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ORIGINAL ARTICLE

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Study of UTI Effect on Renal Function for the Patient with Thyroid Autoimmune Disease

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Abstract

Background and Objectives: A cross-sectional study, effected of urinary tract infection (UTI) and immune thyroid disease (AITD) on the Renal functions in human. Following a literature analysis, the majority of studies focused on the influence of urinary tract infection on kidney function, while others looked at the impact of thyroid gland immunological disorders on renal function. Because urinary tract infection is a widespread condition that affects people of all ages and both sexes, it is regarded as one of the most critical variables impacting kidney function, which can lead to kidney failure in certain circumstances. Aside from the obvious increase in thyroid illnesses, there is also an increase in immunological diseases, which have a direct influence on kidney function. The study was inspired by patients who have both diseases at the same time, and what influence both diseases have on the crucial functioning of the kidneys, as the kidneys are one of the most important vital organs in the human body.

Materials and Methods: The study began by defining the target group at the central medical laboratories in Iraq's holy city of Karbala, where the total number of study samples was 92, divided into two main groups: the natural group, which numbered 44 samples, and the second group for patients, which numbered 48 samples and was divided into three branches. The first branch had 10 samples for patients with urinary tract infections alone, the second branch contained 10 samples for patients with immune thyroid illnesses only, and the third branch contained 28 samples for patients with both conditions, UTI and autoimmune thyroid disease. An information form was created for all patients, including name, age, gender, weight and height. The target group was determined for the age less than 45 years and body mass less than 27%, where the blood serum sample as well as the urine sample are taken at the same time and tests are conducted for them and their results are confirmed. The following tests were conducted for all 92 samples. It included two types of analyzes, the first type which was carried out through blood same as chemical study included (Urea, Creatinine, Uric Acid and albumin) also the hormonal test included (Total T3, Total T4 and TSH) and autoimmune thyroid blood examination such as (Anti-TG Ab and Anti-TPO Ab). As for the second type, the analysis included a urine sample, which included (General urine examination, biochemical test for urine culture to indicated the type of bacterial.

Results: The statistical results indicated to demographic characteristics of patient with renal disease and control the mean for age (36.72 ± 8.12 and 35.18 ± 9.28 for the patients and control respectively) in other hand the gender distributions were (43.7% male and 56.3%, female in patients' group and 27.3% male and 72.7% female in control group). The results were the focus of the statistical study of patients with both diseases, urinary tract infection and immune thyroid disease and its effect on kidney function were (Urea, creatinine, uric acid and albumin is 48.07 ± 7.63, 1.26 ± 0.37, 6.63 ± 0.713 and 4.02 ± 0.9) respectively, and for the (560.07 ± 340.18 and 763.83 ± 671.71 to anti-TPO Ab and anti-TG Ab) respectively. While the results of urine analyze for patients with urinary tract infection only were (50.0%, 28.6%, 17.8% and 3.6% for the one+, two+, three+ and four+ for pus cells in microscope exam), while the results of urine culture were (32.1%, 21.4% and 46.5% for *Escherichia coli*, *K. pneumonia* and *Staph. Aureus*) respectively. The urine culture shows the increase ratio to *Staph. aureus*.

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Conclusion: The findings revealed that patients who have both diseases had a stronger influence on kidney function than those with urinary tract infection or immune thyroid disease. The kinds of bacteria that cause urinary tract infection were also investigated, with Staphylococcus aureus being one of the most common bacteria that cause illness.

Keywords: Bacterial infection study, Renal function, Renal failure, UTI, Autoimmune thyroid disease

1. Introduction

For many years, it has been known that the thyroid and kidney interact in each other's activities. Thyroid illness impacts renal physiology and development, whereas kidney disease can cause thyroid disease. Thyroid and renal disorders may coexist due to shared etiological causes. Furthermore, the therapy tactics for one illness may have an impact on the treatment plans for the other organ. This study focuses on the critical and clinically significant relationships between thyroid and renal function, which are critical for the physician to treat the patient effectively [1, 2]. Thyroid hormone has an impact on nearly all of the body's organ systems. The thyroid gland produces and secretes it under the direction of the anterior pituitary hormone thyroid stimulating hormone (TSH), which is regulated by hypothalamic thyrotropin-releasing hormone. Thyroxine (T4) is generated exclusively by the thyroid gland, but triiodothyronine (T3), the more physiologically active form of thyroid hormone, is created predominantly by the enzyme T4-5′-deiodinase in other organs, such as the kidney [3]. The D1 isoform of this enzyme is found in the kidney, and it becomes less active in uremia. Thyroid hormone has an effect on gene transcription via attaching to thyroid hormone nuclear receptors, which then bind to thyroid hormone response elements in target genes. Thyroid hormones can have nongenomic effects via binding to plasma membrane and cytoplasmic components [4, 5].

