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The relationship between thyroid hormones and IGF-1 after thyroidectomy

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Abstract

Background: decreased IGF-1 and thyroid hormones are one of the major complications following total thyroidectomy that can range in severity from asymptomatic to an acute life-threatening condition. Aim of the study to evaluate the decreased IGF-1 and thyroid hormones in total thyroidectomy patients, with regard to the time periods after the operation. The design of the study included the presence of three groups of patients with different characteristics in terms of time periods after the total removal of the thyroid gland, and a fourth group is the healthy group, and each group consisted of 30 samples. Patients with cancer, diabetes, blood pressure, and pregnant women were excluded from the study, and the study was limited to patients who had thyroid gland removal operations for reasons or benign tumors. The results of this study have shown, decreased IGF-1 and thyroid hormones was different from one group to another, but all three groups were lower than the control group, where the first group was more low, then the second and third groups, which were higher than the first and second groups, and lower than the control group. Conclusion: All patients different ages and time periods after the total thyroidectomy, they were decreased IGF-1 and thyroid hormones.

Keywords

Total thyroidectomy; decreased IGF-1 and thyroid hormones.

There are close interrelations between the multitude of hormones that regulate mammalian growth. Insulin-like growth Factor-I (IGF-I), one of the key mediators of cellular metabolism and proliferation, is directly influenced by growth hormone (GH) (Barranco et al., (2023) and Fitzgerald et al., (2023)). Thyroid hormones (THs) can also modify plasma IGF-I levels, and a direct correlation between circulating levels of IGF-I and THs has been reported. The effects of THs on IGF-I may be mediated by stimulation of GH secretion, as has been demonstrated in pituitary tumour cell lines in vitro and normal thyrotrophs in vivo. The above observations do not generally take account of the regulatory effects of nutritional status on the hormonal axes described. A direct correlation exists between energy intake and circulating levels of THs (Bartke et al., (2023)) and IGF-I, whereas undernutrition leads to an elevation in circulating GH (Dichtel, et al., (2022). Decreased serum levels of IGF-I in patients who are hypothyroid have been reported in only a few studies [Pereira et al., (2023)]. Moreover, the downstream effects of changes in serum levels of IGF-I on somatic growth in thyroid dysfunction is unclear. We have studied the changes of serum IGF-I levels, anthropometric measures, and body composition of patients with acute hypothyroidism after thyroxine (T4) withdrawal.

The relationships among anthropometric measures, body composition, and thyroid dysfunction have also been analyzed (Bremer et al., (2023) and Yosif et al., (2022)

Patients and methods

This study has been conducted at Nasiriyah Teaching Hospital in Thi-Qar, The Endocrine Glands Center in Thi Qar governorate, Biochemistry Laboratory, at the period between 1/4/2022 to 1/4/2023. It included (120) patients, control (30) and patients (90). Divided into three groups, each group containing 30 patients:

There were (120) women subjects, control and patients with euthyroid goiter aged (25-45) years were included in this study. they divided into four groups as the following: -

Group A (control): - included thirty (30) healthy subjects aged (25-45).

Group B (patients**,** after thyroidectomy**):** - included patients from one day to one month after thyroidectomy.

Group C (patients**,** after thyroidectomy**):** included patients from one month and one day to one year after thyroidectomy

Group D (patients**,** after thyroidectomy**):** group included patients from one year, one day and more after thyroidectomy. Medical tests were performed on the patients' blood, including (thyroid hormones, IGF-I), using the ELISA device.

Results

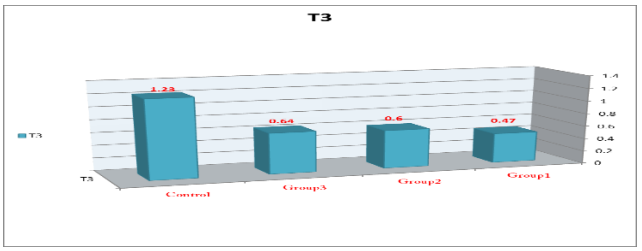
The mean age of the patients who were involved in our study was 25-45 years, all patients were females, they do not have malignant diseases, diabetes, or blood pressure, and they are not pregnant, the main surgical procedure was total thyroidectomy, and the main cause for surgery was a goiter benign or non-toxic. The results are shown in the table .1.

