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Assessment of Serum Testosterone in Patients with Carcinoma Thyroid Before and After Thyroidectomy: A Pilot Study

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Abstract: ***Introduction: To assess the effect of total thyroidectomy on Serum Testosterone present in patients with thyroid carcinoma. Method: This is a hospital - based prospective study carried out between November 2020 to November 2022 on patients diagnosed with a case of carcinoma thyroid who were admitted to J. N. Medical college and hospital. This study was done in the Department of Surgery, Jawaharlal Nehru Medical College and Rajiv Gandhi Centre of Diabetes and Endocrinology, Aligarh Muslim University, Aligarh. Patient's blood samples were collected and assessed for Serum Testosterone prior to and 3 months postoperatively after total thyroidectomy. Result: There was a decrease in the value of Serum Testosterone (P<0.001) when compared pre and post - operatively after 3 months of total thyroidectomy. Conclusion: There was a significant change in the hormonal status after thyroidectomy. There was a decrease in the value of Serum Testosterone. To our best knowledge, this was the first of a kind study to evaluate Serum Testosterone following thyroidectomy in cancer patients.***

Keywords: Testosterone assessment, carcinoma thyroid, thyroidectomy

1. Introduction

The important cellular processes of proliferation, differentiation, apoptosis and metabolism are all controlled by thyroid hormones (TH). Hypothalamic thyrotropin - releasing hormone (TRH) activates the pituitary gland to synthesize and secrete thyroid stimulating hormone (TSH), which, in turn, acts at the thyroid gland to stimulate TH synthesis and secretion. [1]

Pre - clinical research has demonstrated the effect of thyroid hormones on cancer growth. [2] For a few decades, there has been a dramatic increase in the number of people diagnosed with thyroid cancer (TC). [1] According to Globocan 2020, around 586, 202 cases have been reported with 43, 646 deaths. In Asia, the incidence rate was observed to be 59.7%, with more involvement of females than males. [3] According to Globocan 2020, in India, the prevalence rate of thyroid cancer was observed to be 1.5% (20, 432 new cases). [4]

A dramatic increase in the number of cases being diagnosed with thyroid cancer might be due to the wide use of imaging studies, including ultrasounds, computed tomography, magnetic resonance imaging, and scans using positron emission tomography, which also happens to find thyroid lesions. Papillary thyroid cancer is the most prevalent of the three kinds of thyroid cancer. The treatment options for patients with thyroid cancer include the surgical removal of the entire thyroid gland (total thyroidectomy), radioactive iodine therapy, and molecular - targeted therapies with tyrosine kinase inhibitors. [1]

Following thyroid and parathyroid surgery, hypothyroidism and hypocalcemia are frequent side effects. Thyroid hormone replacement (THR) therapy in athyreotic patients following thyroidectomy for thyroid cancer should be a relatively straightforward clinical problem to solve. [5] Patients who were in euthyroid status before they underwent elective surgery may need a change of their hormone dose afterwards depending on the extent of the procedure, even if they are receiving replacement therapy that is closely adapted to body weight; this is true in 17% to 42% of cases (for hemithyroidectomy and subtotal thyroidectomy, respectively). [6]

The thyroid hormone is known to affect sex hormone - binding hormonal globulin (SHBG) concentrations. Men with hyperthyroidism have elevated concentrations of testosterone and SHBG. [7] Patients after total thyroidectomy have a lower level of thyroxine resulting in a lower level of serum testosterone.

Few studies have examined the variations in thyroid hormone release during or after surgical treatment in the literature. [8] Thus the present study was conducted to evaluate the role of total thyroidectomy on patients with thyroid carcinoma and their effect on serum testosterone in such patients. So hormonal supplementation could be done and improve the quality of life of the patient.

Aims and Objective

- To evaluate the level of serum testosterone in patients of carcinoma thyroid pre - operatively.
- To evaluate the status of the above hormones after 3 months of thyroidectomy

- To histopathologically determine the type of thyroid malignancy.

Patient and Method

This is a hospital - based prospective study carried out between November 2020 to November 2022 on patients diagnosed with a case of carcinoma thyroid who were admitted to J. N. Medical college and hospital. This study was done in the Department of Surgery, Jawaharlal Nehru Medical College and Rajiv Gandhi Centre of Diabetes and Endocrinology, Aligarh Muslim University, Aligarh.

Study Design: The study comprised patients with a diagnosis of thyroid swelling who were admitted to the surgical ward for total thyroidectomy. Detail of patients was recorded. All the patients with thyroid malignancies coming into the hospital were assessed and on the basis of the diagnosis of carcinoma thyroid, the patient was included in the study.

The patient's blood samples were collected and assessed for Serum testosterone prior to surgery and after 3 months postoperatively.

Approval was obtained from the institutional ethics committee, Faculty of Medicine, Jawaharlal Nehru Medical College, A. M. U, Aligarh and Informed consent were taken from the 30 patients included in the study

Sample size: As this study is a pilot study so a minimum sample of 30 was taken.