A prior study found a relationship between renal impairment and AITD. In addition to thyroid damage and thyroid functional hormonal changes, AITD may cause further systemic injury. Proteinuria (also known as AITD-related nephropathy) is a symptom of AITD, demonstrating that thyroid antigens are associated to immunological complicated glomerulonephritis in GD. However, the bulk of these investigations are case reports, with few cohort studies investigating the relationship between AITD and nephropathy to yet [6].

2. Materials and methods

2.1. Study design

This study was approved by the Hilla University College so that this study was designed to investigate some parameters related to the effect of Autoimmune thyroid diseases (AITDs) on renal function in humans in (92) females & males' patients and healthy subjects collected, out of these (59) were females, (33) were males. The (59) females included (32) healthy females and (27) patients whereas the (33) males included (12) healthy males and (21) patients. Male and female Patients with renal disease were categorized into (<25) years of age and (≥45) years of age groups. Blood samples were obtained from subjects referred to private laboratories (Dr. Mohammed Salih & Al-Usra Medical laboratories), during the period from (August 2023 to November 2023) 44 samples were taken carefully and accurately by preparing a form containing information about the patient such as weight, height, blood pressure and whether the patient suffers from diabetes, all samples tested Renal Function (Urea, Creatinine, Uric acid, Albumin) and Urinary Tract Infection and Thyroid Hormones (T3, T4, TSH), and Immunological tests (Anti-TPO Ab, Anti-TG Ab).

3. Results

3.1. Control group

44 samples were taken carefully and accurately by preparing a form containing information about the patient such as weight, height, blood pressure and whether the patient suffers from diabetes. The laboratory is under study and the results below refer to the results of the blood and urine test.

3.2. Result of renal function test

The biochemical parameters result of control groups such as urea, creatinine, uric acid and albumin included 44 samples divided to 33 female sample and 11 male sample and the average age <45 years, Table 2 shows the result. The normal values for the (urea 13–43 mg/dL, creatinine 0.6–1.1 mg/dL, uric acid 3.5–7.2 mg/dL for men, uric acid 2.6–6.0 mg/dL for women and albumin 3.4–4.8 g/dL) were taken from the list attached with MANUFACTURER: BIOLABO SAS kits.

Table 1. Demographic characteristics of patients with renal disease and control subjects.

Characteristic	Patients $n = 48$	Control $n = 44$	P
Age (years)			
Mean ± SD	36.72 ± 8.12	35.18 ± 9.28	0.396†
Range	18–49 years	12–70 years	NS
<25, *n* (%)	4 (8.30%)	3 (6.80%)	
25–34, *n* (%)	11 (22.90%)	16 (36.40%)	0.514¥
35–44, *n* (%)	27 (56.30%)	19 (43.20%)	NS
≥45, *n* (%)	6 (12.50%)	6 (13.60%)	
Gender			
Male, *n* (%)	21 (43.70%)	12 (27.30%)	0.153¥
Female, *n* (%)	27 (56.30%)	32 (72.70%)	NS
Male:female ratio	1:1.28		
BMI			
Mean ± SD	27.07 ± 5.1	25.55 ± 4.07	0.628†
Range	18.20–38.80	22.0–36.0	NS

n: number of cases; SD: standard deviation; †: independent samples t-test; ¥: Chi-square test; NS: not significant at $P > 0.05$.

3.3. Result of thyroid autoimmune parameters

For the purpose of confirming the safety of the control group from the absence of thyroid immunodeficiency, blood tests were performed that reveal this disease, Tables 3 and 4, which include the result of (anti-TG Ab and anti-TPO Ab) and result refer to normality when comparing with the normal value for (anti-TG Ab = 115 IU/ml and anti-TPO Ab = 34 IU/ml), the normal value were taken from the list attached with Roche Diagnostics COBAS Elecsys Anti-TG Ab and Anti-TPO Ab kits.

