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CLINICAL ASSESSMENT OF COGNITIVE IMPAIRMENT IN VARIOUS CONDITIONS OF HYPOTHYROIDISM PATIENTS

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ABSTRACT

Aim/objective: To assess the cognitive impairment in various conditions of hypothyroidism patients. To investigate MMSE score in hypothyroid and euthyroid subjects to explore the relationship between thyroid dysfunction and cognition. To assess the MMSE score on the mood and cognitive changes associated with subclinical hypothyroidism (SCH). To assess the MMSE score on the mood and cognitive changes associated with overt hypothyroidism. To explore the association between education status of the patients with MMSE scores. **Methods:** It was a cross sectional observational case control study. **Result:** The average MMSE score of hypothyroid patients was 22.56±3.36, average MMSE score of control group is 24.94±2.48 (**p <0.0001). The average MMSE score of subclinical hypothyroidism patients was 21.93±2.93, average MMSE score of control group is 24.94±2.48 (*p<0.001). The average MMSE score of overt hypothyroidism patients was 23.32±3.72, average MMSE score of control group is 24.94±2.48 (*P<0.0031). **Conclusion:** Present study indicating hypothyroidism patients have low MMSE score than euthyroid participants which reveals hypothyroidism is significantly associated with cognitive impairment. Our finding reveals that SCH was significantly associated with mild cognitive impairment more research is required to determine the nature and extent of this association. Present study also reveals the association between overt hypothyroidism and mild cognitive impairment. Our finding shows that SCH have higher risk of cognitive impairment than overt hypothyroidism in this sample. Present study also reveals patients who have chronic thyroid damage leads to higher risk of cognitive impairment.

KEYWORDS: SCH, overt hypothyroidism, MMSE, cognitive impairment.

INTRODUCTION

Hypothyroidism is defined as failure of the thyroid gland to produce sufficient thyroid hormone to meet the metabolic demands of the body. Hypothyroidism may occur as a result of primary gland failure or insufficient thyroid gland stimulation by the hypothalamus or pituitary gland. Primary gland failure can result from congenital abnormalities, autoimmune destruction (Hashimoto disease), iodine deficiency, and infiltrative diseases. Autoimmune thyroid disease is the most common etiology of hypothyroidism in the United States.[54] Hypothyroidism is diagnosed when the thyroid gland does not produce enough hormones for the necessity of the organism.T_3 (triiodothyronine) and T_4 (thyroxine), which are responsible for regulating the metabolism and maintaining normal functioning of the organism. Hypothyroidism is characterized by the reduction or by low production of T3 (triiodothyronine) and T4 (thyroxine) hormones. There are still no medicines which are capable of increasing the synthesis or release of thyroid hormones; as such the medical treatment is based on the reposition of the hormones with deficient production.[3] The thyroid gland produces hormones that regulate the body's metabolic rate as well as heart and digestive function, muscle control, brain development, mood and bone maintenance. Its correct functioning depends on having a good supply of iodine from the diet.[9] Partial substitution of triiodothyronine for thyroxine may improve mood and neuropsychological function; that finding suggests a specific effect of the triiodothyronine normally secreted by the thyroid gland.[6]

The MMSE is the almost universally accepted and often used as a screening test for signs of cognitive impairment. It tests various abilities, including attention, memory, language and comprehension, figure drawing, and basic orientation. Maximum score is 30 and a score below a cut-off of 24 is often used to indicate possible dementia.[4] The effect of thyroid hormones on depression, cognition, and memory have controversial opinions because some authors report beneficial effects of thyroid hormone treatment, more specifically treatment with T4and T3, in depression and manic diseases. Others consider this simply the result of unexpected association.[7] several studies have controversial opinions but there is no clear information about mental impairment in hypothyroidism patients. The prevalence of depressive symptoms in hypothyroidism is high. Thyroid hormones failure leads to malfunctions at different physical, mental and social aspects. The purpose of present study

was to compare mental health of hypothyroid patients with normal people and the inter comparison of various conditions of hypothyroidism with normal people.