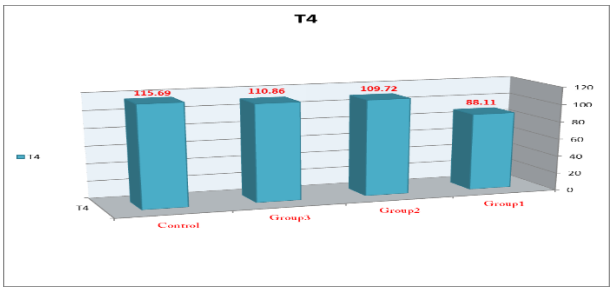
Table (1 – 1): - Thyroid Function Tests and IGF_1 for studied groups

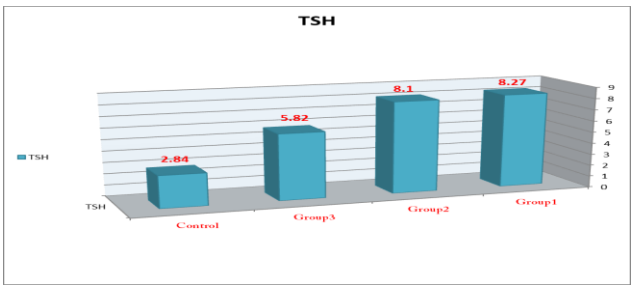
Parameters / Groups	T3	T4	TSH	IGF_1
Group1	0.47 ± 0.01^{b}	88.11 ± 6.73^{b}	8.27 ± 1.03^{a}	13.10 ± 4.01^{a}
Group2	0.60 ± 0.02^{b}	109.72 ± 8.11^{a}	8.10 ± 1.44^{a}	15.53 ± 4.29^{a}
Group3	0.64 ± 0.01^{b}	110.86 ± 7.29^{a}	5.82 ± 0.42^{ab}	20.47 ± 5.32^{a}
Control	1.23 ± 0.08^{a}	115.69 ± 5.75^{a}	2.84 ± 0.02^{b}	21.60 ± 6.98^{a}
L.S.D	0.19	17.40	3.35	9.99

Thyroid hormones

For both T3 and T4 hormones levels there were significant differences among all studied groups as shown in Table (3-1). However, the mentioned table showed a significant Decrease in level Triiodothyronine (T3) and thyroxine (T4), was different from one group to another, but all three groups were lower than the control group, where the first group was more low, then the second and third groups, which were higher than the first and second groups, and lower than the control group. There was no significant difference in age, sex, preoperative thyroid function tests, postoperative thyroid status, or pathology between those who gained weight and those who did not. However, the mentioned table showed increase in level of thyroid-stimulating hormone(TSH) in postoperative groups compared with preoperative group control group. While there were significant differences in the serum concentration of TSH in preoperative control and postoperative groups. Where the first group had the most total increase, then the second and third group, and all the totals were higher than the control group. This agrees with (Barranco et al., (2023); Hemmati et al., (2023); Ma et al., (2023); Yosuf et al., (2022)., and Azmi et al., (2023). See Fig.1,2,3

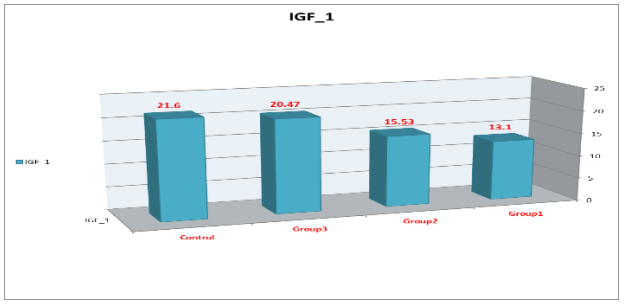






Insulin-like growth Factor-I: Group B:

