution was added to each well and gently mixed for 15-20 seconds. absorbance in each well was read at 450nm (using a reference wavelength of 620-630nm to minimize well imperfections) in a microplate reader. The results were read within thirty (30) minutes of adding the stop solution.

Statistical Analysis

The result of the present study was expressed as mean±standard deviation. The student t-test was calculated using SPSS version sixteen (21) and it was used to compare the parameters at levels of significance (0.05). P<0.05 was considered as statistically significant and results presented in tables.

Results

Table 1: The mean ±Standard deviation of thyroid hormone subject in the study population

Parameter	Congestive Heart Subject n = 30	Control Subject n = 30	t-value	p-value (p<0.0005)
Thyroid Stimulating Hormones (m/u/l)	6.65±0.57	2.91±0.23	33.52	0.0001
Triiodothyronine ng/dl	0.99±0.05	2.25±0.288	23.89	0.0001
Thyroxine (ug/dl)	122.98±17.34	131.32±2.26	2.61	0.01

Key:
P <0.05 = statistically significant
n = sample size

Table 1 shows the mean ± standard deviation of thyroid hormones in congestive heart failure subjects in the study population. Their result showed that the mean value of Thyroid Stimulating Hormones was statistically significantly higher (p=0.0001) in congestive heart failure subjects (6.65±0.57m/u/l) when compared with the control subjects (2.91±0.23m/u/l). The mean value of Triiodothyronine (p=0.0001) was statistically significantly lower in congestive heart failure subjects (0.99±0.5ng/dl) when compared with the control subjects (2.2±0.29ng/dl). The mean value of Thyroxine was statistically significantly lower (p=0.01) in congestive heart failure subjects (122.98±17.34ug/dl) when compared with the control subjects (131.32±2.26ug/dl).

Table 2: Correlation of Thyroid Stimulating Hormones (TSH) with Triiodothyronine (T3) and Thyroxine (T4) in Congestive Heart Failure

Variable	N	R	p-value
Triiodothyronine (T3)	30	0.08	0.682
Thyroxine (T4)	30	0.16	0.407

Key:
P <0.05 = statistically significant
n = sample size
There was a non-significant positive analysis (r=0.08, p=0.682 and r=0.16, p=0.407) between Thyroid Stimulating Hormones **(**TSH**)** with Triiodothyronine (T3) and Thyroxine (T4) in Congestive Heart Failure.

Discussion

The result of this present study showed a significant high mean values Thyroid Stimulating Hormones in test when compared with the mean values of Thyroid Stimulating Hormones in control. Since Thyroid hormone regulates multiple cardiovascular functions, directly affecting the myocardium, the conduction system, and the peripheral vasculature therefore excess can lead to heart failure. The present study also showed a significant decrease in the mean value of Triiodothyronine in test when compared with the mean values of Triiodothyronine in control. The present study also showed a significant decrease in the mean value of Thyroxine in test when compared with the mean values of Thyroxine in control. this is in agreement with the work made by Metra *et al* [14] from their research it was found out that low levels of Thyroxine play a role in exacerbating heart failure in the outpatient setting. The study also showed that there were no significant positive correlation of Thyroid Stimulating Hormones with Triiodothyronine and Thyroxine, showing independence of these parameters in Congestive heart failure patients.

Conclusion

The higher level found in Thyroid Stimulating Hormones and lower level in Triiodothyronine and Thyroxine showed. There is dysregulation in thyroid function which may be associated with congestive heart failure. This can lead to complication and death.

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