Prevalence of Thyroid Disorder in Diabetic Patients

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Background: Thyroid disorders are common in the general population and have shown increasing prevalence with advancing age.

Objective: To evaluate the association between hypothyroidism and diabetes mellitus (DM).

Design: A Retrospective Cross-sectional Study.

Setting: Aseer Central Hospital and Khamis Mushayt Military Hospital, Saudi Arabia.

Method: All DM patients from 1 January 2020 to 30 June 2020 were included in the study. Vital signs such as height, weight, and blood pressure were recorded and blood samples were drawn after 8 hours of fasting for measurement of T4, TSH, Vitamin D and lipid profile.

Result: Four hundred diabetic patients from 1 January 2020 to 30 June 2020 were included in the study. The patients who did not give consent were excluded. Seventy-five (18.75%) diabetic patients had thyroid disorders.

Conclusion: The prevalence of hypothyroidism was 18.75% with a female predisposition in diabetic patients. Given this high prevalence, all diabetic patients in the Gulf region should be considered as high risk for hypothyroidism.

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Thyroid disorders are common in the general population and have shown increasing prevalence with advancing age. Hypothyroidism is more common in the adult population, especially in young adult females. The incidence of hypothyroidism in the United States is approximately 4 million with a female to male ratio of 9:1[1]. Hashimoto's thyroiditis or primary atrophic hypothyroidism is one of the most common causes of hypothyroidism in addition to radioactive iodine and thyroidectomy[2]. Disorders of the pituitary and hypothalamus contribute to secondary hypothyroidism[3]. Graves' disease in the younger population and toxic nodular goiter in the older population is a common cause for hyperthyroidism[4].

DM is a major health concern projected to affect approximately 10% of the population in developed countries and approximately 80 million worldwide[5]. Although thyroid disease and DM are the two most common endocrine disorders encountered in clinical practice and considered as two distinct diseases, studies have reported an association between the two. Studies found an association between hyperthyroidism and the worsening of diabetes[6,7]. Surgical removal of the thyroid tissue in hyperthyroid patients with DM results in an improvement in their glucose tolerance[8].

Perros et al found a prevalence of 13.4% thyroid diseases in diabetic patients with higher prevalence in females (31.4%) compared to males (6.9%)[9]. Approximately 12.3% of Greek diabetic patients and 16% of type 2 DM patients from the Kingdom of Saudi Arabia were found to have thyroid disorder[10,11]. Similarly, in Jordan, 12.5% of diabetic patients had thyroid dysfunction[12]. Thyroxine (T4) and triiodothyronine (T3) and insulin are involved in cellular metabolism antagonistically; excess or deficiency of either one will result in metabolic disorder[13].

Recently, interest has been focused on studying the relationship between thyroid hormones and insulin due to the conflicting data regarding the influence of insulin level on thyroid dysfunction has been reported. The diabetic population has a higher prevalence of thyroid disorder, especially hypothyroidism. Moreover, there may also be a role of insulin resistance leading to metabolic abnormalities[14]. Saudi Arabia has one of the highest rates of diabetes mellitus which was estimated to be 3.4 million in 2015[15]. The prevalence of thyroid disorder varies in the Kingdom and its association with DM has been assessed only in a few studies. Alsolami et al found a strong positive correlation between hypothyroidism and type 2 DM with an odds ratio of greater than 4[16].

The aim of this study is to evaluate the association between hypothyroidism and DM.

METHOD

All DM patients from 1 January 2020 to 30 June 2020 were included in the study. Height, weight, and blood pressure

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were recorded and blood samples were drawn after 8 hours of fasting for the measurement of T4, TSH, Vitamin D and lipid profile. The data were entered in SPSS version 20 for analysis, statistical tests (t-test) was used to measure the significance. P-value <0.05 was considered significant. Ethical consent was taken from the patients.

RESULT

Four hundred diabetic patients from 1 January 2020 to 30 June 2020 were included in the study. The patients who did not give consent were excluded. Seventy-five (18.75%) diabetic patients had thyroid disorders.

Age ranged from 18 to 95, the mean age and SD was 45.8 (16.22). BMI ranged from 17-35; the average BMI was 32.56. TSH ranged from 17 to 35, the average was 32.55, see table 1. Two hundred sixty-four (66%) were females and 134 (34%) were males, see figure 1. We have found a significant difference while comparing TSH with A1C (P=0.03).

