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Research Article

Estimation of thyroid profile in patients with diabetes mellitus in New Civil Hospital, Surat

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ABSTRACT

Background: Diabetes mellitus (DM) and thyroid diseases are the two common endocrinopathies seen commonly in the population. There is inter-dependence between insulin and thyroid hormones for normal cellular metabolism so that DM and thyroid diseases can mutually influence the other disease process. The excess or deficit of one hormone may result in functional derangement of other. Diabetes being a most common endocrine metabolic disorder, the variety of thyroid abnormalities may co-exist and interact with DM. Early detection of thyroid dysfunction and its treatment can delay the long-term complications of DM. The present study was planned to determine prevalence of thyroid dysfunction in DM patients and therefore to provide the appropriate guidelines.

Methods: The study was cross-sectional. 100 patients were enrolled for the study. Among them 50 were control (non-diabetic) and 50 were cases (diabetic). They were enrolled in the study from medicine outpatient department's and inpatient department's according to inclusion and exclusion criteria. Their thyroid profile (free T3, T4 and thyroid stimulating hormone) was done by chemiluminescence assay method.

Results: Results were analyzed by unpaired-*t*-test. Prevalence of thyroid dysfunction was found significantly high in DM patients. $p<0.05$ value considered as statistically significant.

Conclusions: Screening for thyroid disease among patients with diabetes mellitus should be routinely performed for early detection and treatment of thyroid dysfunction to delay the complications of diabetes.

Keywords: Diabetes mellitus, Hyperthyroidism, Hypothyroidism, TSH, T3, T4

INTRODUCTION

Diabetes mellitus (DM) is a "the Bergh" disease affecting at least 20 million people throughout the world.[1] Studies in different parts of India have demonstrated an escalating prevalence of diabetes not only in urban populations, but also in rural populations as a result of urbanization of lifestyle parameters. The prevalence of pre-diabetes is also high.[2] The impact of this disease on the quality of life and on morbidity, mortality through the complications that affect small and large vessels resulting in retinopathy, nephropathy, neuropathy, ischemic heart disease, large vessel obstruction has been emphasized by the finding of the National Commission (USA) on diabetes and diabetes control and complication trial.[3] The major long-term complications relate to damage to blood vessels. Diabetes doubles the risk of cardiovascular disease.[4] The main "macro vascular" diseases are coronary artery disease, stroke and peripheral vascular disease. About 75% of deaths in diabetics are due to coronary artery disease.[5] Diabetes also damages the capillaries (causes microangiopathy).[6] Diabetic retinopathy, which affects blood vessel formation in the retina of the eye can lead to visual symptoms including reduced vision and potentially blindness. Diabetic nephropathy, the impact of diabetes on the kidneys, can lead to scarring changes in the kidney tissue, loss of small or progressively larger amounts of protein in the urine, and eventually chronic kidney disease requiring dialysis. Another risk is diabetic neuropathy, the impact of diabetes on the nervous system, most commonly causing numbness, tingling, pain in the feet and also increasing the risk of skin damage due to altered sensation.[7] Compared to those without diabetes, the research showed that those with the disease have a 1.2-1.5 fold greater rate of decline in cognitive function and are at greaterrisk.[8] Diabetes being a most common endocrine metabolic disorder, there was curiosity to understand the association of this with another common endocrine gland dysfunction that is thyroid gland. The most common thyroid problem involves abnormal production of thyroid hormones. Too much thyroid hormone results in a condition known as hyperthyroidism. Insufficient hormone production leads to hypothyroidism. The variety of thyroid abnormalities may co-exist and interact with DM. The reported frequency of hyperthyroidism and hypothyroidism in patients with diabetes has varied from 3.2% to 4.6% and 0.7% to 4.0% respectively.[9] DM appears to influence thyroid function at two sites, one at the level of hypothalamic control of thyroid stimulating hormone (TSH) release and the other at the conversion of thyroxin (T4) to 3,5,3'-triiodothyronine (T3) in the peripheral tissue. Marked hyperglycemia decreases the activity and concentration of hepatic T4-5' deiodinase. The characteristic findings include low serum concentrations of T3, elevated levels of reverse T3 and low, normal or high levels of T4. The values return to normal after correction of hyperglycemia. When hyperthyroidism is present in a patient with poorly controlled diabetes, free T4 and T3 concentrations may be inappropriately normal, makes the diagnosis difficult. A suppressed serumbasal TSH or an absolutely flat response to TRH would support the diagnosis.[9] Thyroid hormones have a significant effect on glucose metabolism and the development of insulin resistance.[10] In hyperthyroidism, impaired glucose tolerance is the result of mainly hepatic insulin resistance, whereas in hypothyroidism the available data suggests that the insulin resistance of peripheral tissue prevails. Type 1 DM (T1DM) is classified as immune-mediated or idiopathic suggestive of association between thyroid and Type 1 diabetics may be an auto immune process.[11,12] Type 2 DM (T2DM) results from insulin resistance, which may be combined with relatively reduced insulin secretion and is due primarily to lifestyle factors and genetics.[13] A lack of exercise is believed to cause 7% of cases.[14]