MATERIALS AND METHOD

It's a cross sectional observational study to determine the cognitive impairment in various conditions of hypothyroidism patients. Out of 164 participants, 82 hypothyroidism patients were selected from the general medicine department according to inclusion and exclusion criteria. Inclusion criteria were: Patients of subclinical hypothyroidism without neurological disorder, Patients of overt hypothyroidism without neurological disorder, Euthyroid participants. Exclusion criteria were: Pediatrics Patients, Comatose patients, Chronic Illness patients, Patients with neurological disorder pregnant women. Similarly 82 subjects age, sex and education-matched healthy controls were taken. The study proposal was approved by Institutional Ethics Committee. Demographic details were collected by specifically designed data entry form. It consist of the following details name, age, reason for admission, past medication history, height, body mass index (BMI), educational status, marital status, social history, laboratory investigations, diagnosis and therapeutic chart. An informed written consent was obtained prior to conducting the study. Cognitive functions were assessed by using Folstein Mini Mental State Examination (MMSE). Then the hypothyroid patients were divided into subclinical and overt hypothyroidism, by using the laboratory reports of thyroid function test. Then MMSE scores were compared with control group.

Statistical analysis

Analysis was done after the collection of data, by using various statistical parameters such as Mean, Standard Deviation, percentage, and paired t test method. Computerized statistical package of graph pad instat version 3.10 were used to analyze the demographic characteristics and biochemical parameters. All hypothesis tests were considered statistically significant two sided, *$P \leq 0.05$, **$P \leq 0.001$.

RESULTS AND DISSCUSSION

In this study among 164 subjects 28.65% (47) participants were in the age group of 21-30 years. Among the study population 29% (48) subjects were male and 71% (116) were female. The prevalence of hypothyroidism was highest in the females as compared to males.[11]

Weight gain is the classical symptom of hypothyroidism.[10] In this study we have included euthyroid participants even though the overall BMI assessment shows that 38.42% (63) subjects were overweight and 12.80% (21) subjects were obese.

Comparison of Mmse Scorebetween Euthyroid Participants and Hypothyroidism Patients

Table 1: Percentage comparison of cognitive impairment status between euthyroid participants and hypothyroid patients.

Degree of impairment	Patients with hypothyroidism		Euthyroid participants	
	Number of patients	Percentage (%)	Number of patients	Percentage (%)
Normal	22	26.83	46	56.10
Mild	46	56.10	34	41.46
Moderate	14	17.07	02	2.44
Severe	0	0	0	0

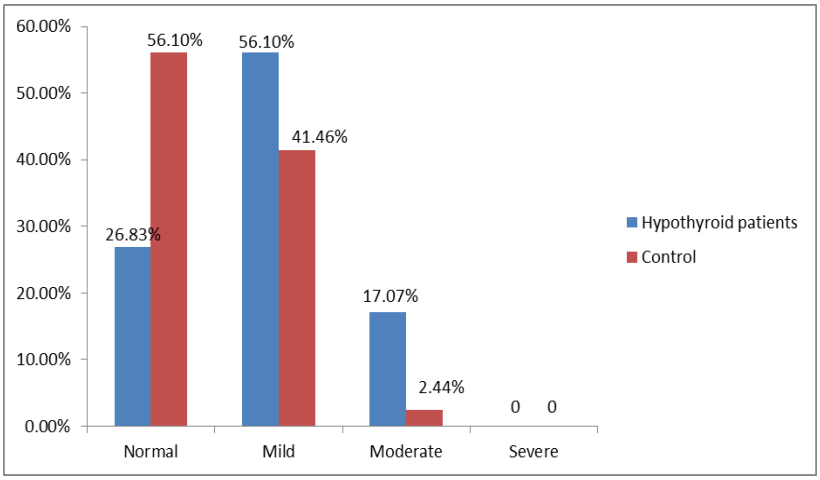

Figure 1: Percentage comparison of cognitive impairment status between euthyroid participants and hypothyroid patients.

Table 2: MMSE score comparison between euthyroid participants and hypothyroid patients.

