

Thyroid Hormones and Cardiac Dilatation and Dysfunction in Iraqi Patients with Idiopathic Dilated Cardiomyopathy Biochemical and Echocardiographic Study

Basil O.M. Saleh*, Hikmat H. Al-Shaarbaf**, William M. Frankul***, Mohammed H Al Baghdadi****

ABSTRACT:

BACKGROUND:

Serum thyroid hormone level can provide a quantitative index for evaluating the severity of chronic heart failure.

OBJECTIVES:

To assess the contributions of thyroid hormones [tri-iodothyronine] (T_3) and thyroxine (T_4) to the left ventricular (LV) dilatation and myocardial dysfunction in patients with idiopathic dilated cardiomyopathy (IDC).

METHODS:

Forty patients with idiopathic dilated cardiomyopathy (IDC) aged 46.20 ± 1.90 years, as (mean \pm SEM) (11 females and 29 males) were studied. Serum total T_3 , total T_4 and thyroid-stimulating hormone (TSH) were measured in these patients. Echocardiographic parameters including LV systolic diameter, septal thickness systolic diameter, LV diastolic diameter, septal thickness diastolic diameter and LV ejection fraction (LVEF) were also be assessed in all patients.

RESULTS:

This study showed that the serum T_4 values were significantly directly correlated with the values of EF % ($r = 0.34$; $p < 0.035$) along with significant inverse relationship between serum levels of T_3 and the diameter of LV systole ($r = -0.34$; $p < 0.032$).

CONCLUSION:

This study revealed an important significant correlation between serum thyroid hormones levels and echocardiographic parameter values that may point to the role of these biochemical factors in the contribution to the LV dilatation and cardiac dysfunction (heart failure) .

KEY WORDS: Idiopathic dilated cardiomyopathy, Thyroid hormones, Echocardiographic parameters.

INTRODUCTION:

Idiopathic dilated cardiomyopathy (IDC) is a disease of unknown cause that results in an enlarged heart that does not pump properly. It is the most common reason for people to get heart transplants ⁽¹⁾. IDC refers to congestive cardiac failure secondary to dilatation and systolic (and/or diastolic) dysfunction of the ventricles (predominantly left) in the absence of congenital, valvular, or coronary artery disease or any systemic disease known to cause myocardial dysfunction ⁽²⁾. The thyroid gland secretes, mainly two hormones, thyroxine ($3, 5, 3', 5' L$ - tetraiodothyronine) and triiodothyronine ($3, 5, 3' L$ - triiodothyronine), which are commonly known as T_4 and T_3 , respectively. The heart is very sensitive to even

small changes in the levels of thyroid hormones (THs) ⁽³⁾. Thyroid hormones metabolism is frequently altered in advanced congestive heart failure (CHF). Serum active T_3 levels are low and the reverse T_3 serum levels are high in most seriously ill CHF patients ⁽⁴⁾. It has been shown that the degree of serum T_3 decrease is proportional to the severity of heart damage and may have a possible prognostic value ⁽⁵⁾.

PATIENTS AND METHODS:

This study was conducted in Ibn-Albitar Hospital in Baghdad. Forty patients aged-years (11 females and 29 males) with idiopathic dilated cardiomyopathy were included in this study. The diagnosis of IDC was based on the WHO/ISFC criteria ⁽⁶⁾. It was made when the echocardiogram showed a left ventricular ejection fraction (less than 50 %) in the absence of angiographic coronary artery disease. Patients were excluded from the study if they had a history of primary valvular disease, severe hypertension, heavy alcohol consumption or other known cause of dilated

* Department of physiol. Chem., College of Medicine, University of Baghdad.

**Department of Medicine, College of Medicine, University of Baghdad.

***Department of physiol. Chem., College of Medicine, University of Baghdad.

****Ibn Al-Bitar Hospital.

cardiomyopathy (DCM). Exclusion criteria also included those patients with thyroid gland disorder. Total serum T_3 and total serum T_4 were determined quantitatively according to the Enzyme Immunoassay (EIA) reported by Wisdom, 1977 ⁽⁷⁾ and Walker, 1977 ⁽⁸⁾. Serum TSH was measured quantitatively according to the Enzyme-Linked Immunosorbent Assay (ELISA), reported by Wada et al, 1982 ⁽⁹⁾. The reference values according to these methods for serum T_3 is 0.6 – 1.85 ng/ml, serum T_4 is 4.8 – 12 μ g/dl and serum TSH is 0.4 – 7.0 μ IU/ml. Measurements of these hormones were performed at Department of Immunology in Al-Kahdmai Teaching Hospital.

