Section: Medicine

Original Research Article

AN OBSERVATIONAL STUDY OF THYROID PROFILE IN DIABETES

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Abstract

Background: Evidence suggests close links between thyroid disorders and diabetes. Thyroid dysfunction can affect a person's insulin and blood sugar levels, which can contribute to the development of diabetes. Both under- and overactive thyroids are more common in people with diabetes than in the general population. Our study was aimed at observing the correlation of thyroid levels in diabetes patients. **Materials and Methods:** This Prospective Observational study was done from June 2022 to June 2023 in tertiary care hospital. A total of 105 cases male and female were studied based on inclusion and exclusion criteria. All patients were done routine investigations, like fbs, plbs, Hba1c.all diabetes patients were tested for thyroid by doing thyroid function tests. furthur patients were thoroughly asked about the onset of diabetes, thyroid by questioning them. **Result:** In our study there was female preponderence with males 24 and females 81 in the ratio 1:3.375 there were more number of patients in the age group 41-50yrs; 31-40yrs 51-60yrs; 61-70yrs;18-30yrs;>70yrs;in our study we had 15 patients out of 53 with hypothyroidism in diabetes with duration of 3years. **Conclusion:** We conclude by saying that thyroid levels are indeed affected in diabetes patients. furthur we observed that the duration of diabetes influenced the hypothyroidism. We observed that female diabetics are more prone to hypothyroidism than males.

INTRODUCTION

Diabetes mellitus is characterised by chronic hyperglycemia with disturbances of carbohydrate, fat, and protein metabolism resulting from defects in insulin secretion, insulin action, or both.[1]

In the first edition of the IDF Diabetes Atlas, released in 2000, the estimated global diabetes prevalence was 151 million. Now the estimated diabetes prevalence for 2010 has risen to 285 million, representing 6.4% of the world's adult population, with a prediction that by 2030 the number of people with diabetes will have risen to 438 million. Far from being a disease of higher income nations, diabetes is very much a disease associated with poverty and disproportionately affecting the lower socioeconomic groups.[3] Although the prevalence of both type 1 and type 2 DM is increasing worldwide, the prevalence of type 2 DM is rising much more rapidly because of increasing obesity and reduced activity levels as countries become more industrialised. Previously a disease of the middle aged and elderly, type 2 diabetes has recently escalated in all age groups and is now being seen in younger age groups.[4] Unfavourable modification of lifestyle and dietary habits with urbanisation are the most important factors for the development of diabetes. The percentage of diabetic cases in urban areas is projected to increase from 54% in 1995 to 73% by the year 2025.[5] According to IDF (2009), India has the highest number of people suffering from diabetes mellitus with 50.8 million and spends 2.8 billionUS$ or 1% of the global health expenditure for diabetes and related problems.[6] United Nations in 2006 in Resolution 61/225 stated that "diabetes is a chronic, debilitating and costly disease associated with severe complications, which poses severe risks for families, Member States and the entire world".[7]

History

Diabetes is as old as medicine. Early evidence of description of symptoms of diabetes recorded in the Ebers papyrus, 1550 B.C.[8] Arateus (30-90 AD), coined the term diabetes, meaning "siphon," to explain the "liquefaction of the flesh and bones into urine". In Greek this word means 'to run through' that describes 'unquenchable thirst' seen in association with this disease.[9] Shushruta (Circa 600AD) noted this disease in Ayurveda and described it as "Madhumeha".[10] In 1869, Paul Langerhans, published in his dissertation on pancreatic histology described "clumps of cells,"

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which were named the 6 islets of Langerhans shortly after his death.[11,12] In 1889, Minkowski and Von Mering, in Strassburg, Germany, discovered the central role of the pancreas in diabetes.[13] In 1910, Jean de Meyer suggested that the pancreatic secretion lacking in diabetic state to be called as "Insulin" to denote it's origin from insulae of Langerhans.[14] Banting and Charles Best in 1921, extracted insulin from dog's pancreas.[15] The first chemical application of insulin was on 14 year old Leon and Thompson, a patient of diabetic ketoacidosis in January 1922 in Canada. This discovery revolutionized the management of diabetes. Oral hypoglycaemic drugs were introduced by Frank and Fuchs in 1955.[8]

Description of Diabetes Mellitus:

When fully expressed, diabetes is characterized by fasting hyperglycemia, but the disease can also be recognized during less overt stages, most usually by the presence of glucose intolerance. Diabetes may present with characteristic symptoms such as thirst, polyuria, blurring of vision, weight loss and polyphagia. Hyperglycemia sufficient to cause pathologic functional changes may quite often be present for a long time before the diagnosis is made.[1] Patients may revert to having impaired glucose regulation or even normal glycemia, particularly in recent-onset type 2 diabetes.[16] In type 1 diabetes, after a short period of insulin treatment, there may be a variable period when insulin is no longer required for survival and glucose tolerance may improve, the so-called honeymoon period. Eventually such patients do need insulin treatment for survival.[17] Etiologic Classification of diabetes mellitus.[2]

I. Type 1 diabetes

A. Immune mediated

B. Idiopathic

II. Type 2 diabetes

III. Other specific types A. Genetic defects of b - cell function B. Genetic defects in insulin action C. Diseases of the exocrine pancreas D. Endocrinopathies E. Drug - or chemical induced F. Infections G. Uncommon forms of immune-mediated diabetes H. Other genetic syndromes sometimes associated with diabetes 8 IV. Gestational diabetes mellitus (GDM) The majority of cases of diabetes fall into two broad etiopathogenetic categories, now called type 1 and type 2 diabetes.

