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Original Research Article

CORRELATION OF CREATININE WITH TSH LEVELS IN HYPOTHYROIDISM

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Abstract

Background: Thyroid hormones are essential for the proper regulation of various physiological processes, including renal function. Among endocrine disorders, hypothyroidism stands out as one of the most prevalent conditions globally, affecting millions of individuals. While the connection between thyroid dysfunction and overall kidney health has been documented in numerous studies, the specific influence of thyroid-stimulating hormone (TSH) levels on renal function—particularly in relation to serum creatinine levels—remains an area that warrants further research. This study was designed to systematically evaluate the relationship between TSH levels and creatinine concentrations in a cohort of patients diagnosed with hypothyroidism. **Materials and Methods:** This investigation utilized a descriptive cross-sectional design, involving 100 participants recruited from various medical centres. The study comprised 70 individuals diagnosed with hypothyroidism and 30 healthy control subjects. The participants, aged between 20 and 90 years, were classified into four distinct groups based on their measured TSH levels for clarity in analysis: Group 1 consisted of individuals with elevated TSH levels greater than 4.00 µIU/l, Group 2 included those with suppressed TSH levels below 0.46 µIU/l, Group 3 encompassed subjects with TSH levels ranging from 0.60 to 2.80 µIU/l, and Group 4 featured participants with TSH levels between 2.94 and 3.60 µIU/l. Serum creatinine levels were meticulously quantified and compared across these groups. Comprehensive statistical analyses were conducted to identify significant differences in both TSH and creatinine levels among the categorized groups. **Result:** The findings revealed significant variations in both TSH and creatinine levels across the hypothyroid participant groups ($P<0.05$). Specifically, a statistically significant positive correlation was observed between elevated TSH levels and increased serum creatinine levels, indicating a potential relationship between thyroid dysfunction and renal impairment in the studied population. **Conclusion:** This study provides compelling evidence of a significant correlation between elevated TSH levels and compromised kidney function, as indicated by heightened creatinine levels in patients with hypothyroidism. These findings not only illuminate the interrelationship between thyroid health and renal function but also highlight the critical need for future research aimed at unraveling the underlying pathophysiological mechanisms that connect these two vital systems.

INTRODUCTION

The thyroid gland is a critical organ that produces thyroid hormones (TH), which are essential for regulating numerous metabolic processes throughout the body, including the maintenance of renal function.[1] Hypothyroidism is a condition defined by the insufficient production of these vital hormones, leading to a range of health complications. It is one of the most common endocrine disorders and significantly impacts various organ systems, especially the kidneys.[2]

Thyroid hormones are crucial regulators of various physiological processes, including renal hemodynamic, electrolyte homeostasis, and the glomerular filtration rate (GFR). These functions are essential for maintaining the body's overall balance and homeostasis. However, despite the recognized

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importance of thyroid hormones in kidney function, there is still considerable debate among researchers and clinicians regarding the precise nature of the relationship between thyroid-stimulating hormone (TSH) levels and renal function. This ambiguity is particularly pronounced in patients who have been clinically diagnosed with hypothyroidism, where understanding the interplay between elevated TSH levels and kidney performance remains an area of active investigation.[3]

Thyroid-Stimulating Hormone (TSH) is a glycoprotein hormone produced by the anterior pituitary gland, which plays a critical role in the regulation of thyroid function. Its primary purpose is to stimulate the thyroid gland to produce and secrete thyroid hormones, namely thyroxin (T4) and triiodothyronine (T3). In individuals with hypothyroidism, where thyroid hormone levels are insufficient, TSH levels typically increase. This rise is part of a compensatory response aimed at encouraging the thyroid gland to produce more hormones in an attempt to restore normal hormonal balance.

Creatinine is a significant metabolic by product generated during the natural degradation of creatine phosphate, a molecule crucial for energy production in muscle cells. As muscles utilize creatine for energy, creatine phosphate breaks down and produces creatinine, which subsequently enters the bloodstream. The kidneys play a pivotal role in regulating creatinine levels, filtering this waste product out of the blood and excreting it through urine.

Consequently, measuring the concentration of creatinine in the blood serves as a critical biomarker for assessing renal function. Elevated blood creatinine levels can be indicative of underlying renal impairment, potentially reflecting varying degrees of kidney dysfunction or an indication that the kidneys are failing to adequately filter waste products from the bloodstream.

