

Investigation of Parvovirus B19 in Hashimoto thyroiditis

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Abstract— Thyroiditis is a broad term that refers to a variety of clinical conditions marked by inflammation and damage to thyroid cells. These disorders could be caused by due to factors, including radiation, a microbial infection, or be linked to autoimmune thyroid disease, such as in Hashimoto thyroiditis (HT). This cross-sectional study aimed to the detection of anti-TPO antibodies and to investigate (Parvovirus B19) IgM and IgG antibodies in serum of patients to investigate their role in the pathogenesis of thyroiditis. The study included 91 patients suffering from thyroid dysfunction and diagnosed by performing of the thyroid hormone tests (FT3, FT4 and TSH) by Snibe Maglumi-800 Chemiluminescence Immunoassay, where they were divided into three groups namely (subclinical thyroiditis, hypothyroidism and hyperthyroidism). Then Moreover, the study investigates the determination which of them has HT by the detection of thyroid autoantibodies anti-TPO Ab and the detection of antibodies to specific (Parvovirus B19) IgM and IgG in the sera of patients by ELISA. The results of serology showed that the percentage of anti-TPO antibodies in the three investigated groups was (54.94%), and the highest percentage was in the hypothyroidism group, which amounted to (71.40%). The serological diagnosis also showed that the presence of antibodies to (Parvovirus B19) IgM was (90.10%) while, IgG levels were (100%) respectively. **Conclusions:** Parvovirus B19 infection is commonly seen in patients with thyroiditis.

Keywords—Thyroiditis, Parvovirus B19, Hashimoto thyroiditis, Hypothyroidism.

I. INTRODUCTION

The term "thyroiditis" refers to the inflammation of the thyroid gland. It is caused by trauma, radiation, drugs or environmental factors such as viruses (Fariduddin et al., 2021). The thyroid dysfunction is classified into three groups: the first one, subclinical thyroiditis, it is an asymptomatic condition associated with increased or decreased thyroid-stimulating hormone (TSH) with normal thyroxine (T4) and triiodothyronine (T3) levels (Chrysant, 2020). The second group, hypothyroidism results from low levels of thyroid hormone. In the United States, autoimmune thyroid disease HT is the most common cause of hypothyroidism. Thirdly, hyperthyroidism it can be defined as a syndrome associated with excess thyroid hormone production. In the United States and most western countries,

Graves' disease (GD) is the most common cause of hyperthyroidism (Mathew et al., 2021).

Viral infections are frequently cited as a major environmental factor implicated in thyroid gland diseases (Gravelsina et al., 2019). The present study includes Parvovirus B19 that associated with autoimmune thyroiditis through molecular mimicry that is defined as the activation of autoreactive T cells by viral peptides with structural similarity to self-peptides (Kerr, 2016). The human Parvovirus B19 is a single-stranded DNA (ssDNA) virus that belongs to the family Parvoviridae, the subfamily Parvovirinae, the genus Erythrovirus, and the human Parvovirus B19 type (Rogo et al., 2014). Parvovirus B19 targets bone marrow erythroid progenitor cells (EPCs) through attaching to glycosphingolipid globoside (Gb4), results in major receptor-induced modifications structural that cause lysis or non-structural (NS1) protein-mediated apoptosis to cause cell death (Rogo et al., 2014 and Fanos and Mohammed, 2021).

II. SUBJECTS AND METHODS

A. Patients:

The current study included 91 patients with thyroid dysfunction, patients were divided into 20 males and 71 females, with an age range of 10 to 68 years old, at different private Laboratories in Al-Nasiriyah City. The study was performed in the period from October 2021 to December 2021. All patients were confirmed to have thyroid dysfunction by performing thyroid tests.

B. Ethical Approval

This study is subjected to the qualifications of ethical considerations and according to the form prepared for this purpose by the Iraqi Ministry of Health. The research also got the agreement of the committee of ethical standards at the College of Science, Thi-Qar University, one of the colleges belonging to the Ministry of Higher Education and Scientific Research, Iraq. In addition, informed consent was obtained from all patients before we took samples.