Type 1 Diabetes Mellitus:

Type 1 diabetes is the form of the disease due primarily to β-cell destruction in which insulin is required for survival. It is characterized by the presence of anti-GAD, anti-islet cell, or antiinsulin antibodies, which reflects the autoimmune processes that have led to β-cell destruction.[18,19]

Type 2 Diabetes Mellitus

Type 2 diabetes is the most common form of diabetes. Insulin resistance and abnormal insulin secretion are central to the development of type 2 DM.2 Patients with type 2 diabetes usually have insulin resistance and relative, rather than absolute, insulin deficiency and are associated with progressive β-cell failure with increasing duration of diabetes.[20] The risk of developing type 2 diabetes increases with age, obesity, physical inactivity and family history of diabetes. 1 The disease can occur at any age and is now seen in children and adolescents.[21]

Diagnostic Criteria for Diabetes Mellitus:[22]

Symptoms of diabetes plus random plasma glucose concentration 200 mg/dl (11.1 mmol/l). Random is defined as any time of day without regard to time since last meal. The classic symptoms of diabetes include polyuria, polydipsia and unexplained weight loss (or) FPG 26 mg/dl (7.0 mmol/l). Fasting is defined as no caloric intake for at least 8 hours. (or) 2 hours post load glucose 200 mg/dl (11.1 mmol/l) during an OGTT. The test should be performed as described by WHO, using a glucose load containing the equivalent of 75 gm anhydrous glucose dissolved in water. In the absence of unequivocal hyperglycaemia these criteria should be confirmed by repeat testing on a different day. FPG is the most reliable and convenient test for identifying DM in asymptomatic individuals. HbA1C is not currently recommended to diagnosis of diabetes. Impaired Glucose Tolerance.[1] Defined as 2 hours values in the oral glucose tolerance test (OGTT) between 140 and 199mg/dl (7.8 and 11.1 mmol/L). Glucose tolerance is above the conventional normal range but lower than the level diagnostic of diabetes. Persons with IGT have a high risk of developing diabetes and 10 arterial disease. IGT is more frequent in obese persons and often is associated with hyperinsulinemia and insulin resistance. Impaired Fasting Glucose.[1] Defined as fasting plasma glucose concentrations of 100 to 125 mg/dL (5.6 toto <7.0 mmol/L). IFG is also a stage of impaired glucose homeostasis with fasting glucose levels were above normal but below those diagnostic for diabetes.

Acute Complications of DM:[2]

Diabetic ketoacidosis (DKA) and hyperglycemic hyperosmolar state (HHS) are acute complications of diabetes. DKA primarily occurs in type 1 DM but, can also occur in type 2 DM. HHS is primarily seen in individuals with type 2 DM. Both disorders are associated with absolute or relative insulin deficiency, volume depletion, and acid-base abnormalities.

Chronic Complications of DM:[2]

The vascular complications of DM are divided into microvascular (retinopathy, neuropathy, and nephropathy) and macrovascular complications [coronary artery disease (CAD), peripheral arterial disease (PAD), cerebrovascular disease]. Nonvascular complications include problems such as gastroparesis, infections, and skin changes. The microvascular complications of both type 1 and type 2 DM result from chronic hyperglycemia. Evidence implicating a causative role for chronic hyperglycemia in the development of macrovascular

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complications was inconclusive. Other factors (dyslipidemia and hypertension) also play important roles in macrovascular complications.

Dyslipidemia in Diabetes:

The dyslipidemia in type 2 diabetes and insulin resistance typically consists of elevated triglycerides and decreased HDL cholesterol level,[23] and of qualitative abnormality in the LDL structure, i.e., decreased size and increased density of the LDL particle.

Metabolic Syndrome and Obesity:[25]

The metabolic syndrome (syndrome X, insulin resistance syndrome) consists of a constellation of metabolic abnormalities that confer increased risk of cardiovascular disease (CVD) and diabetes mellitus (DM). Diagnosis of the metabolic syndrome requires the presence of at least three of the following five criteria.[26]

1. Elevated fasting plasma glucose levels (110 mg/dL) 2. Visceral obesity (waist circumference >35 inches in women and 40 inches in men) 12 3. Hypertension (>130/85 mm Hg) 4. Hypertriglyceridemia (>150 mg/dL) 5. Low high-density lipoprotein (HDL) cholesterol (<40 mg/dL in men and <50 mg/dL in women)

Thyroid

The thyroid (Greek thyreos, shield, plus eidos, form) consists of two lobes that are connected by an isthmus. It is located anterior to the trachea between the cricoid cartilage and the suprasternal notch. Four parathyroid glands, which produce parathyroid hormone are located posterior to each pole of the thyroid.[27] The normal thyroid gland secretes sufficient amounts of the thyroid hormones triiodothyronine (T3) and tetraiodothyronine (T4, thyroxine) to normalize growth and development, body temperature, and energy levels. Calcitonin, the second type of thyroid hormone, is important in the regulation of calcium metabolism.[28]

Biosynthesis of Thyroid Hormones:[27]

