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A SCIENTIFIC REVIEW ON PREVALENCE, DIAGNOSIS AND MANAGEMENT OF HYPOTHYROIDISM

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ABSTRACT

Hypothyroidism is a disorder of the endocrine system in which the thyroid gland does not produce enough thyroid hormone. Iodine deficiency is the most common cause of primary hypothyroidism and endemic goiter worldwide. In areas of the world with sufficient dietary iodine, hypothyroidism is most commonly caused by the Hashimoto's thyroiditis. It was found out that in India inland cities showed a higher prevalence of hypothyroidism [11.73%] as compared to coastal cities [9.45%]. Percentage affected were more in females [around 15.86%] than in males [5.02%] and it also stated that it affected a greater number of elderly people [13.11%] than younger people [7.53%]. Among all cities, Kolkata has recorded the highest prevalence of hypothyroidism [21.67%]. There was a predominance of thyroid dysfunction in women especially in overweight older women. The diagnosis of hypothyroidism is commonly done by measuring thyroid hormones [T3 and T4] level in the blood. Iodine supplements can be used for the prevention or treatment for hypothyroidism, especially in areas of iodine deficiency. Thyroid replacement therapy that are include desiccated thyroid extracts, synthetic T4 therapy and synthetic T3 and T4 combination therapy. However, the most commonly used treatment is levothyroxine that is taken on an empty stomach which is considered to be effective, inexpensive, and free of complications.

KEYWORDS: Hypothyroidism, Hashimoto's thyroiditis, Levothyroxine, Thyroid dysfunction.

INTRODUCTION

Hypothyroidism[1] is a disorder of the endocrine system in which the thyroid gland does not produce enough thyroid hormone. This review conveys everything about its management, how to prevent it and also along with some information like it's signs and symptoms, it's epidemiology, etiology and most importantly the dietary methods and treatment to follow for this disorder. Iodine deficiency[9] is the most common cause of primary hypothyroidism and endemic goiter[10] worldwide. In areas of the world with sufficient dietary iodine, hypothyroidism is most commonly caused by the autoimmune disease Hashimoto's thyroiditis[8] (Chronic autoimmune thyroiditis). Hashimoto's may be associated with a goiter. It can cause a number of symptoms, such as poor ability to tolerate cold, a feeling of tiredness, constipation, depression, and weight gain. Occasionally there may be swelling of the front part of the neck due to goiter.

The prevalence of hypothyroidism is 2% in the UK and 4.6% in the USA. The prevalence[2] of hypothyroidism in India is more in the cities located inland [Eg: Kolkata, Delhi, Bangalore and Hyderabad] – 12%, compared to coastal cities [Eg: Mumbai, Goa and Mangalore] – 9%. The prevalence of hypothyroidism is between 1% and 2% and is more common in older women and 10 times more common in women than in men.

Worldwide about one billion people are estimated to be iodine deficient; however, it is unknown how often this results in hypothyroidism. In large population-based studies in western countries with sufficient dietary iodine, 0.3–0.4% of the population have overt hypothyroidism. A larger proportion, 4.3–8.5%, have subclinical hypothyroidism. Children with subclinical hypothyroidism[3] often return to normal thyroid function, and a small proportion develops overt hypothyroidism.[11] There is a much higher rate of thyroid disorders, the most common of which is hypothyroidism, in individuals with Down syndrome[6] and Turner's syndrome.[7] Salt iodization has prevented hypothyroidism in many populations.[4] Thyroid hormone replacement with levothyroxine treats hypothyroidism.[5] This review aims to provide an information on the prevalence, diagnosis and management of hypothyroidism.

Prevalence

According to the articles reviewed from different sources, the result states that the prevalence of hypothyroidism is 2% in the UK and 4.6% in the USA. In India inland cities showed a higher prevalence of hypothyroidism [11.73%] as compared to coastal cities [9.45%].

Percentage affected were more in females [around 15.86%] than in males [5.02%] and it also stated that it affected more number of elderly people [13.11%] than younger people [7.53%].

