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Original Article

Frequency of Thyroid Dysfunction in Diabetic Patients

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ABSTRACT

Thyroid hormones are involved in the control of insulin secretion, beta-cell function/multiplication, liver glucose synthesis, output and peripheral utilization. Thyroid dysfunction identification and correction help in glycemic control. **Objective:** To know the frequency of thyroid dysfunction in diabetic patients. **Methods:** This descriptive cross-sectional study was done in the Medical-C Department, Ayub Teaching Hospital Abbottabad from July 2018 to August 2019. Total 150 diabetic patients were enrolled by using non-probability consective sampling. Patients were labelled as diabetics on the basis of diabetes history, anti-diabetic medications use, high blood glucose (>200mg/dl) on presentation or on previous high blood sugar reading or a high HbA1c value. Fresh venous blood sample was sent for thyroid function tests (T3, T4 and TSH). Thyroid dysfunction in our study was defined as patient having Thyroid Stimulating Hormone (TSH) value above or below the normal range. Data of patients were collected on study pro forma and was analyzed using statistical program SPSS version-20.0 **Results:** There were 67 (44.66%) male and 83 (55.33%) female patients. The mean age was 51.83 ± 14.52 years. Thyroid dysfunction was detected in 37 (24.66%) study participants. Out of 67 male patients, 11 (16.41%) had thyroid dysfunction and out of 83 female patients, 26 (31.32%) had thyroid dysfunction. Subclinical hypothyroidism was present in 4 (2.7%), 5 (3.3%) had hypothyroidism, 20 (13.3%) had subclinical hyperthyroidism and 8 (5.3%) had hyperthyroidism. **Conclusion:** This study suggests that a significant portion of diabetic patients suffer from thyroid dysfunction.

INTRODUCTION

Diabetes mellitus and thyroid hormone abnormalities are among the common endocrine problems [1, 2]. High blood sugar is due to decrease in insulin secretion, less glucose utilization and increased glucose production. Diabetes is one of the main reasons of end-organ renal failure, lower limb amputations and adult blindness [3, 4]. Diabetes mellitus is a major health threats for the 21st century. Thyroid abnormalities are 2nd common endocrine dysfunction. The rise in patient's number with diabetes has led to significant increase in health-related budget [5]. In 2021; International Diabetes Federation (IDF) said that about 537 million adults are diabetic which 10.5% of the world population is. It is predicted to rise to 643 million by 2030 and to 783 million (12.2%) by 2045. In 2021, highest diabetes prevalence rates were stated in Pakistan (30.8%), French Polynesia (25.2%) and Kuwait (24.9%). It is expected that Pakistan, Kuwait and French Polynesia will have highest prevalence rates by 2045. About 6.7 million adults have died as a result of diabetes or its complications in 2021 which is 12.2% of total deaths in the world [6]. Thyroid hormones control the metabolism of nucleated cells (through cross-talk with nuclear receptors and with the help of corepressor- nuclear corepressor under the influence of thyroid hormones mediate basal repression and ligand-induced gene activation or repression). The diseases involving imbalance of thyroid hormones are