Iodide, ingested from food, water, or medication, is rapidly absorbed from intestine and enters an extracellular fluid pool. Transport of iodide into the thyroid gland is by an intrinsic follicle cell basement membrane sodium/iodide symporter (NIS). At the apical cell membrane a second I- transport enzyme called pendrin is present. Iodide is oxidized by thyroidal peroxidase to iodine that rapidly iodinates tyrosine residues within the thyroglobulin molecule to form monoiodotyrosine (MIT) and diiodotyrosine (DIT). This process is called iodide organification. Two molecules of DIT combine within the thyroglobulin molecule to form L-thyroxine (T4). One molecule of MIT and one molecule of DIT combine to form T3. T4, T3, MIT, and DIT are released from thyroglobulin by exocytosis and proteolysis of thyroglobulin at the apical colloid border. Most of the hormone released is thyroxine. Most of the T3 circulating in the blood is derived from peripheral metabolism of T4. Both hormones are bound to plasma proteins, including thyroxine binding globulin (TBG); transthyretin (TTR); and albumin. The plasma binding proteins increase the pool of circulating hormone, delay hormone clearance, and may modulate hormone delivery to selected tissue sites.

Deiodinases,[27] T4 is converted to T3 by the deiodinase enzyme. Type I deiodinase, which is located primarily in thyroid, liver, and kidney, has a relatively low affinity for T4. 14 type II deiodinase has a higher affinity for T4 and is found primarily in the pituitary gland, brain, brown fat, and thyroid gland. Type III deiodinase inactivates T4 and T3 and is the most important source of reverse T3 (r T3).

Physiological Effects of Thyroid Hormones:[29]

Heart: Increases number of β adrenergic receptors. Enhances response to catecholamines Adipose tissue: Stimulate lipolysis Muscle: Increases protein breakdown Bone: Promote growth and development Nervous system: Promote normal brain development Gut: Increases carbohydrate absorption Lipoprotein: Stimulate LDL receptors others: Increases metabolic rate and oxygen consumption

Regulation of Thyroid Axis:[27]

The thyroid axis is a classic example of an endocrine feedback loop. TRH stimulates pituitary production of TSH, which, in turn, stimulates thyroid hormone synthesis and secretion. Thyroid hormones feedback to inhibit TRH and TSH production.[15]

Exogenous and Endogenous Factors Suppressing TSH Secretion:[30]

Dopamine antagonists, Somatostatin, Dobutamine, Glucocorticoids, Interleukins, TNF-α, Thyroid hormones and Phenytoin.

Factors Associated with Altered Binding of Thyroxine By Thyroxine-Binding Globulin.[30] Increased Binding Pregnancy, Oral contraceptives, Infectious hepatitis, Cirrhosis, HIV, Acute intermittent porphyria and Tamoxifen. Decreased Binding Androgens, Large doses of glucocorticoids, acromegaly, Nephrotic syndrome, Major systemic illness and Psychiatric illness.

Factors Associated with Decreased Conversion of T4 TO T3.[30] Fetal life, Caloric restriction, Hepatic disease, Major Systemic illness, Propylthiouracil, Glucocorticoids, Propranolol, Iodinated X-ray contrast agents, Amiodarone and Selenium deficiency.

Hypothyroidism

Hypothyroidism is the condition resulting from a lack of effects of thyroid hormones on body tissues.[31]

Symptoms Tiredness, weaknes, dry skin, feeling cold, hair loss, difficulty concentrating and poor memory, constipation, weight gain with poor appetite, dyspnea, hoarse voice, menorrhagia (later oligomenorrhea or amenorrhea), paresthesia and impaired hearing. Signs Dry coarse skin; cool peripheral extremity, puffy face, hands, and feet (myxedema), diffuse alopecia, bradycardia, peripheral edema, delayed tendon reflex relaxation,

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carpal tunnel syndrome and serous cavity effusions.[27]

Metabolic Abnormalities in Hypothyroidism

Hypothyroidism is associated with a reduction in glucose disposal to skeletal muscle and adipose tissue and also associated with reduced gluconeogenesis. The net effect of these influences is usually minimal on serum glucose levels. Degradation of insulin, is slowed and the sensitivity to exogenous insulin may be increased.[32] Both the synthesis and the degradation of lipid are depressed in hypothyroidism with a net effect of accumulation of LDL and triglycerides. HDL concentrations and Plasma free fatty acid levels are decreased.[33]

Subclinical Hypothyroidism Defined as a low-normal free T4 but a slightly elevated serum TSH level. The TSH elevation in such patients is modest, with values typically between 4 and 15 mU/L.[33] Rates of progression to overt hypothyroidism ranges from 3% to 8% per year, higher rates seen in individuals with initial TSH concentration greater than 10 mU/L and those with positive anti-TPO antibodies.[34] The association of mild hypothyroidism with an increase in risk for atherosclerotic heart disease has been shown by some, but not others.[35,36]

Hyperthyroidism:[27]

Hyperthyroidism is a state when thyrotoxicosis occurs because of sustained over production of hormones by thyroid gland. Symptoms Heat intolerance and sweating, palpitation, fatigue and weakness, weight loss with increased appetite, diarrhea, polyuria, oligomenorrhea, and loss of libido. Signs Tachycardia; atrial fibrillation in the elderly, tremor, goiter, warm, moist skin, muscle weakness, proximal myopathy, lid retraction or lag and gynecomastia.

