

Memory Impairment in Patients with Depression with and Without Hypothyroidism: A Comparative Study

Sunil Suthar¹, Tanuja², Ishwar Dayal Gupta³

¹Assistant Professor, Department of Psychiatry, Government Medical College, Bharatpur, Rajasthan, India.

²Assistant Professor, Department of Anaesthesiology, Vallabhbhai Patel Chest Institute Delhi, India

³Senior Professor, Department of Psychiatry, SMS Medical College, Jaipur, Rajasthan, India

Received: 25-11-2022 / Revised: 25-12-2022 / Accepted: 30-01-2023

Corresponding author: Dr. Sunil Suthar

Conflict of interest: Nil

Abstract

Introduction: Relationship between hypothyroidism and depression as well as between hypothyroidism and memory impairment is known since long time but remains poorly defined. Hypothyroidism affects both mood and cognition. Thyroid hormones has been found effective as adjunct treatment for depression.

Aim & Design: The aim of this study was to compare memory impairment in patients with depression with and without Hypothyroidism.

Materials and Methods: A total of 186 patients with depression were included in this study. HAM-D-17 (Hamilton Depression Rating Scale) was used to assess depressive symptoms and severity. On the basis of serum TSH level the study group was categorized into two groups- patients with hypothyroid and without hypothyroidism (euthyroid group). Hypothyroid group was further divided into subgroups clinical and subclinical hypothyroidism. PGI memory scale was used to compare memory impairment in groups.

Results: Among 30 hypothyroidism cases 9 were male and 21 were female. Depressed female had higher prevalence of hypothyroidism. With respect to severity of baseline overall depression (total score on the Ham-D-17), the two groups did not differ significantly ($p = 0.472$). Patients with hypothyroidism performed poorly in memory scale in compare to depressed patients without hypothyroidism.

Conclusion: Patients with depression and hypothyroidism appear to have significant memory impairment in compare to depressed patients without hypothyroidism. Hence clinical features like memory impairment may help clinician for early diagnosis of hypothyroidism in patients with depression.

Keywords: Hypothyroidism, Memory Impairment, Depression.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Hypothyroidism is common in adults and is commonly correlated with cognitive issues, such as poor memory, mentally slow and “brain fog”. [1] Hypothyroidism impacts aspects of cognitive functioning

including memory as well as mood. Hypothyroidism can mimic melancholic depression and dementia. [2] Hippocampus plays vital role in memory formation. In a case control study Cooke

GE et al found significant reduction in the right hippocampus volume in patients with hypothyroidism in compare to those without hypothyroidism. [3] The degree to which hypothyroidism impacts mood and cognitive functions and whether these symptoms respond to treatment, remains controversial.

Methodology

The aim of this study was to study memory impairment in patients with depression with hypothyroidism, Objectives being to compare memory impairment in patients with depression with and without hypothyroidism. Study was approved by research review board & ethical committee of the institution. An informed consent was obtained from the subject prior to participation in the study. Inclusion criteria were age range 20-45 years, either sex, literate enough to read and understand consent form & questionnaires, diagnosis of first episode severe depression without psychotic features according to ICD – 10. Exclusion criteria were history of medical illness or neurological illness leading to cognitive impairment ,history of significant head injury, Intellectual Disability (based on medical records or assessments conducted prior to current study), co-morbid psychiatric illness, history of drug abuse or dependency problem and use of any kind of psychotropic medication in past one month.

Instruments of the study:

1) **HAM-D-17 (Hamilton Depression rating Scale) [4]:** This scale is widely used to assess severity of depression.

HAM-D-17 version contains 17 items to rate depressive symptoms.

2) **The PGI memory scale (PGIMS) [5]:**

- was employed to assess memory function of patients. The PGIMS consists of 10 subtests : Remote memory, Current memory, Mental balance, Attention and concentration, Delayed recall, Immediate recall, Verbal retention for similar pairs, Verbal retention for dissimilar pairs, Visual retention and Recognition. The total score is 100. These tests measure different aspects of memory and employ different methods of recall.

3) **Investigations:** Serum TSH, Serum FT4 and Serum FT3. The study group was categorized into two categories, A and B on basis of serum level of TSH (0.4 to 4.0 μ IU/mL). **Category-A** included patients having severe depression without hypothyroidism. (Serum FT4 value = 0.89 – 1.76 ng/dl, Serum FT3 value = 1.8 – 4.2 pg/ml and TSH value = 0.4 - 4.0 μ IU/ml) **Category-B** included patients having severe depression with hypothyroidism. (TSH above 4.0 μ IU/mL, Serum FT4 value = or < 1.76 ng/dl and Serum FT3 value = or < 4.2 pg/ml). In category-B hypothyroid groups were further divided into subgroups clinical and subclinical hypothyroid. Subclinical hypothyroidism defined who had TSH above 4.0 μ IU/mL, but normal f T4. Clinical hypothyroidism defined who had TSH above 4.0 μ IU/mL and ft3 or ft4 below normal.