Echocardiographic Evaluation:-

Echocardiographic parameters including left ventricular end-diastolic diameter (LVEDD), septal thickness diastolic diameter (DD), LV end-systolic diameter (LVESD), septal thickness systolic diameter (SD) and LV ejection fraction (LVEF %)

were measured in all patients by consultant cardiologists at echocardiographic unit in Ibn-Albitar Hospital. The linear regression test was applied for the correlation between different parameters and the significance of the r-values was checked using t-test. P-value of less than (0.05) was considered significant.

RESULTS:

The mean (\pm SEM) of serum T_3 , T_4 and TSH values in the IDC patients were 1.08 ± 0.11 ng/ml; 10.84 ± 0.4 μ g/dl and 2.25 ± 0.30 μ IU/ml, respectively. The mean (\pm SEM) value of the measured echocardiographic parameters including LVEF %, LVEDD, septal thickness DD, LVESD and septal thickness SD in patients with IDC was recorded in Table 1. A significant positive correlation ($r = 0.40$; $p < 0.01$) was observed between serum levels of T_3 and the serum T_4 concentrations (Figure 1).

Table 1: Echocardiographical Data of patients with idiopathic Dilated cardiomyopathy.

	Idiopathic Dilate Cardiomyopathy (n = 40)
LVEF %	34.06 ± 1.10
LVEDD (mm)	67.26 ± 1.28
Septal thickness DD (mm)	8.00 ± 0.30
LVESD (mm)	54.60 ± 1.36
Septal thickness SD (mm)	8.28 ± 0.34

- Results expressed as Mean \pm (SEM).
- LVEF (Left ventricular ejection fraction), LVEDD (Left ventricular end-diastolic diameter), Septal thickness DD (Septal thickness diastolic diameter), LVESD (Left ventricular end-systolic diameter), Septal thickness SD (Septal thickness systolic diameter).

IDC patients also have had a significant inverse correlation ($r = -0.34$; $p < 0.032$) between the serum T_3 concentrations and the diameter values of LV systole (figure 2). The results also revealed a positive significant relationship ($r = 0.34$; $p < 0.035$) between the serum T_4 concentrations and the values of LVEF % (Figure 3).

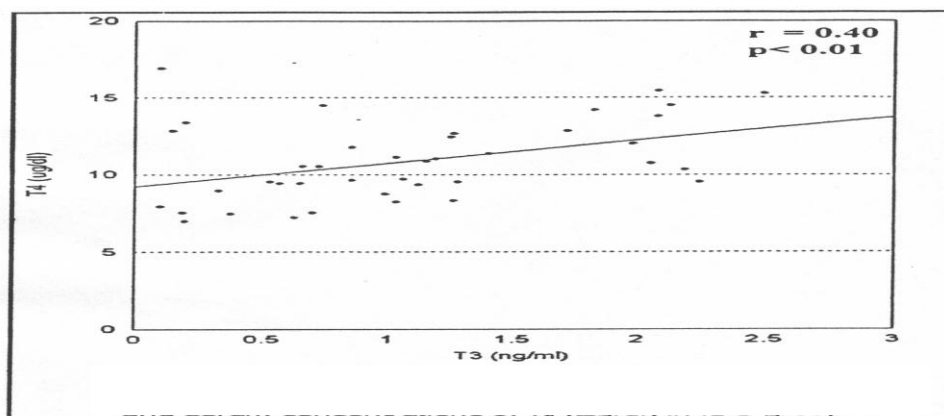


Figure (1): correlation between the serum levels of T_3 (ng/ml) and serum concentrations of T_4 (ug/dl) in IDS group .

