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Original Research Article

Comparative Assessment of the Thyroid Profile of Postmenopausal Women with Those in Reproductive Age Group: an Analytical Study

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Abstract

Aim: The aim of the present study was to compare thyroid profile of postmenopausal women with those in reproductive age group as well as to find the correlation between age and thyroid profile.

Methods: The present study was conducted by the Department of Biochemistry, Shree Narayan Medical Institute & Hospital, Saharsa, Bihar, India, for the period of 1 year. The study includes 100 young and middle-aged pre-menopausal women (18-50 years) and 100 elderly post-menopausal women (>50 years). All the subjects enrolled in the study were female patients attending the outpatient department of the Hospital. Informed and oral consent was obtained from all the study participants and the study was approved by the institutional ethical committee.

Results: Post-menopausal women showed slightly increased TSH activity (3.39±2.45) as compared to pre-menopausal women (2.80±1.36). The activities of T3 and T4, however, revealed no variation among the study groups.

Conclusion: This demonstrates that for the purposes of thyroid-function screening in pre-menopausal and post-natural-menopause women, it suffices to measure the T4 and TBG levels and, obviously, the T4/TBG ratio. In view of the results obtained from the current research and considering the previous reports, there is a possibility of a shift in the activities of thyroid hormones with age.

Keywords: thyroid hormones, thyroid stimulating hormone (tsh), tri-iodothyronine (t3), post-menopausal, tetra-iodothyronine (t4)

Introduction

Human life relies on a delicate balance of hormones such as estrogen, progesterone, testosterone, and many others. Women come across many physiological and anatomical changes throughout their lives, including puberty, pregnancy, and menopause, which are controlled by female sex hormones. Thyroid hormones influence the development and functioning of the reproductive system and the overall body metabolism. Thyroid diseases mainly affect women; the incidence is five to 20 times higher in women than in men. The prevalence of thyroid diseases increases

with age. In women, diseases of the thyroid gland are among the most prevalent disorders worldwide, second only to diabetes. [1]

Thyroid diseases predominantly affect women; their incidence is 5-20 times higher in women than in men. Additionally, the prevalence of most thyroid diseases increases with age. Consequently, thyroid gland autoimmunity, hypothyroidism, nodular goitre, and cancer occur most often in postmenopausal and elderly women. The diagnosis of thyroid disease is difficult in this group of patients because the symptoms like anxiety, heart palpitations, sweating, gaining weight and insomnia are common for the both thyroid and ovarian dysfunction. The additional problems arise from the interpretation of the results of thyroid function tests: according to many observations the serum TSH, thyroxine (T4), and tri-iodothyronine (T3) concentrations depend on age, comorbidities, and medical treatment – these together sometimes make the diagnosis of thyroid dysfunction complicated in older population. Although thyroid status has a well-known impact on cardiovascular risk, cognitive function, disability, and longevity there is no consensus on universal screening for thyroid dysfunction of postmenopausal and elderly women among medical associations worldwide. [2]

Several studies have proposed that subclinical hyperthyroidism is associated with lowered bone mass and increased risk of fracture. [3-5] Abe et al. [4] demonstrated that thyroid-stimulating hormone (TSH; also known as thyrotropin) exerts a modifying effect on osteoblastic and osteoclastic activity through binding to its receptors on bone precursor cells.6 These results suggest that TSH could directly affect bone metabolism independent of the serum concentrations of thyroid hormones. [6]

Endocrine glands exhibit changes as the age advances. Age related fall in circulating T4, reduction in TSH bioavailability, reduced responsiveness of thyroid gland to TSH can result in increased TSH secretion in the absence of overt thyroid disease. Subclinical hypothyroidism with normal free T4 and raised TSH is found to be common in elderly. [7,8] Gender specific alterations in TSH and FT 4 have also been reported in which elderly women had elevated TSH, without any alterations in FT4. [9] These hormones influence other systems in the body as well. Thyroid gland is one among them. Thyroid hormone regulates body metabolism, including reproductive functions. Disorders of thyroid gland are common in women.

The aim of the present study was to compare thyroid profile of postmenopausal women with those in reproductive age group as well as to find the correlation between age and thyroid profile.

