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Evaluation of Thyroid Functions among Visceral Leishmaniasis Sudanese Patients

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Abstract

Background: Thyroid gland produces two related hormones: thyroxine (T₄) and triiodothyronine (T₃). It is under the control of hypothalamus and levels of T₃ and T₄ hormones. The gland plays a vital role in normal human physiology. Disorders of thyroid gland are common in clinical practice and may result in hypothyroidism or hyperthyroidism as well as thyrotoxicosis. Visceral leishmaniasis (kala-azar) is a common endemic parasitic disease especially in Sudan; caused by the *Leishmania* parasites. It is caused by the bite of *Phlebotomine* sand flies. Patients with kala-azar frequently present with anemia, hepatosplenomegaly, weight loss, malnutrition, and widespread inflammatory process involving vital organs. Side effect of drugs used for treatment may also result in negative consequence.

Objective: To evaluate thyroid functions among visceral leishmaniasis Sudanese patients.

Materials and methods: This was a descriptive cross-sectional study carried out during the period from April-June 2014. 73 patients were enrolled in this study (20 males and 53 females). Patients classification was based on treatment: treated and untreated. Serum thyroxine (T₄), triiodothyronine (T₃), and thyroid stimulating hormone (TSH) were measured using the enzyme-linked immuno-sorbent assay (ELISA) technique. Data analysis was performed using statistical package of social science (SPSS) software program.

Results: The treated group showed significant low T₃ and TSH levels ($p = 0.044$ and 0.040 respectively).

Conclusion: Endocrine system alterations are evident in patients with kala-azar; and thyroid functions are affected by this disease.

Key words: Thyroxine, Triiodothyronine, Thyroid stimulating hormone, Leishmaniasis.

Introduction

Leishmaniasis is caused by an obligatory intracellular parasite belonging to the genus *Leishmania*. Over 20 species of this genus can be transmitted to humans by approximately 30 different species of sandflies. Visceral leishmaniasis (VL) or kala-azar is caused by the

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protozoon *Leishmania donovani* complex. Visceral leishmaniasis has a large clinical range, from asymptomatic infection and auto resolution to progressive visceral leishmaniasis, which is characterized by fever, hepatosplenomegaly, hypergammaglobulinemia, and death if not treated properly and promptly¹.

Thyroid hormones play a vital role in normal human physiology. The secretion of thyroid hormones is regulated by the pituitary thyrotropin (TSH) which itself is stimulated by hypothalamic thyrotropin-releasing hormone (TRH) and down-regulated by serum thyroid hormones. The commonest cause of thyroid disease worldwide is iodine deficiency. However, autoimmune thyroid disease is the predominant form of thyroid dysfunction in developed world. Permanent hypothyroidism, which is readily diagnosed and managed but potentially fatal in severe cases. Clinical manifestation of hypothyroidism range from life-threatening to no signs or symptoms, most common symptoms in adult are fatigue, lethargy, cold intolerance, weight gain, constipation, dry skin and change in voice, Hypothyroidism either secondary to hypothalamus or pituitary gland or primary due to problem in thyroid gland commonly attributable to Hashimoto's thyroiditis and less common causes are genetic and environmental factors². Hyperthyroidism which is mostly caused by Graves' disease (autoimmune disease) that leads to the production of anti-TSH receptor antibodies. Although alterations of thyroid hormone levels because of non-thyroid illness are well known among humans, there were very few studies regarding the pathological changes in thyroid hormone levels among patients with VL³.

Materials and methods

This was a descriptive cross-sectional study carried out during the period from April-June 2014. 73 visceral leishmaniasis patients were enrolled in this study (20 males and 53 females). Patients age range was 1.3-45 years. They attended Khartoum Hospitals from different states of Sudan for regular follow-up. Patients presented with autoimmune disease, malignancies, pregnancy, and diabetes mellitus,. Patients under anti-thyroid treatment were excluded. Patients classification was based on treatment: treated and untreated.

A written consent was taken from all participants, and were informed of the aims of the study. Sample and clinical information were used anonymously. The study was approved by the Ethics Committee of Al Neelain University.

5 ml peripheral blood were withdrawn. Blood samples were centrifuged at 3000 rpm for 10 min and stored at -20°C until analysis. Serum level of TSH was measured using direct sandwich enzyme-linked immuno-sorbent assay technique. T₃ and T₄ serum levels were measured using the competitive inhibition ELISA. Samples calculated using plotted standards curve (Sunrise, TECAN).

