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ORIGINAL ARTICLE

Oral Throxin Dose Adjutment in Total Thyroidectomy Patients in Benign Thyroid Disorders

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ABSTRACT

Objective: The purpose of this research was to identify the optimal oral thyroxin dosage for individuals with benign thyroid disorders who had undergone a complete thyroidectomy.

Methods: Included in the study were 75 adult patients who had a complete thyroidectomy for noncancerous thyroid issues. Initially, they were prescribed 75 µg of thyroxine and were then given further doses every two months until they reached euthyroid state on two separate visits. Age, sex, weight (both actual and lean), body mass index (BMI), and biochemical data (triiodothyronine, thyroxine, thyroid-stimulating hormone) were all assessed at this point. All data were analyzed using SPSS 23.0.

Results: There were majority 47 (62.7%) males and 28 (37.3%) females among all cases. Mean age of the cases was 43.7 years. Majority of the cases had nodular colloid goiters, followed by ashimoto's thyroiditis, lymphocytic thyroiditis and follicular adenoma. Optimal thyroxine dose was best predicted by BSA (0.895, $P < 0.01$) and LBM (0.899, $P < 0.01$), but body weight (0.754, $P < 0.01$) and BMI (0.478, $P < 0.01$) were also strong predictors. The patient's age was the least significant factor in our study ($r = 0.104$, $P < 0.01$). The correlation between gender and thyroxine dosage was not statistically significant. The average dosage of thyroxine for each patient was 1.64 µg/kg of body weight.

Conclusion: Based on our findings, thyroxine replacement that takes BSA or LBM into account is superior to that which solely takes BMI or weight into account.

Keywords: T4 dose, total thyroidectomy, benign thyroid disorders, thyroxine dose, BMI, BSA, IBM

INTRODUCTION

There has been an alarming increase in the incidence of thyroid cancer, with papillary thyroid carcinoma (PTC) accounting for the majority of this growth[1]. An moderate to high risk of cancer recurrence has a risk of 5-20% or greater, even though the 5-year survival rate is 90% or higher. The American Thyroid Association (ATA, 2015 edition) suggests a total thyroidectomy as a way to reduce the chances of recurrence[2]. Patients who have had a total thyroidectomy often get given levothyroxine (LT4) to help their thyroids work again. One advantage of administering supraphysiological LT4 is that it inhibits TSH secretion, which in turn reduces the chance of recurrence[3].While making adjustments to the postoperative TSH targets, it is important to evaluate the patient's level of expected risk. Any potential positive effects of TSH suppression medication could be nullified if the risks are magnified with age. Iatrogenic thyrotoxicosis, a side effect of intense suppression therapy, is known to increase the risk of fracture and cardiovascular events by a factor of 2 to 4 in older patients[5]. Choosing the appropriate LT4 dosage for each elderly patient is more challenging due to organ loss and adaptive alterations in the hypothalamic-pituitary-thyroid axis. Their elevated risk of thyroid cancer makes thyroidectomy the treatment of choice for these patients[6]. While ideal TSH targets were established to mitigate the negative effects of TSH suppression and recurrence risk, the matter of individual responses to LT4 is still not resolved, and patients, particularly the elderly, lack a dependable method for predicting the correct dosage of LT4.

Levothyroxine dosage can now be adjusted based on weight, thanks to recent advancements in Thyroid Stimulating Hormone (TSH) immunoassays[7]. The exact euthyroid dose cannot be determined by rigid weight-based dosage (WBD) experiments because they do not account for the first supply of thyroid hormone. Reducing TSH as an additional treatment is the most effective way to reduce thyroid tumor recurrence[8]. The correct amount of levothyroxine to provide depends on a number of factors, including as the patient's age, gender, weight, desired weight, body mass index (BMI), hormonal status, menopausal status, and preexisting diseases. Oral administration of protein pump inhibitors, ferrous sulfate, calcium, or sucralfate is another approach to decrease absorption[9]. A limited number of investigations have shown that LBM can predict levothyroxine levels in post-operative patients with hypothyroidism or primary hypothyroidism. Nevertheless, the available evidence does not lend credence to the claim that LBM outperforms BW as a predictor. For precise LBM estimate, there are state-of-the-art methods that fail when tested in real-world clinical environments. Research on the subject of ideal body weight (IBW) has produced conflicting results[10]. A greater dose of weight-based levothyroxine should be administered to underweight patients compared to overweight patients. That being said, body mass index (BMI), which incorporates both height and weight, might be a more accurate measure of the need for thyroid hormone replacement treatment following a complete thyroidectomy.

More than just BMI is considered when recommending thyroxine dosage. In comparison to weight alone, LBM and BSA have shown to be more reliable indicators of health[11]. A number of factors, including the patient's age and sex, influence the total amount of thyroxine that must be taken[12]. No matter how careful you are, you can't objectively say which prediction is more correct. It is also unclear what the ideal thyroxine dosage is for the Indian population. Patients who have had total thyroidectomies at our center for benign multi-nodular goiters will have their age, sex, weight, BMI, and body surface area (BSA) recorded in order to determine the best dosage of thyroxine replacement.

MATERIALS AND METHODS

This prospective study was conducted at Bilawal Medical College kotri during January 2024 to August 2024. The study included both male and female patients who were between the ages of 15 and

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70 who had complete thyroidectomies performed for benign thyroid diseases. No patients were included if they had a history of cancer, a recent infection, an adrenal problem, a pituitary abnormality, or were using iron, calcium, antacid, or proton pump inhibitor medication.