Materials and methods

The present study was conducted by the Department of Biochemistry, Shree Narayan Medical Institute & Hospital, Saharsa, Bihar, India, for the period of 1 year. The study includes 100 young and middle-aged pre-menopausal women (18-50 years) and 100elderly post-menopausal women (>50 years). All the subjects enrolled in the study were female patients attending the outpatient department of medicine.

Informed and oral consent was obtained from all the study participants and the study was approved by the institutional ethical committee.

Methodology

All the subjects included in the study had no clinical symptoms of thyroid disorder and were not on any medication. Patients with a history of major chronic illnesses, e.g. diabetes mellitus, hypertension, other endocrinal disorders, patients on hormone

replacement therapy or on drug altering serum TSH, hysterectomy patients, pre-pubertal age women, pregnant woman, and premature menopausal women were excluded from the study.

Five milliliters of venous blood was drawn aseptically from all the study subjects and serum TSH, T3, andT4 were measured by using chemiluminescence /magnetic particle immunoassay (CLIA) using an automated analyzer (Abbott i1000SR Architect Plus). The serum concentrations of TSH, T3, and T4 were expressed in µIU/ml and interpreted according to the manufacturer's recommendations.

Statistical analysis- Statistical analysis was carried out using the software SPSS 16. Mann Whitney U test was used to compare thyroid profiles. Correlation of thyroid profile with age was computed by linear regression analysis.

Results

Table 1: Thyroid parameters

Climacteric status	TSH	T3	T4	FT3	FT4	TBG	T4/TBG ratio
Pre-menopausal	3.45	1.50	82.50	3.60	12.50	21.34	390.22
	0.44	0.07	2.70	0.20	0.96	1.70	44.5
Post- menopausal	3.35	1.40	80.12	3.35	13.20	20.05	398.33
	0.35	0.05	2.50	0.17	0.50	0.90	36.4

When the entire sample was broken down according to climacteric situation (Table 1), the only statistically significant difference ($P < 0.05$) observed in the subsamples was a reduction in FT3 concentration as between the pre-menopausal and the late post-menopausal phases. It was also ascertained that there was atendency for this lowering of the FT3 concentration with advancing post-menopausal age to be associated with an increase in the level of binding protein and a fall in the T4/TBG ratio towards hypothyroid levels, with a consequent increase in the thyrotrophin response.

It would seem, therefore, that the reduction in the thyroid function in the climacteric period is not caused by either hypothalamic-hypophyseal changes or primary changes in the thyroid gland, but comes about rather as a result of alterations in the peripheral metabolism of the thyroid hormones - perhaps a reduction in T4 conversion.

Table 2: Association according to Age groups

	TSH			T3			T4		
Climacteric status	40-45	46-50	51-55	40-45	46-50	51-55	40-45	46-50	51-55
Pre-menopausal	3.55	2.78	2.62	1.35	1.50	1.40	86.12	88.14	83.15
	0.40	0.36	0.39	0.06	0.007	0.008	2.80	2.25	2.75
Post- menopausal	3.50	3.10	2.30	1.60	1.45	1.55	1.39	81.17	84.10
	0.80	0.46	0.34	0.08	0.06	0.07	4.46	1.90	2.40

In the case of TSH (Table 2), there is a tendency towards hyposecretion with advancing years in the pre-menopausal and early post-menopausal phases. However, in the late post-menopausal phase, a statistically significant increase ($P < 0.05$) is observed between the intermediate age group (46-50 yr) and the advanced age group (51-55 yr). In the latter group, an increase in TSH (P -C 0.03) occurs with advancing menopausal age.

As regards T3 (Table 2), it can be seen that the women in the early postmenopausal

phase in the 46-50 age group (menopause at expected time, inasmuch as the average menopausal age of the sample was 46.4 + 3.5 yr) demonstrate lower levels than the women in the 40-45 and 50-55 age groups (P -C 0.01). Furthermore, while the T3 levels increase from the early post-menopausal phases in the upper and lower age groups, they decrease significantly in the intermediate age group (46-50 yr), i.e. when the menopause occurs at the expected time. A similar trend is seen for T4 (Table 2).