Results

Table 1: Severity of depression in patients with hypothyroidism and without hypothyroidism

	Group	N	Mean	S.D.	P value
HAM-D-17 Total score	Euthyroid	30	22.13	2.99	0.472
	Hypothyroid	30	21.66	1.86	

Table 2: Memory impairment in depression with/without hypothyroidism (PGI Memory Scale score)

	Group	N	Mean	S.D.	P value
1)Remote Memory	Euthyroid	30	5.8667	0.34575	0.325
	Hypothyroid	30	5.7667	0.43018	
2)Recent Memory	Euthyroid	30	4.8667	0.34575	0.010
	Hypothyroid	30	4.5667	0.50401	
3)Mental Balance	Euthyroid	30	6.9667	1.40156	0.001
	Hypothyroid	30	5.8667	0.86037	
4)Attention Concentration	Euthyroid	30	7.3333	1.51620	0.011
	Hypothyroid	30	6.3333	1.44636	
5)Delayed Recall	Euthyroid	30	8.0000	1.31306	0.498
	Hypothyroid	30	7.8000	0.92476	
6)Immediate Recall	Euthyroid	30	10.1333	1.73669	0.000
	Hypothyroid	30	8.5667	1.38174	
7)Verbal Retention for Similar Pairs	Euthyroid	30	4.6667	0.75810	0.048
	Hypothyroid	30	4.2333	0.89763	
8)Retention for Dissimilar Pairs	Euthyroid	30	9.5333	3.98907	0.936
	Hypothyroid	30	9.6000	2.14315	
9)Visual Retention	Euthyroid	30	10.5333	2.47377	0.008
	Hypothyroid	30	8.9333	2.03306	
10)Recognition	Euthyroid	30	8.6333	1.31918	0.018
	Hypothyroid	30	7.7667	1.44278	
Total Score	Euthyroid	30	76.5333	9.73966	0.001
	Hypothyroid	30	69.4333	5.59053	

Table 3: Memory impairment in subgroups of hypothyroidism

	Subgroups	N	Mean	P Value
PGI Memory Scale score	Subclinical Hypothyroidism	22	71.1	0.04
	Clinical Hypothyroidism	8	64.8	

Table 4: Correlations between thyroid hormone levels and PGI Memory scale (Total score)

		PGI Memory Scale (Total score)
FT3	Pearson Correlation	0.342
	Sig. (2-tailed)	0.007
FT4	Pearson Correlation	0.272
	Sig. (2-tailed)	0.036
TSH	Pearson Correlation	-0.369
	Sig. (2-tailed)	0.004

A total of 186 patients with depression were included in this study, among these 30 (16%) patients had hypothyroidism, from it 22 (12%) patients had subclinical hypothyroidism and 8 (4%) patients had clinical hypothyroidism. These 30 patients of depression with hypothyroidism (Subclinical and Clinical) were compared

with randomly selected 30 patients of depression without hypothyroidism (euthyroid). Both groups were comparable regarding age distribution. Mean age of Depression without hypothyroidism and with hypothyroidism was 30.7 and 31.4 years respectively. Mean duration of illness in depression without

hypothyroidism and with hypothyroidism was 4 months and 4.5 months. No significant difference in mean duration of illness. Among 30 hypothyroidism cases 9 were male and 21 were female. Depressed female had higher prevalence of hypothyroidism. Both groups were comparable with respect to sex, marital status, occupation, education, religion, family type and locality. With respect to severity of baseline overall depression (total score on the Ham-D-17), the two groups did not differ significantly ($p = 0.472$) [table-1]. With respect to total score on memory (PGI memory scale), the two groups differed significantly ($p = 0.001$). Euthyroid group performed better in memory than hypothyroid group. Euthyroid group had higher memory score (mean = 76.5 ± 9.7) in comparison with hypothyroid group (mean = 69.4 ± 5.5). Patients with depression with hypothyroidism had worse scores on PGI memory scale item 2 (Recent Memory), item 3 (Mental Balance), item 4 (Attention and concentration), item 6 (Immediate recall), item 7 (Verbal retention for similar pair), item 9 (Visual retention) and item 10 (recognition). No other significant differences were found between study groups on the other variables measured. [table-2]. In Hypothyroid group patient with clinical (overt) hypothyroidism performed poor on PGI memory scale (total score) in compare to subclinical hypothyroid group. Difference was significant ($P = 0.04$) [table-3]. Significant correlation has been found between levels of thyroid hormones and memory. Higher serum FT3 and FT4 was found to be associated with better performance on PGI memory scale. While serum level of TSH was negatively correlated with performance on memory scale. Higher TSH associated with poor performance on PGI memory scale. [table-4]