The department's policy required all patients to be monitored every two months after discharge and administered 75 µg of thyroxine until they reached euthyroid state. Clinical exams and a thyroid function test were administered to patients over the follow-up period in order to evaluate their improvement. Their dosage of medication was adjusted accordingly based on the results. In our study, we included patients who had consistent biochemical euthyroid status on two separate visits. A normal free T4 level and a thyroid-stimulating hormone (TSH) level ranging from 0.4 to 4 IU/ml were considered euthyroid state for the purposes of the study[7]. Here we recorded age, sex, weight (both actual and lean), BMI, and biochemical data (T3, T4, and TSH). Here, we used the Hume formula[8] to determine LBM. The formula for a male's LBM is (0.328 x weight in kg) + (0.339 x height in cm) - 29.533, whereas the formula for a female's LBM is (0.295 x weight in kg) + (0.418 x height in cm) - 43.293". The DuBois formula[9] was used to determine BSA, which is given as BSA(m2) = 0.202 x height (m) 0.725 x weight (kg) 0.425". To express quantitative variables, we used standard deviation, median, interquartile range, and mean. Using correlation and multiple regressions, we examined the relationships between the quantitative variables. The mean ± SD is how the data were shown. Statistical significance was determined by P values less than 0.05.

RESULT

There were majority 47 (62.7%) males and 28 (37.3%) females among all cases. Mean age of the cases was 43.7 years. Majority of the cases had nodular colloid goiters, followed by ashimoto's thyroiditis, lymphocytic thyroiditis and follicular adenoma. (table 1)

Table-1: Baseline information of the included cases

Variables	Frequency (75)	Percentage
Gender		
Male	47	62.7
Female	28	37.3
Average age (years)	43.7	
Histological findings		
nodular colloid goiters	35	46.7
ashimoto's thyroiditis	22	29.3
lymphocytic thyroiditis	10	13.3
follicular adenoma	8	10.7

Optimal thyroxine dose was best predicted by BSA (0.895, P < 0.01) and LBM (0.899, P < 0.01), but body weight (0.754, P < 0.01) and BMI (0.478, P < 0.01) were also strong predictors. The patient's age was the least significant factor in our study (r = 0.104, P < 0.01). The correlation between gender and thyroxine dosage was not statistically significant.(table 2)

Table-2: Multiple correlation-regression for multivariate analysis

Variables	Mean (stD)	Dosage	Correlation	P Value
BSA	1.587 ± 0.154	71.41 µg/m^2	0.895	< 0.01
LBM	43.17±5.34	2.47 µg/kg	0.899	< 0.01
BMI	26.27±5.63	3.75 µg/kg	0.478	< 0.01
Weight	67.51± 10.47	1.87 µg/kg	0.754	< 0.01
Age	43.7± 11.57	1.18 µg/kg	0.104	<0.01

DISCUSSION

Patients with a moderate to high risk of recurrence must have their TSH suppressed in order to lower this risk[13]. In elderly patients, the benefits of suppression medicine must be carefully considered in light of the hazards of iatrogenic hyperthyroidism. What factors influence LT4 medication across age groups is still unknown. In order to aid in the development of individualized LT4 medication regimens, our study examined the variables impacting postoperative medicine in patients with PTC and intermediate to high recurrence chances based on age. We observed the same thing as another study: that variables like body mass index (BMI) and ambient temperature impacted the treatment result. Prior research concentrated on the effects of weight since thyroid hormone is important for normal development and for controlling metabolism in adults[14,15]. Even though LT4 was administered at an empirical dose of 1.6 µg/kg, more than 70% of the patients in our study did not manage to get the desired degree of TSH suppression. Apparently, there are a lot of variables that influence LT4's effectiveness, and body weight is just one of them. The temperature of the surrounding environment has a significant impact on the metabolic rate. So, we thought about how the surrounding temperature could affect the efficacy of LT4 medication. To reduce their impact on the results, body weight and environmental temperature were included in the propensity score calculation. In individuals with a moderate to high risk of recurrence, age remained an independent factor that affected the therapeutic efficacy of lowering TSH levels, even after controlling for weight and ambient temperature. I am astounded by this discovery.

Our study's findings accord with Jonklaas's[16] as we used a mean body mass index (BMI) of 27 kg/m2 and a daily the hormone thy requirement of 1.8 µg/kg. Meanwhile, research done in the UK found that a thyroxine dosage of 2 µg/kg was connected to a BMI distribution similar to our society's, which averages 27 kg/m2[17]. Nevertheless, a randomised trial conducted in India verified that a comparable thyroxine dosage of 2.04 µg/kg was linked to an average body mass index (BMI) of 22.67 kg/m2. Our data supports this conclusion.

Lean body mass (LBM) is more indicative of health than weight alone since muscle tissue has a faster metabolic rate than fat tissue and bone. Studies on severe hypothyroidism support these hypotheses[19]. Contrarily, other studies that looked at individuals who had a total thyroidectomy and were given thyroxine did not find a link between LBM and dosage. For instance, in their study, Olubowale et al.[20] did not find a statistically significant linear relationship between T4 needs and LBM as measured by anthropometry. According to a study conducted by Sukumar et al.[18], who assessed LBM using the X-ray impedance method, there was no link between LBM and T4 replacement dose after a complete thyroidectomy, even after multivariate analysis. We also found an intriguing association between BSA and thyroxine needs during our investigation. There was a substantial association between the final thyroxine dose and BSA (R 2 = 0.923), out of numerous parameters. Using BSA, a thyroxine dosage of 72.3 µg/m2 was determined daily. The average daily BSA thyroxine need was 75.2 µg/m2 according to a different randomized study that was carried out in 2010[18].

CONCLUSION

Based on our findings, thyroxine replacement that takes BSA or LBM into account is superior to that which solely takes BMI or weight into account.

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