Metabolic Abnormalities in Hyperthyroidism Preexisting diabetes mellitus may be aggravated, one cause being accelerated turnover of insulin.[37] Both lipogenesis and lipolysis are increased in thyrotoxicosis, but the net effect is lipolysis, as reflected by an increase in the plasma concentration of free fatty acids and glycerol and a decrease in serum cholesterol level. Triglyceride levels are usually slightly decreased.[38]

Subclinical Hyperthyroidism There are no signs of thyrotoxicosis but the serum TSH is subnormal despite normal serum free T4 concentration.[37] Subclinical hyperthyroidism may accelerate bone loss in postmenopausal women,[39] and increases the incidence of atrial arrhythmias including atrial fibrillation in elderly patients.[31]

Diabetes and Thyroid Diseases Diabetes mellitus and thyroid diseases are the two common endocrinopathies seen in the adult population. Insulin and thyroid hormones are intimately involved in cellular metabolism. Excess or deficit of either of these hormones could result in the functional derangement of the other.[40]

Effect of Diabetes on Thyroid Function in euthyroid individuals with diabetes mellitus, the serum T3 levels, basal TSH levels and TSH response to thyrotropin releasing hormone (TRH) may all be strongly influenced by the glycemic status.[41] Poorly controlled diabetes, both Type 1 and Type 2, may induce a “Low T3 state” characterized by low serum total and free T3 levels, increase in reverse T3 (r T3) but near normal serum T4 and TSH concentrations.[42] Low serum T3 is due to reduced peripheral conversion of thyroxine (T4) to tri-iodothyronine (T3) via 5’ monodeiodination reaction and may normalize with improvement in glycemic status but even with good diabetes control, the normal nocturnal TSH peak may not be restored in C-peptide negative patients.[43]

Effect of Diabetes Mellitus on Thyroid Diseases Dysthyroid optic neuropathy (DON) resulting in blindness is the most threatening complication of Graves’ orbitopathy (GO). It is due to the compression of optic nerve by enlarged extraocular muscles at the orbital apex. Incidence of DON in patients with diabetes mellitus is higher than that seen in control “GO” group and the recovery after treatment is also poor. This has been explained by reduced oxygenation of optic nerve in diabetic patient owing to the vasculopathy making it more susceptible to the pressure effect.[44]

Effect of Hyperthyroidism on Glycemic Status Graves disease is the commonest cause of hyperthyroidism. While Graves disease may be associated with type 1 diabetes in polyglandular autoimmune syndrome, thyrotoxicosis by itself is diabetogenic. Frank diabetes occurs in 2-3%, when hyperthyroidism develops in normal individuals. In known diabetic patients hyperthyroidism causes deterioration of glycemic control status.[42] These changes are due to alteration in following systems 1. Gastrointestinal System In hyperthyroidism there is accelerated gastric emptying, enhanced intestinal glucose absorption and an increase in portal venous blood flow.[44] 2. Insulin Secretion Insulin secretion decreases in hyperthyroidism.[45,46] Insulin clearance rate is reported to be increased by about 40%.[47] Long term thyrotoxicosis has been shown to cause beta cell dysfunction resulting in poor insulin response to glucose.[48] 3. Endogenous Glucose Production In hyperthyroidism the endogenous glucose production is greatly increased by a variety of mechanisms: (a) there is an increase in the availability of gluconeogenic precursors(lactate, glutamine, alanine and FFA) stimulating hepatic gluconeogenesis;[49] (b) Inhibition of glycogen synthesis;[50] (c) Upregulation of GLUT-2 glucose transporters protein expression in the hepatocyte;[51] (d) Increased secretion and exaggerated effects of glucagon and adrenaline on liver cells.[49] 4. Glucose utilization In adipocytes isolated from rats, the sensitivity of glucose transport and utilization to insulin has been found to be normal, increased or decreased.[45] In skeletal muscle, there is a preferential increase in glucose uptake and lactate formation . This is due to increase in GLUT-1 and GLUT-4 transporters,[52] increased glycogenolysis

