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Study of TSH level at the time of diagnosis of Hypothyroidism in patients with Diabetes Mellitus- A Retrospective Study

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Abstract

Background: To evaluate the difference in the level of TSH in diabetic and non diabetic patients at the time of the diagnosis of hypothyroidism. **Methods:** 100 diagnosed cases of hypothyroidism, 50 with diabetes and 50 without diabetes were studied. The level of TSH at the time of diagnosis and other information were obtained from the medical records. **Results:** The mean TSH in patients with the history of diabetes at the diagnosis of hypothyroidism was 19.9616±26.990 and in those without the history of the diabetes was 10.4797±6.503 (p value 0.018). The females with diabetes had higher level of TSH level at the time of diagnosis of hypothyroidism than females without diabetes (p value 0.045).There was no statistically significant difference in the level of TSH in males with and without diabetes at the time of diagnosis of hypothyroidism. **Conclusion:** Patients with diabetes mellitus had higher level of TSH at the time of diagnosis of hypothyroidism in comparison to those without diabetes. Early identification of the raised TSH levels in diabetic patients and timely intervention will help to reduce the chances of adverse cardiovascular outcomes and diabetic kidney disease in this group of patients.

Key words: Diabetes Mellitus, Hypothyroidism,Thyroid stimulating hormone [TSH]

Introduction

Thyroid diseases and Diabetes Mellitus are the two endocrine disorders which are frequently encountered in the clinical practice by almost all the clinicians.[1] These two diseases have effect over each other and this mutual relationship between them has been shown in various studies.[1] Among various spectrums of the thyroid disorders, hypothyroidism is most frequently found to be associated with the diabetes mellitus.[2,3]

Hypothyroidism is a clinical condition which results from the decreased synthesis of thyroid hormone from the thyroid gland or from the impaired activity of the thyroid hormone at the tissue level.[4] Overt hypothyroidism is diagnosed when patients have low levels of thyroid hormone and high levels of thyroid-stimulating hormones (TSH). The subclinical hypothyroidism is diagnosed when there is elevated thyroid-stimulating hormone (TSH) and normal thyroid hormone level.[5]

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The relationship between diabetes and hypothyroidism is a very well established. Patients with diabetes mellitus who have higher levels of TSH are found to be associated with the increased prevalence of the diabetic kidney disease.[6] Similarly a study done by Ping Zhu et al. showed the independent association of TSH level with the insulin resistance.[7]

TSH level measurement in blood is the main test used for the diagnosis of the hypothyroidism in the clinical practice.[8] The use of TSH for the hypothyroidism is preferred because of the various reasons. TSH has inverse log-linear relationship with free-thyroxine (FT4), so small linear decrease in free-thyroxine level causes exponential increase in the TSH level. Similarly, the modern test methods used for the measurement of TSH have more than 99% sensitivity and specificity. Also, most cases

of the hypothyroidism encountered in the clinical practice are due to decrease in hormone synthesis by the thyroid gland, making TSH a test of choice.[9] Within the current study, we aimed to investigate whether there is exists any significant difference in the level of TSH at the time of diagnosis of hypothyroidism among those with and without diabetes mellitus.

Methods and Methodology

We analyzed retrospectively 100 hypothyroid adult participants of age more than 18 years. 50 patients had diabetes mellitus and remaining 50 without diabetes mellitus were taken as control. All patients were either army personnel, retired armies or their families. All the data were collected on the basis of their medical records. Participants were defined as having T2DM according to self-report, clinical reports,use of anti-diabetic agents and ADA criteria. Serum TSH was estimated by immunoradiometric assay.

Continuous variables were described using means and standard deviations. Chi square test was used for categorical data comparison. ANOVA test was used to compare the means among the groups. P value of <0.05 indicates significance. The statistical analysis was conducted with SPSS version 21.0 for Windows. The data were presented and tables and charts.