4. Discussion

4.1. Demographic characteristics of patients and control subjects

Patients with renal disease were categorized into three groups, those who are with urinary tract infection only, whereas other groups, those who were with autoimmune thyroiditis only and patients with both urinary tract infection and autoimmune thyroiditis. The mean age of patients was 36.72 ± 8.12 and that of control subjects was 35.18 ± 9.28 years and there was no significant difference between patients and control subjects in mean age ($P = 0.396$). Again, there was no significant difference in the frequency distribution of patients and control subjects according to age ($P =$ 0. 514). Patients' group included 21 (43.70%) males and 27 (56.30%) females, whereas, control group included 12 (27.30%) males and 32 (72.70%) females and there was no significant difference in the frequency distribution of patients and control subjects according to gender ($P = 0.153$). These results compatible with other results obtained by Murray et al. (2020), who found that 79% of patients with kidney infection are females, generally, the females are more susceptible to UTI than males, because the urethra is shorter and nearer to anus more than in males, in addition to the vaginal pathogens which my ascend to urinary tract and cause UTI [7].

According to BMI, the mean of BMI of patients was 27.07 ± 5.1 and that of healthy control subjects was 25.55 ± 4.07 and there was no significant difference between patients and control subjects in mean BMI ($P = 0.628$). The above results have ensured statistical matching between patients' group and control group regarding age and gender which is a prerequisite for such case control study.

4.2. Levels of some biochemical markers (Urea, Creatinine, Uric acid and Albumin and UTI) in patients' groups and healthy controls

The comparison of some biochemical markers between patient groups and control group has been carried out and the results were demonstrated in Table 2. Mean levels of urea were 39.40 ± 8.09, 35.70 ± 8.45, 48.07 ± 7.63 and 24.79 ± 5.44, in patients with urinary tract infection only, patient with autoimmune thyroiditis only, patients with both urinary tract infection and autoimmune thyroiditis and healthy control group respectively; the mean levels was higher in patients with both urinary tract infection and autoimmune thyroiditis in comparison with other groups and the difference was highly significant ($P < 0.001$). These results compatible with other results obtained by Suher et al. (2005) who found the increase of UAER was mildly significant in patients who had thyroid autoantibody positiveness compared with those with autoantibody negative, most patients with autoantibody positive were hypothyroid. Furthermore, among the hypothyroid population, differences between values of UAER and CC in the autoantibody positive group and those in the negative group were not significant. In this situation, we consider that albuminuria probably is due mainly to hypothyroidism rather than to thyroid autoimmunity [8]. Also the mean levels of creatinine were 0.906 ± 0.191, 0.706 ± 0.191, 1.26 ± 0.370 and 0.629 ± 0.137, in patients with urinary tract infection only, patient with autoimmune thyroiditis only, patients with both urinary tract infection and autoimmune thyroiditis and healthy control group respectively; the mean levels was higher in patients with both urinary tract infection and autoimmune thyroiditis in comparison with other groups and the difference was highly significant ($P < 0.001$). These results compatible with other results obtained by Ford et al. (1989) who found in

Table 2. Levels of some Biochemical markers (Urea, Creatinine, Uric acid and Albumin) in patients' groups and healthy controls.

		Cases–control comparison				
		Urinary tract infection n = 10	Autoimmune thyroiditis n = 10	Both urinary tract infection and autoimmune thyroiditis n = 28	Control subjects n = 44	Total P value
Urea mg/dl						
Mean ± SD		39.40 ± 8.09	35.70 ± 8.45	48.07 ± 7.63	24.79 ± 5.44	
Range		29.00–52.00	24.00–47.00	36.00–68.00	14.00–38.00	
LSD	UTI vs AT			0.228		<0.001† HS
	UTI vs B			0.001		
	UTI vs C			0.001		
	AT vs B			0.001		
	AT vs C			0.001		
	B vs C			0.001		
Creatinine mg/dl						
Mean ± SD		0.906 ± 0.191	0.706 ± 0.191	1.26 ± 0.370	0.629 ± 0.137	
Range		0.70–1.30	0.50–1.10	0.80–2.10	0.40–0.97	
LSD	UTI vs AT			0.0.68		<0.001† HS
	UTI vs B			0.001		
	UTI vs C			0.002		
	AT vs B			0.001		
	AT vs C			0.370		
	B vs C			0.001		
Uric acid mg/dl						
Mean ± SD		5.34 ± .878	4.34 ± 0.867	6.63 ± 0.713	4.02 ± 0.90	
Range		4.10–6.90	3.10–5.90	5.70–8.10	2.70–6.00	
LSD	UTI vs AT			0.009		<0.001† HS
	UTI vs B			0.001		
	UTI vs C			0.001		
	AT vs B			0.001		
	AT vs C			0.289		
	B vs C			0.001		
Albumin						
Mean ± SD		4.15 ± 0.75	4.80 ± 0.54	4.50 ± 0.72	4.10 ± 0.71	
Range		2.99–5.20	3.99–5.70	3.11–5.80	3.10–5.40	
LSD	UTI vs AT			0.067		0.150† NS
	UTI vs B			0.186		
	UTI vs C			0.912		
	AT vs B			0.103		
	AT vs C			0.027		
	B vs C			0.355		

