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PREVALENCE OF DEMENTIA IN HYPOTHYROID POPULATION- A PROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

Background: Thyroid hormones play a crucial role in maintaining normal brain function and cognitive processes. Hypothyroidism has been associated with cognitive decline due to its effects on neuronal metabolism and neurotransmission. This study was aimed to evaluate the prevalence of dementia among hypothyroid patients and assess the association between thyroid dysfunction and cognitive impairment. **Methods:** A prospective observational study was conducted among 100 patients diagnosed with thyroid disorders. Data collected included demographic details, thyroid function tests (TSH, Free T3, Free T4), and cognitive assessment using MMSE and cognitive scoring systems. Statistical analysis included Chi-square test, ANOVA, and Pearson correlation. **Results:** Dementia was observed in 53% of patients. A significant association was found between thyroid condition and dementia

severity (p = 0.009). TSH showed a negative correlation (r = -0.261), while Free T4 showed a positive correlation (r = 0.313) with cognitive scores. Age was significantly associated with dementia severity (p < 0.001). **Conclusion:** Hypothyroidism is significantly associated with cognitive impairment. Early screening and management may help prevent progression of dementia.

KEYWORDS: Hypothyroidism, Dementia, MMSE, Cognitive Impairment, Thyroid Hormones.

INTRODUCTION

Dementia is a condition which causes disruption in memory, thought and daily activities which prevents people from performing their regular tasks. The condition usually affects elderly people although its initial signs can emerge before people reach their senior years. The development of dementia results from various elements which include a person's age and their lifestyle activities and their existing health conditions.[1] Thyroid dysfunction stands as one significant element which people often forget about its importance. The thyroid gland generates hormones which control energy consumption and essential brain functioning processes. Cognitive health suffers when patients develop hypothyroidism because it causes their body to produce excessive thyroid hormones.[2]

People with hypothyroidism experience an endocrine disorder which leads to decreased thyroid hormone production. This condition occurs more commonly in females than in males because it can happen at any point in life but its frequency rises during later life stages. People with hypothyroidism tend to show symptoms which include fatigue and weight gain and sensitivity to cold and depressive disorders.[3] Thyroid hormone shortages create physical problems that lead to severe brain function impairments. The condition disrupts neurotransmitter functions while it decreases blood circulation to critical brain areas which include those that manage memory and learning. The cognitive decline which begins in hypothyroidism patients can advance to dementia when the condition remains untreated or inadequately controlled.[4]

Scientists have started to study how thyroid disorders affect cognitive function more actively during the past few years. Researchers have found that people with thyroid hormone levels which show high TSH and low Free T4 experience decreased cognitive abilities. The relationship between these two factors depends on particular study results which show both

supporting evidence and contradictory evidence about their connection.[5] The Mini-Mental State Examination (MMSE) functions as a standard tool for assessing mental capabilities while it helps identify dementia which begins in its initial stages. Identifying the impact of thyroid dysfunction on cognition is important, as it may help in early diagnosis and timely intervention, potentially preventing progression to severe cognitive impairment.[6]

The present study investigates how common dementia appears in hypothyroid patients while examining how thyroid hormone levels affect their cognitive abilities. The researchers study how different factors including age and gender impact cognitive decline severity. The study examines clinical data together with cognitive assessment scores to establish a connection between thyroid dysfunction and dementia.[7] The results assist healthcare professionals in understanding why they should conduct regular cognitive assessments for patients with hypothyroidism while showing the methods which help patients achieve better outcomes and enhanced life quality.[8]

METHODOLOGY

Study Design: A prospective observational study was conducted to evaluate the relationship between thyroid dysfunction and cognitive impairment among patients.

Study Setting: The study was carried out in Shadan Hospital gathered from the Endocrinology outpatient department of the hospital and Peerancheru area regarding the correlation of hypothyroidism.

Study Duration: The study was conducted over a period of 6 months.

Study Population: A total of 100 patients diagnosed with thyroid disorders were included in the study.

