Research article

Predictive value of insulin marker before and after recovery of Grave's disease patients

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ABSTRACT

Introduction and Aim: Grave's disease is a disease of the thyroid glands. Early diagnosis of hyperthyroidism can improve treatment and control. This study examined hyperthyroidism-related insulin hormone alterations before and after radioactive iodine 131 treatment. This study also examined how the medical condition affected these indicators.

Materials and Methods: The participants in this study included 50 people who were diagnosed with Grave's disease, as well as 23 healthy individuals as controls. Direct inquiry was used as the technique for gathering demographic information from the patients who participated in the study. The thyroid stimulating and insulin hormonal levels of each patient were recorded before and after undergoing a hypothyroidism treatment regimen of three months that consisted of a dose of radioactive iodine 131 ranging from 10 to 20 mci.

Results: This research indicated a significant relation to exist between age and insulin levels among patients diagnosed with Grave's disease. In addition, the research also demonstrated a significant association between levels of thyroid-stimulating hormone (TSH) and insulin hormones in patients both before and after radiation therapy.

Conclusion: Insulin hormonal levels could be used as a predictor of the severity of hyperthyroidism.

Keywords: Insulin; Grave's disease; thyroid stimulating hormone; radioactive iodine 131.

INTRODUCTION

Insulin, a protein hormone made up of 51 amino acids, plays a pivotal role in a wide variety of essential bodily processes. The binding of the hormone in its monomeric form to its demerit state initiates a signaling cascade that controls glucose uptake into cells, thus fulfilling the hormone's regulatory purpose. The insulin receptor is a tyrosine-kinase receptor found in cell membranes. Insulin is pivotal in controlling carbon sources and regulating glucose metabolism. Furthermore, it helps in lipogenesis, glycogen synthesis, and protein synthesis by inhibiting their decelerating effects (1). In addition, insulin aids in the proliferation and differentiation of cells (2). In the field of polyglandular autoimmune diseases, including T1DM, the connection between the two is well-established. Hypothyroidism is associated with a reduced need for insulin, while hyperthyroidism is associated with an increased need for insulin (3). Autoimmune thyroiditis disease (AITD) is a disorder of the thyroid gland caused by the immune system. When the immune system mistakenly attacks the thyroid, two distinct diseases emerge: Hashimoto thyroiditis and Grave's disease (4). Increased numbers of activated T cells and the development of autoantibodies directed against the thyroid gland are hallmarks of Grave's disease. Antibodies that target the TSH receptor stimulate the thyroid, leading to over activity of the gland (5). The most prevalent clinical diseases that modify basal metabolic rate are thyroid disorders (both hypothyroid and hyperthyroid). A number of published scientific literature exist that describe the effects of thyroid hormones on glucose metabolism in both normal and diabetic conditions. To describe the effects of too much thyroid hormone, the phrase "thyroid diabetes" appeared in the earliest medical writings (6). Grave's disease, an autoimmune disorder, is a common cause of hyperthyroidism due to overproduction of the thyroid hormone. Evidence suggests a link between this disease and insulin levels that can lead to the development of type 2 diabetes (1,5). Hence, the purpose of this study was to look into hyperthyroidism related insulin hormone alterations before and after radioactive iodine 131 treatments.

MATERIALS AND METHODS

Study design and setting

The study carried out during December 2022 to March 2023, included 33 patients admitted and receiving treatment at the Medical City facility in Baghdad, Iraq. These patients were diagnosed with Grave's disease but did not have diabetes as a comorbid condition. The study also included 30 healthy individuals as controls. The age of the participants (male and female) ranged between 20-60 years. Individuals < 18 years of age and patients did not receive a single dose of radioactive iodine 131 treatment were excluded from the study. Participants were asked to sign a written consent and assured of data confidentiality.

Data collection

Demographic data such as age, gender, body mass index, smoking habits, and primary illnesses were obtained. Blood samples (5 ml) collected from each participant were analyzed for total blood counts and thyroid hormonal levels. Following radioactive iodine 131 treatment a minimum duration of three months of post-treatment observation was made, following which the patients were classified into two groups: those who exhibited signs of recovery and those who did not, with the categorization being determined by the extent of their sickness.

Statistical analysis

Quantitative data obtained is given as means and standard deviations. T-test was used to compare data. The data consisted of binomial variables which are expressed as frequency percentages, which were subsequently subjected to analysis using the Chi-square test (7).

RESULTS

The age range of patients (n=33) in the study was between 20 to 60 years having different backgrounds. Among the patients 15 (46%) were males while 18 (54%) were females. 2% of the male patients were found to be smokers.

A statistically significant difference ($p \leq 0.05$) was observed between insulin levels before radiation therapy (174.54 ±32.89) and after radiation therapy (117.66 ±3.42), as well as the insulin levels found in the healthy control group (Table 1). Similarly, the TSH level (mg/dl) was found to be significantly different between Grave's disease patients in comparison to healthy controls in before and after radiotherapy treatment groups (Table 2). Among the patients the TSH levels were found to be elevated after radiotherapy treatment with a recovery percentage of 88.7% (Table 2).

Based on the data, it was found that only 36% of people with Grave's disease have a family history of the disease (Table 3). On the other hand, no significant difference was observed between insulin levels in people with Grave's disease and healthy controls who were aged <40. However, a significant difference ($p=0.0451$) was seen among individuals aged >40 years for insulin levels in people with Grave's disease as compared to healthy individuals (Table 4).

Table 1: Insulin levels in patients and healthy controls radiotherapy treatments

Groups	**Glucose levels (mg/dl) before radiotherapy treatment**	**Glucose levels (mg/dl) after radiotherapy treatment**
Grave's disease patients	174.54 ±32.89	117.66 ±3.42
Healthy control	109.69 ±2.63	109.69 ±2.63
T-test	57.281 *	37.633 NS
P-value	0.0277	0.594

*Significant ($P \leq 0.05$), NS: Non-Significant.