Score	Degree of impairment	Average MMSE Score	
		Patients with hypothyroidism	Control
25-30	Questionably significant	26.5±1.3	26.7±1.2
20-25	Mild	22.3±1.3	22.6±1.4
10-20	Moderate	17.1±1.9	21.6±2.8
0-10	Severe	0	0
P value	<0.0001		

In this study 26.83% (22) were having normal, 56.10% (46) were having mild cognitive impairment, 17.07% (14) were having moderate cognitive impairment and none of the patients were having severe cognitive impairment **(Table 1).**

MMSE assessment of control group reveals 56.10% (46) normal, 41.46(34) mild, 2.44(2) moderate cognitive impairment, none of the patient were having severe cognitive impairment **(Table 2).**

The average MMSE score of hypothyroid patients was 22.56±3.36, average MMSE score of control group is 24.94±2.48.When compared the both group shows ($p < 0.0001$) extremely significant **(Table 2).**

Comparison Between Mmse Score of Subclinical Hypothyroidism Patients And Mmse of Euthyroid Participants

In a total number of 82 hypothyroidism patients 45 have subclinical hypothyroidism the MMSE score for those patients were analyzed. Then score of patients with subclinical hypothyroidism were compared with euthyroid participants (control).

Table 3: Comparison based on the MMSE score between subclinical hypothyroid patients and euthyroid participants.

Degree of impairment	Patients of subclinical hypothyroidism		Control	
	Number of patients	Percentage (%)	Number of patients	Percentage (%)
Normal	6	13.33	46	56.10
Mild	30	66.67	34	41.46
Moderate	9	20	02	2.44
Severe	0	0	0	0
Mean MMSE score	21.93±2.93		24.94±2.49	

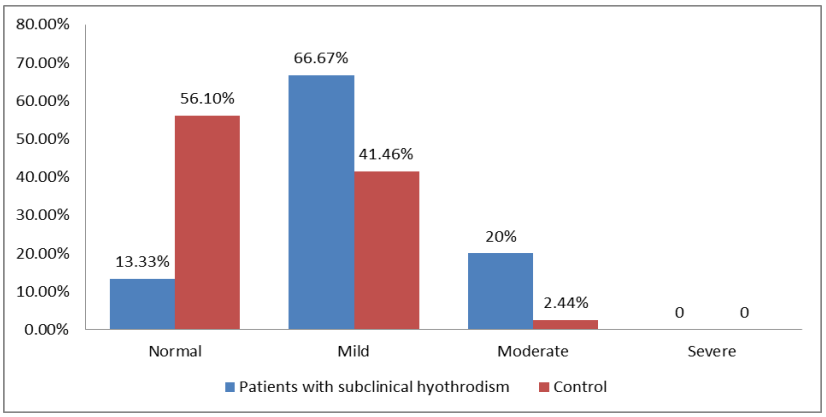

Figure 2: Percentage Comparison of cognitive impairment status between subclinical hypothyroidism patients and euthyroid participants.

It remains unclear whether SCH leads to significant mood and cognitive impairments in most elderly patients.

Subclinical hypothyroidism is not associated with widespread or severe cognitive dificits.[53]

In this study among 82 hypothyroid patients 45 were having subclinical hypothyroidism. By the assessment of MMSE score for this group reveals 66.67% (30) were having mild cognitive impairment, 20% (9) were having moderate cognitive impairment and none of them were having severe impairment (**Table 3**).

The average MMSE score of subclinical hypothyroidism patients was 21.93±2.93, average MMSE score of control group is 24.94±2.48.Whencompared the both group shows ($p<0.001$) significant (**Table 3).**

In this study among 82 hypothyroid patients 45 were having subclinical hypothyroidism. By the assessment of MMSE score for this group reveals 66.67% (30) were having mild cognitive impairment, 20% (9) were having moderate cognitive impairment and none of them were having severe impairment.

The average MMSE score of subclinical hypothyroidism patients was 21.93±2.93, average MMSE score of control group is 24.94±2.48.Whencompared the both group shows ($p<0.001$) significant (**Table 3**).

Comparison of Mmse Score Between Overt Hypothyroidism Patients Vs Mmse of Euthyroid Participants

In a total number of 82 hypothyroidism patients 37 have subclinical hypothyroidism the MMSE score for those patients were analyzed. Then score of patients with overt hypothyroidism were compared with euthyroid participants (control).