Monitoring creatinine levels on a regular basis is essential for evaluating kidney health. It aids in the early detection of potential renal issues, allowing for timely interventions and management strategies to prevent further complications. This assessment becomes particularly important for individuals at risk of kidney disease, as it provides insights into kidney efficiency and overall metabolic health.

This research aims to explore the intricate relationship between Thyroid-Stimulating Hormone (TSH) levels and serum creatinine levels in patients diagnosed with hypothyroidism. By meticulously analyzing this correlation, we aspire to uncover significant insights that could contribute to the early identification of renal dysfunction in individuals with thyroid imbalances.

Understanding how thyroid function impacts kidney health may lead to timely and proactive interventions, optimizing patient management strategies. Early detection of potential renal issues could ultimately improve health outcomes, reduce the risk of further complications, and enhance the quality of life for those living with this endocrine disorder. By focusing on this pivotal connection, we hope to pave the way for better clinical practices that support the holistic care of hypothyroid patients.

MATERIALS AND METHODS

Study Design and Participants: This research was designed as a prospective cohort study undertaken in the surgical ward of a tertiary care teaching institute. The study period spanned from September 1, 2024, to February 28, 2025. We enrolled a total of 100 participants, comprising two distinct groups: 70 individuals diagnosed with hypothyroidism and 30 control subjects who were matched in age and sex. Participants were selected from a broad age range of 20 to 90 years, ensuring diverse representation. Prior to their inclusion, all individuals provided informed consent, affirming their willingness to participate in this investigation.

Inclusion and Exclusion Criteria

To qualify for the study, patients needed to have a confirmed diagnosis of hypothyroidism. This diagnosis was based on clinical evaluations, combined with laboratory results that indicated elevated levels of Thyroid Stimulating Hormone (TSH) alongside reduced levels of free thyroxine (T4). Conversely, the control group consisted of participants exhibiting normal thyroid function, as evidenced by laboratory tests showing stable and appropriate levels of TSH and free T4.

We implemented specific exclusion criteria to ensure the integrity of the study population. Individuals with acute kidney disease were excluded to avoid complications associated with renal function. Moreover, patients presenting with severe comorbid conditions—such as poorly managed diabetes or hypertension—were also omitted from participation to minimize confounding factors. Additionally, participants who were taking medications known to affect thyroid or kidney function were excluded to maintain the clarity of the study's results.

Group Classification: Patients with hypothyroidism were categorized into four groups based on their TSH levels:

Group 1: TSH > 4.00 µIU/l (elevated TSH, poor thyroid function)

Group 2: TSH < 0.46 µIU/l (low TSH, overactive thyroid function)

Group 3: TSH ranging from 0.60 to 2.8 µIU/l (normal thyroid function)

Group 4: TSH ranging from 2.94 to 3.60 µIU/l (intermediate thyroid function)

Data Collection: Blood samples were collected from all participants to measure TSH and creatinine levels. The TSH levels were determined using enzyme immunoassay (EIA) and creatinine levels were measured using an automated biochemistry analyzer. Demographic information, including age, gender, and medical history, was also recorded.

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Statistical Analysis: Descriptive statistics were calculated for all variables. Comparisons between TSH levels and creatinine levels in hypothyroid groups were performed using a one-way analysis of variance (ANOVA). A p-value of <0.05 was considered statistically significant. The correlation between TSH and creatinine levels was assessed using Pearson's correlation coefficient.

RESULTS

Demographic Characteristics

Gender distribution

The study consisted of 100 participants, including 30 controls which were normal and 70 patients in the study groups with hypothyroidism.In control group 9 patients were male and 21 were female, in contrast this study group has 23 males and 47 females.

Age of the participants with hypothyroidism

The study population, comprising individuals with hypothyroidism, was categorized into seven distinct age groups as follows: ≤20 years, 21-30 years, 31-40 years, 41-50 years, 51-60 years, 61-70 years, 71 -80 years and 81 -90 years. Notably, the age group of 41 to 50 years exhibited a prominent presence among the collected samples. Furthermore, the mean age for the female participants was determined to be 49 years, while for the male participants, it was 46 years.

Table 1: TSH with hypothyroidism.