In a recent year several studies in different countries were conducted to estimate the prevalence of thyroid dysfunction in diabetic patients showing great variability in general population. This difference can be explained by different diagnostic criteria of thyroid dysfunction. The degree of iodine uptake in different regions, different sensitivity of TSH assay and large population diversity. Screening of thyroid dysfunction, especially the subclinical dysfunction, in patients with DM is justified because most patients can be asymptomatic. Determine the prevalence of clinical and subclinical thyroid disease in diabetic patients in our country and its implications in the course of diabetes and known factor for cardiovascular risk is necessary. Early detection of thyroid dysfunction and its treatment can delay the long term complications of DM especially cardiovascular complications[15] and also stated that treatment of hypothyroidism in diabetes improves renal function.[16] Some of the study recently demonstrated that diabetic patients with subclinical hypothyroidism have more severe retinopathy than euthyroid patients with diabetes.[17] To the best of our knowledge no studies have been done to estimate the prevalence of thyroid dysfunction in DM patients in New Civil Hospital (NCH), Surat. So, the present study was planned to determine prevalence of thyroid dysfunction in DM patients in this institute with the objective to study the thyroid dysfunction in DM for early detection and to provide guideline about treatment strategy accordingly.

METHODS

The study includes all diabetes patients from outpatient department (OPD's) and inpatient department (IPD's) of medicine department of NCH, Surat, in a period between August 2012 and September 2014.

The study was approved by the local Institutional Ethics Committee. Informed consent of each participant was taken.

Study subjects

50 confirmed cases of DM and 50 non-diabetic patients were enrolled as study subjects from OPD's and IPD's of medicine department in a random fashion. Confirmed DM patients were selected for the study according to following inclusion and exclusion criteria:

Inclusion criteria

- Confirmed cases of T1DM, T2DM of both gender and of any age
- Patients willing to participate.

Exclusion criteria

- Patients not willing to participate

Patients with complications like:

- Nephropathy
- Neuropathy
- Retinopathy
- Cardiovascular events.

Patients giving a history of smoking, alcoholism or taking any drugs affecting thyroid function except metformin.

A detailed history was elicited, and examination was done as per the performa.

All patients were evaluated for thyroid status (free T3, T4 and TSH levels) by a pathologist in a private laboratory.

Laboratory methods for estimation of thyroid profile

The laboratory evaluation of thyroid functions was done by estimation of serum T3, T4 and TSH levels by chemiluminescence assay method. Two ml of blood was drawn, centrifuged and serum (500 µml) collected from that which was incubated with reagent (separate for T3, T4 and TSH) for about 1 hr at room temperature. Readings were taken from the instrument COBAS 6000.[18] The electro chemoluminescence immunoassay is intended for use on Elecsys and cobase immunoassay analyzers.

Statistical analysis

Statistical analysis was done by unpaired *t*-test using IBM-SPSS statistical analyzer. $p<0.05$ value considered as statistically significant.

RESULTS

Prevalence of thyroid dysfunction

In this study, 50 diabetic patients (cases) and 50 non-diabetic patients (control) were screened for thyroid dysfunction by thyroid function tests (TFT). Abnormal thyroid function was found in 14 (28%) DM cases and 50 control had normal thyroid function, which is statistically significant ($p<0.0001$) (Table 1 and Figure 1).

Spectrum of thyroid dysfunction in diabetes patients

In my study out of 50 diabetic patients 14 (28%) patients had thyroid dysfunction. Among them 1 (3%) had hypothyroidism, 8 (16%) had subclinical hypothyroidism and hyperthyroidism was noted in 5 (10%) patients (Table 2 and Figure 2).

Thyroid dysfunction in relation to the duration of diabetes

We have divided 50 diabetics in this study into three groups according the duration of diabetes:

- 0-5 years: Out of 31 patients in this group 2 (6%) had a thyroid disorder
- 6-10 years: Out of 14 patients in this group 8 (57%) had thyroid dysfunction
- >10 years: Out of 5 patients in this group 4 (80%) had thyroid dysfunction.

In the present study, prevalence of thyroid dysfunction is high 80% among the cases having diabetes for more than 10 years, 57.14% in a cases who are having diabetes for 5-10 years and 6% among the cases having diabetes for <5 years.

Increased duration of diabetes had significant relation with the increase in thyroid dysfunction in this study (Table 3 and Figure 3).