Inclusion Criteria

- Age group: The 18 to 75 age range
- Patients who are willing to participate
- Patients of either sex

Exclusion Criteria

- Gestating Mother
- Hypothyroid patients beneath the years of 18 and over 75
- Members who are not interested to participate.
- Chronic systemic diseases and known psychological disorders

Data Collection

Data were collected using a structured data collection form, including

- Demographic details (age, gender)
- Thyroid function tests (TSH, Free T3, Free T4)
- Levothyroxine dosage
- Cognitive assessment using MMSE
- Cognitive assessment scoring

Outcome Measures

- Prevalence of dementia among hypothyroid patients
- Association between thyroid parameters and cognitive function
- Relationship between age, gender, and dementia severity

Statistical Analysis

Data were analyzed using appropriate statistical methods

- Descriptive statistics (mean, median, percentage)
- Chi-square test for association
- ANOVA for comparison between groups
- Pearson correlation for relationship analysis A p-value < 0.05 was considered statistically significant.

RESULTS

Table 1: Demographic Distribution of Study Participants.

Gender	Number (n=100)	Percentage (%)
Female	89	89%
Male	11	11%

This table shows the demographic distribution of participants. Out of 100 subjects, 89% were female and 11% were male, indicating a clear female predominance in hypothyroid patients. This suggests that hypothyroidism is more commonly observed among females in this study population, which is consistent with existing epidemiological trends reported in thyroid-related disorders.

Table 2: Distribution of Dementia Severity.

Dementia Category	Number (n=100)	Percentage (%)
No Impairment	47	47%
Mild Dementia	39	39%
Severe Dementia	14	14%

The distribution of dementia severity reveals that 47% of participants had no impairment, 39% had mild dementia, and 14% had severe dementia. These findings indicate that although most patients were cognitively normal, a considerable proportion exhibited mild cognitive decline, highlighting the potential impact of hypothyroidism on cognitive function.

Table 3: Thyroid Function Test Values.

Parameter	Mean	Median	Minimum	Maximum
TSH (µIU/mL)	6.1	5.7	0.26	21.7
Free T3 (pg/mL)	96	80	50	220
Free T4 (ng/dL)	0.79	0.70	0.39	2.42

Descriptive statistics of thyroid parameters show that the mean TSH level was 6.1 µIU/mL, Free T3 was 96 pg/mL, and Free T4 was 0.79 ng/dL. The wide range of TSH values (0.26–21.7) reflects variability in thyroid dysfunction severity among patients included in the study.

Table 4: Distribution of Thyroid Conditions.

Thyroid Condition	Number (n=100)	Percentage (%)
Primary Hypothyroidism	32	32%
Secondary Hypothyroidism	27	27%
Subclinical Hypothyroidism	22	22%
Euthyroid	19	19%

Among the study population, 32% had primary hypothyroidism, 27% had secondary hypothyroidism, 22% had subclinical hypothyroidism, and 19% were euthyroid. This distribution indicates that primary hypothyroidism was the most common thyroid disorder observed among participants.

Table 5: Thyroid Condition vs Dementia Severity.

Thyroid Condition	Mild	No Impairment	Severe	Total	Chi Square Value	P Value
Euthyroid	2	16	1	19	16.93	0.009
Primary Hypothyroidism	15	10	7	32		
Secondary Hypothyroidism	11	11	5	27		
Subclinical Hypothyroidism	11	10	1	22		
Total	**39**	**47**	**14**	**100**		

A significant association was observed between thyroid condition and dementia severity (χ^2 = 16.93, p = 0.009). Primary hypothyroidism showed higher cases of mild (15) and severe (7) dementia. Euthyroid individuals mostly had no impairment (16), indicating thyroid dysfunction may contribute to increased cognitive impairment.

Table 6: Cognitive Scores – Descriptive Statistics.