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found commonly in the world population [7, 8]. There prevalence of thyroid diseases is different in different general populations. It ranges from 6.6% to 13.4%. Its prevalence in general papulation in United States is 5.9% and in UK is 6.6%.9 It is shown that hypothyroidism 'prevalence is between 0.2% and 4.8% whereas hyperthyroidism' prevalence between 0.5% and 3.0% [10]. The co-existence of diabetes and thyroid disease is common [11]. Thyroid hormone abnormalities are present more frequently in diabetic patients and mutually affect each other [12]. Thyroxine and triiodothyronine (T3) excess increases the glucose production in body, increasing insulin need. These reduce the insulin sensitivity in liver. Pre & post-meal insulin/proinsulin levels and free fatty acids concentrations are high in hyperthyroidism. Oral glucose tolerance test leads to increase in glucose and insulin response in patients having hyperthyroidism.4 Poorly controlled diabetes leads to low blood level of thyroxine (T4) and triiodothyronine (T3) [13]. Thyroid hormone abnormalities in diabetic patients increases the risk of its implications [14]. Studies have shown impaired glucose tolerance in 57% of hyperthyroid patients which dropped to 30% when patients were rendered euthyroid [12]. Thyroid hormone abnormalities in diabetics is estimated about 10–24% [15]. This common co-existence of diabetes and thyroid dysfunction led to the suggestion by American Diabetes Association (ADA) that people with diabetes must be checked periodically for thyroid dysfunction [16]. Thyroid hormone abnormalities should be checked yearly in patients with diabetes to detect asymptomatic patients [17]. Patients having thyroid hormone abnormalities may be tested for abnormal glucose metabolism as there is increase in glucose production in liver, rapid intestinal glucose absorption, and decreased insulin sensitivity [18-20]. The purpose of our research study was to check the frequency of thyroid disorders in diabetic patients in our hospital. As diabetes is among the commonest diseases in our country and admissions due to diabetes complications have a major part in hospital economic burden. Thyroid dysfunction in diabetic patients increases the risk of complications so results of this study would be useful to devise interventions at the level of planning, care provision and management.

METHODS

It was a cross-sectional study which was conducted in Medical C department of Ayub Teaching Hospital, Abbottabad from July 2018 to August 2019. Total 150 diabetic patients were included through non-probability consecutive sampling. By using WHO software for sample size determination in health studies, sample size was calculated. Formula to determine proportions with specified absolute precision was used by keeping Confidence level at 95%, anticipated proportion of thyroid dysfunction at 6.6%[9] and an absolute precision of 4%.[13] The study included diabetic patients of both genders who were admitted and were between the ages of 16 and 80 years. Those patients who had diabetes duration for less than 12 months were excluded from the study. Patients were documented as having diabetes if they have known from their history or from their previous documents; they were already on anti-diabetic medications, if their fasting blood sugar was ≥ 126 mg/dl, random blood sugar level was ≥ 200 mg/dl or HbA1c value was ≥ 6.5 %. Thyroid dysfunction was diagnosed in our study when patients had a known thyroid dysfunction status or if their TSH level was outside the normal range (0.4–4.5mIU/L). Patient with TSH level below 0.4 mIU/L with normal T3 and T4 were labelled as subclinical hyperthyroid. Patients with TSH level below 0.4 and raised T4 & T3 were labelled as hyperthyroid. Patients with TSH level above 4.5 mIU/L and normal T3 & T4 were labelled as subclinical hypothyroid. Patient with TSH level above 4.5 mIU/L and low T3 & T4 were labelled as hypothyroid. Data of the included patients were collected on a structured pro forma. Approval of Hospital administration and Ethical Committee of the institution was taken. Informed consent from every conscious patient and from the attendants of unconscious patient after full explanation of study work. Patients with diabetes mellitus who were admitted in medical unit and who also met the inclusion criteria were enrolled in this study. History was documented regarding diabetes, glycemic control, hypoglycemic medications use, previous blood sugar test reports, thyroid hormone abnormalities, thyroid dysfunction medication use and previous thyroid function test reports. Fresh blood samples were taken and sent for assesment of the glycemic control & thyroid dysfunction. The collected data were entered and analyzed by using statistical program SPSS version 20.0. Categorical variables such as gender, presence or absence of thyroid dysfunction and type of thyroid dysfunction were described as frequencies and percentages. Quantitative variables such as thyroid function tests levels were reported in terms of mean ± standard deviation. Stratification of thyroid dysfunction was done by its type with age group and gender and Chi-square test was applied after stratification at 5% level of significance.

RESULTS

In this study, 150 patients of diabetes mellitus were enrolled having ages of 16 to 80 years. The mean age of the patients was 51.83 ± 14.52 years. There were 67 (44.6%) male and 83 (55.3%) female patients in the study (Table 1).