Table 1: Prevalence of thyroid dysfunction.

Study subjects	Normal	Thyroid dysfunction
Control (non-diabetics)	50	0
Cases (diabetics)	36	14 (28%)*

*p<0.0001

Table 2: Spectrum of thyroid dysfunction in diabetes.

Thyroid disorder	Number of cases 14 (28%)
Hypothyroidism	1 (2)
Sub-clinical hypothyroidism	8 (16)
Hyperthyroidism	5 (10)

Table 3: Thyroid dysfunction in relation to duration of diabetes.

Duration of DM	Number of cases	Thyroid disorder	Percentage
0-5 years	31	2	6
6-10 years	14	8	57
>10 years	5	4	80

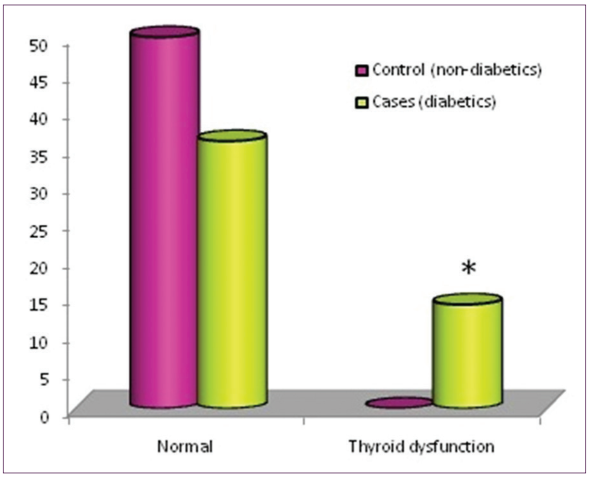

Figure 1: Prevalence of thyroid dysfunction.

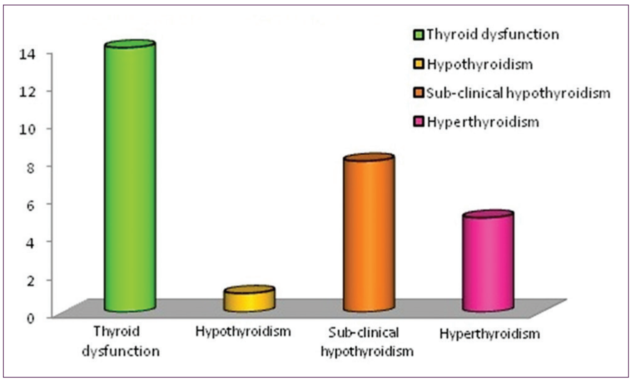

Figure 2: Spectrum of thyroid dysfunction.

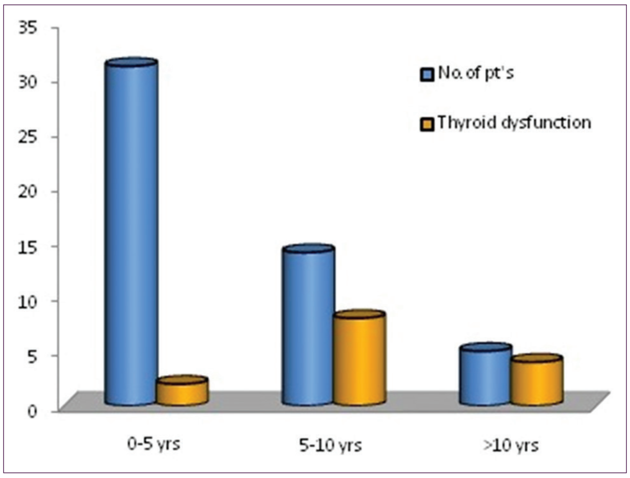

Figure 3: Thyroid dysfunction in relation to duration of diabetes.

DISCUSSION

Among the endocrinal metabolic diseases, DM occupies the major share. India has the dubious distinction of being home to largest number of people suffering from diabetes in any country. The disease is responsible for significant mortality and morbidity due to complications.[15]

DM and thyroid diseases are the two common endocrinopathies seen commonly in the population. There is inter-dependence between insulin and thyroid hormones for normal cellular metabolism so that DM and thyroid diseases can mutually influence the other disease process.[3] On one hand, thyroid hormones contribute to the regulation of carbohydrate metabolism and pancreatic function, and on the other hand, diabetes affects TFT to variable extents. Studies have found that diabetes and thyroid disorders tend to coexist in the majority of the patients. Thyroid disorders can have a major impact on glucose control and untreated thyroid disorders affect the management of diabetes in patients. Consequently, a systematic approach to thyroid testing in patients with diabetes is recommended earlier which will prevent the occurrence of cardiovascular complications and other diabetic complications such as nephropathy and retinopathy.[19] Thus, the detection of abnormal hormone levels in addition to other biochemical variables in the early stage of diabetes will help patients to improve their health and reduce that morbidity and mortality.