Results

Among the total 100 participants in the study, 50 had history of diabetes and 50 didn't have the history of diabetes. Among 100 patients 49 patients were male and 51 patients were females. Out of the 50 patients with diabetes 31 were males and 19 were females. Among the 50 patients without diabetes 18 were males and 32 were females. The mean age of participants with diabetes mellitus was 60.50±10.42 µIU/mL and without diabetes was 52.54±15.97µIU/mL. (Table 1 and Table 2)

Table 1. History of Diabetes * Sex of Participant Cross-tabulation

		Sex of Participant		Total
		Male	Female	
History of Diabetes	Present	31	19	50
	Absent	18	32	50
Total		49	51	100

Table 2. Mean age of participants

History of Diabetes	Mean	N	Std. Deviation
Present	60.50	50	10.420
Absent	52.54	50	15.965
Total	56.52	100	13.996

The mean TSH in patients with the history of diabetes at the diagnosis of hypothyroidism was 19.9616±26.990 µIU/mL and in those without the history of the diabetes was 10.4797±6.503 µIU/mL. On comparing the mean difference between these two groups using ANOVA, the p value was found to be 0.018, which is statistically significant. (Table 3 and Figure 1)

Table 3. Relation between TSH level at diagnosis of hypothyroidism and history of diabetes mellitus

History of Diabetes	Mean	N	Std. Deviation
Present	19.9616	50	26.99041
Absent	10.4797	50	6.50346
Total	15.2207	100	20.10471
df-1; F-5.832; p value-0.018; CI-1.69-17.27			

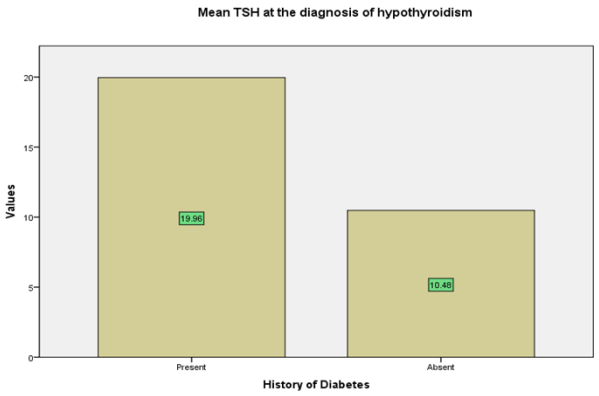

Figure 1. Bar diagram showing mean TSH level on diagnosis of hypothyroidism

In this study, while comparing the mean TSH level among the males with and without diabetes, the mean TSH level among those with diabetes was 17.315±20.99 µIU/mL and among those without

diabetes was 9.232±3.143 µIU/mL.The mean difference among these two categories was not statistically significant (p value 0.113). This implies that there was no statistically significant difference in the level of TSH in males with and without diabetes at the time of diagnosis of hypothyroidism. (Table 4)

Table 4. Difference in TSH level among males with and without diabetes at the time of diagnosis of hypothyroidism

History of Diabetes	Sex of Participant		Statistic	95% Confidence Interval	
				Upper	Lower
Present	Male	Mean	17.3152	11.1457	25.7020
		N	31	31	31
		Std. Deviation	20.98780	5.71590	31.45213
Absent					
	Male	Mean	9.2326	7.7633	10.7583
		N	18	18	18
		Std. Deviation	3.14274	1.87317	3.77188
Total	Total	Mean	14.3461	10.4281	19.7306
		N	49	49	49
		Std. Deviation	17.15522	5.04543	26.08701

df-1; F- 2.613; p value- 0.113

In this study, while comparing the mean TSH level among the females with and without diabetes, the mean TSH level among those with diabetes was 24.280±34.888 µIU/mL and among those without diabetes was 11.181±7.748 µIU/mL.The mean difference among these two categories was statistically significant (p value 0.045). This implies that there was statistically significant difference in the level of TSH in females with and without diabetes at the time of diagnosis of hypothyroidism. Thus, the females with diabetes have higher level of TSH level at the time of diagnosis of hypothyroidism than females without diabetes. (Table 5)