Among all cities, Kolkata has recorded the highest prevalence of hypothyroidism [21.67%], while other cities showed comparable rates ranging from 8.88% [Hyderabad] to 11.07% [Delhi]. In comparison, young adults [aged 18- 35 years], older adults [mainly females] had greater propensity of being diagnosed of hypothyroidism. Salt iodization has prevented hypothyroidism in many populations. Thyroid hormone replacement with levothyroxine and its congeners along with the supplements have been fruitful in the treatment of hypothyroidism.[12]

The results of the review stated that the prevalence of hypothyroidism was more in the population residing in inland cities compared with the coastal cities/ areas. On the other hand, among the subjects who self reported themselves to be hypothyroid, a significant proportion [28%] still had a high TSH (Thyroid stimulating hormone) value. The review also throws light on the current practices in the management of thyroid disorders, including active screening of endocrine function among patients at greater risks and an emphasis on regular monitoring of the thyroid status and dose adjustments, in order to provide effective therapy in those with established diagnosis. The emergence of Kolkata as the worst affected city was unanticipated, particularly as the city was established to be iodine replete over a decade back. The high prevalence figures in Kolkata have ascertained that thyroid disorders in India are not confined to the conventional iodine-deficient sub-himalayan zone but also extended to the plain fertile lands.

There was a predominance of thyroid dysfunction in women in our review, and is consistent with worldwide reports, especially it mainly occurred to the middle and as well as old aged people – mainly older women, which is common and it is 10 times more common in women than in men. If hypothyroidism is not treated properly, it can lead to complications like heart problems, nerve injury, infertility, and in severe cases death. Salt iodization has prevented hypothyroidism in many populations. Thyroid hormone replacement with levothyroxine and its congeners along with the supplements have been fruitful in the treatment of hypothyroidism.

Diagnosis

TSH levels above the typical reference range (usually 0.5–5 mIU/L) and free T4 levels below the reference range are indicative of primary hypothyroidism, depending on the test type used and the population being studied. 0.1–2.5 mIU/L in the first trimester, 0.2–3.0 mIU/L in the second trimester, and 0.3–3.5 mIU/L in the third trimester are the reference ranges for expectant mothers.

TSH levels fluctuate throughout the day, reaching their highest value in the late afternoon and evening. Extremely high and sometimes irregular TSH secretion is seen in patients with profound hypothyroidism. TSH levels are also reported to be impacted by seasonal variations. TSH levels are lower in the fall and summer and higher in the winter and spring.[13,14]

Management

The preferred treatment is swallowing a single tablet of levothyroxine on an empty stomach. The first sign of hypothyroidism is the presence of clinical symptoms along with laboratory evidence of overt hypothyroidism. Changing the brand of levothyroxine tablets for stable individuals is not advised. People suffering from overt hypothyroidism have to take daily medication starting at a dose of 1.5 to 1.8 mcg/kg, ideally. A dose of 2.0 to 2.4 mcg/kg of full replacement thyroxine can be administered to pregnant women. Individuals with coronary artery disease should begin taking the drugs at a dose of 12.5 to 25 mcg per day; the dosage needs to be adjusted according to symptoms and blood TSH levels. For elderly individuals, especially those with numerous comorbidities, this treatment strategy is advised.[15]

Desiccated thyroid extract

Murray published the first thyroid hormone replacement therapy regimen in 1891, which involved injecting sheep thyroid extract subcutaneously. Shortly after, it was demonstrated that thyroid extract administered orally was as effective. T4 and T3 are both present in desiccated thyroid extract (DTE), which is lyophilized thyroid gland tissue. Pigs are the primary source of DTE utilized nowadays. However, since the advent of synthetic hormones, there has been much discussion on the use of DTE to treat hypothyroidism in any form.[16]

The T4 ratio, which is typically about 4:1 compared to the human physiological ratio of 14:1, is a reason not to utilize pig DTE. Because of this, the treatment may result in a supraphysiological concentration of T3, which can have serious side effects including thyrotoxicosis, including palpitations, heat intolerance, and in extreme situations,

unconsciousness. The Food and Drug Administration (FDA) has not yet authorized the use of DTE formulations. This data emphasizes the necessity for more investigation on the application of DTE in the management of hypothyroidism.[17]