This group is considered the lowest in, IGF-I, as it is less than group C, group D and group A (control). This means that this group is more hypothyroidism than the other groups. The order of the groups is based on the severity of the, IGF-I B > C > D > A. There are significant differences between the three groups and the control. This agrees with (Giorgio et al., (2023); He et al., (2023), Rao et al., (2023), and Vlad et al., (2023). So far, we have not found a study showing the relationship between thyroid hormones and growth factor after thyroidectomy for patients with non-toxic tumors, and the studies mentioned are for cancer patients. As well as children's growth, and my study included ages different from those mentioned in the sources See Fig.4



Discussion

The IGF-1 serum levels negatively correlated with serum or plasma levels of TSH, investigated subclinical hypothyroid and subclinical hyperthyroid patients, among whom IGF-1 serum concentration was lower in subclinical hypothyroid, also indicated that T4 therapy in patients with primary or central hypothyroidism lower the serum concentration of IGF-1. All these articles further support our findings and the novel conclusion that the IGF-1 axis is disrupted again in hypothyroid. of bone metabolism (Chang et al., (2014). It has been well established that IGF-1 is are important regulators. In vitro studies have shown that GH can promote the formation of colonies of young pre-chondrocytes, and that IGF-1stimulates cells at a later phase of maturation, most serum IGF-1 is produced in the liver, and locally produced IGF-1 is derived frombone and other tissue. Both serum and bone-derived IGF-1 contribute to longitudinal bone growth and cortical bone formation, and also the maintenance of bone mass in later stages of life, have reported a relationship between IGF-1 and bone mass. In addition, found that a low serum IGF-1 level was associated with greater femoral bone loss in postmenopausal (women Seck et al., (2001). In the large cross-sectional Rancho Bernardo Study of 483 men and 455 postmenopausal women, reported a positive relationship between serum IGF-1 concentration and BMD only in women (Barrett-Connor et al., (1988). Moreover, the Longitudinal Aging Study Amsterdam of 627 men and 656 women conducted by van Varsseveld et al. also reported a greater 3-year decrease in total hip BMD in elderly women with lower serum IGF-1 concentrations (van Varsseveld et al., (2015). In addition to its direct effect on bone, IGF-1 may contribute to bone mass in other ways. The IGF-1 signaling pathway has been shown to be related to skeletal muscle protein synthesis (Philippou et al., (2007). Studies have shown who had undergone total

thyroidectomy demonstrated a positive association skeletal muscle mass index, vitamin D level and serum IGF-1 level, and an inverse relationship between serum bone ALP level and BMD. Our findings suggest that in this specific patient group of postmenopausal total thyroidectomy, it is possible to identify those at a high risk of osteoporosis not only through BMD but also through parameters of nutritional status, skeletal muscle mass index and bone turnover biomarkers (Giorgio et al., (2023); He et al., (2023), Rao et al., (2023), and Vlad et al., (2023). IGF-I and thyroid hormones interact on growth. Some contradictory findings have been reported in human dysthyroidemia. Plasma levels of IGF-I were found to be reduced in hypothyroid individuals; these were increased substantially with adequate thyroid hormone replacement. Basal IGF-I levels are lower in hypothyroid patients compared to those who are euthyroid, in another report, serum IGF-I levels were lower in hyperthyroid patients while levels trended toward elevation in hypothyroid individuals, Other components of the IGF-I pathway are influenced by thyroid hormone. Thyroxine replacement therapy appears to increase serum levels of IGFBP1 (Smith et al., (2021).

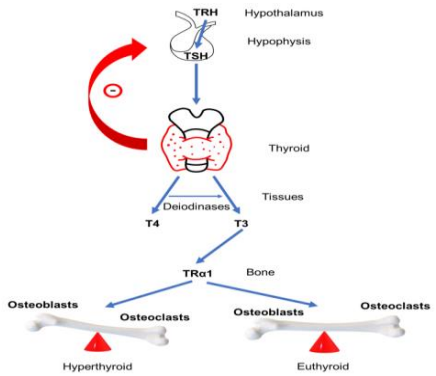


Fig.1. Schematic representation of the hypothalamus–pituitary–thyroid axis and effect on bone in hyperthyroidism and euthyroidism, TRH thyroid releasing hormone, TSH thyroid stimulating hormone, T4 thyroxine, T3 three iodothyronine, and TRα1 thyroid hormone receptor α.

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