World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(RESEARCH ARTICLE)

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Correlation between hypothyroidism and type 2 diabetes: A cross-sectional study

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World Journal of Advanced Research and Reviews, 2023, 18(03), 234–239

Publication history: Received on 23 April 2023; revised on 02 June 2023; accepted on 04 June 2023

Article DOI: https://doi.org/10.30574/wjarr.2023.18.3.1040

Abstract

Diabetes is the most common chronic endocrine disease. Numerous studies suggest that hypothyroidism is associated with hypertension, high cholesterol, and abnormal homocysteine level and patients with hypothyroidism have a higher risk of metabolic syndrome. This prospective study was conducted at Lahore General Hospital to estimate the frequency of hypothyroidism in patients with T2DM.

Objectives: To determine the frequency of hypothyroidism in patients with type 2 diabetes mellitus.

Study design: This was a cross-sectional study.

Setting: Department of Medicine, Lahore General Hospital, Lahore.

Duration of study: Study duration was six months from 06-12-2019 to 05-05-2020.

Subjects: Hundred patients through Non-probability consecutive sampling.

Methods: Patients fulfilling inclusion and exclusion criteria were included. Detailed history and examination and Free Serum Thyroxine (T4), Thyroid Stimulating Hormone (TSH) levels were measured in all patients using standard immunoassay in the hospital laboratory. Data was analysed using SPSS 21.

Results: Among 100 patients, 64% patients were male and 58% patients were between ages of 41-60 years with mean age of 46.6 $\pm$ 4.7 years. Regarding blood sugar levels, 62% patients had $\leq$ 200 mg/dl whereas remaining patients had blood sugar levels of > 200 mg/dl. Results of study showed that 12% of patients had hypothyroidism. Further stratification of data revealed no significant association between different age groups, gender, duration of diabetes, high BMI and presence of hypothyroidism i.e. p value was 0.9801, 0.9081, 0.8825 and 0.9601 respectively.

Conclusion: Frequency of hypothyroidism in patients with type 2 diabetes mellitus is high.

Key words: Diabetes Mellitus; Hypothyroidism; Frequency; Correlation

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1. Introduction

Diabetes is the most common chronic endocrine disease characterised by hyperglycemia resulting from impaired insulin secretion and/or insulin action[1]. Chronic diabetic hyperglycaemia is associated with long-term organ damage, dysfunction and failure. Complications, such as vision loss, renal failure and cardiovascular diseases, are often outcomes of diabetes[1]. Numerous epidemiological studies indicate the higher prevalence of overt hypothyroidism in type 1 diabetes mellitus (T1DM) population than in the general population[1-2]. However, the relationship between hypothyroidism and T2DM is controversial. The guidelines of the American Thyroid Association (ATA) and the European Thyroid Association (ETA) recommend screening thyroid function in patients with Type 1 diabetes annually[1-2]. However, there is lack of definitive guidance, local policies and/or practices focused on the screening of thyroid dysfunction in T2DM. Numerous studies suggest that hypothyroidism is associated with hypertension, high cholesterol, and abnormal homocysteine level and therefore patients with hypothyroidism have a higher risk of metabolic syndrome, atherosclerosis, cardiovascular events, and mortality[1-7].

Several studies on thyroid dysfunction in type 2 diabetes have reported wide variation in results ranging from 4.5% to 40% frequency but a few studies including one from Norway found no association between T2DM and hypothyroidism[4]. In addition, many of these studies are retrospective and one is population based which did not find any association. In a study conducted among Kurd patients, primary hypothyroidism was found in 24 (40%) diabetic patients (5.67 ± 3.35 μIU/mL) versus three (10%) controls (1.76 ± 1.19 μIU/mL) ($P < 0.001$)[2]. In contrast, a study from Indian Punjab found a prevalence of 4.5% in T2DM[3]. A retrospective study from a tertiary care hospital in India found frequency of overt hypothyroidism in T2DM to be 15%[5]. Another study from India reported the prevalence of hypothyroidism in T2DM to be 9.2%[6]. A recent study from Saudi Arabia reported that among cases of T2DM, there were 467 patients (30.7%) with hypothyroidism[7]. Keeping in view these variations in the prevalence, variable results, small sample sizes, retrospective design, a prospective study with adequate sample size is desirable to conclude a significant association in our relevant study. It is essential to determine the frequency of Hypothyroidism in T2DM as it increases the risk of cardiovascular disease and metabolic syndrome in these patients. Thus, this prospective, cross-sectional study was conducted to estimate the frequency of hypothyroidism in patients with T2DM in Lahore, Pakistan.