C. Serological test:

Serological diagnosis includes the detection of anti-TPO antibodies and (anti-Parvovirus B19) IgM and IgG antibodies by ELISA kit uses Sandwich-ELISA as the of choice.

D. Statistical Analysis

The statistical analysis of this cross-sectional study was performed with Statistical Package for the Social Sciences (SPSS) 20.0 and Microsoft Excel 2016.

Numerical data with normal distribution were described as mean and standard deviation.

Kruskal-wallis test used for comparison among the median of three groups of patients, and categorical data were described as count and percentage.

The lower level of accepted statistically significant difference is below or equal to 0.05 and the high level of accepted statistically significant difference is below or equal to 0.001.

III. RESULTS

A. Patients groups

Patients were divided into three groups according to the level of thyroid hormones (FT3, FT4 and TSH), as shown in Table 1.

Table 1 : Distribution of patients according to the type of thyroid dysfunction

Thyroid dysfunction	No. of patients (%)	Thyroid Hormones (Mean $\pm$ SD)		
		FT3 (pg/m)	FT4 (pg/m)	TSH (μ IU/ml)
Hypothyroidism	14 (15.4%)	2.5 $\pm$ 1.3	6.8 $\pm$ 2.8	43.5 $\pm$ 34.3
Hyperthyroidism	20 (21.97%)	6.5 $\pm$ 3.2	21.5 $\pm$ 8.4	0.02 $\pm$ 0.025
Subclinical thyroiditis	57 (62.63%)	3.3 $\pm$ 0.6	12.3 $\pm$ 2.6	7.2 $\pm$ 14.3

On the other hand, the detection of anti-TPO antibody was performed to investigate the patients who have HT. The results indicate the presence of anti-TPO antibody in 50 of 91 patients (54.94 %) and in high percentage (71.40%) in hypothyroidism, Table 2.

Table 2 : Detection of anti-TPO antibodies in thyroid dysfunction patients

Parameter		Study groups			P value
		Hypothyroidism	Hyperthyroidism	Subclinical thyroiditis	
Anti-TPO	Negative	4	7	30	0.069 _{NS}
		28.60%	35%	52.60%	
	Positive	10	13	27	
		71.40%	65%	47.40%	

B. Age and sex data

The median of age for patients groups (hypothyroidism, hyperthyroidism and subclinical thyroiditis) were 35, 46 and 37 years old, respectively, Table 3.

Table 3 : Distribution of thyroid dysfunction patients according to age and sex

Parameter		Study Groups			P value
		Hypothyroidism	Hyperthyroidism	Subclinical thyroiditis	
Age	Median	35	46	37	0.015*
	Percentile 05	24	29	15	
	Percentile 95	52	62	55	
sex	Female	10	17	44	0.623 _{NS}
		71.40%	85.00%	77.20%	
	Male	4	3	13	
		28.60%	15.00%	22.80%	

C. The detection of anti-Parvovirus B19 IgM and IgG Abs

The detection of anti-parvovirus B19 IgM antibody appears to be high (91.20%) in subclinical thyroiditis group followed by 90% in hyperthyroidism and 85.70% in hypothyroidism. While anti-parvovirus B19 IgG antibody appears in 100% of all patients groups, as shown in, Table 4.