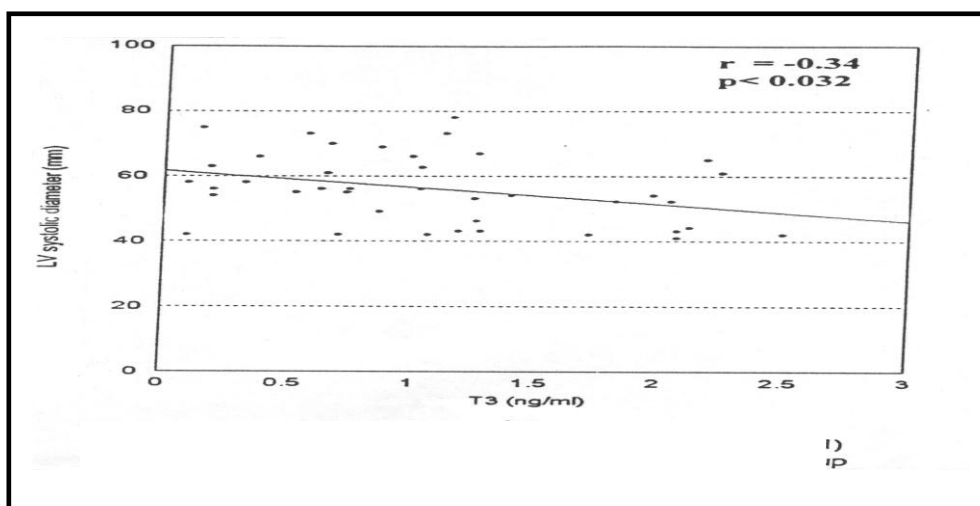


Figure (2): correlation between the serum levels of T_3 (ng/ml) and the values of LV systolic diameter in IDC group

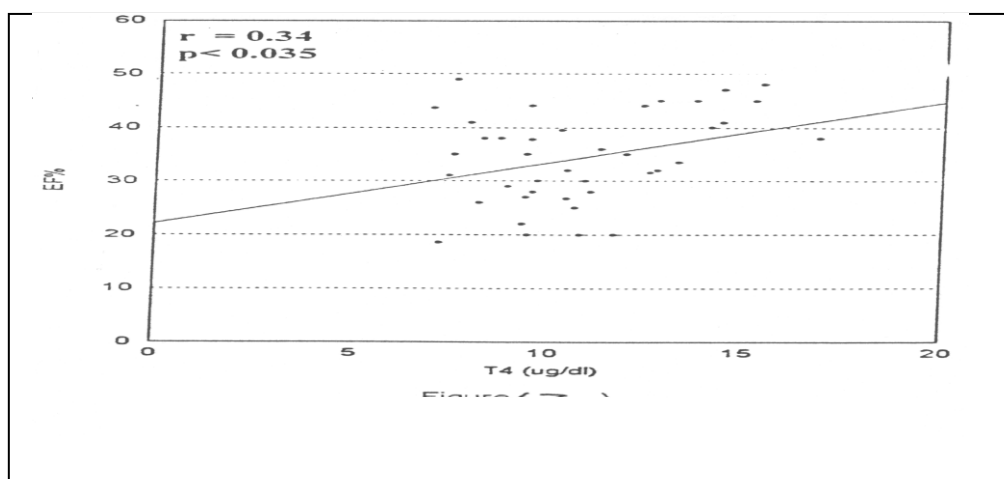


Figure (3): correlation between the serum levels of T_4 (ug/ml) and the values of ejection (EF %) In IDC group

DISCUSSION:

Zhou and colleagues, 2004⁽¹⁰⁾ demonstrated that serum T_3 levels was positively correlated with serum T_4 levels ($r = 0.20$; $p < 0.05$) as well as with LVEF ($r = 0.293$; $p < 0.01$). They concluded that the lowering of serum T_3 and T_4 values may be one of the important reasons for decreasing LVEF in CHF patients. More recently, Kozdag et al. 2005⁽¹¹⁾ observed that the ratio of free T_3 /free T_4 was significantly correlated with most of echocardiographic parameters, such as chamber diameters and ejection fraction. Pingitore et al. 2005⁽¹²⁾ suggested that low T_3 serum levels are independent predictors of all causes of cardiac mortality in patients with DCM, and add prognostic information to conventional clinical and functional cardiac parameters. It has also been found that a short-term thyroxine administration

normalizes thyroid function state and improves both cardiac inotropic state (increased LVEF) and exercise performance in patients with IDC^(13, 14). Recently, it has been observed that thyroxine administration may be beneficial to ventricular remodeling of patients with IDC⁽¹⁵⁾. The authors also found, after one month of treatment, a significant decrease in LVED, which was attributed to improvement of cardiac inotropic and hemodynamic states. Thus, specific impairment of cardiac action of thyroid hormones may be a contributing causative factor in the progression of heart failure. The present study concluded that evaluation of thyroid gland function by assessing serum T_3 and serum T_4 may be of some help in the assessment of cardiac function in patients with IDC. A clinical study is needed to evaluate the

beneficial effect of an appropriate dose of thyroxine in Iraqi patients with IDC, in order to improve LV structure and function.

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