Objectives of the study

The objective of this study was to determine the frequency of hypothyroidism in patients with type 2 diabetes mellitus.

1.1. Operational definitions

- **Diabetes mellitus**

Patients were classified as having DM if they are receiving treatment with oral hypoglycemic agents or insulin or have elevated fasting blood glucose levels (greater than 126 mg/dL) on two consecutive days or HbA1c greater than or equal to 6.5%.

- **Hypothyroidism**

Hypothyroidism was defined by elevated TSH levels with low total T4 levels. Elevated TSH level will be defined as above 5 mU/L while low free T4 will be defined as below 0.9 ng/dL

2. Material and methods

2.1. Study design

This was a cross sectional study.

2.2. Setting

Study was conducted at the Department of Medicine, Lahore General Hospital.

2.3. Duration of study

Study duration was six months from 06-12-2019 to 05-05-2020.

2.4. Sample size

Sample size was calculated to be 100 with 95% confidence interval, 7% margin of error and 15% expected frequency of hypothyroidism in patients with T2DM.

2.5. Sampling technique

Sampling technique was non-probability of consecutive sampling.

2.6. Inclusion criteria

- Patients of both genders with T2DM as per operational definition aged 20-60 years.
- Those who were willing to participate in study.

2.7. Exclusion criteria

- Participants with other disorders like type 1 diabetes mellitus, renal diseases, liver diseases, pregnancy, critically ill patients were excluded (determined from history/medical record).
- Patients taking medications affecting thyroid function e.g; amiodarone, interferon were excluded. These were assessed from history and medical record.
- Patients who refused to participate in the study.

2.8. Data collection procedure

A total of 100 patients with T2DM fulfilling the criteria were enrolled after taking informed consent. Patients were classified as having hypothyroidism if they fulfilled the criteria outlined in operational definition. Thorough medical history and relevant physical examination was done. Free Serum Thyroxine (T4), Thyroid Stimulating Hormone (TSH) levels were measured in all patients using standard immunoassay in the hospital laboratory. Biodata was entered in a predesigned structured pro forma. Patients diagnosed with hypothyroidism were treated as per protocol.

2.9. Data analysis procedure:

Statistical analysis was done using Statistical Package for Social Sciences (SPSS) version 18. Qualitative data like gender, presence of hypothyroidism was presented as frequencies and percentages. Quantitative data i.e., age, blood glucose was presented as means and standard deviations. Data was stratified by age, gender, and duration of diabetes to control the effect modifier. Post stratification chi square test was applied to check significance with p value ≤0.05 statistically significant.

3. Results

A total of hundred patients participated in our study. According to the results of our study, 42% of patients were between the ages of 20-40 years while 58% of patients were between the ages of 41-60 years. Mean age of patients was 46.6 ± 4.7 years.

Regarding gender distribution, 64% patients were male while remaining 36% patients were female. Furthermore, blood sugar levels were $\leq$ 200 mg/dl in 62% patients whereas remaining patients had blood sugar levels of > 200 mg/dl. Results of the study showed that 12% of patients had hypothyroidism.

When we stratified our data according to different age groups, it was seen that 5 diabetic patients 42 (i.e. 11.9%) in age group 20-40 months had hypothyroidism compared to 7 diabetics out of 51 (i.e. 13.7%) in age group between 41-60 years who had hypothyroidism. Chi square was 0.001 and p value of 0.9801 i.e. non-significant.

When we further stratified our results for gender, 7 male diabetics out of 64 total (10%) had hypothyroidism whereas 5 female diabetics out of 36 total (13%) had hypothyroidism. Chi square value was 0.013 and p value of 0.9081 i.e. non-significant.

Further stratification of data showed that duration of diabetes and high BMI was not significantly associated with hypothyroidism in diabetic patients i.e. p value was 0.8825 and 0.9601 respectively.