Inclusion Criteria:

- Patients diagnosed to be having carcinoma thyroid through clinical and histopathological or radiological examination.
- Patients are not on any hormonal replacement medications
- The patient is ready for follow up
- Patients giving consent for their inclusion in the study

Exclusion Criteria:

- Patient not giving consent.
- Patient taking any Hormone replacement therapy.

Data Collection: In the present study, patients' blood samples of around 4 ml were collected one day prior to surgery in a plain vial and sent to the Rajiv Gandhi Centre of Diabetes and Endocrinology for assessment. Patients' information was kept confidential. The patient was followed for 3 months and another blood sample was collected (after a period of 3 months post - surgery). Both samples were analyzed for Serum testosterone and compared.
The instrument used for measuring Serum testosterone

- **PC - RIA MAS STRATEC**

The principle is based on radio - immunoassay (RIA) which is a competitive binding of radiolabeled antigen and unlabeled antigen to a high - affinity antibody. The labelled antigen is mixed with the antibody at a concentration that saturates the antigen - binding sites of the antibody. as the concentration of the unlabeled antigen increases more labelled antigens will be replaced from the binding site.

Statistical Analysis

In the present study, all the qualitative data were analyzed using the Pearson Chi - square test. A paired sample t - test was also used to check the significant difference between pre - op and post - op hormonal assessments. All the Statistical test was performed using the Statistical Package for the Social Science computer program (SPSS) version 25.0

2. Observations and Results

Among the cases included in the study 46.7% (n; 14) were from the younger age group falling under the category of 20 - 30 years followed by 41 - 50 & 51 - 60 years with a mean age of 37.07 years.

There was a significant pre - dominance ($p<0.001$) of females having thyroid malignancy with 93.3% (n; 28) among the cases included in the study.

Among the Ultra - Sonography (USG) findings for classifying thyroid malignancy, the score of TIRADS 5 was found to be the most common with 46.7% (n; 14) followed by TIRADS 4 with 43.3% (n; 13) out of the cases included in the study.

Among the Fine Needle Aspiration Cytology (FNAC) findings for thyroid malignancy, the Bethesda Category 4 (BETHESDA 4) was found to be the most common with 36.7% (n; 11) followed by BETHESDA 5 with 33.3% (n; 10) out of the cases included in the study.

Among the histopathology examination (HPE) for thyroid malignancy, papillary thyroid cancer (PTC) was found to be the most common with 73.3% (n; 22) followed by FTC with 16.7% (n; 5) out of the cases taken for the study.

The hormonal assessment for Serum Testosterone (ng/ml) showed a significant **decrease** with $P<0.001$. The mean value in the pre - op was 0.35 ng/ml and the mean value in the post - op was 0.27 ng/ml. (Table 1 and Graph 1)

3. Discussion

This entire study was designed to compare the pre - operative and post - operative value of serum testosterone at an interval of 3 months after total thyroidectomy. So, it could be supplemented; which in turn, would alter the lifestyle and improve the quality of life of the patient.

The thyroid hormone has profound influences on serum SHBG concentrations. In men, primary hypothyroidism not only decreases SHBG and total testosterone but also reduces free testosterone in approximately 60% of hypothyroid men. Within 6 weeks of correction of hypothyroidism with replacement thyroid hormone, free testosterone concentrations return to normal in hypothyroid men with subnormal serum free testosterone concentrations. Administration of thyroid hormone to both euthyroid and hypothyroid men produces a rise in both SHBG and total serum testosterone [7]

Results of a community - based study of 1021 randomly recruited healthy women showed a direct association between an endogenous level of dehydroepiandrosterone sulfate below

the tenth percentile and low sexual responsiveness in women aged 45 years or older. In women aged 18–44 years, concentrations of DHEAS below the tenth percentile were directly associated with low sexual desire, arousal, and responsiveness. [9] No associations with andro - stenedione or total and free testosterone were seen

In our study, there was a significant decrease in the post - operative value of serum testosterone (P<0.001). A study in Taiwan, the Republic of China on rats regarding the effect of T4 on the levels of testosterone. Thyroidectomy decreased the basal release of hypothalamic GnRH and testicular testosterone in rats. Administration of T4 in vitro restored the release of testosterone by rat testicular interstitial cells [10].

4. Conclusion

This prospective study was carried out at a tertiary hospital in India. the study sample included patients with high suspicion of thyroid malignancy and later confirmed through Histopathological examination. There was a significant decrease in Serum testosterone (P<0.001) status after thyroidectomy. To our best knowledge, this was the first of a kind study to evaluate Serum testosterone levels following thyroidectomy in cancer patients. Further study is definitely required in this field

Author Contribution
All authors have made substantial contributions to the research design, as well as have read and approved the final manuscript.

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Ethics approval and informed consent there is ethical clearance from the local ethical committee, JNMCH, AMU, Aligarh, UP, India

Conflict of interest There is no conflict of interest

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