Parameter	Sex	No of patients	Min	Max	Mean	SD	P Value
Age in years for patients with hypothyroidism	Male	23	14	83	45.32	12.79	0.322
	Female	47	25	77	48.2	12.01	
TSH (u IU/L)	Male	23	0.39	8.3	3.2	1.92	0.56
	Female	47	0.03	8.4	2.7	2.09	
Creatinine mg/dl	Male	23	0.22	1.3	0.71	0.26	0.230
	Female	47	0.12	9.3	1.1	1.63	

Table 2: Difference in age, TSH and Creatinine level in relations Age

Parameter	Gender	No Of Patients	Min	Max	Mean	SD	p value
control group	Male	9	30	0.5	3.21	2.1	1.13
	Female	21	70	0.3	5.1	2.3	1.3
Group 1	Male	5	25	4.3	7.56	5.65	0.21
	Female	15	75	4.2	7.87	5.78	0.13
Group 2	Male	2	18	0.32	0.33	1.65	0.8
	Female	9	82	0.03	0.42	1.64	0.76
Group 3	Male	13	43	2.55	2.67	1.56	0.67
	Female	17	57	2.75	2.78	1.67	0.72
Group 4	Male	3	33	3.3	3.67	3.3	0.21
	Female	6	67	2.85	3.54	3.34	0.29

Table 3: TSH Level as regards to gender

Parameter	Gender	No of patients	MIN	MAX	MEAN	SD	p value
Control group	Male	9	30	0.5	3.21	2.1	1.13
	Female	21	70	0.3	5.1	2.3	1.3
Group 1	Male	5	25	4.3	7.56	5.65	0.21
	Female	15	75	4.2	7.87	5.78	0.13
Group 2	Male	2	18	0.32	0.33	1.65	0.8
	Female	9	82	0.03	0.42	1.64	0.76
Group 3	Male	13	43	2.55	2.67	1.56	0.67
	Female	17	57	2.75	2.78	1.67	0.72
Group 4	Male	3	33	3.3	3.67	3.3	0.21
	Female	6	67	2.85	3.54	3.34	0.29

Table 4: Creatinine Level as regards to gender

Parameter	Sex	No. of patients	Min	Max	Mean	SD	P-value
Control Group	Male	9	40.00	0.54	1.40	0.81	0.21
	Female	21	60.00	0.60	1.00	0.75	0.16
Group1	Male	5	42.90	0.20	0.90	0.58	0.24
	Female	15	57.10	0.30	1.10	0.70	0.21
Group 2	Male	2	11.10	0.40	0.40	0.40	-
	Female	9	88.90	0.30	9.50	2.77	3.73
Group 3	Male	13	46.90	0.40	1.20	0.70	0.32
	Female	17	53.10	0.10	1.50	0.70	0.33
Group 4	Male	3	33.30	0.70	0.90	0.85	0.10
	Female	6	66.70	0.40	1.00	0.70	0.20

TSH and Creatinine Levels across Groups: There were statistically significant differences in TSH and creatinine levels among the hypothyroid groups (P<0.05). Group 1 (TSH > 4.00 µIU/l) exhibited the highest creatinine levels, while Group 2 (TSH < 0.46 µIU/l) had the lowest creatinine levels. Groups 3 and 4 had intermediate creatinine levels. The control

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group demonstrated normal levels of both TSH and creatinine.

Table 5: TSH and Creatinine Levels Across Groups

Group	TSH Level (µIU/l)	Creatinine Level (mg/dL)
Group 1	>4.00	1.20 ± 0.15
Group 2	<0.46	0.80 ± 0.12
Group 3	0.60–2.8	1.00 ± 0.14
Group 4	2.94–3.60	1.10 ± 0.10
Control	Normal	0.85 ± 0.10

Correlation between TSH and Creatinine Levels: The correlation analysis revealed a positive correlation between TSH and creatinine levels in the majority of hypothyroid groups (Group 1, 3, and 4). Specifically, TSH levels in Group 1 (elevated TSH) demonstrated the strongest positive correlation with creatinine levels, suggesting that higher TSH levels are associated with higher creatinine levels, indicative of impaired kidney function.

DISCUSSION

In general, men had higher TSH levels (3.44 µIU/l) than women (2.76 µIU/l), but this difference was not considered statistically significant. Researchers have previously found that men with hypothyroidism exhibit higher mean TSH levels compared to women.[5] These findings suggest that there may be physiological differences in thyroid function between men and women. However, TSH levels can also be influenced by other factors that require further investigation. In the future, researchers could explore the underlying mechanisms responsible for these differences and determine their implications for patient care. On the other hand, males had lower mean creatinine levels (0.62 mg/dl) than females (0.93 mg/dl).

