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Research Article

THYROID DYSFUNCTION AND TYPE 2 DIABETES MELLITUS: SCREENING STRATEGIES AND IMPLICATIONS FOR MANAGEMENT.

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Abstract:

The chronic endocrine diseases, thyroid dysfunction (TD), and diabetes mellitus (DM) are strongly associated with each other as well as high prevalence found in different populations. Diabetic patients commonly experienced hypothyroidism and hyperthyroidism especially patients with type-II diabetes mellitus. The present guidelines have not clearly elucidated the recommendation of monitoring of thyroid dysfunction in patients with T2DM. Excessive thyroid hormones influence the different organs and cells, have a severe impact on glucose, lipid, and protein metabolism, and inadequate glycemic control in T2DM patients. Thyrotoxicosis has contributed to the development of diabetic complications such as ketoacidosis and endothelial dysfunction, which further impart to enhance the risk of cardiovascular disease. T2DM brings a reduction in thyroid-stimulating hormone level and impaired the formation of thyroxine and triiodothyronine lead to insulin resistance. The insulin resistance and hyperinsulinaemia induce the proliferation of thyroid tissues to lead to developing nodular thyroid disease and enlargement of the goiter. Eventually, TD can more complicate the T2DM and diabetes worsen thyroid function. Drugs used in the therapy of diabetes have adverse effects on thyroid function.

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INTRODUCTION:

The chronic endocrine diseases, thyroid dysfunction (TD), and diabetes mellitus (DM) are strongly associated with each other as well as the varied prevalence rate in different folk of a region. These coexisted endocrinopathies are frequently observed in routine practice. [1] However, the prevalence of TD is higher in women than men, enhance with the age, and in Europe and the United States, 6.6% of adults are facing this issue. TD has a prominent contribution in both diabetes mellitus type-I (T2DM) and type-II but its complications are more severe in T2DM. The two thyroid dysfunction clinical forms are hyperthyroidism and hypothyroidism exist in T2DM. [2] DM is also effect the large population of the world and its percent has been raised from 4.5% to 8.7% in adults. According to an examination survey report, 15% of adults in the USA have experienced DM or impaired fasting glucose level, and 35% adults of age 20 years remain undiagnosed in the United States, they are prediabetic patients based on fasting glucose level. [3] People with diabetes are more susceptible to TD than non-diabetic patients.

Moreover, this paper will sum up knowledge about the association between DM and TD. Discuss the screening strategies and implications related to thyroid dysfunction and diabetes mellitus.

Clinical Guidelines on Screening for Thyroid Disorders In Diabetes:

The highly complex interdependent interactions in both these endocrinopathies enhance the risk to develop cardiovascular-related issues therefore it is very essential to screen for TD in T2DM patients. Although, not all the guidelines mention the monitoring of thyroid function in T2DM only a few of the many guidelines recommend an annual thyroid screening in T2DM to check the thyroid function. [5] In 2000, the American Thyroid Association recommended thyroid screening for thyroid dysfunction or disease to measure the serum thyrotropins after 5 years either they are diabetic or not especially at the age of 35 years old. [7] The screening guidelines in 2015 of the US Preventive Services Task Force evaluated that there is a lack of evidence to support the recommendation of a TD screening test in asymptomatic adults.⁸ Further, studies have not shown obvious screening recommendations to determine the thyroid function in patients with TD. Nonetheless, escalating shreds of evidence are the supportive link for TD and T2DM that suggests screening may be required. [6]

Clinical Implications of Diabetes and Thyroid Disease Coexistence:

The autoimmune pathology may affect the insulin thyroid hormone that is a constituent of metabolic syndrome and impact cellular metabolism. The interconnected reactions such as biochemical, genetic, and hormonal malfunction are pathophysiologically associated with TD and T2DM. Herein the hyperthyroidism is associated with increased expression of hepatic glucose transporter type 2 gene and insulin sensitivity is also connected with intercellular triiodothyronine. [11] it behave like to conciliate the transporter type 2 gene in skeletal muscles and enhance the basal and insulin-mediated glucose transport. The similarity was found in the sign and symptoms of TD and T2DM such as weight gain, edema, fatigue, and pallor. Thus both diseases can hide the effect of each other like T2DM can mask TD and TD can mask the initial complications of diabetes. The adjustment of dose is required during the clinical implementation because antidiabetic drugs may influence thyroid activity and antithyroid therapies have an adverse effect on glycemic control. [12]

Thyroid Hormones and Glucose Homeostasis:

