Annals of R.S.C.B., ISSN:1583-6258, Vol.28, Issue1, 2024 Pages: 514 - 521

Received 30 July 2024; Accepted 15 August 2024

Thyroid Gland Dysfunction and the Accompanying Mental Changes

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Abstract

Background: Hypothyroidism is frequently associated with various mental health disorders, primarily due to the interplay between thyroid hormones and brain function. This study aimed to investigate the potential connection between hypothyroidism and its psychological impact, particularly focusing on anxiety and depression.

Materials and Methods: This cross-sectional study was conducted to assess the psychological impact of hypothyroidism. One hundred and nine (76 female & 33 male) patients were included in this study. Participants were recruited from Azadi Teaching Hospital in Kirkuk city and various other laboratory settings. The patients were further classified into two groups according to receiving hormonal therapy (before and after treatment). Hamilton Depression Rating Scale (HAM-D) & Hospital Anxiety and Depression Scale (HADS) used for psychological assessment

Results: Across different TSH categories, there were no significant differences in (HAM-D & HADS) anxiety & depression scales for both male and female hypothyroid patients; also, the HADS score of anxiety and depression shows no significant difference in patients before and after treatment. But HAM-D Scale scores were significantly higher in hypothyroid untreated patients in comparison to euthyroid treated patients.

Conclusion: Anxiety and depressive symptoms are common mental health disorders associated with hypothyroidism. Our study did not find a significant link between TSH regulation and psychological outcomes, but the treatment lowers the severity of mental symptoms. It highlights the complexity of mental health in hypothyroid patients.

Keywords: Anxiety, Depression, Thyroid Hormone, Hypothyroidism, Mental Health

Introduction

Hypothyroidism happens when the thyroid organ neglects to create adequate chemicals required by the body. The thyroid organ is a butterfly-molded organ situated toward the front of the neck, just beneath Throat cartilage. It is a vital piece of the endocrine framework. As one of the body's biggest and most crucial organs, it produces two key chemicals, T3 and T4, which are fundamental for directing digestion and guaranteeing the body's ordinary capability [1, 2]. These chemicals are significant for appropriate mind capability, and disturbance in thyroid hormone, whether hypothyroidism or hyperthyroidism, are frequently connected to mental side effects, especially influencing feelings, cognizance, temperament, and ways of behaving [3-5].

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The relationship between psychiatric disorders and hypothyroidism has garnered increasing attention in recent years, highlighting the complex interplay between endocrine function and mental health [3, 5].

Thyroid issues are commonly analyzed and characterized in light of the degrees of chemicals in the nerve center pituitary-thyroid pivot, which incorporates TRH (thyrotropin releasing hormone), TSH (thyroid stimulating hormone), T3 (tri-iodothyronine), and T4(tetra-iodothyronine) Thyroid hormones-primarily thyroxine (T4) and triiodothyronine (T3)-are crucial for regulating metabolism, energy levels, and organ function. However, they also play a significant role in brain function and mood regulation. When hormone levels are imbalanced due to hypothyroidism, many psychiatric effects can manifest [6, 7].

The relationship between psychiatric disorders and hypothyroidism has garnered increasing attention in recent years, highlighting the complex interplay between endocrine function and mental health. This study planned to find the relationship hypothyroidism and psychological wellness issues, especially anxiety, raising questions about the organic basis of these mood disorders and the potential for thyroid regulation to mitigate symptoms.

Methods

Study population

This cross-sectional study was conducted to assess the psychological impact of hypothyroidism. One hundred and nine (76 female &33male) Patient were included in this study with mean age 42±7.6. Participants were recruited from Azadi Teaching Hospital in Kirkuk city and various other laboratory settings. Between May 2024 and December 2024.Ethical Permission was taken from all the patients. Individuals eligible for inclusion were adults aged 20 years and older who had been diagnosed with hypothyroidism. The patients were divided into two groups based on whether they were obtaining hormonal therapy (levothyroxine): the before-treatment group and the after-treatment group.

Additionally, the after-treatment group was divided into three groups based on their TSH levels.

1. 0-5 m U/L(euthyroid)
2. 6-10 mU/L
3. 10> mU/L

The exclusion criteria include patients' refusal, drug history of psychological drugs.

Samples

Blood samples were collected from the participants to measure Thyroid-Stimulating Hormone (TSH) levels, T3 and T4. To assess the statistical association between the categorical parameters, the Chi square test was used.