The Student's t-test was employed to compare differences between the means of continuous variables. P-values less than 0.05 were considered statistically significant. Data were analyzed by SPSS statistical package of social science (version 14.0; SPSS Inc.)

Results

73 patients with visceral leishmania were 72.6% men and 27.4% women. Treated and untreated

males were more common than females (73% and 74 %, 27% and 26%) respectively (Fig. 1).

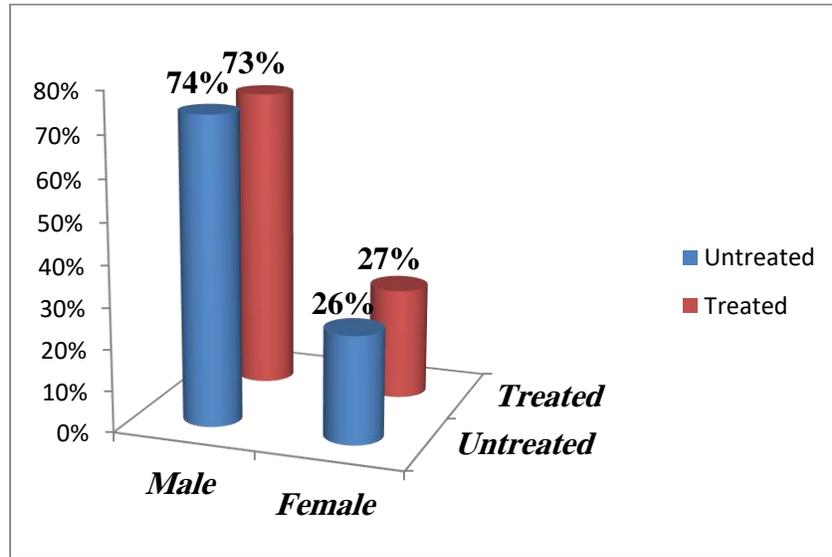


Fig. (1): Distribution of patients investigated according to gender and treatment program.

Table (1) shows the mean serum levels of T₃ (1.80±1.13, 2.50±1.82), T₄ (15.27±5.48, 14.69±5.92) and TSH (1.10±0.62, 1.63±0.72) in treated and untreated groups respectively. In general, the mean level difference of T₄ between treated and untreated patients was not significant (p = 0.651). Whereas the mean level differences of T₃ and TSH between treated and untreated patients was significant (p = 0.044 and p = 0.040 respectively).

Table (1): Mean serum levels of T₃, T₄, and TSH hormones among treated and untreated patients

Parameters	Untreated (Mean±SD)	Treated (Mean±SD)	p-value
T ₃ ng/ml	2.50±1.82	1.80±1.13	0.044
T ₄ ng/ml	14.69±5.92	15.27±5.48	0.651
TSH μIU/ml	1.63±0.72	1.10±0.62	0.040

Significant difference p < 0.05

As shown in Table (2) and according to gender, the mean level of T₄ was significantly different (p = 0.034); while the mean level of T₃ and TSH were insignificantly different (p = 0.233 and p = 0.345 respectively).

Table (2): Mean serum levels of T₃, T₄, and TSH hormones among patients investigated according to gender

Parameters	Male (Mean±SD)	Female (Mean±SD)	p-value
T ₃ ng/ml	2.01±1.69	1.96±1.25	0.233
T ₄ ng/ml	14.10±6.00	16.42±5.60	0.034
TSH μIU/ml	1.40±0.65	1.44±0.93	0.345

Significant difference $p < 0.05$

As shown in Fig. (2) and Fig. (3) respectively, there was a negative correlation between T₃ and TSH hormones and the age incidence of patients investigated (i.e. correlation decreases with increasing age of patients).

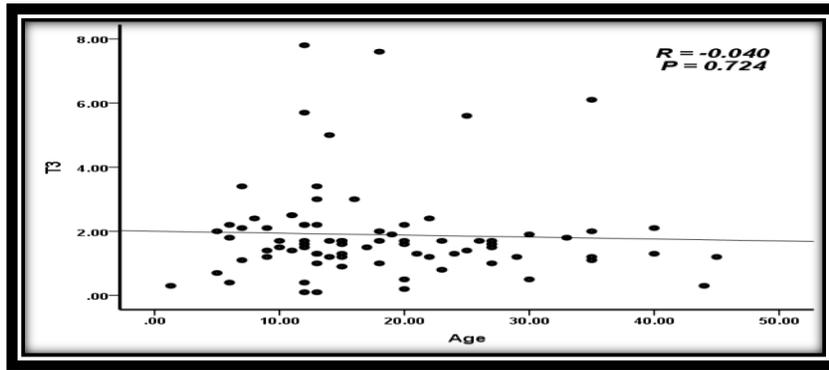


Fig. (2): Negative correlation between T₃ hormone and the age incidence of patients investigated