Table 2: The TSH levels in Grave's disease patients and healthy controls before and after radiotherapy treatments

Groups	**TSH levels (mg/dl) before radiotherapy treatment**	**TSH levels (mg/dl) after radiotherapy treatment**	**Recovery %**
Grave's disease patients	0.621 ±0.15	5.556 ±0.89	88.7
Healthy control	2.063 ±0.13	2.063 ±0.13	100
T-test	0.489 **	0.582 **	7.602*
P-value	0.0001	0.0001	0.0372

Significant at * ($P \leq 0.05$),** ($P \leq 0.01$)

Table 3: The effect of family history on Grave's disease

Groups	**Family history No. (%)**		**Thyroid glands removal No. (%)**	
	Yes	No	Yes	No
Grave's disease patients	18 (36.0%)	32 (64.0%)	1 (2.0%)	49 (98.0%)
Healthy control	0 (100%)	23 (100%)	0 (100%)	23 (100%)
P-value	0.0074 **		0.0478 *	

Significant at *($P \leq 0.05$),** ($P \leq 0.01$

Table 4: The effect of age on insulin level in Grave's disease patients treated with radiotherapy

Groups	**Insulin levels (mg/dl) Age <40**	**Insulin levels (mg/dl) Age >40**
Grave's disease patients	154.37 ±7.02	168.24 ±5.94
Healthy control	104.72 ±2.55	113.69 ±2.85
P-value	0.0771 NS	0.0451 *

*Significant ($P \leq 0.05$), NS: Non-significant.

DISCUSSION

The investigation included a group of 50 people who were diagnosed as having Grave's disease. There are only a few occasions in which patients will experience the coexistence of several comorbidities, such as a history of disease in the patient's family as well as the removal of the patient's thyroid gland. These instances are rare. Following the injection of radiation, the levels of insulin were found to have restored to within the normal range, as evidenced by the outcomes of the study. These occurrences occur as a direct result of the effects that hyperthyroidism has on the metabolic processes of the pancreas. People who exhibit evident symptoms of hyperthyroidism or hypothyroidism have a higher predisposition for developing insulin resistance, according to a study (8). Previous studies have demonstrated a correlation between mild thyroid dysfunctions, specifically subclinical hyperthyroidism and subclinical hypothyroidism, and the presence of insulin resistance (9, 10). Graves' patients exhibit low serum thyrotropin (TSH) and higher IL-38 gene expression than healthy controls (11). The results of this study suggest that there is a potential association between abnormal levels of thyroid hormones and thyroid-stimulating hormone (TSH) and the onset of insulin resistance. In a study conducted by Lambadiari and his coworkers (12), the study demonstrated a significant association between thyroid hormone levels and insulin resistance in people diagnosed with type 2 diabetes mellitus (DM). On the other hand, this study aimed to assess the impact of pre- and post-treatment TSH levels following radiation. The findings from the study revealed that the percentage of recovery in individuals with Graves' illness to be 88%. According to Arenas *et al.,* (13), Graves' illness is classified as an autoimmune disorder, and radiation (RT) has been identified as a viable therapeutic approach for managing ocular problems associated with this condition.

The study also examined the potential association between familial history and the occurrence of thyroid gland excision. Results showed that there is a significant difference in history family relation to hyperthyroidism infection between Graves' disease patients and healthy control. Results confirmed that there is a significant difference in thyroid gland removal with Grave's disease infection where 98% of patients do not remove their thyroid glands before radiotherapy which indicates that thyroid removal has no effect on the disease. The study evaluated the insulin levels in Grave's patients and healthy control to determine the effect of disease on insulin before treatment. It showed that there is a significant effect of age on the insulin level in Grave's disease patients before radiotherapy compared with their levels in the healthy control group. People with hyperthyroidism often have impaired glucose tolerance because thyroid hormones have been shown to have a major impact on intermediate metabolism. Two-thirds of the patients had impaired glucose tolerance at the outset. 34.7 % of the people who had impaired glucose tolerance at the start of the trial still had it at the end of the follow-up period. During the time of observation, insulin resistance markers did not show any noteworthy changes. Hyperthyroidism is associated with a significant increase in the risk of developing diabetes and a worsening of the condition in those who already have it.

According to the published data, the percentage of people with impaired glucose tolerance lies between 39.4% and 57% (14). Our findings differed from these studies which found that people with impaired glucose tolerance had higher T4 levels before the start of the study. Despite maintaining a stable euthyroid condition for a period of three months, it was observed that approximately one-third of individuals who initially exhibited abnormal glucose tolerance continued to display such abnormalities during the subsequent oral glucose tolerance test (OGTT) conducted during the follow-up period. According to the research conducted by Maxon *et al.*, (14), it was found that approximately 40% of the patients continued to exhibit impaired glucose tolerance even after attaining a euthyroid condition for a duration of 9 months. This suggests that the restoration of glucose homeostasis may need a significantly longer period of time, necessitating extended monitoring of individuals with hyperthyroidism and impaired glucose tolerance. Maratou and colleagues (9) observed a higher degree of insulin resistance in individuals with clinical and subclinical hyperthyroidism in comparison to euthyroid controls.

CONCLUSION

Abnormal insulin levels are a common metabolic symptom of hyperthyroidism. The current study found no statistically significant difference in insulin levels after euthyroid recovery in patients with Graves' disease. Few individuals with abnormal glucose levels had their metabolic irregularity persist for three months even after their euthyroid condition was restored. This indicates that longer-term follow-up of individuals with high glucose levels is necessary to fully comprehend the development of metabolic problems due to hyperthyroidism.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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