Psychological assessment

- To evaluate psychological impact of hypothyroidism, two validated scales were used:

- Hamilton Depression Rating Scale (HAM-D): The 17-item HAM-D is a clinician-administered tool that measures the severity of depression symptoms. Items are scored to

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reflect the intensity of symptoms like mood disturbances, guilt, and anxiety. The total score indicates the overall depression severity [8].

- Hospital Anxiety and Depression Scale (HADS) – The HADS is a 14-item self-assessment scale designed to measure anxiety (HADS-A) and depression (HADS-D). Each item is rated on a 4-point scale, and the scores are used to evaluate the presence and severity of anxiety and depression, minimizing the influence of physical symptoms [9].

Ethical consideration

The current study was conducted in accordance with the Declaration of Helsinki's ethical guidelines. Every participant gave verbal and analytical consent before samples are taken. In compliance with Document Number 48, the research was approved on May 20, 2023, by the University of Kirkuk's College of Medicine ethics committee.

Result

The research had 109 respondents in total, with 76 females (46 receiving therapy and 30 not receiving treatment) and 33 males (13 receiving treatment and 20 not receiving treatment) making up the larger percentage of respondents. The majority of respondents were over 30, and their ages varied from 20 to 75, with a mean age of 42±7.6. The HADS & HAM-D Depression and anxiety ratings did not differ statistically significantly amongst the various TSH categories in the post-treatment groups (Tables 1, 2, 5, 6). In female hypothyroid patients, there was a significant difference in HAM-D scales between the groups that received therapy before and after (p value <0.05), (Table 8). However, the HADS anxiety and depression measure showed no discernible difference (Table 7). Regarding male patients this difference were not observed (Tables 3, 4).

Table (1): Results of anxiety and depression score of HADS test in different TSH categories in hypothyroid Male patients (after treatment).

TSH	**No.**	**HADS**							***p-value***
		Anxiety			***p-value***	**Depression**			
		N.	**B.**	**A.**		**N.**	**B.**	**A.**	
0-5	6	1	2	3		2	2	2	
6-10	4	2	1	1	<0.05	2	1	1	<0.05
10<	3	1	1	1		1	1	1	
Total	13	4	4	5		5	4	4	

Table (2): Results of HAM-D scores in different TSH Categories in hypothyroid Male patients (after treatment)

TSH	**HAM-D**					***p-value***
	N.	**MI. D**	**MO. D**	**S. D**	**V. S**	

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0-5	1	1	1	1	2	<0.05
6-10	1	1	1	1	0	
10<	1	0	0	1	1	

Table (3): Results of HADS Score (depression, anxiety) in male patients before and after (euthyroid) treatment

TRT	**No.**	**HADS**							***p-value***
		Anxiety			***p-value***	**Depression**			
		N.	**B.**	**A.**		**N.**	**B.**	**A.**	
After	6	1	2	3	<0.97	2	2	2	<0.83
Before	20	4	7	9		4	10	6	

Table (4): Results of HAM-D score in male patient before and after treatment (euthyroid)

TRT	**No.**	**HAM-D**					***p-value***
		N.	**MI. D**	**MO. D**	**S. D**	**V. S**	<0.73
After	6	1	1	1	2	1	
Before	20	2	8	2	3	5	

Table (5): Results of anxiety and depression score of HADS test in different TSH categories in female hypothyroid patients (after treatment).

TSH	**No.**	**HADS**							***p-value***
		Anxiety			***p-value***	**Depression**			
		N.	**B.**	**A.**		**N.**	**B.**	**A.**	
0-5	25	5	5	15	<0.05	6	11	8	<0.05
6-10	10	4	3	3		5	2	3	
10<	11	2	2	7		3	6	2	

Table (6): Results of HAM-D scores in different TSH Categories in Female hypothyroid patients (after treatment

TSH	**No.**	**HAMD**					***p-value***
		N.	**MI. D**	**MO. D**	**S. D**	**V. S**	

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0-5	25	3	6	5	3	8	<0.05
6-10	10	1	2	4	1	2	
10<	11	1	1	1	2	6	

Table (7): Results of HADS Score (depression, anxiety) in hypothyroid female patients before and after treatment (euthyroid)

TRT	**No.**	**HADS**							***p-value***
		Anxiety			***p-value***	**Depression**			
		N.	**B.**	**A.**		N.	B.	A.	
After	25	5	5	15	0.93	6	11	8	0.5 7
Before	30	4	9	17		4	14	12	

Table (8): Results of HAM-D score in hypothyroid female patient before and after treatment (euthyroid)

TRT	**No.**	**HAMD**					***p-value***
		N.	**MI. D**	**MO. D**	**S. D**	**V. S**	
After	25	3	6	5	3	8	0.03
Before	30	2	1	3	12	12	

Discussion

Understanding thyroid gland dysfunction is essential not only for addressing physical symptoms but also for recognizing its impact on mental health. As we move forward, it is important to explore these mental health implications of hypothyroidism, as they highlight the interconnectedness of physical and psychological health in individuals facing thyroid-related challenges.