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due to beta adrenergic stimulation,[49] increased activity of hexokinase and 5 phosphofructokinase.[53] Thus the net effect of changes occurring at various levels such as gastrointestinal tract, beta cells, hepatocytes, adipocytes and skeletal muscles is hyperglycemia. Effect of Hypothyroidism on Glycemic Status In hypothyroidism, the synthesis and release of insulin is decreased.[46] The rate of hepatic glucose output is decreased probably due to reduced gluconeogenesis. A post receptor defect has been proposed to explain the decrease in insulin stimulated glucose utilization in peripheral tissues.[49] The net effect is an increased risk of recurrent hypoglycemia in a diabetic individual.[54] Association Between Diabetes Mellitus and Thyroid Disorders Celani MF et al in their study found that abnormal TSH values in type 2 diabetic patients found before tight glycemic control reverted to normal values with adequate treatment of diabetes with OHA or insulin. They suggested that the diagnosis of thyroid dysfunction in type 2 diabetes should be delayed until improvement of metabolic status.[55] Proces S et al in their study found that in diabetic patients TSH was lower than in non-diabetic subjects. They concluded that besides known parameters such as age and drugs, thyroid function tests can also be altered in diabetes mellitus and obesity.[56] Warren RE et al in their study found that serum thyrotropin (i.e. baseline TSH) is a better predictor of thyroid dysfunction than thyroid autoantibodies in people with diabetes.[57] Vondra K et al in their study found that prevalence of thyroid disease in diabetic patients is 2-3 times higher than in non-diabetic subjects. It raises with age and is strongly influenced by female gender and autoimmune diabetes. They even recommended thyroid disease screening and diagnosis in patients with diabetes mellitus.[58] Abdel Rahman et al in their study found that overall prevalence of thyroid diseases was 12.5% in type 2 diabetes mellitus group. The study suggested that diabetic patients should be screened for asymptomatic thyroid dysfunction.[59] Perros P et al in their study found that the prevalence of thyroid disease was 13.4% in a randomly selected group of 1310 adult diabetic patients attending a diabetic clinic. They suggested that thyroid function should be screened annually in diabetic patients to detect asymptomatic thyroid dysfunction which is increased in frequency in a diabetic population.[60] Smithson MJ in his study found that the prevalence of thyroid disease (previously known and diagnosed as a result of screening) in the entire population of diabetic patients in his sample of 4300 general 24 practice patients was 10.8%. He concluded by suggesting that screening for thyroid disease should be considered in patients receiving diabetes care in community.[61] Zdrojewicz Z et al in their study found that there was no difference in thyroid gland function in patients with non-insulin dependent diabetes mellitus (type 2) and different therapies have no influence on thyroid gland function.[62] Parr JH et al in their study found that improvement in long term metabolic control did not influence free thyroid hormone levels in well controlled and moderately-poor controlled diabetics taking insulin.[63] Chubb SA et al in their study found that none of those patients with type 2 diabetes diagnosed as subclinical hypothyroidism had overt hypothyroidism when restudied after 5 years. So they concluded that subclinical hypothyroidism is a common but incidental finding and routine screening of thyroid function in type 2 diabetes is questionable.[64]

MATERIALS AND METHODS

The present Prospective observational study was done in Department of general medicine in tertiary care hospital from June 2022 to April 2023. All patients admitted to the hospital with diabetes were thoroughly screened with routine investigations. All patients were asked in detail about the duration of diabetes. The diabetes patients were ordered for thyroid profile tests and the values were tabulated to elicit results.

Inclusion criteria:-1.patients in all age groups and both sexes were included 2.all patients with diabetes were included

Exclusion Criteria

1. Patients with prior hypothyroidism before diagnosis of diabetes were excluded.
2. Patients with chronic renal failure and Diabetic nephropathy.
3. Patients with acute illness (sepsis, acute MI, severe heart failure, recent admission in intensive care unit)
4. Patients with hepatic dysfunction
5. Patients with psychiatric illness.
6. Pregnancy
7. Patients on treatment with drugs interfering with thyroid function (amiodarone, propranolol, corticosteroids and oral contraceptives)

The statistical software SPASS was used to analyse the data and Microsoft word and excel have been used to generate graphs, figure etc.

RESULTS

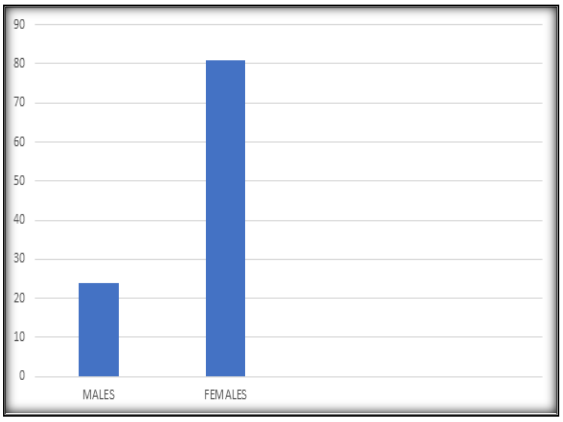

Figure 1: Gender distribution

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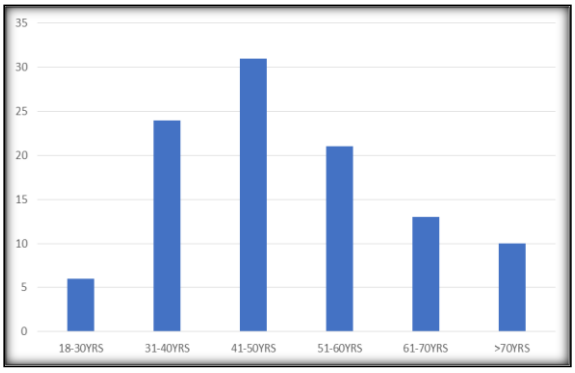

Figure 2: Age Group

P value for duration of diabetes and hypothyroidism <0.5.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.8942782
R Square	0.7997336
Adjusted R Square	0.7329781
Standard Error	2.5472793
Observations	5

ANOVA

	df	SS	MS	F	Significance F
Regression	1	77.73410405	77.7341	11.98005	0.040604166
Residual	3	19.46589595	6.488632		
Total	4	97.2			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	3.4231214	1.834468477	1.866002	0.158882	-2.414976041	9.26121882	-2.414976041	9.261218815
no. of patients	0.2369942	0.068471293	3.46122	0.040604	0.019088008	0.45490043	0.019088008	0.454900432