Table 4: Comparison based on the MMSE score between Overt hypothyroidism patients and euthyroid participants.

Degree of impairment	Average MMSE score	Patients of overt hypothyroidism		Control	
		Number of patients	Percentage (%)	Number of patients	Percentage (%)
Significant	26.7 ± 1.30	16	43.24	46	56.10
Mild	22 ± 1.37	16	43.24	34	41.46
Moderate	16.8 ± 2.39	5	13.52	02	2.44
Severe	0	0	0	0	0
Mean MMSE score	23.32±3.72			24.94±2.49	

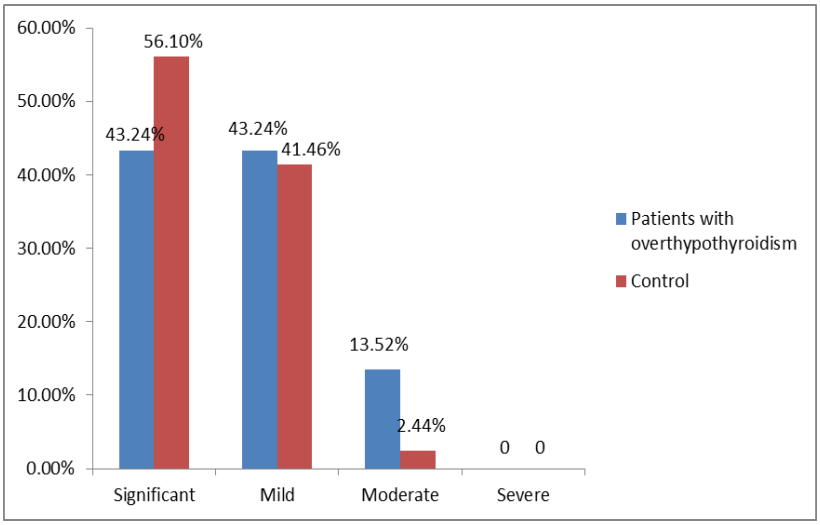

Figure 3: Percentage Comparison of cognitive impairment status between overt hypothyroidism patients and euthyroid participants.

Overt hypothyroidism can affect a range of cognitive domains. That is decrement in general intelligence, attention/concentration, memory, language, psychomotor functions. Memory is the most consistently affected domain.

In this study among 82 hypothyroid patients 37 were having overt hypothyroidism. By the assessment of MMSE score for this group reveals 43.24% (16) were having mild cognitive impairment, 13.52% (5) were having moderate cognitive impairment and none of them were having severe impairment. The average MMSE score of overt hypothyroidism patients was 23.32±3.72, average MMSE score of control group is 24.94±2.48.When compared the both group shows (P<0.0031) significant (**Table 4**).

Comparison Mmse Score Between Subclinical And Overt Hypothyroidism.

Table 5: Comparison based on the MMSE score between patients Overt hypothyroidism and subclinical hypothyroidism.

Degree of impairment	Patients with subclinical hypothyroidism		Patients with overt hypothyroidism	
	Number of patients	Percentage (%)	Number of patients	Percentage (%)
Normal	6	13.33	16	43.24
Mild	30	66.67	16	43.24
Moderate	9	20	5	13.52
severe	0	0	0	0
Mean MMSE Score ±SD	21.93±2.93		23.32±3.72	

*P value is<0.03010 is considered to be significant.