Table 5. Difference in TSH level among females with and without diabetes at the time of diagnosis of hypothyroidism

History of Diabetes	Sex of Participant		Statistic	95% Confidence Interval	
				Lower	Upper
Present	Female	Mean	24.2795	11.1235	42.0303
		N	19	19	19
		Std. Deviation	34.88844	7.35747	49.53283
Absent	Female	Mean	11.1813	8.7824	13.7807
		N	32	32	32
		Std. Deviation	7.74764	4.26692	10.31682
Total	Female	Mean	16.0610	10.9975	22.6109
		N	51	51	51
		Std. Deviation	22.72257	7.44397	34.08326

df-1; F-4.216; p value- 0.045

Discussion

This study was done with the purpose to evaluate the difference in the level of TSH among the hypothyroid patients with and without the history of the diabetes at the time of their diagnosis of the hypothyroidism. To our knowledge, this is the first study which has compared the TSH level at the time of diagnosis of hypothyroidism in both group of patients with and without diabetes.

Our study included 100 participants. 50 participants had diabetes when they were diagnosed of having hypothyroidism. 50 hypothyroid patients without the diabetes were taken as control. In the present study, the mean values of serum TSH was 19.9616±26.990 µIU/mL in those with history of diabetes, and was 10.4797±6.503 µIU/mL in those without the history of the diabetes mellitus. The mean TSH level was higher in those patients with diabetes during the time of their diagnosis of hypothyroidism. This difference in TSH level among those with and without diabetes was statistically significant with the p-value of 0.018. one of the study conducted by Acharya et al. in Nepal also showed statistically significant difference in the TSH level in patients with and without diabetes with the TSH level being higher in diabetic patients.[10] Similarly, in the studies done by Prasad et al. and Swamy et al., statistically significant increased level of TSH was found in diabetic patients as compared to non-diabetic patients.[11,12] These results are similar to that of our study showing increased TSH level in patient with diabetes in comparison to those without diabetes; however these studies used healthy persons as control, whereas we used hypothyroid patients without diabetes as controls in our study. However, in a study done by Islam et al there was no significant difference in the level of TSH among diabetic and non-diabetic patients.[13]

In our study, females with diabetes were found to have higher level of TSH at the time of diagnosis of hypothyroidism than females without diabetes (p value 0.045).Bharat et al. also found statistically significant higher level of TSH in diabetic females in comparison to females without diabetes mellitus.[14] However study done by Ishay et al. didn't not find the statistically significant difference in TSH between female patients with and without diabetes, which contradicts the results of our study.[15] In our study, however, there was no statistically significant difference in the TSH level among male patients at the time of diagnosis of hypothyroidism irrespective of the presence or absence of diabetes mellitus.

The elevation of TSH in the diabetic patient might be due to the effect of Hyperinsulinemia and the Leptin on the Hypothalamic-Pituitary-Thyroid Axis resulting in stimulation of TSH secretion.[16] Undiagnosed or diagnosed elevated TSH level, as seen in hypothyroidism, increases the existing cardiovascular risk and diabetic kidney disease in patients with diabetes mellitus.[6,17] So, early diagnosis of elevated TSH level in diabetic patients will help in the reduction of mortality and morbidity.

However our study has some limitations. First, this study is a retrospective and observational study and it was tough to avoid selection and confounding bias. Second, the sample size of this study was relatively small. Third, as this study was done at a tertiary referral centre, the results of this study may not be applicable at the community level.

Conclusion

Patients with diabetes mellitus had higher level of TSH at the time of diagnosis of hypothyroidism in comparison to those without diabetes. Early identification of the raised TSH levels in diabetic patients and timely intervention will help to reduce the chances of adverse cardiovascular outcomes and diabetic kidney disease in this group of patients.

Also, as elevated TSH is independently related with the insulin resistance, early identification of raised TSH and proper treatment of thyroid dysfunction can reverse the insulin resistance in diabetic patients.

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