Table 3: Thyroid hormone activities among the pre -and post-menopausal women

Thyroid Hormones	Pre-menopausal women (Mean±SD)	Post-menopausal women (Mean±SD)	Normal range	P value
TSH	2.80±1.36	3.45±2.75	0.35-4.94 Miu/Ml	0.080
T3	1.10±0.25	0.88±0.25	0.64-1.52 ng/Ml	0.525
T4	7.78±1.35	7.66±1.30	4.87-11.72 µg/dL	0.756

Post-menopausal women showed slightly increased TSH activity (3.39±2.45) as compared to pre-menopausal women (2.80±1.36). The activities of T3 and T4, however, revealed no variation among the study groups. Table 3 shows the serum activities of TSH, T 3, and T4 among both study groups.

Discussion

In the present study, we encountered mean serum TSH activities in older post-menopausal women (3.45±2.75 µIU/mL) that were comparatively higher than those observed among young, middle-aged premenopausal women (2.80±1.36 µIU/mL). However, the difference was not statistically significant. Multiple causes were proposed for increased TSH activities in the elderly, including nutritional iodine supply, sleep disturbances, altered sleep patterns, and others.10 Aging is associated with changes in the pituitary-thyroid axis and there was a progressive shift in the serum TSH activities with increasing age. [11] The endocrine system undergoes changes with aging even in the absence of overt disease. Thus, an age-related fall in T4 activities and the reduced responsiveness of the thyroid to TSH could result in increased TSH secretion. [12]

Another possibility of increased TSH activities may be due to occult thyroid disease in older people. [13] With aging, the variations in the activities of serum TSH may not be too significant as compared to the activities of other endocrine hormones, such as the ones secreted by the adrenal gland, as noted in previous studies. [14]

Rojas LV et al. found higher TSH activities in post-menopausal women (2.80 µIU/mL) as compared to premenopausal (2.52 µIU/mL). They found an average increase in TSH values with age, although the change between groups was not significant, which was similar to the results observed from the current study. It has been suggested that an evaluation of baseline TSH levels within a group and in a defined geographical location may be significant. [15]

A large, population-based study conducted by the National Health And Nutrition Examination Survey (NHANES) found higher TSH activities in women in the older age group. [16] An analysis of NHANES III (2007) showed that age-related shifts in TSH activities were not significantly altered when individuals with antithyroid antibodies were excluded from the study. Alterations in the activities of thyroid hormones under the influence of food (soy) were also previously reported. [17] Aging could influence the activities of various hormones that include the growth hormone, growth hormone-releasing hormone (GHRH), estrogen, progesterone,

androgens, follicle-stimulating hormone, insulin-like growth factor 1, and others. [18] Therefore, it is important to understand the activities of thyroid hormones with aging. [19]

From this study, it can be concluded that although the menopause does not give rise to important changes in thyroid function, it nevertheless exerts an influence in that the function is reduced, especially when menopause occurs at the expected time. The major variations have in fact been observed in the women in the recent post-menopausal phase who fall into the intermediate age group (46-50 yr), this being the group in the middle of which the average menopausal age of the entire sample is situated. A correlated study of the TSH and T4 values in each individual case has shown that when physiological changes in thyroid function occur in the climacteric, they do not usually have a central origin. In fact, in the case of variations in above-normal TSH values, there are never corresponding changes in T4 levels, and, in the case of below-normal TSH values, T4 levels are either within normal limits or are slightly above normal.

Conclusions

Finally, when the total thyroid hormone values were correlated with their respective free fractions for the entire sample, a positive correlation emerged only in the case of T4. This demonstrates that for the purposes of thyroid-function screening in pre-menopausal and post-natural-menopause women, it suffices to measure the T4 and TBG levels and, obviously, the T4/TBG ratio. In view of the results obtained from the current research and considering the previous reports, there is a possibility of a shift in the activities of thyroid hormones with age. Considering the improved life expectancy and the fact that the activities of thyroid hormones could influence the reproductive and other metabolic pathways, it is important for us to have a better understanding of the activities of thyroid hormones as a person ages for appropriate management. This suggests a necessity to assess functional status of thyroid gland periodically in the post-menopausal period.

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