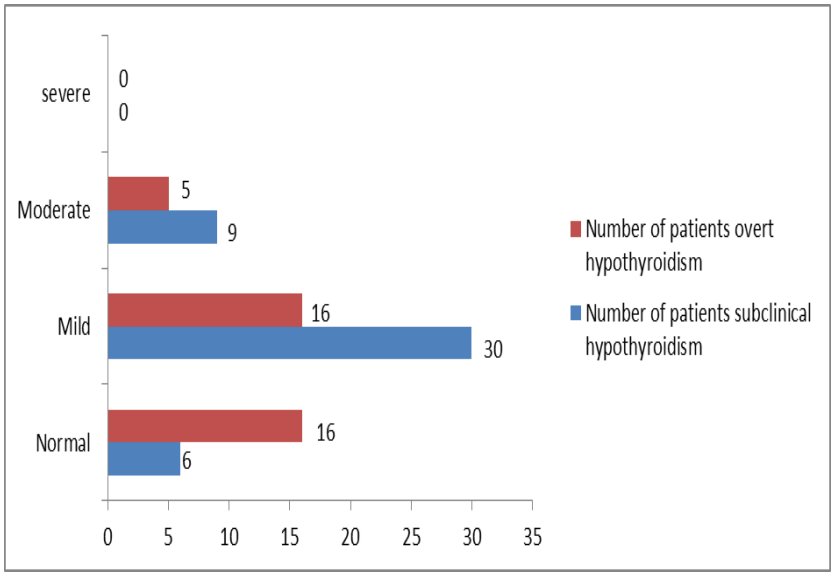

Figure 4: Comparison of cognitive impairment status between the patients with subclinical and overt hypothyroidism.

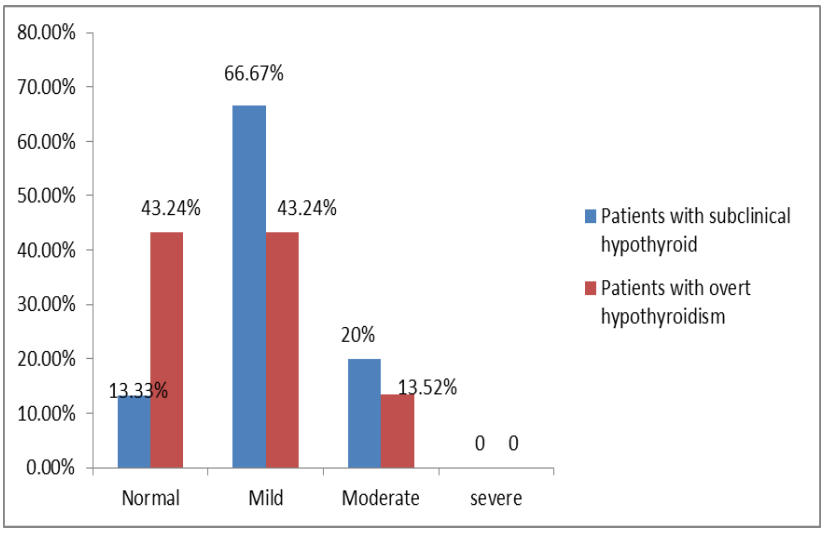

Figure 5: Percentage Comparison of cognitive impairment status in Subclinical hypothyroidism patients Vs Overt hypothyroidism patients.

The average MMSE score of overt hypothyroidism patients was 23.32±3.72, average MMSE score of subclinical hypothyroidism patients was 21.93±2.93. When comparing the both group shows ($p < 0.05$) considered to be significant (**Table 5**).

Comparison of MMSE score based on History of hypothyroidism

Table 6: Comparison of cognitive impairment status based on the history hypothyroidism.

History of hypothyroidism	MMSE score						
	Normal		Mild		Moderate		severe
	Number of patients	Average score ± SD	Number of patients	Average score ± SD	Number of patients	Average score ± SD	
<3 years	9	26.4±0.55	10	22.7±0.96	0	0	0
3-5 years	9	23.1±1.05	7	26.3±0.75	0	0	0
6-10 years	5	25.6±1.34	21	22.0±1.24	4	17.7±1.26	0
>10years	1	25±0	6	21.7±1.63	10	16.9±2.23	0