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Table 1: Frequency of gender of the patients

Gender	Frequency (%)
Male	67(44.66)
Female	83(55.33)
Total	150(100)

In frequency of thyroid function status, 37 (24.66%) patients were found to have thyroid dysfunction while 113 (75.33%) patients were found to have eu-thyroidism (Table 2).

Table 2: Frequency of thyroid function status of patients

Thyroid Status	Frequency (%)
Thyroid dysfunction	37(24.66)
Euthyroid	113(75.33)
Total	150(100)

Moreover, patients found with subclinical hypothyroidism were 4 (2.7%), with hypothyroidism were 5 (3.3%), subclinical hyperthyroidism were 20 (13.3%) and with hyperthyroidism were 8(5.3%) patients (Table 3).

Table 3: Thyroid status of patients

Thyroid Status	Frequency (%)
Subclinical hypothyroid	4(2.7)
Hypothyroid	5(3.3)
Euthyroid	113(75.3)
Subclinical hyperthyroid	20(13.3)
Hyperthyroid	8(5.3)
Total	150(100)

Frequency of age group is shown in table 4.

Table 4: Frequency of age group of the patients

Age Groups	Frequency (%)
16 to 30 years	16(10.66)
31 to 45 years	30(20)
46 to 60 years	69(46)
>60 years	35(23.33)
TOTAL	150(100)

Thyroid hormone level distribution level is shown in table 5.

Table 5: Thyroid hormones level distribution

Thyroid hormones level	N	Minimum	Maximum	Mean ± SD
Serum TSH level	150	0.003	176.213	3.733 ± 16.526
Serum T3 level	150	0.05	4.97	1.587 ± 0.768
Serum free T4 level	150	0.21	4.65	1.448 ± 0.575

Frequency distribution of age with thyroid dysfunction is shown in table 6.

Table 6: Frequency distribution of age with thyroid status

Age groups	Thyroid status of the Patient					Total	p-value
	Subclinical hypothyroid	Hypothyroid	Euthyroid	Subclinical hyperthyroid	Hyperthyroid		
1(16-30 years)	0	0	12	4	0	16	0.254
2(31-45 years)	1	2	20	3	4	30	
3(46-60 years)	2	1	51	12	3	69	
4(more than 60 years)	1	2	30	1	1	35	
Total	4	5	113	20	8	150	

The frequency distribution of gender with thyroid status is shown in Table 7. With regard to the association of thyroid hormone abnormalities with the duration of diabetes, p-value was 0.115 stating statistically insignificant relation of thyroid dysfunction with diabetes duration. Moreover, with regard to the association of thyroid dysfunction with age and gender of study participants, the p value was found to be 0.254 and 0.126 respectively which indicates statistically insignificant relationship of thyroid dysfunction with age and gender of the patients.

Table 7: Frequency distribution of gender with thyroid status

Thyroid status	Gender of patient		Total N (%)	p-value
	Male N (%)	Female N (%)		
Subclinical hypothyroid	2 (1.3%)	2 (1.3%)	4 (2.6%)	0.126
Hypothyroid	0 (0%)	5 (3.3%)	5 (3.3%)	
Euthyroid	56 (37.33%)	57 (38%)	113 (75.33%)	
Subclinical hyperthyroid	7 (4.6%)	13 (8.66%)	20 (13.26%)	
Hyperthyroid	2 (1.3%)	6 (4%)	8 (5.3%)	
Total	67 (44.66%)	83 (55.33%)	150 (100%)	