Parameter	Mean	Median	Minimum	Maximum
MMSE Score (Cognitive Examination)	24.47	25	0	30
Cognitive Assessment Score	7.16	7	0	13

The mean MMSE score was 24.47, while the cognitive assessment score averaged 7.16. Scores ranged from 0 to 30 for MMSE and 0 to 13 for assessment scores, indicating variability in cognitive function among participants, with most individuals showing relatively preserved cognitive performance.

Table 7: Correlation of Thyroid Parameters with Cognitive Examination (MMSE).

Parameter	Pearson Correlation (r)	p-value	Significance
TSH	-0.261	0.009	Significant
Free T3	0.041	0.684	Not Significant
Free T4	0.313	0.001	Significant

Correlation analysis showed a significant negative correlation between TSH and MMSE scores ($r = -0.261$, $p = 0.009$), and a significant positive correlation between Free T4 and MMSE ($r = 0.313$, $p = 0.001$). Free T3 showed no significant association ($p = 0.684$).

Table 8: Correlation of Thyroid Parameters with Cognitive Assessment Score.

Parameter	Pearson Correlation (r)	p-value	Significance
TSH	-0.002	0.986	Not Significant
Free T3	0.114	0.259	Not Significant
Free T4	-0.102	0.313	Not Significant

No significant correlations were found between thyroid parameters and cognitive assessment scores. TSH ($r = -0.002$, $p = 0.986$), Free T3 ($r = 0.114$, $p = 0.259$), and Free T4 ($r = -0.102$, $p = 0.313$) all showed non-significant relationships, suggesting limited association with this scoring method.

Table 9: Age Distribution by Dementia Severity.

Dementia Category	Mean Age (Years)	Median	Standard Deviation	ANOVA Value	P Value
Mild	43.69	45	6.75	16.326	0.000
No Impairment	37.91	38	9.42		
Severe	52.00	52	8.80		

Age showed a significant association with dementia severity ($F = 16.326$, $p < 0.001$). Mean age increased from 37.91 years in the no impairment group to 52 years in the severe group, indicating that higher age is strongly associated with increased dementia severity.

Table 10: TSH Levels by Dementia Severity.

Dementia Category	Mean	Median	Standard Deviation	ANOVA Value	P Value
Mild	6.78	6.8	4.5	1.13	0.326
No Impairment	5.34	4.5	4.69		
Severe	6.76	8.6	5.04		

Age showed a significant association with dementia severity ($F = 16.326$, $p < 0.001$). Mean age increased from 37.91 years in the no impairment group to 52 years in the severe group, indicating that higher age is strongly associated with increased dementia severity.

Table 11: Free T3 Levels by Dementia Severity.

Dementia Category	Mean	Median	Standard Deviation	ANOVA Value	P Value
Mild	100.1	79	47.8	0.429	0.65
No Impairment	94.69	90	34.89		
Severe	88.97	71.5	40.71		

Free T3 levels did not show significant differences across dementia categories ($F = 0.429$, $p = 0.65$). Mean values were slightly higher in mild dementia but overall variability did not indicate any meaningful association between Free T3 and cognitive impairment.

Table 12: Free T4 Levels by Dementia Severity.

Dementia Category	Mean	Median	Standard Deviation	ANOVA Value	P Value
Mild	0.70	0.70	0.18	6.99	0.001
No Impairment	0.91	0.88	0.42		
Severe	0.64	0.65	0.16		

Free T4 levels showed a significant association with dementia severity ($F = 6.99$, $p = 0.001$). Higher levels were observed in the no impairment group (0.91), while lower levels were seen in severe dementia (0.64), indicating its role in cognitive function.

Table 14: Association Between Gender and Dementia Severity Among Study Participants.

Row Labels	Mild	No Impairment	Severe	Grand Total	Chi Square Value	P Value
Female	33	44	12	89	1.94	0.37
Male	6	3	2	11		
Grand Total	39	47	14	100		

There was no significant association between gender and dementia severity ($\chi^2 = 1.94$, $p = 0.37$). Both males and females showed similar distribution patterns of cognitive impairment, suggesting gender does not significantly influence dementia occurrence in this study.