Figure 3: p value calculation

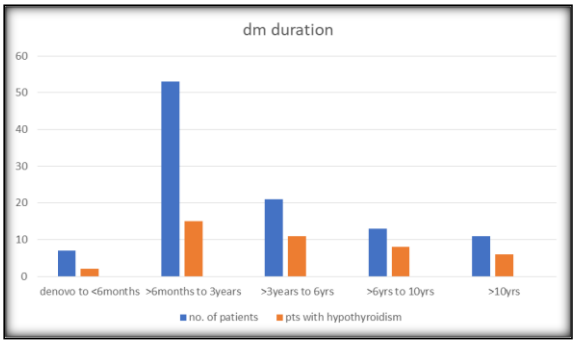

Figure 4: Duration of dm and hypothyroidism

DISCUSSION

There were more number of patients in the age group 41-50yrs,[31];31-40yrs,[24];51-60yrs,[21];61-70yrs,[13];18-30yrs,[6];>70yrs,[10] this observation was similar to WHO report which predicts that while the main increase in diabetes would be in the > 65 year age group65 in the developed countries, in India and developing countries the highest increase would occur in the age group of 45-65 year of age group.[65] This observation is also similar to Kapur et al, who reported that maximum number of cases were diagnosed between 40 and 59 year of age with no significant difference between the genders.[66]

In our study there was female preponderence with males 24 and females 81 in the ratio 1:3.375 .This observation was not similar to Jali et al,[68] and Flatau E et al,[69] who reported that diabetes was more prevalent in men than in women. This is in similarity to Arthur M. Michalek et al who reported that prevalence of diabetes among women was higher than in men.[67]

In our study out of 105 patients 7[6.6%] patients had dm duration less than 6months.53[50.4%] patients had dm duration 6 months to 3years.21[20%] patients had dm duration between 3yrs to 6yrs.13[12.3%] patients had dm between 6yrs to 10yrs.11[10.4%] patients had dm duration greater than 10 years.

In our study 42[40%] patients had abnormal thyroid profile. The present study is similar to Abdel-Rahman et al who in his study of 908 type 2 diabetic patients found that the prevalence of thyroid disease was 12.5%, 6.6% of whom were newly diagnosed and 5.9% had known thyroid dysfunction. The prevalence of thyroid disease in the non-diabetic control group was 6.6%.59 Chubb et al in a cross-sectional study of 420 patients with type 2 diabetes mellitus found that 8.6% of patients had subclinical hypothyroidism.64 Smithson M J in his study found that the prevalence of thyroid disease in the entire population of diabetic patients registered in the general practice was 10.8%. In the control group of non-diabetics, the prevalence was 6.6%.61,62 D.H. Akbar et al in their study of 100 type 2 diabetics found that the prevalence of thyroid dysfunction was 16% and in control group of non-diabetics, it was 7%.76 Zdrojewicz et al in their study of 75 diabetic patients found that there was no differences in thyroid gland function between patients with type 2 diabetes mellitus and non-diabetics. This study contradicts our findings.[62]

The presence of altered thyroid profile in diabetic patients may be due to the fact that: In euthyroid individuals with diabetes mellitus, the serum T3 levels, basal TSH levels and TSH response to thyrotropin releasing hormone (TRH) may all be strongly influenced by the glycemic status.41 Poorly controlled diabetes may also result in impaired TSH response to TRH or loss of normal nocturnal TSH peak42. It may be related to older age of the type 2 DM patients.[64]

CONCLUSION

We conclude that there is female preponderance. We conclude that there is indeed association between diabetes and hypothyroidism with statistical significance p<0.5. We conclude that duration of diabetes influenced the hypothyroidism. We conclude that hypothyroidism was more common in diabetes than normal population. Routine screening for thyroid dysfunction in type 2 diabetes mellitus patients may be justified especially in females because the progression to overt thyroid dysfunction is associated with significant morbidity including the adverse effects on glycemic control.