By keeping this in mind this study was conducted at NCH, Surat, between 2012 and 2013 to determine the prevalence of thyroid dysfunction in DM patients. We have also found the spectrum of thyroid dysfunction in DM patients. Along with this thyroid dysfunction in relation to the duration of diabetes was also tested. The prevalence of thyroid disorder was 45% in Type 2 diabetics, among them 28% had hypothyroidism, and 17% had hyperthyroidism in a study conducted by Pasupthi et al.[20] Similar type of study by C. E. J. Udiong from Nigeria was showing 46.5% prevalence of thyroid disorder in which hypothyroidism was present in 26.6% and 19.9% had hyperthyroidism.[21] A prevalence of 12.3% was reported among Greek diabetic patients[22] and 16% of Saudi patients with Type 2 diabetes were found to have thyroid dysfunction.[23] While in Jordan, a study reported that thyroid dysfunction was present in 12.5% of Type 2 diabetic patients.[24] In Scotland, the prevalence of thyroid dysfunction was 13.4% among diabetics, 31.4% in Type 1 female diabetic patients and 6.9% in Type 2 male diabetic patients.[25] Risk factors for thyroid dysfunction among T2DM patients in a highly DM prevalent society was found to range from 4.8% to 6.3%.[25,26] This was clearly shown in the United States, where prevalence was 5.8% in white women and 1.2% in black women but 3.4% in white men and 1.8% in black men. So, the overall prevalence is variable among different genders and ethnic groups.[27] Hyperthyroidism is a less common thyroid dysfunction in both general and diabetic patients. It has been reported to be 0.53% in Caucasian children with T1DM and 4.4% in Type 2 diabetic adult patients,[28,29] while subclinical hyperthyroidism is reported to be approximately 2%.[30] Data from the Whickham survey conducted in the late 1970s in the north of England revealed a prevalence of 6.6% of thyroid dysfunction in the adult general population.[31] Perros et al. demonstrated an overall prevalence of 13.4% of thyroid diseases in diabetics.[32] A study by Smithson et al. showed a prevalence of 10.8% of thyroid dysfunction in diabetic patients registered in general practice.[22] In the Colorado thyroid disease prevalence study the patients attending a state health fair and studied the population were found to have an elevated TSH as well as low TSH.[33] It is noted that there is a lower incidence of thyroid dysfunction in diabetics among Europeans as compared to that of Indians as per the Indians studies. In our study, prevalence of thyroid dysfunction is 28% in T2DM among them 2% had hypothyroidism, 16% had sub-clinical hypothyroidism and 10% had hyperthyroidism. So, the prevalence of sub-clinical hypothyroidism is more as compared to hypothyroidism and hyperthyroidism.

In our study, we have found that there is variation in the TSH, T3 and T4 levels, found in diabetics and diabetics with thyroid disorders. Patients with thyroid disorders had higher levels of TSH compared to those without thyroid disorders whereas there was no much difference in T4 and T3 levels. Findings in our study are similar to that of Pashupathi et al. and Shalinigupta et al.[19,34] The guidelines of American Thyroid Association and American Association of Clinical Endocrinology recommends serum TSH measurement as single most relevant test to diagnose all forms of hypo and hyperthyroidism.[35]

In our study, we have found that 80% of the patients of thyroid dysfunction had diabetes for more than 10 years, 57% patients of thyroid dysfunction had duration of diabetes between 6 and 10 years and 6% had thyroid dysfunction having duration of diabetes <5 years. So, we conclude that increased duration of diabetes has significant relation with thyroid dysfunction and therefore screening for thyroid is required earlier in DM patients. In conclusion, there was 28% prevalence of thyroid dysfunction in diabetic patients. Subclinical hypothyroidism is most common thyroid disorder constituting 16% of diabetes as compared to hyperthyroidism 10% and hypothyroidism 2%. Prevalence of thyroid dysfunction is high 80% among the cases having diabetes for more than 10 years, increased duration of diabetes had significant relation with the increase in thyroid dysfunction.

CONCLUSIONS

In our study, overall 28% prevalence of thyroid dysfunction was found in diabetic patients with highest prevalence of subclinical hypothyroidism (16%), followed by hyperthyroidism (10%) and hypothyroidism (2%). Prevalence of thyroid dysfunction is high 80% among the cases having diabetes for more than 10 years suggestive of increased duration of diabetes had significant relation with the increase in thyroid dysfunction. Therefore, screening for thyroid disease among patients with DM should be routinely performed for early detection and treatment of thyroid dysfunction to delay the complications of diabetes.

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