Table 4 : Detection of anti-Parvovirus B19 IgM and IgG antibodies in patients with thyroid dysfunction

Type of antibody against Parvovirus B19		Study groups			p value
		Hypothyroidism	Hyperthyroidism	Subclinical thyroiditis	
B19 - IgM	Positive	12	18	52	0.492 _{NS}
		85.70%	90%	91.20%	
	Negative	2	2	5	
		14.30%	10%	8.80%	
B19 - IgG	Positive	14	20	57	No Value
		100.0%	100.0%	100.0%	

IV. DISCUSSION

A. *Distribution of patients according to the type of thyroid dysfunction*

The results of the present study revealed that the distribution of thyroid dysfunction was uneven across the groups, with the most common group being the subclinical thyroiditis group, with a total percentage of 62.63% and could be divided into subclinical hypothyroidism and subclinical hyperthyroidism at 61.40% and 38.60%, respectively. This is in agreement with a cross-sectional study conducted in Kurdistan-Iraq where the subclinical hypothyroidism was 94.85% but the subclinical hyperthyroidism was 2.20% (Zaman et al., 2021). The results also showed that the presence of hyperthyroidism was 21.97% and the percentage of hypothyroidism was 15.4%. These results are similar to the results of a study conducted in Nigeria which showed hyperthyroidism at 58% and hypothyroidism at 39% (Okafor et al., 2019). On the other hand, the results of the present study showed that the percentage of patients with anti-TPO antibodies in hypothyroidism, hyperthyroidism, and subclinical thyroiditis was 71.40%, 65% and 47.40%, respectively. These results are similar to the results of a study that showed the presence of anti-TPO antibody in hypothyroidism was 100%, while hyperthyroidism was 76.3% and euthyroidism was 7%. (Ojo et al., 2019). Moreover, it was found that the highest percentage of patients with anti-TPO antibodies in the hypothyroidism group was 71.40%, which may indicate a higher risk of HT. These results are consistent with the study in Egypt revealed the presence of anti-TPO antibodies in HT patients, where it was 95% (Assaad et al., 2020).

B. *Distribution of thyroid dysfunction patients according to age and sex*

The results revealed that the mean age in the three groups was 35, 46 and 37 years old. Figure 3 is in agreement with the study conducted in Iraq in Dohuk governorate, where the majority of thyroid disorders were in adults aged 30-50 years (Hasan and Raziq, 2019). It was conducted that the number of females was higher than that of males, as the percentage of females was 78.02%, while in males it was 21.97%. Most studies indicate a female predominance over males in thyroid diseases, such as the study conducted in Iraq's Diyala Governorate, where the incidence of thyroid diseases in females (86.57%) was found to be higher than in males (13.43%) (Mohammud, 2021). Because thyroid disorders are among the most common pathological conditions, especially in females, although the reasons for the prevalence in females are still unknown, a possible explanation can be found in the role of female sex hormones (Shetty and Chowdappa, 2019).

C. *The detection of anti-Parvovirus B19 IgM and IgG Abs*

The results showed that the proportion of patients carrying Parvovirus B19 IgM in hypothyroidism, hyperthyroidism and subclinical thyroiditis was 85.70%, 90% and 91.20%, respectively. While the anti-Parvovirus

B19 IgG antibody indicated that the prior infection status appeared in 100% of all patient groups. These results are in consistent with the results of a study conducted in Iran. The results of Irani study showed that detection of anti-B19V IgG antibody in HT group, GD group and euthyroid group was 61.1%, 58.9% and 47.1% respectively (Heidari and Jami, 2021). The mechanisms in B19-associated autoimmunity include molecular mimicry (IgG antibody to Parvovirus B19 proteins has been shown to cross react with a variety of recognized human autoantigens, including collagen II, keratin, angiotensin II type 1 receptor, myelin basic protein, cardiolipin, and platelet membrane glycoprotein IIb/IIIa), B19-induced apoptosis with presentation of self-antigens to T lymphocytes, and the phospholipase activity of the B19V unique VP1 protein (Kerr, 2016).

V. CONCLUSION

Thyroid tests indicate the division of patients into 3 main groups, subclinical thyroiditis which, was the most common group followed by hyperthyroidism and hypothyroidism. The detection of anti-TPO antibodies in the serum of patients concluded the presence of high percentage of HT among the participated patients'. Also the detection of anti-(Parvovirus B19) antibodies in patients serum samples gave an evidence to the presence of the virus in patient's tissue and this may be contributed in the pathogenesis of thyroiditis.

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