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REFERENCES

1. Peter H Bennett, William C Knowlap. Definition, diagnosis and classification of diabetes. Joslin's diabetes mellitus 14th edition,2005: 331-337.
2. Alvin C .Powers. Diabetes mellitus. Harrison's principles of internal medicine 17th edition,2008: 2275-2304.
3. IDF Diabetes atlas 4th edition, 2009.
4. WHO(2003), Tech. Rep. Ser., N 916.
5. WHO(2002), Health situation in the South East Asia Region 1998-2000, New Delhi.
6. International Diabetes Federation, 20th October 2009, Montreal.
7. UN. 83rd plenary meeting, 20th December 2006. 61st session; Agenda 113.
8. Donald M Barnett, Leo P. Krall. History of diabetes. Joslin's diabetes mellitus 14th edition,2005: 1-17.
9. Porter R. The greatest benefit to mankind, al medical history of humanity. New York: WW Norton, 1997:71.
10. Schadewaldt H. The history of diabetes mellitus. In: Van Englehardt D, ed. Diabetes, its medical and cultural history. Berlin: Springer Verlag, 1987:43–100.
11. Langerhans P. Beitrage zur mikroskopischen Anatomie der Bauchspeicheldruse. Med Diss (Berlin), 1869.
12. Morrison H. Translation and introductory essay. Langerhans P. Contributions to the microscopic anatomy of the pancreas. Bull Inst Hist Med 1937;5:259–269.
13. Minkowski O. Historical development of the theory of pancreaticdiabetes (introduction and translation by R. Levine). Diabetes 1989;38:1–6.
14. De Meyer J. Contribution l'ude de la pathogie du diabete pancreatique. Archive Internationale de Physiologie 1909:121–180.
15. Banting FG, Best CH. The internal secretion of the pancreas. J Lab Clin Med 1922;7:251–266.
16. Savage PJ, Bennion LJ, Bennett PH. Normalization of insulin and glucagon secretion in ketosis-resistant diabetes mellitus with prolonged diet therapy. J Clin Endocrinol Metab 1979;49:830–833.
17. Agner T, Damm P, Binder C. Remission in IDDM: prospective study of basal C-peptide and insulin dose in 268 consecutive patients. Diabetes Care 1987;10:164–169.
18. Gavin JR III, Alberti KGMM, Davidson MB, et al. Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. Diabetes Care 1997;20:1183–1197
19. WHO Consultation Group. Definition, diagnosis and classification of diabetes mellitus and its complications, 2nded. Part 1: Diagnosis and classification of diabetes mellitus WHO/NCD/NCS/99. Geneva: World Health Organisation, 1999:1–59.
20. Turner RC, Cull CA, Frighi V, et al. Glycemic control with diet, sulfonylurea, metformin, or insulin in patients with type 2 diabetes mellitus: progressive requirement for multiple therapies (UKPDS 49). UK Prospective Diabetes Study (UKPDS) Group. JAMA 1999;281:2005–2012.
21. Dabelea D, Pettitt DJ, Jones KL, et al. Type 2 diabetes mellitus in minority children and adolescents. An emerging problem.Endocrinol Metab Clin North Am 1999;28: 709-29.
22. American Diabetes Association 2007, Criteria for the diagnosis of diabetes mellitus. Diabetes care, Volume 30, Supplement 1, anuary 2007.
23. Howard BV. Pathogenesis of diabetic dyslipidemia. Diabetes Rev 1995;3:423–432.
24. Siegel RD, Cupples A, Schaefer EJ, et al. Lipoproteins, apolipoproteins, and low-density lipoprotein size among diabetics in the Framingham offspring study. Metabolism 1996;45:1267–1272.
25. Robert H. Eckel. The metabolic Syndrome. Harrison's principles of internal medicine 17th edition,2008:1509-1514.
26. Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults. Executive Summary of the Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). JAMA 2001; 285:2486–2497.
27. J, Larry Jameson, Anthony P. Weetman. Disorders of thyroid gland. Harrison's principles of internal medicine 17th edition, 2008: 2224-2247.
28. Thyroid and Antithyroid drugs. Katzung Basic clinical pharmacology 10thedition,2007: 618-634.
29. Physiological effects of thyroid hormones. William F. Ganong Review of medical physiology 22nd edition: 317-332.
30. P.Reed Lorson, F. Davies. Quantitation of serum thyroid hormone concentration. Williams textbook of Endocrinology 11th edition: 299-332.
31. Nikhil Tandon. API Text book of medicine 8th edition:1002-1010.
32. 32. Chidakel A, Mentuccia D, Celi FS: Peripheral metabolism of thyroid hormone and glucose homeostasis. Thyroid 2005; 15:899-903.
33. Gregory A. Brent, P. Reed Larsen, Terry F. Davies. Hypothyroidism and thyroiditis. Williams textbook of Endocrinology 11th edition: 377-409.
34. Huber G, Staub J-J, Meier C, et al: Prospective study of the spontaneous course of subclinical hypothyroidism: prognostic value of thyrotropin, thyroid reserve, and thyroid antibodies. J Clin Endocrinol Metab 2002; 87:3221-3226
35. Kvetny J, Heldgaard PE, Bladbjerg EM, et al: Subclinical hypothyroidism is associated with a low-grade inflammation, increased triglyceride levels and predicts cardiovascular disease in males below 50 years. Clin Endocrinol (Oxf.) 2004; 61: 232-238
36. Cappola AR, Fried LP, Arnold AM, et al: Thyroid status,cardiovascular risk, and mortality in older adults. JAMA 2006; 295:1033-1041.
37. F. Davies, P.Reed Lorson. Thyrotoxicosis. Williams textbook of Endocrinology 11th edition: 333-368.
38. Silva JE: The thermogenic effect of thyroid hormone and its clinical implications. Ann Intern Med 2003; 139:205-213.
39. Faber J, Galloe AM: Changes in bone mass during prolonged subclinical hyperthyroidism due to L-thyroxine treatment: a metaanalysis. Eur JEndocrinol 1994; 130:350-356.
40. R. Sathish,V. Mohan. Diabetes and Thyroid disease-A Review. Int J of Diabetes in Developing countries 2003;23; 120-123.
41. Schlienger JL, Anceau A, Chabrier G, North ML,. Stephan F. Effect of diabetic control on the level of circulating thyroid hormones. Diabetologia. 1982;22;486-8
42. Donckier JE. Endocrine diseases and diabetes. In: Textbook of Diabetes mellitus. Pickup JC, Williams G (eds), Blackwell Publishing Company, Chichester, 2003: 27.1– 27.25.
43. Coiro V, Volpi R, Marchesi C, et al. Influence of residual Cpeptide secretion on nocturnal serum TSH peak in well-controlled diabetic patients. Clin. Endocrinal. 1997;47:305-10.
44. Kalmann R, Mourits M. Diabetes Mellitus: a risk factor in patients with Grave's orbitopathy. Br. J. Ophthalmol. 1999; 83: 463-465.
45. Taylor R, Muculloch A, Zeuzem S, Gray P, Clark F, Alberti G. Insulin secretion, adipocyte insulin binding and insulin sensitivity in thyrotoxicosis. Acta Endorcinol. 1985;109:96-103.
46. Ahren B, Lundquist I, Hedner P, Valdemassan S, Scheroten B. Glucose tolerance and insulin and C-peptide responses after various insulin secretions stimuli in hyperthyroid and hypothyroid subjects before and after treatment diab. Res. Clin. Practice.1985;2:95-103.
47. Randin J, Tappy L, Scazziga B, Jequier E, Felber J. Insulin sensitivity and exogenous insulin clearance in Grave's disease. Measurements by the glucose clamp technique and continuous glucose calorimetry. Diabetes. 1986;35:178-81.
48. Bech K, Damsbo P, Eldrup E, et al. Beta cell function and glucose and lipid oxidation in Grave's disease. Clin. Endocrinol. 1996;44: 59-66.
49. Dimitriadis G, Raptis S A. Thyroid hormone excess and glucose intolerance. Exp Clin. Endocrinol. Diabetes. 2001; 109: S225-S239.
50. Holness M, Sugden M. Continued glucose output after refeeding contributes to glucose intolerance in thyroid disease. Biochem. J. 1987;247:801-4.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