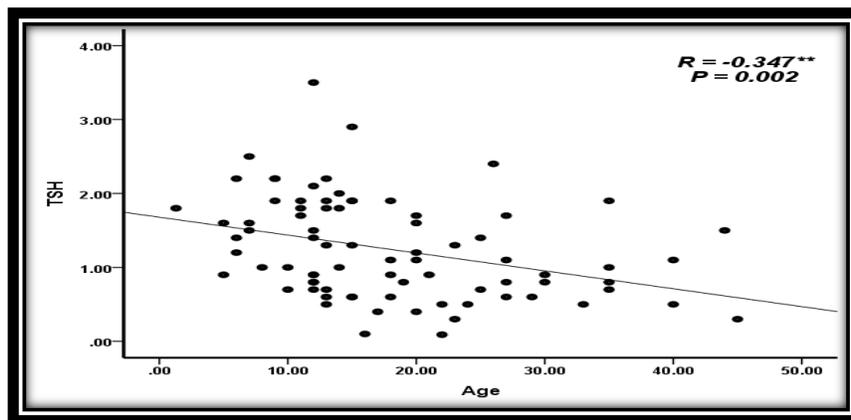


Fig. (3): Negative correlation between TSH hormone and the age incidence of patients investigated

As shown in Fig. (4), there was a positive correlation between T₄ hormone and the age incidence of patients investigated (i.e. correlation increases with increasing age of patients).

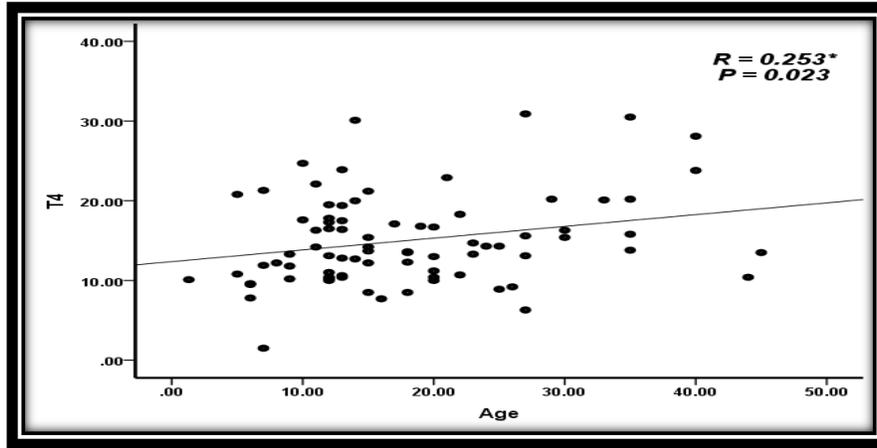


Fig. (4): Positive correlation between T₄ hormone and the age incidence of patients investigated

Discussion

Leishmaniasis is an important parasitic infection of the blood. It is classified as a protozoan disease, and it is caused by *Leishmania* spp. Leishmaniasis is found in many countries throughout the world, and it is classified as an important vector-borne infection. The transmission of disease is via a vector: in this case, the bite of a sandfly. Visceral leishmaniasis is classified as a treatable disease. Early diagnosis and treatment are important to the successful management of patients, thyroid dysfunction in kala-azar patients occur as part of an endocrine response to stress⁴.

The results of independent t-test showed a significant decrease in mean concentration of T₃ and TSH in treated patients compared to untreated patients ($p = 0.044$ and $p = 0.040$ respectively). In contrast to T₄ level was normal and had a positive correlation. According to a previous study performed in Brazil⁵ these findings agreed in T₃ and disagreed in TSH; while T₄ and TSH were not statistically different ($p = 0.627$); and T₃ and T₄ were statistically lower ($p = 0.0001$ and $p = 0.05$ respectively).

The present study revealed that there was an insignificant difference between the mean level of T₃ and TSH according to gender ($p = 0.233$ and $p = 0.345$ respectively). However, there was a significant difference between the mean level of T₄ according to gender ($p = 0.034$). These finding agreed in T₃ and disagreed in T₄. Comparing TSH with the findings of Chaurasia and his colleagues (2008)⁶ it showed a higher mean level in females than in males. T₄ was slightly higher in males and T₃ was similar in both genders.

Conclusion: Endocrine system alterations are evident in patients with kala-azar; and thyroid functions are affected by this disease.

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