Table 1: Descriptive Statistics

	Descriptive Statistics		
	Range	**Mean**	**Std. Deviation**
Age	18-95	45.8111	16.22815
BMI	17-35	32.5617	6.05959
Systolic BP	100-174	125.2477	16.64340
Diastolic BP	56-90	73.2771	10.69060
A1C	3.5-15.6	10.2234	43.49446
Serum fasting glucose	3.9-17.5	96.7969	104.12193
Total Cholesterol	2.78-8.7	95.3258	88.17417
Triglyceride	75.02-222	92.0716	105.13359
HDL	19.25-40.8	18.7171	23.43608
LDL	60.1-163.4	40.4570	52.53897
AST	11.5-39.4	28.6408	22.51682
ALT	11.2-42.1	29.2364	19.50499
ALP	50.1-110.2	74.2031	30.74020
Creatinine	0.7-1.6	37.0182	41.68887
TSH	0.2-4.2	3.5537	4.01675
FT3	3.8-10.8	4.5969	1.51563
FT4	5.2-13.8	11.8337	63.30636
vitamin D	10.2-28.3	21.9439	12.26226
Hb	12.1-18.5	16.4582	64.19864
MCV	74.1-109.4	80.7370	18.19665
Platelets	212.01-398.1	274.6459	87.01204

Table 2: Comparison of Normal and Above Normal TSH with Other Variables

TSH ranged from 0.2 to 4.2 mIU/L. Hence, we divided the participants into two groups. One group had TSH less than 0.4 and another group had TSH greater than 0.4.

Variables	TSH 0-0.4		TSH Above 0.4		P-value
	Mean	**S.D**	**Mean**	**S.D**	
Age	45.8726	15.7651	44.5241	15.2594	Not Significant
BMI	32.8857	5.88433	32.3879	6.40114	N.S
Systolic BP	125.788	16.5011	121.093	16.1804	N.S
Diastolic BP	73.6765	9.27496	73.093	14.0259	N.S
A1C	7.74908	2.43852	19.7507	95.9545	0.03
Serum fasting glucose	110.09	110.95	93.5466	87.4662	N.S
Total Cholesterol	104.85	87.2102	98.8516	89.6359	N.S
Triglyceride	105.094	111.056	85.3052	89.6973	N.S
HDL	21.0486	23.7721	17.9034	21.7685	N.S
LDL	44.4847	53.0948	46.281	57.3854	N.S
AST	29.2388	23.9493	28.401	19.2362	N.S
ALT	30.5292	19.4671	27.9184	20.1697	N.S
ALP	73.871	32.7593	76.5385	30.132	N.S
Creatinine	31.8025	41.4937	33.4534	39.8816	N.S
fT3	4.72724	1.52639	4.3058	1.45875	N.S
fT4	8.48385	7.10921	7.28207	11.6588	N.S
vitamin D	22.5073	12.3325	20.9404	12.2445	N.S
Hb	18.0565	79.9188	13.3015	2.19036	N.S
MCV	81.0509	21.2256	78.1839	11.5662	N.S
Platelets	275.282	88.0123	266.046	93.4024	N.S

N.S. = not significant

DISCUSSION

DM and thyroid disorder are the two common endocrine disorders; both regulate the metabolic function. A defect in the respective hormones has multiple systemic manifestations. Both the thyroid hormones and insulin antagonize each other and they affect metabolism in body cells; a defect in either one of these glands may affect the functioning of the other[17-20]. Various studies have shown an association between abnormal thyroid function and DM, a prevalence ranging from 12.3% to 46.5%[21]. A study of type 2 DM patients found that 16% had thyroid abnormalities[11]. In this study, it was found that 18.75% of diabetic patients had thyroid disorder which was similar to other reported studies. Hypothyroidism is associated with increased body weight, which in turn increases BMI which is a risk factor for developing DM[20]. Although the fasting glucose levels were comparable in euthyroid and hypothyroid patients, glycated hemoglobin was significantly elevated (P-value=0.03) in hypothyroid patients[22,23]. Glycated hemoglobin refers to the non-enzymatic addition of glucose moiety to circulating hemoglobin and reflects the glycemic control over the past three months. Hence, a significant association between HbA1c and TSH indicates that prolonged insulin resistance or deficiency has a deleterious effect on circulating thyroid hormones.

Numerous mechanisms may be responsible for the association between thyroid disease and DM. Graves' disease or Hashimoto's thyroiditis and DM have common autoimmune etiology; therefore, cross-reaction of autoantibodies may be possible. Elevated TSH levels in diabetic patients could also result from insulin therapy. Decreased peripheral conversion of T4 to T3 due to the presence of thyroid hormone-binding inhibitor, dysfunction of the hypothalamus-pituitary-thyroid axis, and poor glycemic control on thyroid hormone concentration predispose diabetic patients to develop hypothyroidism[1,24]. The British Thyroid Association and the Association of Clinical Biochemistry Recommendations have advised the study of thyroid function tests and antibodies in pregnant diabetic patients[21].

Recent studies have shown that fT3 plays an important role in insulin secretion and glucose metabolism. Although some studies have shown an association between fT3, fT4, and poor glycemic control, no significant association was observed in our study. Wu et al found no association between them[25,26]. Hypothyroidism and DM have been found to be risk factors for dyslipidemia; an association between the two may have a compounding effect on the development of the cardiovascular disease. Hence, it is necessary to regularly screen all DM patients for thyroid disturbances.

CONCLUSION

The prevalence of hypothyroidism was found to be 18.75% in diabetic patients with a predisposition towards the female gender. Because of this high prevalence, all diabetic patients in this region should be considered as a high risk for developing hypothyroidism. It is recommended to regularly screen these patients, identify potential hypothyroid patients and manage them accordingly.

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