n: number of cases; SD: standard deviation; UTI: Urinary tract infection patients; AT: Autoimmune thyroiditis patients; B: Both urinary tract infection and autoimmune thyroiditis patients; C: Control: †: Anova test; HS: Highly significant at P ≤ 0.001; NS: not significant at P ≤ 0.05.

hyperthyroid patients, both renal blood flow and the capacity of the renal tubules to carry out active transport are increased. Ford et al. (1989) found that the total protein/creatinine ratio was increased in random urine specimens from hyperthyroid patients. In addition, they observed significant elevations in the values for albumin/creatinine in hyperthyroid patients compared with the same patients when they became euthyroid [9]. According to serum uric acid, the present study shows the mean levels of serum uric acid highly significant increase in patients with both urinary tract infection and autoimmune thyroiditis in compared to other groups, 6.63 ± 0.713 versus 5.34 ± .878, 4.34± 0.867 and 4.02 ± 0.90 respectively, (P < 0.001).

But according to serum levels of albumin, the present study show the mean levels of serum albumin non-significant increase in patients with autoimmune thyroiditis in compared to other groups, 4.80 ± 0.54 versus 4.15 ± 0.75, 4.50 ± 0.72 and 4.10 ± 0.71 respectively, (P = 0.150).

Through the results that appeared in this study, it was found several kinds of glomerulonephritis have been linked to thyroid problems, including hypo- and hyperthyroidism. Membranous, IgA, mesangiocapillary, membranoproliferative, and minimal change

Table 3. Mean levels of serum Anti-TPO in patients and healthy controls.

		Cases–control comparison				
		Urinary tract infection n = 10	Autoimmune thyroiditis n = 10	Both UTI and autoimmune thyroiditis n = 28	Control subjects n = 44	Total P value
Anti-TPO IU/ml						
Mean ± SD		18.84 ± 13.92	769.90 ± 179.19	560.07 ± 340.18	17.90 ± 8.36	
Range		0.70–48.00	486.0–1019.0	126.14–1401.00	7.70–36.20	
LSD	UTI vs AT			0.001		0.001† HS
	UTI vs B			0.001		
	UTI vs C			0.989		
	AT vs B			0.001		
	AT vs C			0.001		
	B vs C			0.001		

n: number of cases; SD: standard deviation; UTI: Urinary tract infection patients; AT: Autoimmune thyroiditis patients; B: Both urinary tract infection and autoimmune thyroiditis patients; C: Control: †: Anova test; HS: Highly significant at P ≤ 0.001; NS: not significant at P ≤ 0.05.

Table 4. Mean levels of serum Anti-TG in patients and healthy controls.

		Cases–control comparison				
		Urinary tract infection n = 10	Autoimmune thyroiditis n = 10	Both UTI and autoimmune thyroiditis n = 28	Control subjects n = 44	Total P value
Anti-TG IU/ml						
Mean ± SD		10.90 ± 7.89	1068.00 ± 886.50	763.83 ± 671.71	43.37 ± 25.28	
Range		2.30–26.30	220.0–2875.0	176.14–2871.00	7.10–90.10	
LSD	UTI vs AT			0.001		0.001† HS
	UTI vs B			0.001		
	UTI vs C			0.854		
	AT vs B			0.111		
	AT vs C			0.001		
	B vs C			0.001		

n: number of cases; SD: standard deviation; UTI: Urinary tract infection patients; AT: Autoimmune thyroiditis patients; B: Both urinary tract infection and autoimmune thyroiditis patients; C: Control: †: Anova test; HS: Highly significant at P ≤ 0.001; NS: not significant at P ≤ 0.05.

glomerulonephritis are the several forms of glomerulonephritis that can occur with thyroid illness. Membranous glomerulonephritis is the most common type of these, these results compatible with other results [10, 11].

5. Conclusion

The findings revealed that patients who have both diseases had a stronger influence on kidney function than those with urinary tract infection or immune thyroid disease. The kinds of bacteria that cause urinary tract infection were also investigated, with Staphylococcus aureus being one of the most common bacteria that cause illness.

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