A large amount of thyroxine present in blood in hyperthyroidism is linked with bad glycemic control, inclusive hyperglycemia, and insulinopenia. When healthy persons found with hyperthyroidism 2-3% of them are at the stage of prediabetes. 50% of patients with Graves' disease may experience a smaller degree of glucose intolerance.⁹ Moreover, very poor glycemic control was measured in diabetes patients with hyperthyroidism. Thyrotoxicosis has contributed to the development of diabetic complications such as ketoacidosis and endothelial dysfunction, which further impart to enhance the risk of cardiovascular disease. Glucose metabolism can be affected through the action of thyroid hormones on different organs, somehow it may escalate gastrointestinal mortality and increase glucose absorption.¹⁰ Thyroid hormone may increase the activity of an enzyme known as phosphoenolpyruvate carboxykinase, directly or indirectly enhanced gluconeogenesis, glycogenolysis, and ultimately developed hyperinsulinaemia and glucose intolerance. Overall, it aggravates subclinical diabetes and overstates the hyperglycemia in type II diabetes mellitus.[13]

Effects of Diabetes on Thyroid Disorders:

In a study, the diabetic effects of thyroid activity are changed with variation in thyroid-stimulating hormones which cause the impairment of thyroxine to triiodothyronine in the peripheral tissues. In the case of euthyroid DM patients, reduction in the secretion of nocturnal thyroid stimulated hormone (TSH) and the obscure response of TSH to

thyrotropin-releasing hormone. [14] if hyperglycemia remains for a longer time, imposed the progressive effect on TD. On the other hand, during the elucidation of thyroid function tests, it is essential to deem that, as with other acute systemic disorders, diabetes (ketoacidosis) can reduce the level of thyroxine and triiodothyronine by maintaining the TSH level normal. One more study revealed that insulin resistance and hyperinsulinaemia induce the proliferation of thyroid tissues to lead to developing nodular thyroid disease and the enlargement of the goiter. [15] patients with hypothyroid and coexisting diabetes may influence the treatment of thyroid hormones. Further, repercussions of comparison with the normal population, T1DM found most common in patients with Graves' orbitopathy. The recurring of Graves' orbitopathy and high severity was found in patients with T2DM and substantially affected with a duration of disease, obesity, and vascular disease. The dysthyroid optic neuropathy was commonly found in patients with diabetes than non-diabetic patients. [16]

Diabetes Mellitus, Thyroid Dysfunction, and Pregnancy:

DM and TD strongly impact maternal and fetal health. Notably, a greater percentage of hyperthyroxinaemia was found in women with gastrointestinal DM.¹⁷ The results of the case study shows that hypothyroidism can bring the more complication in pregnancy and induce the pregnancy to induce hypertension, abruptio placentae, impaired neurodevelopment of infant, low birth weight with preterm delivery. The child of the hypothyroid mother may suffer from neuropsychological abnormalities. [18]

DISCUSSION:

Another study about the screening of patients with TD and diabetes. The randomized selected 1310 adults with diabetes with annual clinical screening for thyroid function. The obtained results show overall prevalence was 13.4%, including 31.4% females with T1DM and 6.9% males with type 2 diabetes and 6.8% adults, 4.8% with subclinical hypothyroidism, 0.8 % hyperthyroidism. Females with type 1 diabetes are at higher risk to develop thyroid dysfunction. [20]

There are multiple studies on thyroid dysfunction and complications related to diabetes. A study concluded that 20 females with severe complications of TD with type 2 diabetes and 10 males, with thyroid dysfunction and related complication were diagnosed. This study found a higher ratio of females affects by TD than the males. They are also at high risk to develop cardiovascular. [21]

A more researched was found with an evaluation of the pathogenic mechanism of autoimmune disorder inclusive in the onset of type-I diabetes mellitus and thyroid dysfunction disease. The results of this study concluded that if patient thyroid dysfunction remains untreated, it can more impair the metabolic control of diabetic patients. [19]

CONCLUSION:

Finally, we concluded that the prevalence rate of TD is high in patients with T2DM. Various studies have evidence supporting the results of thyroid function tests that significant numbers of new patients with TD have subclinical hypothyroidism. The variation was found in the international guidelines for the screening of thyroid dysfunction which clear that no need for screening for milder forms of TD with T2DM. The close association of TD and DM increase the risk of cardiovascular disease and insulin resistance link these condition. TD can more complicate the T2DM and diabetes worsen thyroid function. Drugs used in the therapy of diabetes have adverse effects on thyroid function. More systemic approaches are needed for thyroid testing with T2DM. The glycemic control in thyroid dysfunction suggests regular monitoring. Further research can proceed to explore the relationship and complications between T2DM and TD.

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