51. Mokuno T, Uchimura K, Hayashi R, et al. Glucose transporter concentration in hyper and hypothyroid rat livers. J. Endocrinol. 1999;160:285-9.
52. Haber R, Wilson C, Weinstein S, Pritsker A, Cushman S. Thyriod hormone increases the partitioning of glucose transporters to the plasma membrane in ARL 15 cells. Amer. J. Physiol. 1995; 269:E605-E610.
53. Dimitriadis G. Parry-Billings M, Bevan S, et al. The effects of insulin on transport and metabolism of glucose in skeletal muscle from hyperthyroid and hypothyroid rats. Eur. J. Clinical. Invest. 1997; 27:475-83.
54. Mohn A, Di Michele S, Di Luzio R, Tumini S, Chiarelli F. The effect of sub clinical hypothyroidism on metabolic control in children and adolescents with type 1 diabetes mellitus. Diab. Med. 2002; 19:70-3.
55. Celani MF, Bonati ME, Stucci N. Prevalence of abnormal thyrotropin concentrations measured by a sensitive assay in patients with Type 2 diabetes mellitus. Diabetes Res 1994; 27: 15-25.
56. Proces S, Delgrange E,Vander Borght TV, Jamart J, Donckier JE. Minor alterations in thyroid-function tests associated with diabetes mellitus and obesity in outpatients without known thyroid illness. Acta Clin Belg. 2001 Mar-Apr; 56(2):86-90.
57. Roderick E. Warren, Petros Perros, Moffat J. Nyirenda, Brian M. Frier. Serum Thyrotropin is a better predictor of future thyroid Dysfunction than Thyroid Autoantibody status in biochemically euthyroid patients with Diabetes: Implications for Screening Thyroid. 2004, 14(10): 853-857.
58. Vondra K, Vrbikova J, Dyorakova K. Thyroid gland diseases in adult patients with diabetes mellitus. Minerva Endocrinol. 2005 Dec;30(4):217-36
59. Abdel Rahman, Nusier MK, Amari FL et al. Thyroid dysfunction in patients with type 2 diabetes mellitus in Jordan. Saudi Med J. 2004 Aug;25(8):1046-50.
60. Perros P, Mc Crimmon RJ, Shaw G, Frier BM, Frequency of thyroid dysfunction in diabetic patients, value of annual screening. Diabet Med 1995;12:622-627.
61. Smithson MJ. Screening for thyroid dysfunction in a community population of diabetic patients. Diabet Med 1998; 15 (2): 148-50.
62. Zdrojewicz Z, Humpich G, Januszewski A, Adamek J. The assessment of thyroid gland function in patients with non-insulin dependent diabetes mellitus(type 2). Wiad Lek.1999;52(1-2): 35-41.
63. Parr JH. The effect of long-term metabolic control on free thyroid hormone levels in diabetics during insulin treatment. Ann Clin Biochem. 1987 Sep; 24 (Pt 5):466-9.
64. Chubb SA, Davis WA, Inman Z, Davis DME.Prevalence and progression of subclinical hypothyroidism in women with type 2 diabetes: the Fremantle Diabetes Study. clinEndocrinol (Oxf).2005 Apr;62(4):480-6.
65. Wild S, Rogli G, Green A. Global prevalence of diabetes
66. Kapur A., Snehlatha C., Ramchandran A., Vijay V., Mohan V.,Das A.K., Rao P.V., Yajnik C.S., Prasanna Kumar K.M., Jyotsna Nair: High prevalence of diabetes and impaired glucose tolerance in India. National Urban diabetes survey. Diabetologia 2001; Vol. 44: 1094 –1101.
67. Arthur M.Michalek, Martin C.Mahoney, Donald Calebaugh:Hypothyroidism and Diabetes Mellitus in an American Indian Population. Journal of family practice 2000 July; 49:638-640.
68. Jali MV, Mohan V, Ramchandran A, Snehlatha C and Viswanathan M; High Prevalence of diabetes in an Urban population in South India. BMJ Sept 1988; Vol. 297: p- 587-590.
69. Flatau E.; Trougouboff P.; Kaufman N.; Reichman N.; Luboshitzky R. Prevalence of hypothyroidism and diabetes mellitus in elderly kibbutz members. European Journal of Epidemiology, Volume 16, Number 1, January 2000 , pp. 43-46(4).

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