Table 1 Age distribution (n=100)

Age (in years)	No. of patients	%
20-40	42	42.0%
41-60	58	58.0%
Total	100	100

Mean±SD: 44.6 ± 4.7

Table 2 Gender distribution (n=100)

Gender	No. of patients	%
Male	64	64.0%
Female	36	36.0%
Total	103	100.0

Table 3 Blood glucose (n=100)

BLOOD GLUCOSE	No. of patients	%
≤200 mg/dl	62	62.0%
>200 mg/dl	38	38.0%
Total	103	100.0

mean±sd: 267.9 ± 111.9

Table 4 Frequency of hypothyroidism (n=100)

Hypothyroidism	No. of patients	%
Yes	12	12.0%
No	88	88.0%
Total	100	100.0

Table 5 Stratification of patients with hypothyroidism by age (n=100)

Age in years	Hypothyroidism		Total
	Yes	No	
20-40	5	37	42
41-60	7	51	58
Total	12	88	

Chi square 0.001; P value: 0.9801

Table 6 Stratification of patients with hypothyroidism by gender (n=100)

Gender	Hypothyroidism		Total
	Yes	No	
Male	7	57	64

Female	5	31	36
Total	12	88	

Chi square 0.013; P value: 0.9081

Table 7 Stratification of patients with hypothyroidism by duration of diabetes (n=100)

Duration	**Hypothyroidism**		**Total**
	Yes	No	
Upto 2 years	6	46	52
>2 Years	6	42	48
Total	12	88	

Chi square 0.022; P value: 0.8825

Table 8 Stratification of patients with hypothyroidism by BMI (n=100)

Duration	**Hypothyroidism**		**Total**
	Yes	No	
Upto 25 kg/m2	5	36	41
>25 kg/m2	7	52	59
Total	12	88	

Chi square 0.003; P value: 0.9601

4. Discussion

Diabetes is the most common chronic endocrine disease. Numerous studies suggest that hypothyroidism is associated with hypertension, high cholesterol, and abnormal homocysteine level and patients with hypothyroidism have a higher risk of metabolic syndrome. This prospective study was conducted at Lahore General Hospital to estimate the frequency of hypothyroidism in patients with T2DM.

According to the results of our study, the frequency of hypothyroidism in diabetic patients was 12%. Different studies showed that frequency of hypothyroidism in patients with diabetes mellitus type-II was variable. Results of some studies were comparable to our study. A retrospective study conducted in India revealed that the frequency of overt hypothyroidism in patients with diabetes mellitus type-II was 15% [5]. Another study conducted at a tertiary care hospital of Eastern India reported prevalence of hypothyroidism in diabetes mellitus type-II patients to be 9.2%[6]. Asrar Ahmed conducted a similar study at Jaipur to find prevalence of hypothyroidism in diabetic patients and found that 13% diabetic patients had hypothyroidism[8]. A similar study conducted by Talwalker and his colleagues showed that prevalence of hypothyroidism in patients of diabetes mellitus type-II was 24.8%[9]. One study conducted at Puerto by Bernal and his colleagues found hypothyroidism in 22.7% type-II diabetic patients[7]. Some studies revealed a very high prevalence of hypothyroidism in patients with diabetes mellitus-II. One Kurd study found that hypothyroidism was as high as 40% of patients with diabetes mellitus type-II. Another large study was conducted on 3760 patients at King Fahad Armed Forces Hospital, Jeddah, Saudi Arabia. This study reported the prevalence of hypothyroidism to be 30.7% in patients with diabetes-II[7]. Furthermore, a similar study conducted in Nigeria reported frequency of hypothyroidism among diabetics as 26.6%[10]. Another study conducted in Saudi Arabia has reported prevalence of hypothyroidism as 25.3% among diabetes mellitus type-II patients[7].

When we stratified our data according to different age groups, it was seen that hypothyroidism was not significantly associated with different age group diabetic patients i.e. p value=0.9801. In a similar study conducted in Saudi Arabia, no significant association was found between different diabetic patient's age groups and hypothyroidism i.e. p value=0.6[7].

On further stratification of data according to gender, it was found that 10% male diabetics had hypothyroidism compared to 13% female diabetics who had hypothyroidism (p value=0.9081). A similar study conducted on American

Indian tribes reported prevalence of hypothyroidism in 8.8% female diabetic patients[11]. A Nigerian study reported prevalence of hypothyroidism in women as 16.8% compared to 9.9% men[12]. On other hand, a study conducted by Khalid and his colleagues at Saudi Arabia showed significant association between gender and presence of hypothyroidism in diabetics (p value=0.0001)[7] which was not comparable to our study.

5. Conclusion

It was concluded from our study that the frequency of hypothyroidism in patients with type 2 diabetes mellitus is significant, though further stratification of data revealed no significant association between different age groups, gender, duration of diabetes, high BMI and presence of hypothyroidism.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare that they have no competing interests.

Funding information

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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