Synthetic T4 monotherapy

Kendall first refined T4 crystals in 1914, and they were quickly made commercially available. By the 1930s, synthetic T4 was ready for clinical usage after Harrington and Barger were able to define its structure twelve years later. But it wasn't widely utilized until nearly 20 years later, when it was advertised like a brand-new medication, probably because of its expensive price. Nowadays, the preferred treatment for primary hyperthyroidism is levothyroxine (L-T4). Although L-T4's efficacy and safety are well proven, there are a number of problems and disadvantages with using it therapeutically.[18]

Treatment with L-T4 cannot be approached in a one-size-fits-all manner; throughout the course of medication, serum thyroid-stimulating hormone (TSH) levels, which control thyroid hormone release, must be monitored. TSH levels should be checked at the beginning of treatment, after each dose adjustment, and once the L-T4 dosage is stable, once a year. Serum TSH levels stay high and hypothyroidism symptoms endure if insufficient L-T4 is given. On the other hand, if the dosage is too high, thyrotoxicosis symptoms may arise from an extreme drop in blood TSH levels. This covers severe heart conditions such palpitations, arrhythmias, and tachycardia.[19]

Overuse of L-T4, which lowers TSH levels below 0.1 mIU/L, has also been linked to negative skeletal health outcomes, including a decrease in bone mineral density, which raises the risk of osteoporosis and fractures, particularly in older individuals. Additionally, individuals with pre-existing ischemic heart disease should begin on a modest dose of L-T4 and be gradually titrated upwards due to the beneficial inotropic and chronotropic effects of thyroid hormone on the heart. For certain people, cardiac medication may need to be modified in order to tolerate a sufficient amount of L-T4 and preserve euthyroid status.[20]

Additionally, a number of drugs, meals, and supplements may affect how well L-T4 is absorbed, metabolized, and works. The opposite is true for glucocorticoids and anabolic steroids, which lowers thyroid-binding globulin levels and frequently need lowering the L-T4 dosage. Poor patient compliance is the main cause of L-T4 therapy's shortcomings. This is frequently brought on by the restrictions and inconveniences that the therapy entails, like

avoiding the previously listed drugs, taking the prescription every day, and avoiding eating for 30 to 60 minutes before and after taking L-T4.[21]

Synthetic combination therapy

Unlike T4, serum T3 was identified by Gross and Pitt-Rivers in 1952. Through the use of DTE, a therapy combining "natural" T3 and T4 was first used to treat hypothyroidism. Mixtures of synthetic T3, typically liothyronine (L-T3) and L-T4, were used in place of DTE when its use began to be questioned, mostly because of dissatisfaction with its inconsistent efficacy. However, L-T4 monotherapy became the first-line treatment after the groundbreaking finding that T4 can be peripherally converted into T3 in patients with thyroid deficiencies.[22]

This suggests that the best method for determining the kind of thyroid hormone replacement therapy (HRT) required may be individualized medicine based on genotype. Before this can be put into practice, more research determining the impact of SNPs on T3 combination therapy as well as its safety and effectiveness must be done. There may be additional challenges due to the cost-effectiveness of precision medicine strategies like this one and the need to restructure healthcare systems in order to apply them for a condition as prevalent as hypothyroidism.[23]

CONCLUSION

The review is conclusive that hypothyroidism is a commonly prevailing disorder in adult Indian population. Older overweight females are considered to be more prone. An autoimmune mechanism has appeared to play an etiological role in a significant proportion of patients. Iodine intake has ceased to be the sole etiological contender for thyroid disorders in urban areas. Identification of multiple risk factors and plausible underlying mechanisms was warranted.

With proper patient monitoring, levothyroxine and its congener replacement therapy was considered to be effective, inexpensive, and free of complications. Recommendations for thyroid-stimulating hormone suppression with levothyroxine were based on risk-benefit considerations of the biologic characteristics of the thyroid disorder and the individual patient characteristics.

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