This study aimed to investigate the potential connection between hypothyroidism and its psychological impact, particularly focusing on anxiety and depression. Conducted among109 with higher proportion of women (76 female & 33 males), our findings align with global trends showing a higher prevalence of hypothyroidism in women [10-12]. To explore the relationship between thyroid-stimulating hormone (TSH) levels and mood disturbances, we used both the Hamilton Depression Rating Scale (HAM-D) and the Hospital Anxiety and Depression Scale (HADS).

Our analysis revealed no significant association between TSH levels and depression outcomes. Even after adjusting TSH levels to achieve treatment targets (euthyroid), no noticeable changes in mood function were observed. These findings are consistent with previous research that similarly found no strong correlation between Levothyroxine (L-T4)

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dosage and mood, cognitive function, or overall health. Past studies with randomized, blinded dosing to achieve different TSH levels (ranging from low-normal to mild elevation) also reported no substantial psychological differences after a six-month follow-up [13].

Several potential factors may explain the absence of significant findings. Hypothyroid patients, even when considered chemically euthyroid, may experience subtle dysfunctions in the hypothalamic-pituitary-thyroid axis, including slight increases in serum thyroxine (T4), a blunted nocturnal rise in TSH, and a reduced thyrotropin response to thyrotropin-releasing hormone (TRH), making them more prone to mood disturbances [14]. Also in the present study in after treatment groups (euthyroid) were with normal TSH level but still T3 and T4 where not adjusted, individualized treatment approaches considering both TSH and free T4 levels are crucial for optimal mental health outcomes [15].

Our result demonstrated that mental status in hypothyroid females shows significant improvement after treatment where Hamilton score was significantly higher in euthyroid patients in comparison with patients before treatment (Table 8). Treating hypothyroidism with hormone replacement therapy can lead to significant improvements in mood and overall quality of life. It is not uncommon for patients to experience a decrease in depressive symptoms once their thyroid levels are stabilized [16]. Treatment can alleviate depressive symptoms and stabilize mood in both bipolar and unipolar patients, particularly in women who do not respond to conventional treatments [17]. Levothyroxine treatment may reduce mental disturbances in hypothyroid patients by enhancing serotonergic neurotransmission, modulating gene transcription, and normalizing receptor densities, particularly affecting 5-HT1A and 5-HT1B auto-receptors [18]. Patient-reported outcomes suggest that even biochemically adequate treatment may not alleviate all symptoms, particularly in those with autoimmune conditions[19] .In contrast, some argue that standardized treatment protocols could suffice for most patients, as many respond positively to levothyroxine. Furthermore, the plausible rationale behind the reversal of memory with LT-4 treatment is restoring thyroid-stimulating hormone (TSH), thyroxine (T4) levels, and gamma-aminobutyric acid (GABA) concentrations [20]. However, the evidence suggests that a one-size-fits-all approach may overlook critical individual differences in treatment response. Beyond biological factors, external influences such as age, lifestyle, and comorbidities may also play a role in the mental health of hypothyroid patients. The female predominance in our sample, while reflecting the higher prevalence of hypothyroidism in women, may have introduced gender-related bias in the psychological assessments.

Limitations

The relatively small sample size and short study duration likely limited our ability to detect subtle changes in mood and cognitive function. While the predominance of women in the sample is representative of the general hypothyroid population, it may have contributed to the lack of significant gender-specific psychological findings.

Conclusion

Though our study did not find no significant link between TSH regulation and psychological outcomes, but there was significant difference in HAM-D Score in hypothyroid female

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patients before and after treatment, it highlights the complexity of mental health in hypothyroid patients. The treatment reduces the mental problems. For individuals diagnosed with hypothyroidism, being aware of the potential psychiatric implications is crucial. Future research should focus on larger cohorts and longer follow-up periods to better understand how TSH regulation impacts mood and cognitive function. Additionally, examining the roles of comorbidities and lifestyle factors may provide deeper insight into the psychological challenges faced by individuals with hypothyroidism.

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