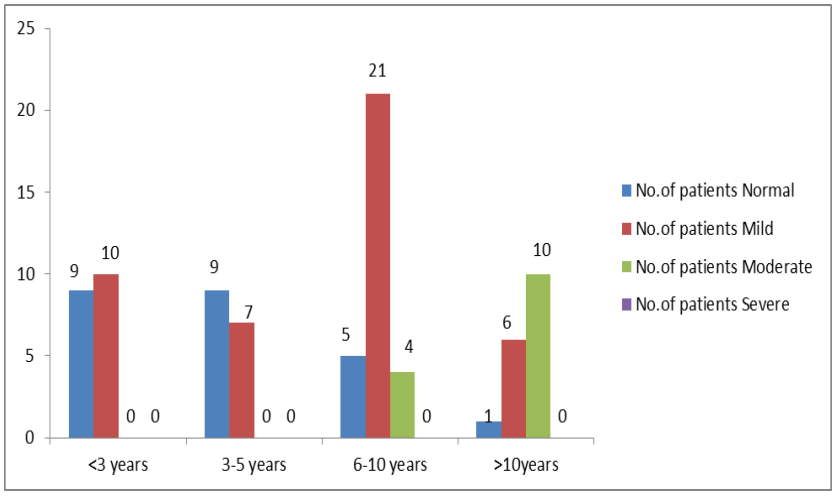

Figure 6: Comparison of cognitive impairment status based on the history hypothyroidism.

Table 7: Percentage Comparison of cognitive impairment status based on the history hypothyroidism.

History of hypothyroidism	MMSE score						
	Normal		Mild		Moderate		Mean± SD
	Number of patients	Percentage (%)	Number of patients	Percentage (%)	Number of patients	Percentage (%)	
<3 years	9	10.97	10	12.20	0	0	24.78 ± 2.05
3-5 years	9	10.97	7	8.36	0	0	24.5 ± 1.86
6-10 years	5	6.10	21	25.60	4	4.88	22.07 ± 2.49
>10 years	1	1.22	6	7.32	10	12.20	19.06± 3.36

**P value is < 0.0001 considered extremely significant.

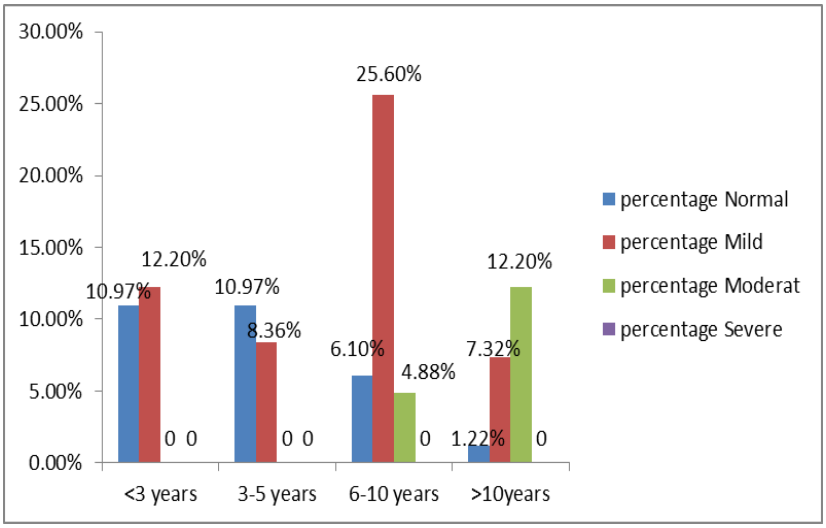

Figure 7: Percentage Comparison of cognitive impairment status based on the history hypothyroidism.

The assessment of MMSE score based on the history of hypothyroidism reveals <3 years were having 12.20% (10) patients were having mild cognitive impairment, 8.36% (7).

The mean vale for MMSE score of patients having history of hypothyroidism less than three years was 24.78±2.05, history of hypothyroidism between 3 to 5 years was 24.5±, 6-10 years having mean value of 22.07 ±2.49,and more than 10 years have 19.06±3.36. (**Table 6**).

Comparing all the groups shows p <0.0001 considered extremely significant among all the groups.

CONCLUSION

Present study indicating hypothyroidism patients have low MMSE score than euthyroid participants which reveals hypothyroidism is significantly associated with cognitive impairment.

Our finding reveals that SCH was significantly associated with mild cognitive impairment more research is required to determine the nature and extent of this association.

Present study also reveals the association between overt hypothyroidism and mild cognitive impairment.

Our finding shows that SCH have higher risk of cognitive impairment than overt hypothyroidism in this sample.

Present study also reveals patients who have chronic thyroid damage leads to higher risk of cognitive impairment.

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