Discussion

In our study depressed females had higher prevalence of hypothyroidism in compare to males. There are many studies which reports high prevalence of hypothyroidism and depression in female. [6,7] In Indian population based study Unnikrishnan et al found higher prevalence of clinical and subclinical hypothyroidism in female. [8] As per our knowledge we didn't find any study which had assessed memory impairment in depression with hypothyroid. But there are the studies which had assessed memory impairment in severe depression and hypothyroidism separately and had found memory impairment in depression as well as in hypothyroidism. [9] Both depression and memory impairment are associated with poor psychosocial functioning. In our study we found that euthyroid group had higher total memory score in compare to hypothyroid group and this difference was statistically significant. In depressive patients with hypothyroid recent memory, mental balance, attention and concentration, Immediate recall, verbal retention for similar pair, visual retention and recognition are significantly impaired in compare to euthyroid patients with depression. Significant correlation between levels of TSH and memory. Higher serum TSH level is associated with poor performance on PGI memory scale. These findings correlate with study conducted by Beydoun, M. A et al 2013. They investigated associations between thyroid hormones and cognitive performance. They found that elevated free thyroxine (fT4) was associated with better performance on tests of visuo-spatial/visuo-construction ability (overall, women, and African Americans) and learning/memory (women and African Americans), whereas a higher total thyroxine (tT4) level was associated with better performance in the domain of psychomotor speed and higher levels of both fT4 and tT4 were linked to better language/verbal test performance among men. In contrast, higher T3 (% uptake)

was related to better performance on tests of visuo-spatial/visuo-construction ability and psychomotor speed among whites. [10] Similarly in a case control study Aghili et al., 2012 assessed memory in subclinical hypothyroid patients using Wechsler Memory Scale, they found deficit in mental control, logical memory, associate learning and memory quotient, which were improved significantly after levothyroxine treatment. [11] Hypothyroidism is associated with an increased risk of depression and poor quality of life. [12] Although studies suggest that cognitive and mood symptoms improve with treatment of hypothyroidism, though the data are equivocal and limited due to diverse methodologies. [12,13]

Conclusion

Based on our study we can conclude that hypothyroidism is more prevalent in depressed female in compare to depressed male. Hypothyroidism also affects memory in patients with depression. Hence, early diagnosis of hypothyroidism and treatment is critical for better management of depression. This may also resolve specific memory deficits.

References

1. Ettleson MD, Raine A, Batistuzzo A, Batista SP, McAninch E, Teixeira MCTV, Jonklaas J, Laiteerapong N, Ribeiro MO, Bianco AC. Brain Fog in Hypothyroidism: Understanding the Patient's Perspective. *Endocr Pract.* 2022 Mar;28(3):257-264.
2. Hage MP, Azar ST. The Link between Thyroid Function and Depression. *J Thyroid Res.* 2012; 2012:590648.
3. Cooke GE, Mullally S, Correia N, O'Mara SM, Gibney J. Hippocampal volume is decreased in adults with hypothyroidism. *Thyroid.* 2014 Mar; 24(3):433-40.
4. Hamilton M. A rating scale for depression. *J Neurol Neurosurg Psychiatry.* 1960 Feb;23(1):56-62.
5. Pershad D, Wig NN. The Construction and Standardization of Clinical Test of Memory in Simple Hindi. Agra: National Psychological Corporation; 1977.
6. Bashir H, Farooq R, Bhat MH, Majid S. Increased prevalence of subclinical hypothyroidism in females in mountainous valley of Kashmir. *Indian J Endocrinol Metab.* 2013 Mar;17 (2): 276-80.
7. Chiovato L, Magri F, Carlé A. Hypothyroidism in Context: Where We've Been and Where We're Going. *Adv Ther.* 2019 Sep;36(Suppl 2):47-58.
8. Unnikrishnan AG, Kalra S, Sahay RK, Bantwal G, John M, Tewari N. Prevalence of hypothyroidism in adults: An epidemiological study in eight cities of India. *Indian J Endocrinol Metab.* 2013 Jul;17(4):647-52.
9. Nicola Marioara OM, Popescu M, Vlădoianu CN, Carlig V, Carsote M, Ghenea AE. Study of Cognitive Disfunctions in Thyroid Pathology. *Curr Health Sci J.* 2021 Apr-Jun;47 (2):256-262.
10. Beydoun MA, Beydoun HA, Kitner-Triolo MH, Kaufman JS, Evans MK, Zonderman AB. Thyroid hormones are associated with cognitive function: moderation by sex, race, and depressive symptoms. *J Clin Endocrinol Metab.* 2013 Aug;98(8): 34 70-81.
11. Aghili R, Khamseh ME, Malek M, Hadian A, Baradaran HR, Najafi L, Emami Z. Changes of subtests of Wechsler Memory Scale and cognitive function in subjects with subclinical hypothyroidism following treatment with levothyroxine. *Arch Med Sci.* 2012 Dec 20;8(6):1096-101.
12. Davis JD, Tremont G. Neuropsychiatric aspects of hypothyroidism and treatment reversibility. *Minerva Endocrinol.* 2007 Mar;32(1):49-65.

13. Muñoz A. F. D., Ibrahim T. M., Ortiz, C. T. N., Chávez Ángel F. L., Amaya, G. P. B., Galvis M. C. C., Pacheco, M. E. F., & Herrera M. A. I. Typical Mri

Findings of Ramsay Hunt Syndrome. Journal of Medical Research and Health Sciences, 2022;5(4): 1899–1905.