Table 15: Association Between Age and Dementia Severity Among Study Participants.

Age Group	No Impairment	Mild	Severe	Total	Chi Square Value	P Value
20 to 30	2	11	0	13	41.70	0.0000
31 to 40	10	19	2	31		
41 to 50	20	13	2	35		
51 to 60	7	4	8	19		
Greater or equal to 61	0	0	2	2		
Grand Total	39	47	14	100		

A highly significant association was found between age group and dementia severity ($\chi^2 = 41.70$, $p < 0.001$). Severe dementia was predominantly observed in older age groups, particularly ≥51 years, confirming that advancing age is a major risk factor for cognitive decline.

DISCUSSION

The present study highlights a substantial burden of cognitive impairment among hypothyroid patients, with 53% showing dementia (39% mild, 14% severe). A statistically significant association between thyroid condition and dementia severity ($\chi^2 = 16.93$, $p = 0.009$) indicates that primary hypothyroidism contributes more prominently to cognitive decline, with 15 mild and 7 severe cases. Euthyroid individuals predominantly exhibited no impairment (16/19), suggesting a protective effect of normal thyroid function. These findings support the concept that thyroid hormone imbalance affects neuronal metabolism and synaptic activity, thereby impairing cognition. The overall mean MMSE score of 24.47 further reflects mild cognitive compromise in the study population.[9]

Correlation analysis demonstrated a significant negative relationship between TSH and MMSE ($r = -0.261$, $p = 0.009$) and a positive association between Free T4 and MMSE ($r = 0.313$, $p = 0.001$), indicating that increasing TSH and decreasing T4 levels are linked to worsening cognition. However, Free T3 showed no significant association ($p = 0.684$), suggesting limited utility as a predictor. Similarly, no thyroid parameter showed significant correlation with cognitive assessment scores ($p > 0.05$), indicating variability between assessment tools. Although mean TSH levels were higher in mild and severe groups, the

difference was not statistically significant (F = 1.13, p = 0.326), emphasizing that TSH alone may not fully explain cognitive decline.[10]

Age emerged as a strong determinant of dementia severity, with mean age increasing significantly from 37.91 years (no impairment) to 52 years (severe dementia) (F = 16.326, p < 0.001). Age group analysis further confirmed this association (χ^2 = 41.70, p < 0.001), with severe dementia predominantly observed in individuals aged ≥51 years. These findings suggest that advancing age amplifies the cognitive impact of thyroid dysfunction, possibly due to cumulative neurodegenerative changes. The higher prevalence of mild dementia in middle-aged groups (31–50 years) indicates that cognitive decline may begin earlier but worsens with aging.[11]

Free T4 levels showed a significant association with dementia severity (F = 6.99, p = 0.001), with higher levels in the no impairment group (0.91) and lower levels in severe dementia (0.64), highlighting its neuroprotective role. In contrast, Free T3 levels did not differ significantly (F = 0.429, p = 0.65). Gender distribution showed a female predominance (89%), but no significant association with dementia (χ^2 = 1.94, p = 0.37), indicating that cognitive decline occurs irrespective of sex. Overall, the findings emphasize that thyroid dysfunction, particularly reduced Free T4 and increasing age, plays a critical role in cognitive impairment among hypothyroid patients.[12,13]

CONCLUSION

The present study demonstrates a significant association between hypothyroidism and cognitive impairment, with 53% of participants exhibiting dementia, including 39% mild and 14% severe cases. Primary hypothyroidism showed a stronger association with cognitive decline, supported by a significant relationship between thyroid condition and dementia severity (p = 0.009). Elevated TSH levels were associated with reduced cognitive performance, while higher Free T4 levels showed a protective effect (p = 0.001). Age was identified as a major contributing factor, with increasing severity of dementia observed in older individuals (p < 0.001), whereas gender showed no significant association. These findings emphasize the importance of early diagnosis, regular cognitive assessment, and appropriate management of thyroid dysfunction to prevent or delay cognitive decline.

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