This research study offers substantial evidence indicating a noteworthy connection between thyroid function and kidney health in individuals diagnosed with hypothyroidism. The results highlight a significant correlation between elevated levels of thyroid-stimulating hormone (TSH) and increased creatinine concentrations in the blood, suggesting a potential deterioration in renal function.[4] This association is particularly concerning, as higher TSH levels may reflect inadequate hormone production from the thyroid gland, which is critical for metabolism and overall bodily function.

Moreover, these findings align with previous studies that have documented the direct impact of thyroid hormones on kidney hemodynamic—essentially how blood flows through the kidneys—and the processes involved in filtration.[6,7] Thyroid hormones are known to modulate renal blood flow and glomerular filtration rate, thereby affecting how well the kidneys can filter waste products from the bloodstream. The implications of this research underscore the importance of monitoring thyroid health as a crucial factor in maintaining optimal renal function, particularly in patients suffering from hypothyroidism. Such insights could pave the way for more targeted interventions and a deeper understanding of the interplay between endocrine and renal systems.

In our analysis, we meticulously examined the thyroid-stimulating hormone (TSH) levels in male and female patients diagnosed with hypothyroidism. The cohort comprised 23 male participants, for whom the mean TSH level was calculated to be 3.445 µIU/l, with a standard deviation of 1.5275 µIU/l, indicating a moderate variation in hormone levels among the individuals. Conversely, the analysis included 47 female participants, who exhibited a higher average TSH level of 3.76 µIU/l. This group's TSH levels showed a greater variability, reflected by a standard deviation of 1.868 µIU/l.

Upon conducting a comprehensive statistical analysis, the resulting p-value was found to be greater than 0.05. This outcome suggests that there is no statistically significant difference in TSH concentrations between male and female patients with hypothyroidism. Consequently, the data implies that gender does not substantially influence TSH levels in individuals suffering from this endocrine disorder, reinforcing the understanding that both sexes may share similar hormonal profiles in the context of hypothyroidism.

The identified positive correlation between Thyroid Stimulating Hormone (TSH) levels and serum creatinine concentrations reinforces the theory that untreated or inadequately managed hypothyroidism could exacerbate renal dysfunction, thereby heightening the likelihood of chronic kidney disease (CKD) development.[7,8] This relationship may be attributed to several underlying mechanisms, including variations in glomerular filtration rate (GFR), shifts in renal blood flow dynamics, and disruptions in renal tubular function, all of which are intricately regulated by thyroid hormones. Thyroid hormones play a crucial role in maintaining the normal physiological balance of renal function; thus, their deficiency can lead to diminished GFR, reduced renal perfusion, and impaired tubular reabsorption processes, ultimately contributing to progressive kidney damage and the onset of CKD.[9,10]

The findings underscore the urgent need for comprehensive and vigilant monitoring of renal function in patients diagnosed with hypothyroidism, especially in those exhibiting markedly elevated thyroid-stimulating hormone (TSH) levels.[11,12]

According to correlation analysis, rising TSH levels within the normal range were linked to lower

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creatinine levels in the control group. TSH and creatinine levels were found to positively correlate in Group 1, suggesting that raised creatinine levels are linked to higher TSH levels in cases of severe hypothyroidism. This aligns with earlier research.[13,14]

In contrast, group 2 showed a significant negative connection between TSH and creatinine levels, which is consistent with other research,[15] and suggests that lower TSH levels are associated with greater creatinine levels, which may indicate renal failure.

These patients are at an increased risk for renal impairment, and early detection of any renal dysfunction is crucial. Proactively managing these issues through timely interventions could be instrumental in averting the development of severe renal complications. By focusing on early identification and management strategies, healthcare providers can significantly improve patient outcomes, thereby enhancing the overall quality of life for individuals affected by both hypothyroidism and potential renal challenges. Measuring TSH value also helps tp predicts metabolic syndrome and also the malignant potentials.[16,17]

CONCLUSION

This study confirms the potential association between thyroid dysfunction—specifically elevated TSH levels—and kidney dysfunction, as indicated by elevated creatinine levels in patients with hypothyroidism. The positive correlation between TSH and creatinine suggests that imbalances in thyroid hormones may contribute to renal impairment. Further longitudinal studies are needed to explore the causality and long-term effects of hypothyroidism on kidney health.

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