DISCUSSION

The prevalence of thyroid hormone abnormalities in common population is stated in literature as 6.6% whereas its prevalence in diabetic patients is 10.8% [21]. Prevalence of hypothyroidism is stated 0.2-4.8% whereas of hyperthyroidism is 0.5-3.0%.10Thyroid disorders are more common in diabetic patients [22-25]. Our study included 150 patients, 68 (45.3%) were male and 82 (54.7%) were female with female to male ratio of 1.20. The study done by Ogbonna and Ezeani had 56.5% female participants and 43.5% male participants, result is similar to our study [26]. The mean age in our study was 51.83 ± 14.52 years. Mean age in the study of Khan *et al.*, was 51.2 ± 6.18 years, in the study of Shahbazian *et al.*, mean age was 49.8 ± 11.4 years, study done by Khassawneh *et al.*, reported mean age of 60.14 ± 12.21 and Ogbonna *et al.*, reported mean age of 57.5 ± 9.3 years [12, 27, 9, 26]. Mean age of our study was comparable to all these studies. Our study showed that duration of diabetes was 1-5 years in 33.33% of the patients, 5-10 years in 36% patients and more than 10 years in 30.66 %. Data collected by Khan *et al.*, in Karachi showed that 34.37% patients had diabetes of 5 years duration, 41.31 % patients had diabetes duration of 5-10 years and 24.32 % had diabetes for more than 10 years [12]. The study done by Khurana *et al.*, showed that 12.5% of the patients had diabetes duration of 1 year, 34.37% had diabetes duration of 1-5 years, 40.62 % had it for 6-10 years and 12.5 % had diabetes duration of more than 10 years [28]. Like our study, the other 2 studies showed that most patients included had diabetes duration of 5-10 years. Our study had thyroid dysfunction in 24.66% of the patients, out of these 18.66% of the patients had hyperthyroidism and 6 % had hypothyroidism. These results were similar to the study done by Khan *et al.*, in Karachi which showed thyroid

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dysfunction in 19.7% with 13.20% hyperthyroidism and 6.50% hypothyroidism [12]. Data collected by Saran *et al.*, in Northern India reported thyroid dysfunction in 33.3% of the patients, out of these 11.1% of the patients had subclinical hypothyroidism, 14.4% patients had hypothyroidism, 4.9% had subclinical hyperthyroidism and 2.9% of the patients were diagnosed with hyperthyroidism [29]. This study had thyroid dysfunction frequency similar to our study but had higher frequency of hypothyroidism whereas in our study hyperthyroidism was more common disorder. Demitrost *et al.*, in their study observed thyroid dysfunction of 31.2% with 16.3% subclinical hypothyroidism, 11.4% hypothyroidism, 2% subclinical hyperthyroidism and 1.5% hyperthyroidism [16]. Overall thyroid dysfunction frequency is similar to our study but here subclinical hypothyroidism (16.3%) is more common in contrast to subclinical hyperthyroidism which was more common in our study (13.26%). Khurana *et al.*, reported 16% thyroid dysfunction with subclinical hypothyroidism in 7.5% patients, hypothyroidism in 4.5%, hyperthyroidism in 2.5%, and subclinical hyperthyroidism in 1.5% [28]. Thyroid dysfunction frequency is comparable to our study but hypothyroidism is more common here. The study done by Kaeley *et al.*, showed thyroid dysfunction in 24%, out of these 19% had hypothyroidism (11% had subclinical hypothyroidism and 8% hypothyroidism) and 5% had hyperthyroidism (all had subclinical hyperthyroidism) [30]. Ogbonna *et al.*, showed 12.4% thyroid dysfunction in type 2 diabetes mellitus patients (hypothyroidism in 11.6% and hyperthyroidism in 0.8% of the patients) [26]. Thyroid dysfunction in all these studies was similar to our study but hypothyroidism was most common disorder in contrast to our study where hyperthyroidism was most common disorder. In our study, out of 67 male patients 11 (16.41%) patients had thyroid dysfunction and out of 83 female patients, 26 (31.32%) patients had thyroid dysfunction showing that thyroid dysfunction was more pronounced in females which is according to previous studies conducted [3].

CONCLUSIONS

This study suggests that a significant portion of diabetic patients suffer from thyroid dysfunction. More studies are required to establish this association, its implications and inclusion of routine screening of thyroid functions during admission and OPD visits of diabetic patients.

Authors Contribution

Conceptualization: MFHA, SM
Methodology: MFHA, SAA, RA
Formal analysis: MFHA, SFA, RA
Writing-review and editing: SAA, MNQ, MHS, RA, QA

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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